Percentage of new courses introduced of the total number of courses across all programmes offered during the last five years

Program: Bachelor of Engineering		
Course Title: **Engineering Design Practice [Part B] [Part A – Central Level]**		Course Code: **17ECSP202**
L-T-P: **0-0-1.5**	Credits: **1.5**	Contact Hrs: **3 hrs/week**
ISA Marks: **40**	ESA Marks: **0**	Total Marks: **40**
Teaching Hrs: **39 hrs**	Exam Duration: **3 hrs**	

Experiments	Lab assignments/experiment
Phase 1 (Plannig)	Introduction to Eclipse –IDE Requirement modeling : • Identifying use cases and actors • Apply UML notations to draw use case diagram
Phase 2 (Conceptual Design)	Behaviour Modeling using DFD • List behavior of system/sub-system • List states, tasks and their dependencies Illustrate DFD : • Identify data flow and processes of a system • Draw data flow diagrams for system/sub-system • Draw system diagram to show interaction of all domain components (Draw state and sequence diagram for identified tasks)
Phase 3(System Design)	Software Architectures: • List components of architecture • List type of architectures Choose appropriate architecture for given system
Phase 4 (Detail Design)	UI Design using GUI wireframe: • Design function prototyping for event diagrams(DFD) • Identify user interface components • Choose appropriate property of component • Use wireframe to design a user interface
Text books: 1. Ian Somerville, Software Engineering, 9th, Pearson Ed, 2015 2. Clive L Dym and Patrick Little, "Engineering Design: A Project Based Introduction", John Wiley & Sons	
Reference books: 1. Roger S. Pressman, Software Engineering: A Practitioners Approach, 7th, McGraw, 2007 2. Shari Lawrence Pfleeger and Joanne M. Atlee, Software Engineering Theory and Practice, 3rd, Pearson Ed, 2006 3. Jalote, P, An Integrated Approach to Software Engineering, 3rd, Narosa Pub, 2005	

Program: **Bachelor of Engineering**		
Course Title: **Product Realization**		Course Code: **17ECSP203**
L-T-P: **0-0-2**	Credits: **02**	Contact Hrs: **03 Hrs**
ISA Marks: **80**	ESA Marks: **20**	Total Marks: **100**
Teaching Hrs:	Exam Duration:	

Experiments	Lab assignments/experiment
Week 1 And Week 2	IOT workshop: Introduction to Android studio, Introduction to Arduino programming, PHP
Week 3	Selection of UI and Core Component of Android
Week 4	UI implementation using XML
Week 5	UI implementation and validation
Week 6	Android core component implementation and Unit Testing
Week 7	Android core component implementation and Unit Testing
Week 8	Android core components integration and testing
Week 9	Configuration of IoT Server
Week 10	Integratesubsystems for prototype testing, Analyze the test results, System modification, and System integration.
Week 11	System Testing

Reference:

1. Beginning Android Programming with Android Studio by J.F. DiMarzio

Program: **Bachelor of Engineering**		
Course Title: **Algorithmic Problem Solving**		Course Code: **17ECSE309**
L-T-P: **0-0-6**	Credits: **6**	Contact Hrs: 74
ISA Marks: **70**	ESA Marks: 30	Total Marks: **100**
Teaching Hrs: 74	Exam Duration: 2 to 3 days	

Course Content

Unit – 1	
Chapter 0: Building Blocks Understanding coding platforms and tools, Data Structures and Algorithms revisited	**06 hrs**
Chapter 1: Strategies and Performance Warm up problems, Parsing and Formatting text, Code performance analysis and tools	**06 hrs**
Chapter 2: Advanced Data Structures Matrix, Grids, Trees and variants, Lists, Skip lists, Hash, Trie and variants	**10 hrs**
Chapter 3: Dynamic Programming Memory functions, Optimization problems	**08 hrs**
Unit – 2	
Chapter 4: Graph algorithms Traversal Algorithms, Shortest Path Algorithms, Spanning Tree Algorithms and variants	**25 hrs**
Chapter 5: Introduction to Computational Geometry Points, Line Segments, Polygons and Basics of Geometric Problems	**05 hrs**
Unit – 3	
Chapter 6: Problem Solving Assortment of problems and techniques.	**14 hrs**

Text Book

1. Levitin A., “Introduction to the Design and Analysis of Algorithms”, Third Edition, Pearson Education, 2017.

2. Levitin A, Levitin M, “Algorithmic Puzzles”, First Edition, Oxford University Press, 2011.

3. Online Coding Platforms

References

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, “Introduction to Algorithms”, Third Edition, MIT Press, 2010.

Program: **Bachelor of Engineering**		
Course Title: **Fuzzy Set Theory**		Course Code: **19ECSE402**
L-T-P: **3-0-0**	Credits: 3	Contact Hrs: 3**hrs/week**
ISA Marks: 50	ESA Marks: 50	Total Marks:100
Teaching Hrs: 40	Exam Duration: 3hrs	

Unit –I		
1	**Introduction** : Introduction to Fuzzy Logic, Fuzzy Membership Functions, Operations on Fuzzy Sets	8hrs
2	**Fuzzy Measures:** Fuzzy Relations,Fuzzy Proposition,Fuzzy Implications,Fuzzy Inferences	8hrs
Unit –II		
3	**Fuzzy Relations and Fuzzy Graphs**: Fuzzy Relations, Compositions of Fuzzy Relations, Properties of the Min-Max Composition, DefuzzificatinTechniques,Lambda-cut method, Weighted average method, Maxima methods, Centroid methods, Output of a Fuzzy System	8 hrs
4	**Uncertainty Modeling:** Application-oriented Modeling of Uncertainty, Causes of Uncertainty, Uncertainty Methods, Possibility Theory	8hrs
Unit –III		
5	**Fuzzy Data Bases and Queries:** Introduction, Fuzzy Relational Databases, Fuzzy Queries in Crisp Databases	4 hrs
6	**Fuzzy Sets and Expert Systems:** Introduction to Expert Systems, Uncertainty Modeling in Expert Systems, Applications	4 hrs

Text Books:

1. H. J. Zimmermann ., Fuzzy Set Theory-and Its Applications, Fourth Edition, 4th Ed., Springer Science Business Media, LLC , 2001
2. Chander Mohan, An Introduction to Fuzzy Set Theory and Fuzzy Logic,2nd ed. Vivo Books pvt ltd , 2015

Reference Books:

1. Timothy J. Ross, Fuzzy Logic With Engineering Applications, 3ed., 2010, A John Wiley and Sons, Ltd., Publication
2. Kumar S. Ray,Soft Computing and Its Applications: Fuzzy Reasoning and Fuzzy Control, 1st Edition, Apple Academic Press 2014
3. Ahmed M. Ibrahim, Fuzzy Logic for Embedded Systems Applications, Elesvier Press, 2004.

Scheme for End Semester Assessment (ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter Numbers	Instructions
I	Q.No.-1, Q.No.-2, Q.No.-3	1, 2	Solve Any **2**
II	Q.No.-4, Q.No.-5, Q.No.-6	3,4	Solve Any **2**
III	Q.No.-7	5	Solve Any **1**
	Q.No.-8	6	

Program: **Bachelor of Engineering**		
Course Title: **Natural Language Processing**		Course Code: **18ECSE403**
L-T-P: **2-0-1**	Credits: **3**	Contact Hrs: **04 hrs/week**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs: **30**	Exam Duration: **3 hrs**	

	Unit –I	
1	**Introduction to NLP and Deep Learning** Introduction to Natural Language Processing, Applications of Natural Language Processing, Word2vec introduction, Word2vec objective function gradients	**05 hrs**
2	**Dependency Parsing, Recurrent Neural Networks** Dependency Grammar , Neural dependency parsing, Recurrent Neural Networks and Language Models, Vanishing Gradients, Fancy RNNs	**07 hrs**
	Unit –II	
3	**Machine Translation, Seq2Seq and Attention** Machine Translation, Seq2Seq and Attention, Advanced Attention	**06 hrs**
4	**Transformer Networks , Coreference Resolution, Memory Networks** Transformer Networks and CNNs, Tree Recursive Neural Networks and Constituency Parsing , Advanced Architectures and Memory Networks	**06 hrs**
	Unit –III	
5	**Reinforcement Learning** Reinforcement Learning for NLP, Semi-supervised Learning for NLP, Future of NLP Models, Multi-task Learning and QA Systems	**06 hrs**

Text Books:

1. Yoav Goldberg. A Primer on Neural Network Models for Natural Language Processing , 2016.

Reference Books:

Dan Jurafsky and James H. Martin. Speech and Language Processing (3rd ed. draft).

Ian Goodfellow, YoshuaBengio, and Aaron Courville. *Deep Learning*. MIT Press.

Scheme for End Semester Assessment(ESA)

UNIT	**8 Questions to be set of 20 Marks Each**	**Chapter Numbers**	**Instructions**
I	Q.No.-1, Q.No.-2, Q.No.-3	1, 2	Solve Any **2** out of **3**
II	Q.No.-4, Q.No.-5, Q.No.-6	4,5	Solve Any **2** out of **3**
III	Q.No.-7	6	Solve Any **1** out of **2**
	Q.No.-8		

Program: **Bachelor of Engineering**		
Course Title: **Advanced Parallel Computing**		Course Code:**18ECSE408**
L-T-P:**3-0-0**	Credits: **3**	Contact Hrs: **03 hrs/week**
CIE Marks**: 50**	SEE Marks: **50**	Total Marks: **100**
Teaching Hrs: **40**	Exam Duration: **3 hrs**	

Unit –I		
1	**Introduction and History** GPUs as Parallel Computers; Architecture of a Modem GPU; Parallel Programming Languages and Models; Overarching Goals; Evolution of Graphics Pipelines; The Era of Fixed- Function ; Graphics Pipelines; Evolution of Programmable Real-Time Graphics; Unified Graphics and Computing Processors; GPGPU; An Intermediate Step; GPU Computing; Scalable GPUs Recent Developments; Future Trends.	**07 hrs**
2	**Introduction to CUDA** Data Parallelism; CUDA Program Structure; A Matrix-Matrix Multiplication Example; Device Memories and Data Transfer; Kernel Functions and Threading; Function declarations; Kernel launch; Predefined variables; Runtime API.CUDA Thread Organization; Using b1ock Id x and thread Id x ; Synchronization and Transparent Scalability; Thread Assignment ; Thread Scheduling and Latency Tolerance.	**09 hrs**
Unit –II		
3	**CUDA Memories** Importance of Memory Access Efficiency; CUDA Device Memory Types; A Strategy for Reducing Global Memory Traffic; Memory as a Limiting Factor to Parallelism; Global Memory Bandwidth; Dynamic Partitioning of SM Resources; Data Perfetching; Instruction Mix; Thread Granularity; Measured Performance.	**07 hrs**
4	**Introduction to OPENCL** Introduction to OPENCL; Background; Data Parallelism Model; Device Architecture; Kernel Functions; Device Management and Kernel Launch; Electrostatic Potential Map in OpenCL.	**09 hrs**
Unit –III		
5.	**Case Study** Concepts of Game Design, Applications like Matrix multiplication, MRI reconstruction Molecular Visualization and Gaming.	**04 hrs**
6.	**Parallel Programming and Computational Thinking** Goals of Parallel Programming, Problem Decomposition, Algorithm Selection, Computational Thinking.	**04 hrs**

Text Books: 1. David B. Kirk, Wen-mei W. Hwu, “Programming Massively Parallel Processors: A Hands on Approach”, Morgan Kaufmann/Elsevier India reprint, 2010.	
Reference Books: 1. Benedict R Gaster, Lee Howes, David Kaeli, Perhaad Mistry and Dana Schaa, “Heterogeneous Computing with OpenCl”, Morgan Kaufmann/Elsevier reprint, 2012.	

Scheme for End Semester Assessment(ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter Numbers	Instructions
I	Q.No.-1, Q.No.-2, Q.No.-3	1, 2	Solve Any **2** out of **3**
II	Q.No.-4, Q.No.-5, Q.No.-6	3,4	Solve Any **2** out of **3**
III	Q.No.-7	5	Solve Any **1** out of **2**
	Q.No.-8	6	

Program: Bachelor of Engineering		
Course Title: **Wireless Ad Hoc and Sensor Networks**		Course Code: **18ECSE406**
L-T-P: **3-0-0**	Credits: **3**	Contact Hrs: **3hrs/week**
CIE Marks: **50**	SEE Marks: **50**	Total Marks: **100**
Teaching Hrs: **40 hrs**	Exam Duration: **3 hrs**	

Unit –I		
1	**Introduction:** Fundamentals of wireless communication technology, Characteristics of wireless channel, Multiple Access Techniques, IEEE802.11 Standards, Bluetooth, Cellular Concept, Cellular Architecture.	**07 hrs**
2	**Ad hoc Networks:** Introduction, Issues in Ad hoc wireless networks, Ad hoc wireless internet.	**04 hrs**
3	**MAC Protocols:** Introduction, Issues in Designing MAC protocol, Design goals, Classification, Contention Based Protocols with Reservation Mechanisms. Contention-Based MAC Protocols with Scheduling Mechanism.	**05 hrs**
Unit –II		
4	**Routing Protocols:** Introduction, Issues in designing a routing protocol, classification, Table drive routing protocol, On-demand routing protocol, Hybrid routing protocol, Hierarchical routing protocols, Power aware routing protocols.	**06 hrs**
5	**Energy Management:** Introduction, Need for Energy Management, Classification, Battery Management Scheme, Transmission Power Management Schemes, System Management Scheme.	**05 hrs**
6	**Sensor Networks:** Introduction, Architecture, Data Dissemination, Data Gathering, MAC Protocols (schedule based protocols).	**05 hrs**
Unit –III		
7	**Routing Protocols for Sensor Networks:** Routing Characteristics, Routing Strategies, LEACH, SPIN.	**04 hrs**
8	**Sensor Network Applications:** Case Study: Traffic Control, Health Care, Green House Monitoring.	**04 hrs**

Text Books:

1. C. Siva Ram Murthy and B. S. Manoj, “Ad hoc Wireless Networks”,2nd Edition, Pearson Education, 2006.
2. KazemSohraby, Daniel Minoli, TaiebZnati, “Wireless Sensor Networks: Technology, Protocols, and Applications”, John Wiley and Sons, 2007.

Reference Books:

1. Ozan K. Tonguz and Gianguigi Ferrari, “Ad hoc Wireless Networks”,John Wiley, 2006.
2. C.K. Toh, “Adhoc Mobile Wireless Networks”,Protocols and Systems, Prentice-Hall PTR, 2002.

UNIT	8 Questions to be set of 20 Marks Each	Chapter Numbers	Instructions
I	Q.No.-1, Q.No.-2, Q.No.-3	1, 2,3	Solve Any **2** out of **3**
II	Q.No.-4, Q.No.-5, Q.No.-6	4,5,6	Solve Any **2** out of **3**
III	Q.No.-7	7	Solve Any **1** out of **2**
	Q.No.-8	8	

Program: **Bachelor of Engineering**		
Course Title: **Software Architecture and Design Thinking**		Course Code:**18ECSE410**
L-T-P:**3-0-0**	Credits: **3**	Contact Hrs: 3**hrs/week**
CIE Marks**: 50**	SEE Marks: **50**	Total Marks: **100**
Teaching Hrs: **40**	Exam Duration: **3 hrs**	

Unit –I		
1	**Chapter No. 1 What Is Software Architecture?** What Software Architecture Is and What It Isn’t ,Architectural Structures and Views, Architectural Patterns, What Makes a “Good” Architecture?	**5 hrs**
2	**Chapter No. 2 Why Is Software Architecture Important?** Inhibiting or Enabling a System’s Quality Attributes, Reasoning About and Managing Change, Predicting System Qualities, Enhancing Communication among Stakeholders, Carrying Early Design Decisions, Defining Constraints on an Implementation, Influencing the Organizational Structure, Enabling Evolutionary Prototyping, Improving Cost and Schedule Estimates, Supplying a Transferable, Reusable Model, Allowing Incorporation of Independently Developed Components, Restricting the Vocabulary of Design Alternatives, Providing a Basis for Training	**6hrs**
3	**Chapter No. 3 The Many Contexts of Software Architecture** Architecture in a Technical Context, Architecture in a Project Life-Cycle Context, Architecture in a Business Context, Architecture in a Professional Context, Stakeholders, How Is Architecture Influenced?,What Do Architectures Influence?	**5 hrs**
Unit –II		
4	**Chapter No. 4. Understanding Quality Attributes** Architecture and Requirements, Functionality, Quality Attribute Considerations, Specifying Quality Attribute Requirements, Achieving Quality Attributes through Tactics, Guiding Quality Design Decisions	**5 hrs**
5	**Chapter No. 5. Quality Attributes** Tactics for Availability, Tactics for Interoperability, Tactics for Modifiability,	**6hrs**

	Tactics for Performance, Tactics for Security, Tactics for Testability, Tactics for Usability,	
6	**Chapter No. 6. Architectural Tactics and Patterns** Architectural Patterns, Overview of the Patterns Catalog, Relationships between Tactics and Patterns, Using Tactics Together	**5 hrs**
Unit –III		
5.	**Chapter No. 7 Architecture and Requirements** Gathering ASRs from Requirements Documents, Gathering ASRs by Interviewing Stakeholders, Gathering ASRs by Understanding the Business Goals, Capturing ASRs in a Utility Tree, Tying the Methods Together	**4 hrs**
6.	**Chapter No. 8 Designing an Architecture, Implementation, Testing and EvaluationDesigning:** Design Strategy, The Attribute-Driven Design Method, The Steps of ADD, Implementation, and Testing:Architecture and Implementation, Architecture and Testing, Evaluation:Evaluation Factors, The Architecture Tradeoff Analysis Method, Lightweight Architecture Evaluation	**4 hrs**
Text Books: 1. Len Bass, Paul Clements, Rick Kazman, Software Architecture in Practice (3rd Edition), Addison-Wesley Professional; 3 edition		
Reference Books:		

Scheme for End Semester Assessment(ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter Numbers	Instructions
I	Q.No.-1, Q.No.-2, Q.No.-3	1, 2	Solve Any **2** out of **3**
II	Q.No.-4, Q.No.-5, Q.No.-6	3,4	Solve Any **2** out of **3**
III	Q.No.-7	5	Solve Any **1** out of **2**
	Q.No.-8	6	

Program: **Bachelor of Engineering**		
Course Title: **Embedded Intelligent Systems**		Course Code: **18ECSE302**
L-T-P: 0-0-3	Credits: 3	Contact Hrs: **6hrs/week**
ISA Marks: 80	ESA Marks: 20	Total Marks: 100
Teaching Hrs: 60	Exam Duration: 3 hrs	

1	**Basics of embedded systems** Linux Application Programming, System V IPC, . Linux Kernel Internals and Architecture , Kernel Core , Linux Device Driver Programming, Interrupts & Timers , Sample shell script, application program, driver source build and execute	**10 hrs**
2	**Heterogeneous computing** Basics of heterogeneous computing with various hardware architectures designed for specific type of tasks, Advanced heterogeneous computing with a. Introduction to Parallel programming b.GPU programming (OpenCL) c. Open standards for heterogeneous computing (Openvx) , Basic OpenCL examples - Coding, compilation and execution	**12 hrs**
3	**ML Frameworks lab with the target device** Caffe, tensorflow, TF Lite machine learning frameworks & architecture ,Model parsing, feature support and flexibility ,Supported layers , advantages and disadvantages with each of these frameworks, Android NN architecture overview , Full stack compilation and execution on embedded device	**16 hrs**
4	**Model Development and Optimization** Significance of on device AI ,Quantization , pruning, weight sharing, Distillation ,Various pre-trained networks and design considerations to choose a particular pre-trained model ,Federated Learning , Flexible Inferencing	**8 hrs**
6	**Android Anatomy** Android Architecture ,Linux Kernel , Binder , HAL Native Libraries , Android Runtime, Dalvik Application framework , Applications, IPC	**8 hrs**

Course Title: **Model Thinking**	Course Code: **18ECSE411**	
L-T-P: **3-0-0**	Credits: **3**	Contact Hrs: **30**
CIA Marks: **50**	SEE Marks: 50	Total Marks: **100**
Teaching Hrs: **40**		Exam Duration: **3 hrs**

Content	40 Hrs
Unit – 1	
1. **Why Model** Model Thinking - The need, Advantages and disadvantages, Segregation/Peer Effects, Case study	4 hrs
2.**Modeling People, Tipping Points & Economic Growth** Rational models, Behavioral models, Rule based models, Percolation Models, Growth and its kinds	6 hrs
3. **Special Topics** Standing ovation model, Game of Life, Lyapunov Functions: Equilibrium, A cycle, Randomness or complexity, Coordination and culture. Urn models, Polya process, paths and networks, Prisoners' Dilemma, Collective Action & Mechanism Design	6 hrs
Unit – 2	
4. **Randomness and Learning Models** Luck as randomness, Random Walks & Colonel Blotto, Replicator Dynamics, Fisher's fundamental theorem, Prediction and the Many Model Thinker	8 hrs
5**. Model Checking and Modelling Concurrent Systems** Model Checking, Characteristics of Model Checking, Transition Systems, Parallelism and Communication, The State Space Explosion	8 hrs
Unit – 3	
6**. Linear-Time Properties** Linear-Time behavior, Safety Properties and Invariants, Liveness Properties, Fairness	4 hrs
7. **Regular Properties** Automata on Finite Words, Model-Checking Regular Safety Properties, Automata on Infinite Words, Model Checking with omega-regular properties	4 hrs

Text Books

1. Scott E Page, The Model Thinker, Basic Books Publication, 2018
2. ChristelBaier and Joost-Pieter Katoen, Principles of Model Checking (Representation and Mind Series), The MIT Press, 2008

References

1. Model Thinking Coursera online course from Michigan University.

Program: **Bachelor of Engineering**		
Course Title **Scripting Languages Lab**		Course Code: **18ECSP201**
L-T-P: **0-0-2**	Credits: **2**	Contact Hrs: **4hrs/week**
ISA Marks: **80**	ESA Marks: **20**	Total Marks: **100**
Teaching Hrs: **30**	Exam Duration: **3 hrs**	

1	**Introduction to UNIX Utilities** Architecture, Commands, File Attributes, vi Editor, Process, Simple Filter, File System, Handling Files and Basic File Attributes.	**06hrs**
2	**UNIX shell Scripting** Shell Basics, Shell Environment, Shell Script Programming Concepts, Decision Structures, Looping Structures, and Command line arguments, Functions and Arrays, Regular Expression & Filters, Processes.	**06hrs**
3	**Python Scripting** Python: Types, Variables, and Simple I/O, Branching and Looping, String Manipulation,Numbers, Lists and Dictionaries, Regular Expressions, Functions, Files and Exceptions, Programming using numpy and scipy libraries.	**12hrs**
4	**System Administration** Common administrative tasks, creating and mounting file system, File system management, managing users and group accounts, monitoring system performance, accessing system information, backup and restore files, reconfiguration hardware with kudzu, installing and removing packages.	**06 hrs**

Tentative plan of lab implementation

Expt./ Job No.	Lab assignments/experiment	No. of Lab. Slots per batch (estimate)
1-2	Introduction to UNIX Utilities	02
3-4	Shell Script	03
5-10	Python programming	05
11-12	System Administration	02

Text Books

1. Sumitabha Das, UNIX Concepts and Applications", 4th Edition, McGraw-Hill, 2017.
2. Mark Lutz, "Programming Python", 4th Edition, O'Reilly, 2010.

Reference Books

1. Noah Gift, Jeremy Jones, Python for Unix and Linux System Administration, 2008.
2. RytisSileikam, Pro Python System Administration, 2nd Edition, 2014
3. Michael Dawson, Python Programing for the Absolute Beginner, Premier Press, 3rd Edition 2010.

Program: Bachelor of Engineering		
Course Title: Object Oriented Programming with C++		Course Code: 18ECSC207
L-T-P: **3-0-0**	Credits: **3**	Contact Hrs: **3 hrs/week**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs: **40**	Exam Duration: **3hrs**	

Unit –I		
1	**Chapter No. 1: Introduction:** Introduction to object oriented programming. Characteristics of object oriented languages, Programming Basics, arrays, Functions in C++ (parameter passing techniques.)	**4 hrs**
2	**Chapter No. 2:Classes and Objects:** Introduction to Classes and Objects, encapsulation visibility modifiers, constructor and its types, nested classes, String class. UML diagrams to describe classes and relationships.	**6 hrs**
3	**Chapter No. 3:Inheritance:** Introduction, types of Inheritance, constructors, Abstract class,Aggregation: classes within classes	**6 hrs**
Unit –II		
4	**Chapter No. 4:Virtual Functions and Polymorphism:** Virtual functions, Friend functions, static functions, The 'this' pointer	**6 hrs**
5	**Chapter No. 5:Templates and Exception Handling:** Function and class templates.Introduction to exceptions, Throwing an Exception, Try Block, Exception Handler (Catching an Exception), Multiple exceptions. Exceptions with arguments	**6hrs**
6	**Chapter No. 6:Design Patterns:** Creational, Structural and Behavioural design patterns.	**4 hrs**
Unit –III		
7	**Chapter No. 7:Streams and Files:** Stream classes, File I/O with streams.	**4 hrs**
8	**Chapter No. 8:Standard Template Library:** container classes**:** Sequence and Associative Containers	**4 hrs**

Textbooks

1. Robert Lafore, "Object oriented programming in C++", 4th Edition, Pearson education,

Reference Books

1. Lippman S B, Lajorie J, Moo B E, C++ Primer, 5ed, Addison Wesley, 2013.
2. Herbert Schildt: The Complete Reference C++, 4th Edition, Tata McGraw Hill

Course Code: 18ECSC206	Course Title: Microcontroller Programming& Interfacing	
L-T-P-SS: 3-0-1	Credits: 4	Contact Hrs: 3+2 hrs
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 40		Exam Duration: 3 hrs

Content	Hrs
Unit – I	
Chapter No. 1.The 8051 Architecture Introduction, 8051 Microcontroller hardware, input/output pins, ports & circuits, External memory,	04 hrs
Chapter No. 2. Assembly Programming Introduction, addressing modes, External Data Moves, Code Memory Read Only Data Moves / Indexed Addressing mode, PUSH and POP opcodes, Data exchanges, assembler directives, example programs. Byte level logical Operations, Bit level Logical Operations, Rotate and Swap Operations, Example Programs. Arithmetic Operations: Flags, Incrementing and Decrementing, Addition, Subtraction, Multiplication and Division, Decimal Arithmetic, Example Programs. The JUMP and CALL Program range, Jumps, Call and Subroutines, Example programs	12hrs +08 hrs (Lab)
Unit – II	
Chapter No. 3. Timer/Counter & Serial Port Programming. C Data Types and Time delay computation in 8051 Counters and Timers, Programming 8051 Timers/counters in different modes, Basics of Serial Communication, RS232 standards, 8051 connection to RS232, 8051 serial port Programming.	12 hrs
Chapter No. 4. Interrupts Programming 8051 Interrupts, Programming Timer Interrupts, Programming external hardware interrupts, Programming the Serial Communication Interrupts, Interrupt Priority in the 8051, Interrupt programming.	04 hrs
	4 hrs
Unit – III	
Chapter No. 5. Interfacing to Peripheral Devices Interfacing 8051 to LEDs, DIP switches, BCD Decoder display, 7 Segment Display, LCD, Keypad, DAC, ADC, Stepper Motor and DC Motor	08hrs +12 Hrs (Lab)

Text Books (List of books as mentioned in the approved syllabus)

2. Ayala.K.J, “The 8051 Microcontroller”, 3rd.,CENGAGELearning, 2007.
3. Mazidi.M.A, Mazidi.J.G and McKinlay.R.D, “The 8051 Microcontroller and Embedded Systems-using Assembly and C”, 2ed, PHI 2006/Pearson, 2006.

References

1. Ayala.K.J., Gadre D.V., “The 8051 Microcontroller & Embedded Systems using Assembly and C”, 1ed., CENGAGE Learning, 2010
2. V. Udayashankara, M.S. Mallikarajunaswamy, ”8051 Microcontroller Hardware, Software and Applications”, 1ed., Tata McGraw Hill, 2009.

Scheme for End Semester Assessment (ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter Numbers	Instructions
I	Q.No.-1, Q.No.-2, Q.No.-3	1 & 2	Solve Any **2** out of **3**
II	Q.No.-4, Q.No.-5, Q.No.-6	3 &4	Solve Any **2** out of **3**
III	Q.No.-7	5	Solve Any **1** out of **2**
	Q.No.-8	5	

Program: Bachelor of Engineering		
Course Title: **Object** Oriented **Programming with C++ Lab**		Course Code: **18ECSP203**
L-T-P: **0-0-1.5**	Credits: **1.5**	Contact Hrs: **3 hrs/week**
ISA Marks: **80**	ESA Marks: **20**	Total Marks: **100**
Teaching Hrs: **39**	Exam Duration: **3hrs**	

Experiments	**Lab assignments/experiment**
2-Demonstration	Introduction to Code Blocks IDE (Integrated Development Environment), C++ programming basics.
4–Exercise	Classes and objects, Inheritance, Polymorphism, Templates and Exceptions Handling
2-Structured Enquiry	Classes and objects, Inheritance, Polymorphism, Templates and Exceptions Handling
1-Open Ended	Data types, Classes and Objects, Inheritance polymorphism, Exception Handling. Design patterns

Text Book:

1. Robert Lafore, "Object oriented programming in C++", 4th Edition, Pearson education.

Reference Books:

1. Lippman S B, Lajorie J, Moo B E, C++ Primer, 5ed, Addison Wesley, 2013.
2. Herbert Schildt: The Complete Reference C++, 4th Edition, Tata McGraw Hill
1.

Evaluation :

Students Assessment Through CIE (80%) + SEE (20%)

	Assessment	**Weightage in Marks**
Continuous Internal Evaluation (80%)	Exercises	40
	Structured Enquiry	20
	Open Ended Experiment	20
Semester End Examination (20%)	Structured Enquiry	**20**
	Total	**100**

Program: Bachelor of Engineering			
Course Title: **JAVA Programming**		Course Code: 19ECSP301	
L-T-P:**1-0-1.5**	Credits: **2.5**	Contact Hrs: 4 Hrs/week	
ISA Marks: **80**	ESA Marks: **20**	Total Marks: **100**	
Teaching Hrs: **52**	Exam Duration: **3hrs**		
Unit –I			
1	**JAVA Language Fundamentals:** Java Features, Programming basics, Arrays and Strings, classes and objects		**4 Hrs**
2	**Inheritance**: Introduction, types of inheritance, static and dynamic polymorphism.		**2 Hrs**
Unit –II			
3	**Interfaces and Exception Handling:** Introduction,Create and implement interfaces, Exception handling,		**2 Hrs**
4	**Generics and Collections Frame work:** Introduction to generic programming, Collections: Interfaces: List, Set, Queue Classes: ArrayList, LinkedList and HashSet, Map		**2 Hrs**
Unit –III			
5	**Lambda Expressions:** Functional programming, Functional interface, Bulk operations on collections		**2hrs**
6	**Java Database Connectivity (JDBC):** Introduction, Drivers, Interfaces and classes to develop data base applications, case study		**2 Hrs**

Text Books:

1. JAVA The Complete Reference, Herbert Schildt, 10th Ed, 2017, McGraw-Hill

Reference Book

1. Kathy Sierra and Bert Bates, Head First Java: A Brain-Friendly Guide, 2nd Edition, O'Reilly Media
2. Introduction to Java Programming, Liang Y D, Pearson, 11^{th} Edition

Program: **Bachelor of Engineering**		
Course Title: **Semantic Web**		Course Code:**19ECSE303**
L-T-P: **3-0-0**	Credits: **3**	Contact Hrs: **3hrs/week**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs: **40**	Exam Duration: **03 hrs**	

Unit –I		
1	**Introduction to Semantics** History of the Web, Limitations, Vision of Semantic Web, Principles, Data Integration Across Web, Data Modeling Methods, Semantic Relationships, Metadata, Perpetual Data	**4 hrs**
2	**Expressing Meaning** Triple Store, Merging Graphs, Querying: Case Study	**4 hrs**
3	**Using Semantic Data** Query Language, Feed Forward Inference, Searching for Connections, Linked Data, Freebase	**8 hrs**
Unit –II		
4	**Working with Semantics** RDF—The Basis of the Semantic Web, OWL, Metadata with RDF, Metadata Taxonomies, Ontology	**8 hrs**
5	**Reasoning and Social Web** Reasoning types: Approximate Reasoning and Bounded Reasoning, Social Semantic Web, Semantic Crawlers	**8 hrs**
Unit –III		
6	**Semantic Modeling** Semantic Modeling, Semantic Web Applications, Logic for Semantic Web, Case Studies: Dr. Watson, Yahoo! SearchMonkey	**8 hrs**

Text Books

1. Grigoris Antoniou, Paul Groth, Frank van Harmelen and Rinke Hoekstra, A Semantic Web Primer, MIT Press; 3rd edition, 2012.
2. Toby Segaran, Colin Evans, and Jamie Taylor, Programming the Semantic Web: Build Flexible Applications with Graph Data, O'Reilly Media; 2 edition, July 2009.

Reference Books:

1. Pascal Hitzler, Markus Krötzsch, Sebastian Rudolph, Foundations of Semantic Web Technologies, Chapman and Hall; 1st edition, 2009.
2. Dean Allemang, and James Hendler, Semantic Web for the Working Ontologist, Effective Modeling in RDFS and OWL, Morgan Kaufmann; 2nd edition, 2011.
3. John Hebeler, Matthew Fisher, Ryan Blace, Andrew Perez-Lopez, and Mike Dean (Foreword), Semantic Web Programming, Wiley Publishers, 1 edition 2009.

Scheme for End Semester Assessment (ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter Numbers	Instructions

I	Q.No.-1, Q.No.-2, Q.No.-3	1, 2,3	Solve Any **2**
II	Q.No.-4, Q.No.-5, Q.No.-6	4,5	Solve Any **2**
III	Q.No.-7	6	Solve Any **1**
	Q.No.-8	6	

Course Title: Block Chain Technology		Course ode:19ECSE301
L-T-P: **2-0-1**	Credits: **3**	Contact Hrs: **3hrs/week**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs: **40**	Exam Duration: **3 hrs**	

	Unit –I	
1	**Introduction** Overview of Blockchain, History: Digital Money to Distributed Ledgers, Design Primitives: Protocols, Security, Consensus, Permissions, Privacy	**08 hrs**
2	**Blockchain Architecture and Design** Crypto primitives- Hash, Signature, Hashchain to Blockchain, basic consensus mechanisms, Requirements for the consensus protocols, Proof of Work, Proof of State, Scalability issues of consensus protocols	**08 hrs**
	Unit –II	
3	**Blockchain Contracts** Financial Services, Crowdfunding, Bitcoin Prediction Markets, Smart Property, Smart Contracts, Blockchain Development Platforms and APIs, Blockchain Ecosystem: Decentralized Storage, Communication, and Computation	**08 hrs**
4	**Etherium** Etherium transactions, accounts, smart contracts, smart contract development, Solidity basics, basic contracts, distributed storage, Etherium scaling	**08 hrs**
	Unit –III	
5	**Blockchain Applications** Blockchain in Financial Software and Systems: Settlements, KYC, InsuranceBlockchain for Government: Digital identity, land records and other kinds of record keeping between government entities, public distribution system social welfare systems	**08hrs**

Text Books:

1. Melanie Swan, “Blockchain: Blueprint for New Economy", 1st Edition, O'Reilly Media, 2014.

Reference Books:

1. ArshdeepBhaga, Vijay Madisetti, "Blockchain Applications: A Hands-On Approach", Paperback– January 31, 2017

Scheme for End Semester Assessment (ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter Numbers	Instructions

I	Q.No.-1, Q.No.-2, Q.No.-3	1,2	Solve Any **2**
II	Q.No.-4, Q.No.-5, Q.No.-6	3,4	Solve Any **2**
III	Q.No.-7, 8	5	Solve Any **1**

Course Title: The ARM Architecture		**Coursecode:19ECSE302**
L-T-P: 2-1-0	**Credits: 3**	**Contact Hrs: 3hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hrs: 30	**Exam Duration: 3 hrs**	

	Unit –I	
1	**ARM Embedded Systems and Processor Fundamentals** The RISC Design Philosophy , The ARM Design Philosophy, Embedded System Hardware, Embedded System Software, Registers, Current Program Status Register, Pipeline, Exceptions, Interrupts, and the Vector Table, Core Extensions, Architecture Revisions, ARM Processor Families	06 hrs
2	**Introduction to the ARM Instruction Set & Assembly Programming** Data Processing Instructions, Branch Instructions, Load-Store Instructions, Software Interrupt Instruction, Program Status Register Instructions, Loading Constants, ARMv5E Extensions, Conditional Execution, Thumb instruction set.	06 hrs
	Unit –II	
3	**Efficient C Programming** Overview of C Compilers and Optimization, Basic C Data Types, C Looping Structures, Register Allocation, Function Calls, Pointer Aliasing, Structure Arrangement, Bit-fields, Unaligned Data and Endianness, Division.	06 hrs
4	**Writing and Optimizing ARM Assembly Code** Writing Assembly Code, Profiling and Cycle Counting, Instruction Scheduling, Register Allocation, Conditional Execution, Looping Constructs, Bit Manipulation, Efficient Switches, Handling Unaligned Data.	06 hrs
	Unit –III	
5	**Introduction to LPC-2148 controller** Input output Ports, Pin select registers, Input output select registers, direction control and control registers, Introduction to interfacing standards	03 hrs
6	**ARM Interfacing** ARM interfacing to peripherals like LED, LCD, Seven segments, Motors, Converters, Keypad.	03 hrs

Text Books

1. Andrew N.Sloss et al, ARM System Developer's Guide- Designing and Optimizing System Software

Reference Books:

1. Marilyn Wolf, Computers as Components: Principles of embedded computing system design, Morgan Ka, 2012
2. Steve Furber, ARM System-on-chip Architecture, 2, Pearson, 2000

Tutorial Plan

Expt./ Job No.	assignments/experiment	No. of Lab. Slots per batch (estimate)
1	ALP on arithmetic instructions set	*01*
2	ALP on logical instructions set	01
3	ALP on loop and branch instructions	01
4	Interface LED and Seven segments to ARM for displaying message.	01
5	Interface LCD to ARM for displaying message.	01
6	Interface Keypad to read the characters	01
7	Rotate DC and stepper motor for variable speed and direction	01
8	Interface DAC to ARM controller	01

Scheme for End Semester Assessment (ESA)

UNIT	**8 Questions to be set of 20 Marks Each**	**Chapter Numbers**	**Instructions**
I	Q.No.-1, Q.No.-2, Q.No.-3	1,2	Solve Any **2** out of **3**
II	Q.No.-4, Q.No.-5, Q.No.-6	3,4	Solve Any **2** out of **3**
III	Q.No.-7, 8	5	Solve Any **1** out of **2**

Syllabus of New Courses of MTech

Computer Science and Engineering

2015 to 2020

Course Code: **16ECSE707**	Course Title: **Cryptography and Network Security**	
L-T-P: **3-0-0**	Credits: 3	Contact Hrs: 42
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 3		Exam Duration: 3 hrs

Ch. No	Content	Hrs
1	**Network Security Overview** **Common Attacks and Defense Mechanisms:** Eavesdropping, Cryptanalysis Password Pilfering, Identity Spoofing, Buffer-Overflow Exploitations, Repudiation, Intrusion, Traffic Analysis, Denial of Service Attacks, Marvelous Software. **Attacker Profiles:** Hackers, Script Kiddies, Cyber Spies, VICIOUS Employees, Cyber Terrorists, Hypothetical Attackers. **Basic Security Model.**	05
2	**Data Encryption Algorithms**	07

	Data Encryption Algorithm Design Criteria: ASCII Code, XOR Encryption, Criteria of Data Encryptions, implementation Criteria. **Data Encryption Standard :** Feistel's Cipher Scheme , DES Subkeys, DES Substitution Boxes , DES Encryption , DES Decryption and Correctness Proof., DES Security Strength. **Multiple DES**. **Advanced Encryption Standard:** AES Basic Structures., AES S-Boxes 60, AES-128 Round Keys , Add Round Keys Substitute-Byt, Shift-Ro, Mix-Colum, AES-128 Encryption, AES-128 Decryption and Correctness Proof, Galois Fields, Construction of the AES S-Box and Its Inverse , AES Security Strength. **Standard Block-Cipher Modes of Operations:** Electronic-Codebook Mode, Cipher-Block-Chaining Mode, Cipher-Feedback Mode Output-Feedback Mode, Counter Mode. **Stream Ciphers:** RC4 Stream Cipher, RC4 Security Weaknesses. **Key Generations**.	
3	**Public-Key Cryptography and Key Management** **Concepts of Public-Key Cryptography, Elementary Concepts and Theorems In Number Theory**: Modular Arithmetic and Congruence Re1attons, Modular Inverse. **Diffie-Hellman Key Exchange**, Key Exchange Protocol , Man-in-the-Middle Attacks , Elgamal PKC. **RSA Cryptosystem :** RSA Key Pairs, Encryptions, and Decryptions , RSA Parameter Attacks RSA Challenge Numbers. **Key Distributions and Management**: Master Keys and Session Keys , Public-Key Certificates CA Networks, Key Rings.	**05**
4	**Data Authentication**	**07**

	Cryptographic Hash Functions: Design Criteria of Cryptographic Hash F Unctions , Quest for Cryptographic Hash Functions, Basic Structure of Standard Hash Functions , SHA-512 , WHIRLPOOL , **Cryptographic Checksums**: Exclusive-OR Cryptographic Checksums , Design Criteria of MAC Algorithms , Data Authentication Algorithm. **HMAC :** Design Criteria of HMAC , HMAC Algorithm, **Offset Codebook Mode of Operations**: Basic Operations , OCB Encryption and Tag Generation , OCB Decryption and Tag Verification. **Birthday Attacks**: Complexity Upper Bound of Breaking Strong Collision, Resistance, Set Intersection Attack. **Digital Signature Standard, Dual Signatures and Electronic Transactions:** Dual Signature Applications, Dual Signatures and Electronic Transactions, **Blind Signatures and Electronic Cash:** RSA Blind Signatures , Electronic Cash .	
5	**Network Security Protocols in Practice** **Crypto Placements in Networks:** Crypto Placement at the Application Layer , Crypto Placement at the Transport Layer , Crypto Placement at the Network Layer , Crypto Placement at the Data-Link Layer , Hardware versus Software Implementations of, Cryptographic Algorithms. **Public-Key Infrastructure**: X.509 Public-Key Infrastructure , X.509 Certificate Formats **, IPsec: A Security Protocol at the Network Layer:** Security Association, Application Modes and Security Associations , AH Format , ESP Format Secret Key Determination and Distribution.	**06**
6	**Security Protocols at Transport and Application Layers**	**04**

	SSL Handshake Protocol , SSL Record Protocol. **PGP and SIMIME**: **Email Security Protocols**: Basic Email Security Mechanisms. PGP, S/MIME. **Kerberos' An Authentication Protocol:** Basic Ideas , Smgle-Realm Kerberos , Multiple-Realm Kerberos , **SSH: Security Protocols for Remote Logins .**	
7	**Wireless Network Security -1:** **Wireless Communications and 802 11 WLAN Standards:** WLAN Architecture, 802.11 Essentials Wireless Security Vulnerabilities. **WEP**: Device Authentication and Access Control, Data Integrity Check LLC Frame Encryption, Security Flaws of WEP. **WPA:** Device Authentication and Access Controls, TKIP Key Generations, TKIP Message Integrity Code , TKIP Key Mixing , WPA Encryption and Decryption , WPA Security Strength and Weaknesses.	**04**
8	**Wireless Network Security -2 :** **IEEE 802.11i/WPA2:** Key Generations 230, CCMP Encryptions and MIC 802.11i Security Strength and Weaknesses , **Bluetooth Security:** Piconets , Secure Pairings SAFER+ Block Ciphers, Bluetooth Algorithms E_1, E_{2l}, and E_{22}, Bluetooth Authentication, A PIN Cracking Attack , Bluetooth Secure Simple Pairing. **Wireless Mesh Network Security.**	**04**

Text Book:

1. Jiewang, "Network Security Theory and Practices", Springer Higher Higher Education, 2009

References:

1. William Stallings, Cryptography and Network Security Principles And Practices, 5th Edition, Pearson Publication, 2011.
2. Mark Stamp And Richard M Low, Applied Cryptanalysis, John Wiley & Sons, 2007

Course Code: 16ECSC711	Course Title: Distributed and Cloud Computing	
L-T-P: 4-0-0	Credits: 4	Contact Hrs: 4
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 55		Exam Duration: 3 hrs

Content	Hrs

Chapter No. 1: Distributed System Models and Enabling Technologies Scalable Computing over the Internet, Technologies for Network-Based Systems, System Models for Distributed and Cloud Computing, Software Environments for Distributed Systems and Clouds.	6 hrs
Chapter No. 2: Virtual Machines and Virtualization of Clusters and Data Centers Implementation Levels of Virtualization, Virtualization Structures/Tools and Mechanisms, Virtualization of CPU, Memory, and I/O Devices, Virtual Clusters and Resources Management, Virtualization for Data-center Automation.	8 hrs
Chapter No. 3: Cloud Platform Architecture over Virtualized Data Centers Cloud Computing and Service Models, Architectural Design of Compute and Storage Clouds, Public Cloud Platforms.	8 hrs
Chapter No. 4: Cloud Programming and Software Environments Features of Cloud and Grid Platforms, Parallel and Distributed Programming Paradigms, Programming Support of Google App Engine, Emerging Cloud Software Environments.	10 hrs
Chapter No. 5: Cloud Resource Management and Scheduling PoliISAs and mechanisms for resource management, Applications of control theory to task scheduling on a cloud, Stability of a two-level resource allocation architecture, Feedback control based on dynamic thresholds, Coordination of specialized autonomic performance managers, A utility-based model for cloud-based web services. Resource bundling; combinatorial auctions for cloud resources, Scheduling algorithms for computing clouds. Fair queuing, Start-time fair queuing, Borrowed virtual time, Cloud scheduling subject to deadlines, Scheduling MapReduce applications subject to deadlines, Resource management and dynamic application scaling.	12 hrs
Chapter No. 6: Cloud Security	11 hrs

Cloud security risks, Security; the top concern for cloud users, Privacy; privacy impact assessment, Trust, Operating system security, Security of virtualization. Security risks posed by shared images, Security risks posed by a management OS, Xoar - breaking the monolithic design of the TCB, A trusted virtual machine monitor.	

Text Books:

1. Kai Hwang, Geoffrey C. Fox, Jack J. Dongarra, "Distributed and Cloud Computing from Parallel Processing to the Internet of Things", Morgan Kaufman, Elsevier- 2012.
2. Dan C. Marinescu "Cloud Computing Theory and Practice", Morgan Kaufman, Elsevier-2013.

Reference Books:

1. Rajkumar Buyya, Christian Vecchiola, S.Thamarai Selvi "Mastering Cloud Computing", McGraw Hill Education (India) Pvt. Limited, 2013.
2. Anthony T. Velte, Toby J. Velte, Robert Elsenpeter: Cloud Computing, A Practical Approach, McGraw Hill, 2010.

Course Code: 16ECSC712	Course Title: Computer Networks	
L-T-P: 4-0-0	Credits: 4	Contact Hrs: 4
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 55		Exam Duration: 3 hrs

Content	Hrs
Chapter No.1 Review of Basic Concepts Basic definitions in networks, Types of Packet-Switched Networks, TCP/IP protocol Model, Performance.	5 hrs
Chapter No. 2: Data Links Layer and LAN networks Data Links, Error Detection and Correction on Links, Flow Control on Links, Link Access by Multiple, LANs and Basic Topologies, LAN Protocols, Networks of LANs, MAC/IP Address Conversion Protocols, Spanning-Tree Protocol (STP), Virtual LANs (VLANs)	10 hrs
Chapter No. 3: Network Layer Addressing Scheme in the Internet, IP Packets and Basic Routing PoliISAs, Path Selection Algorithms, Intradomain Routing Protocols, Interdomain Routing Protocols, Congestion Control at the Network Layer.	8 hrs
Chapter No. 4:Transport Layer Overview of the Transport Layer, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), TCP Congestion Control	8 hrs
Chapter No.5: Network Queues and Delay Analysis Little's Theorem, Birth-and-Death Process, Queueing Disciplines, Markovian FIFO Queueing Systems, Non-Markovian and Self-Similar Models, Networks of Queues	10 hrs
Chapter No. 6. Software-Defined Networking (SDN) and Beyond Software-Defined Networking (SDN), SDN-Based Network Model, Small-Size SDN Architectures, SDN Architectures for Clouds, Network Functions Virtualization (NFV)	8 hrs

Information-Centric Networking (ICN), ICN Security..	
Chapter No. 7: Wireless Sensor Networks Sensor Networks and Protocol Structures, Communication Energy Model, Clustering Protocols, Routing Protocols,	6 hrs

Text Book:

1. Computer and Communication Networks (2nd Edition) 2nd Edition by Nader F. Mir (Author) Pearson Education 2015
2. Larry L Peterson & Bruce S Davien *Computer Networks, 5th Ed* ,Morgan Kaufmann (Elsevier), 2011

References:

1. J. F. Kurose, K. W. Ross, Computer Networking, A Top-Down Approach 6th Ed, Pearson 2012.
2. Behrouz Forouzan, Data Communications and Networking, McGraw Hill, 4th ed. 2007
3. W. Stallings, Data and Computer Communications, Pearson, Ninth Edition, 2011.

Course Code: 16ECSC713	Course Title: Software Testing	
L-T-P :3-0-0	Credits: 4	Contact Hrs: 4 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 42		Exam Duration: 3 hrs

Content	Hrs
Chapter No. 1. Principles of Testing	3 hrs

Context of testing in producing software: About the chapter, The incomplete Car, Dijkstra's Doctrine, A test time , The cat and the saint, Test the test first, The pesticide paradox, The convoy and the rags, The police man on the bridge, The Ends of Pendulum, Men in black, Automation syndrome, Putting it all together.	
Chapter No. 2. Software Development Life Cycle Models Phases of Software Project: Requirements gathering and analysis, Planning, Design, Development or coding, Testing, Development and Maintenance, Quality, Quality assurance, and Quality Control, Testing, Verification and validation, Process model to represent different phases: Life cycle Models, Waterfall model, Prototyping and Rapid Application Development models, Spiral or Iterative model, The V model, Comparison of various life cycle models, References.	5 hrs
Chapter No. 3. Defect Testing White Box Testing: What is white box testing, Static testing, Static testing by humans, Static analysis tools: Structural testing, Unit /code fundamental testing, Code coverage testing, Code complexity testing, Black Box Testing: What is black box testing?, Why black box testing?, When to do black box testing?, How to do black box testing?, Requirement based testing, Positive and negative testing, Boundary value analysis, Decision tables, Equivalence participating , State based or graphic based testing, Compatibility testing, User documentation testing, Domain testing.	5 hrs
Chapter No. 4. Regression Testing What is regression testing?, Types of regression testing, When to do regression testing?, How to do regression testing?, Performing an initial "smoke" or "sanity" test, Understanding the criteria for selecting the test cases, Classifying the test cases, Methodology for selecting test cases, Resetting the test cases for regression testing, Concludes the results of regression testing, Best practices in regression testing.	4 hrs
Chapter No. 5. Unit Testing & Integration Testing What is integration testing?, Types of integration testing, Top-down integration, Bottom– up integration, Bi-directional integration, System integration, Choosing integration method, Integration testing as a phase of testing, Scenario testing, System scenarios, Use case scenarios, Defect bash, Choosing the frequency and duration of defect bash, Selecting right	5 hrs

product build, Communicating the object of defect bash, Setting up monitoring lab, Taking action and Fixing issues, Optimizing the effort involved in defect bash.	
Chapter No. 6. System and Acceptance Testing System Testing overview: Why is System testing done?, Functional versus Non-Functional testing, Functional system testing, Design/Architecture verification, Business vertical testing, Development testing, Beta testing, Certification, Standards and testing compliance, Non – Function testing, Setting up the configuration, Coming up with entry/exit criteria, Balancing key resources, Scalability testing, Reliability testing, Stress testing, Interoperability testing, Acceptance testing, Acceptance criteria, Selecting test cases for acceptance testing, Executing acceptance tests, Summary of testing phases, Multiphase testing model.	5 hrs
Chapter No. 7. Performance Testing Introduction, Factors governing performance testing, Methodology for performance testing, Collecting requirements, Writing test cases, Automating performance test cases, Executing performance test cases, Analyzing the performance test results, Performance tuning, Performance bench marking, Capacity planning, Tools for performance testing, Processes for performance testing, Challenges, Problems and Exercises.	5 hrs
Chapter No. 8. Test Planning, Management and Execution Introduction, Test planning, Preparing a test plan, Scope management – deciding features to be tested / not tested, Deciding test approach/strategy, Setting up criteria for testing, Identifying responsibilities, Staffing, and Training needs, Identifying resource requirements, Identifying test deliverables, Testing tasks – Size and effort estimation, Activity breakdown and scheduling, Communication management, Risk management: Test management, Choice of standards, Test infrastructure management, Test people management, Integration with product release, Test process, Putting together and base lining a test plan, Test case specifications, Update of traceability matrix, Identifying possible candidates for automation, Developing and base lining test cases. Executing test cases and keeping traceability matrix current, Collecting and analyzing matrix	5 hrs
Chapter No. 9. Reporting and Software Test Automation	5 hrs

Preparing test summary report, Recommending product release criteria: Test reporting, Recommending product release, Best practices, Process related best practices, People related best practices, Technology related best practices, What is Test automation?, Terms used in automation, Skills needed for automation, What to automate?, Scope of automation-Identifying the types of testing amenable to automation, Automating areas less prone to change, Automate tests that pertain to standards, Management aspects in automation, Design and architecture for automation.	
Text Book: 1. Desikan Srinivasan and Gopalswamy, Ramesh, Software Testing- Principles and Practices, Published by Person Education, 2^{nd} edition, Pearson Education, 2007. ***References:*** 1. Edward Kit, Software Testing in the Real World Improving the Process, Published by Person Education, 1995. 2. Ron, Patton, Software Testing, 2^{nd} edition Person Education, 2004. 3. Marnie, Hutcheson L., Software Testing Fundamentals, Wiley India, 2003. **4.** Roger S. Pressman, Software Engineering A Practitioners Approach, 5^{th} edition McGraw Hill.	

<table>
<tr><td colspan="2">Course Code: 16ECSC801</td><td colspan="3">Course Title: Data Mining and Business Analytics</td></tr>
<tr><td colspan="2">L-T-P: 4-0-0</td><td>Credits: 4</td><td colspan="2">Contact Hrs:4 hrs/week</td></tr>
<tr><td colspan="2">ISA Marks: 50</td><td>ESA Marks: 50</td><td colspan="2">Total Marks: 100</td></tr>
<tr><td colspan="2">Teaching Hrs: 50 hrs</td><td></td><td colspan="2">Exam Duration: 3 hrs</td></tr>
<tr><td>1</td><td colspan="3">Introduction to Data Mining
Fundamentals of data mining, Data mining Functionalities, Classification of Data Mining Systems, Major issues in Data Mining, Data Warehouse and OLAP Technology for Data mining: Data Warehouse, Multidimensional Data Model, Data Warehouse Architecture.</td><td>06 hrs</td></tr>
<tr><td>2</td><td colspan="3">Association Rule Mining
Mining Frequent Patterns, Associations: Basic Concepts, EffiISAnt and Scalable Frequent Itemset Mining methods (Apriori Algoithm, improving effiISAncy of Apriori, Mining frequent Itemsets without Candidate generation, using vertical data formats). Mining various kinds of association rules, from association analysis to Correlation analysis.</td><td>06hrs</td></tr>
<tr><td>3</td><td colspan="3">Analytical Characterization & Statistical Measures: Analytical Characterization: Analysis of Attribute Relevance, Mining Descriptive Statistical Measures in Large Databases</td><td>04 hrs</td></tr>
<tr><td>4.</td><td colspan="3">Classification and Prediction</td><td>08 hrs</td></tr>
</table>

	Classification, Prediction, Classification by Decision tree Induction, Bayesian classification, Associative classification, Prediction: Linear Regression, non-linear regression.	
5	**Cluster Analysis** Types of data in cluster analysis, Categorization of major clustering methods, Classical Partitioning methods : k-Means and k-Medoids.	**08 hrs**
6	**Graph Mining & Social Network Analysis** Graph mining: Methods for Mining Frequent Subgraphs, Mining Variant and Constrained substructure patterns, Social Network Analysis: Social networks, Characteristics of Social Networks,Link Mining, Mining on Social networks	**08 hrs**
7	**Business Analytical Modeling** Analytical Modeling by Factor and Cluster Analysis, Analytical Modeling by Logistics Regression and Discriminant Analysis.	**05 hrs**
8	**Segmentation of Target Market** Segmentation of primary target market by Heuristic Modeling such as RFM (Recency, Frequency, Monetary) analysis, Segmentation of target market based on large databases using Decision Tree approaches such as CHAID (Chi-square Automatic Interaction Detection) and other Classification and Regression Trees.	**05hrs**

Text Book

1. Jiawei Han and MichelineKamber, Data Mining: Concepts and Techniques, Second Edition, Elsevier.
2. Purba Halady Rao, Business Analytics: An Application Focus, PHI, New Delhi, 2013.

References

1. Michael Berry and Gordon Linoff, *Data Mining Techniques,*Wiley Publishing, 2004.
2. Kimball and Ross, The Data Warehouse Toolkit, Second Edition, John Wiley & Sons, 2002.
3. T. Davenport, "Competing on Analytics," Harvard Business Review (Decision Making), January 2006.

Course Code: 16ECSC801	Course Title: **Data Mining and Business Analytics**		
L-T-P: **4-0-0**	Credits: **4**	Contact Hrs:**4 hrs/week**	
ISA Marks: 50	ESA Marks: 50	Total Marks: 100	
Teaching Hrs: **50 hrs**		Exam Duration: **3 hrs**	

1	**Introduction to Data Mining** Fundamentals of data mining, Data mining Functionalities, Classification of Data Mining Systems, Major issues in Data Mining, Data Warehouse and OLAP Technology for Data mining: Data Warehouse, Multidimensional Data Model, Data Warehouse Architecture.	**06 hrs**
2	**Association Rule Mining** Mining Frequent Patterns, Associations: Basic Concepts, EffiISAnt and Scalable Frequent Itemset Mining methods (Apriori Algoithm, improving effiISAncy of Apriori, Mining frequent Itemsets without Candidate generation, using vertical data formats). Mining various kinds of association rules, from association analysis to Correlation analysis.	**06hrs**
3	**Analytical Characterization & Statistical Measures:** Analytical Characterization: Analysis of Attribute Relevance, Mining Descriptive Statistical Measures in Large Databases	**04 hrs**
4.	**Classification and Prediction**	**08 hrs**

	Classification, Prediction, Classification by Decision tree Induction, Bayesian classification, Associative classification, Prediction: Linear Regression, non-linear regression.	
5	**Cluster Analysis** Types of data in cluster analysis, Categorization of major clustering methods, Classical Partitioning methods : k-Means and k-Medoids.	**08 hrs**
6	**Graph Mining & Social Network Analysis** Graph mining: Methods for Mining Frequent Subgraphs, Mining Variant and Constrained substructure patterns, Social Network Analysis: Social networks, Characteristics of Social Networks,Link Mining, Mining on Social networks	**08 hrs**
7	**Business Analytical Modeling** Analytical Modeling by Factor and Cluster Analysis, Analytical Modeling by Logistics Regression and Discriminant Analysis.	**05 hrs**
8	**Segmentation of Target Market** Segmentation of primary target market by Heuristic Modeling such as RFM (Recency, Frequency, Monetary) analysis, Segmentation of target market based on large databases using Decision Tree approaches such as CHAID (Chi-square Automatic Interaction Detection) and other Classification and Regression Trees.	**05hrs**

Text Book

3. Jiawei Han and MichelineKamber, Data Mining: Concepts and Techniques, Second Edition, Elsevier.
4. Purba Halady Rao, Business Analytics: An Application Focus, PHI, New Delhi, 2013.

References

4. Michael Berry and Gordon Linoff, *Data Mining Techniques,*Wiley Publishing, 2004.
5. Kimball and Ross, The Data Warehouse Toolkit, Second Edition, John Wiley & Sons, 2002.
6. T. Davenport, “Competing on Analytics,” Harvard Business Review (Decision Making), January 2006.

Course Content

Course Code: 17ECSE706 **Course Title: Embedded Systems.**

Teaching Hours: 42 hours **ESA: 50 marks** **ISA: 50 marks** **L-T-P: 3-0-1**

Unit–I	
Chapter 1: The 8051 Architecture Introduction, 8051 Microcontroller hardware, input/output pins, ports & circuits, External memory.	**6 hours**
Chapter 2: Addressing modes & operations Introduction, addressing modes, external data Moves. Code Memory Read Only Data Moves / Indexed Addressing mode, PUSH and POP opcodes, Data exchanges, example programs. Byte level logical Operations, Bit level Logical Operations, Rotate and Swap Operations, Example Programs. Arithmetic Operations: Flags, Incrementing and Decrementing, Addition, Subtraction, Multiplication and Division, Decimal Arithmetic, Example Programs.	**7 hours**
Chapter 3: Jump and Call Instructions The JUMP and CALL Program range, jump calls and Subroutines, Example programs	**4 hours**
Unit–II	
Chapter 4: 8051 Programming in C Data Types and Time delays in 8051C, I/O Programming, Logic operations, Data Conversion programs, Data serialization.	**4 hours**

Chapter 5: 8051 Timer/Counter Programming in Assembly and C Programming 8051 Timers, Counter Programming, Programming Timer 0 and Timer1 in 8051.	**4 hours**
Chapter 6: 8051 Serial Port Programming in Assembly and C Basics of Serial Communication, 8051 connection to RS232, 8051 serial port Programming in Assembly, 8051 serial port Programming in C.	**4 hours**
Chapter 7: 8051 Interrupts Programming in Assembly and C 8051 Interrupts, Programming Timer Interrupts, Programming external hardware interrupts, Programming the Serial Communication Interrupts, Interrupt Priority in the 8051, Interrupt programming in assembly and C.	**5 hours**
Unit–III	
Chapter 8: 8051 Interfacing techniques Interfacing 8051 to LEDs, DIP switches, BCD Decoder display, 7 Segment Display, Timers hyperterminal (Serial Communication)	**4 hours**
Chapter 9: 8051 Interfacing to peripheral devices Interfacing 8051 to LCD, Keypad, DAC, parallel and serial ADC, Stepper Motor and DC Motor.	**4 hours**
Embedded Systems Lab: Experiments on all the above mentioned chapters to be conducted.	

Text Books

1. Ayala.K.J, “The 8051 Microcontroller Architecture, Programming & Applications”, 2ed., Penram International, 2006
2. Mazidi.M.A, Mazidi.J.G and McKinlay.R.D, “The 8051 Microcontroller and Embedded Systems-using Assembly and C”, 2ed, PHI 2006/Pearson, 2006

Reference

1. Hall.D.V, “Microprocessors and Interfacing”, Revised 2ed., TMH,2006

MOBILE APPLICATION DEVELOPMENT SEMESTER – III			
Subject Code	17ECSE803	ISA Marks	50
Number of Lecture Hours/Week	03	ESAMarks	50
Total Number of Lecture Hours	42hrs + 2hr/week Lab	Exam Hours	03
CREDITS – 3-0-1			

Course objectives: This course will enable students to

- Analyze system requirements for mobile applications.
- Apply of mobile development frameworks.
- Demonstrate mobile application design.
- Demonstrate and implement mobile application.

Module -1	**Teaching Hours**
Introduction to mobile communication and computing: Introduction to mobile computing, Novel applications, limitations and GSM architecture, Mobile services, System architecture, Radio interface, protocols, Handover and security. Smart phone operating systems and smart phones applications.	**8 Hours**
Module -2	
Fundamentals of Android Development: Introduction to Android., The Android 4.1 Jelly Bean SDK, Understanding the Android Software Stack, Installing the Android SDK, Creating Android Virtual Devices, Creating the First Android Project, Using the Text View Control, Using the Android Emulator.	**8 Hours**
Module – 3	
The Intent of Android Development, Four kinds of Android Components: Activity, Service, Broadcast Receiver and Content Provider. Building Blocks for Android Application Design, Laying Out Controls in Containers. Graphics and Animation: Drawing graphics in Android, Creating Animation with Android's Graphics API.	**8 Hours**
Module-4	
Creating the Activity, Working with views: Exploring common views, using a list view, creating custom views, understanding layout. Using Selection Widgets and Debugging Displaying and Fetching Information Using Dialogs and Fragments. Multimedia: Playing Audio, Playing Video and Capturing Media. Advanced Android Programming: Internet, Entertainment, and Services.	**9 Hours**
Module-5	
Displaying web pages and maps, communicating with SMS and emails,. Creating and using content providers: Creating and consuming services, publishing android applications	**9 Hours**

Course outcomes:
The students should be able to: • Describe the requirements for mobile applications • Explain the challenges in mobile application design and development • Develop design for mobile applications for specific requirements • Implement the design using Android SDK • Implement the design using Objective C and iOS • Deploy mobile applications in Android and iPone marketplace for distribution
Mobile Application Lab: To develop Simple t o Complex Mobile Applications
Text Books: 1. Mobile Computing: (technologies and Applications-N. N. Jani S chand 2. B.M.Hirwani- Android programming Pearson publications-2013 3. W. Frank Ableson, Robi Sen and C. E. Ortiz - **Android in Action**, Third Edition-2012 DreamTech Publisher

MOBILE APPLICATION DEVELOPMENT SEMESTER – III			
Subject Code	17ECSE803	ISA Marks	50
Number of Lecture Hours/Week	03	ESAMarks	50
Total Number of Lecture Hours	42hrs + 2hr/week Lab	Exam Hours	03
CREDITS – 3-0-1			

Course objectives: This course will enable students to

- Analyze system requirements for mobile applications.
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Module -1	Teaching Hours
Introduction to mobile communication and computing: Introduction to mobile computing, Novel applications, limitations and GSM architecture, Mobile services, System architecture, Radio interface, protocols, Handover and security. Smart phone operating systems and smart phones applications.	**8 Hours**
Module -2	
Fundamentals of Android Development: Introduction to Android., The Android 4.1 Jelly Bean SDK, Understanding the Android Software Stack, Installing the Android SDK, Creating Android Virtual Devices, Creating the First Android Project, Using the Text View Control, Using the Android Emulator.	**8 Hours**
Module – 3	
The Intent of Android Development, Four kinds of Android Components: Activity, Service, Broadcast Receiver and Content Provider. Building Blocks for Android Application Design, Laying Out Controls in Containers. Graphics and Animation: Drawing graphics in Android, Creating Animation with Android’s Graphics API.	**8 Hours**
Module-4	
Creating the Activity, Working with views: Exploring common views, using a list view, creating custom views, understanding layout. Using Selection Widgets and Debugging Displaying and Fetching Information Using Dialogs and Fragments. Multimedia: Playing Audio, Playing Video and Capturing Media. Advanced Android Programming: Internet, Entertainment, and Services.	**9 Hours**
Module-5	
Displaying web pages and maps, communicating with SMS and emails,. Creating and using content providers: Creating and consuming services, publishing android applications	**9 Hours**

Course outcomes:
The students should be able to: • Describe the requirements for mobile applications • Explain the challenges in mobile application design and development • Develop design for mobile applications for specific requirements • Implement the design using Android SDK • Implement the design using Objective C and iOS • Deploy mobile applications in Android and iPone marketplace for distribution
Mobile Application Lab: To develop Simple t o Complex Mobile Applications
Text Books: 4. Mobile Computing: (technologies and Applications-N. N. Jani S chand 5. B.M.Hirwani- Android programming Pearson publications-2013 6. W. Frank Ableson, Robi Sen and C. E. Ortiz - **Android in Action**, Third Edition-2012 DreamTech Publisher

Program: Master of Technology		
Course Title: **Applied Mathematics**		Course Code: **18ECSC701**
L-T-P:**3-0-1**	Credits: **3**	Contact Hrs: **3 hrs/week**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs:**42**	Exam Duration: **3 hrs**	

1	**Introduction to Statistics** Statistical Thinking, Collecting data, Statistical Modeling Framework, Measure of Central Tendency and Variance, Importance of Data symmetry and Display, Graphical and Tabular Display.	**04 hrs**
2	**Discrete Random Variables and Probability Distribution** Discrete Random variables, Probability distributions and Probability mass function, Cumulative distribution function, Mean and Variance of a discrete random variable, Discrete Uniform distribution, Binomial distribution, Geometric distribution, Poisson distribution, Applications.	**07 hrs**
3	**Continuous Random Variables and Probability Distributions** Continuous random variables, Probability distributions and probability density functions, cumulative distribution functions, Mean and Variance of a continuous random variable, Uniform distribution, Normal Distribution, Normal approximation to Binomial and Poisson distribution, Exponential distribution.	**07hrs**
4	**Testing of Hypothesis** Estimation theory, Hypothesis testing, Inference on the mean of population (variance known and unknown) Inference on the variance of a normal population, Inference on a population proportion, Testing for Goodness of fit, Inference for a difference in Means(variances known), Inference for a difference in means of two normal distributions (variances unknown), Inference on the Variances of two normal populations, Inference on two population proportions.	**08hrs**

5	**Simple Linear Regression and Correlation** Simple Linear Regression, Properties of Least square Estimators and Estimation of Variances, Transformations to a Straight line, Correlation, Multiple linear regression model, Least square Estimation of parameters, Matrix approach to multiple linear regression, Properties of least square estimators and estimation of variance.	**06 hrs**
6	**Queuing Theory 1 :** Basics of queuing models, Model I (M /M/ 1): (∞/FIFO), Single Server with Infinite Capacity, Model II (M/M/s): (∞/FIFO), Multiple Server with Infinite Capacity	**05 hrs**
7	**Queuing Theory 2:** Model III (M/M/1): (k/FIFO), Single Server with Finite Capacity, Model IV (M/M/s): (k/FIFO), Multiple Server with Finite Capacity.	**05 hrs**

References:

1. Douglas C Montgomery, George C Runger, Applied Statistics for Engineers, 2nd Edition,John Wiley and Sons, ISBN-0-471-170027-5.
2. Richard I Levin, David S Rubin, Statistics for Management, 6th Edition, Prentice Hall India.
3. Willian W Hines, Douglas C Montgomery, Probability and Statistics in Engineering, 2nd Edition, John Wiley and Sons.
4. V. Sundarapandian, Probability, Statistics and Queuing theory, PHI, 2009.
5. Arnold Oral Allen, Probability, statistics, and queuing theory: with computer science applications, Gulf Professional Publishing, Edition: 2 ,28-Aug-1990

Course Content

Course Code: **18ECSC702**	Course Title: **Internet Of Things**	
L-T-P: **3-0-1**	Credits: **4**	Contact Hrs: **42**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs: **42**		Exam Duration: **3 hrs**

Content	Hrs
Chapter No 1. Introduction to Internet of Things (IoT): Definition & Characteristics of IoT, Physical Design of IoT: IoT protocols, Logical Design of IoT: IoT functional blocks, communication models and APIs.	**4**
Chapter No 2. IoT Enabling Technologies: Wireless Sensor Networks, Cloud Computing, Big Data Analytics, Communication Protocols, Embedded Systems, IoT Levels and Deployment Templates.	**6**
Chapter No 3. Domain specific IoTs: Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health and Lifestyle.	**6**
Chapter No 4. IoT Platforms Design Methodology: IoT Design Methodology, Case Study on IoT System for Weather Monitoring.	**4**
Chapter No 5. IoT systems – Logical design using Python: Introduction to Python, Data types, data structures, Control of flow, functions modules, packages, file handling, data/time operations, classes, Python packages - JSON, XML, HTTPLib, URLLib, SMTPLib.	**6**
Chapter No 6. IoT Physical Devices and Endpoints: Basic building blocks of an IoT device, Exemplary device: Rasyberry Pi, interface (serial, SPI, I2C), Programming Rasyberry Pi with Python.	**6**
Chapter No 7. IoT Physical Servers & Cloud Offerings:	**5**

Introduction to Cloud Storage models and communication APIs ,Webserver – Web server for IoT, Cloud for IoT, Python web application framework, Designing a RESTful web API	
Chapter No 8. Case Studies Illustrating IoT Design: Home Automation-smart lighting, home intrusion detection, Cities-smart parking.	**5**

Text Books :

1. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547

References:

1. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759

Course Content

Course Code: 18ECSC704	Course Title: Computer Networks	
L-T-P-Self Study: 3-0-1	Credits: 4	Contact Hrs: 42
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 42		Exam Duration: 3 hrs

Content	Hrs
Chapter No. 1 Fundamental Concepts of computer Networks Basic Definitions in Data Networks, Applications, Requirements, Network Architecture, Packet Size and Optimizations, Performance.	4 hrs
Chapter No. 2 Data Links Layer Perspectives on Connecting, Encoding (NRZ, NRZI,Manchester, 4B/5B), Framing, Error Detection, Reliable Transmission, Ethernet and Multiple Access Networks.	8 hrs
Chapter No. 3 Network Layer : Data plane Overview of Network Layer, Router Architecture, The Internet Protocol (IP): IPv4, Addressing, IPv6, Generalized Forwarding and SDN.	8 hrs
Chapter No. 4 Network Layer : Control plane Introduction, Routing Algorithms, Intra-AS Routing in the Internet: OSPF, Routing Among the ISPs: BGP, The SDN Control Plane, ICMP: The Internet Control Message Protocol, Multicast, Multiprotocol Label Switching (MPLS).	8 hrs
Chapter No. 5Transport layer Introduction and Transport-Layer Services, Multiplexing and De-multiplexing, connectionless Transport: UDP, Connection-Oriented Transport: TCP, Principles of Congestion Control, TCP Congestion Control.	8 hrs

Chapter No. 6Application Layer Principles of Network Applications, The Web and HTTP, Electronic Mail in the Internet, DNS—The Internet's Directory Service, Peer-to-Peer Applications, Video Streaming and Content Distribution Networks.	6 hrs

Text Books (List of books as mentioned in the approved syllabus)

1. J. F. Kurose and K. W. Ross, "Computer Networking, A Top-Down Approach", 7th Ed, , Pearson , 2017
2. Larry L Peterson & Bruce S Davien, "Computer Networks A System Approach", 5th Ed , Morgan Kaufmann (Elsevier),, 2011

References

1. Nader F. Mir, Computer and Communication Networks, 2nd Edition, Pearson Prentice-Hall, 2015
BehrouzForouzan, Data Communications and Networking, 5th Ed, McGraw Hill, 2012.
2.
A S Tanenbaum, D J Wetherall, Computer Networks, 5th Ed., Prentice-Hall, 2010.
3.

Course Content

Course Code: **18ECSCP709**	Course Title: **Design and Analysis of Algorithms**	
L-T-P: 2-0-2	Credits: 4	Contact Hrs: 4hrs/week
CIA Marks: 50	SEE Marks: 50	Total Marks: 100
Teaching Hrs: 42		Exam Duration: 3 hrs

Content	Hrs
Chapter No. 1: Introduction Analysis Framework, Asymptotic Notations and Basic Efficiency Classes, Mathematical Analysis of Non-Recursive Algorithms and Mathematical Analysis of Recursive Algorithms.	6
Chapter 2: Hashing Technique Direct Address Table, Hash Table, Hash Function and Collision Resolution Techniques.	6
Chapter No. 3: Algorithm design techniques: **Divide and conquer:** General Method, Merge sort, quick sort, Matrix Computations **Greedy Technique:** General Method, Huffmann Coding, knapsack problem, Task Scheduling and minimum spanning tree. **Dynamic Programming:** General Method, Floyd-Warshall algorithm, String Editing, Longest Common Subsequence and shortest paths	15
Chapter No. 4: Combinatorial Problem solving Techniques: **Backtracking Method**: General Method, Sum of subsets, knapsack Problem and Game strategies **Branch and Bound method:** General Method, knapsack Problem,	15

Approximation algorithms and Randomized algorithms. **NP- Hard and NP Complete:** Examples, proof of NP-hardness and NP-completeness.	

Reference Books:

1. Introduction to Design and Analysis of Algorithms – Anany Levitin 3rd Edition, Pearson, 2012
2. T.H.Cormen, C.E.Leiserson, R.L.Rivest, C. Stein, Introduction to Algorithms, 3nd edition, MIT, 2009.
3. Michael T. Goodrich, Roberto Tamassia, Algorithm Design and Applications, Wiley Publications, 2015

Course Content

Course Code: **18ECSC710**	Course Title: **Distributed and Cloud Computing**	
L-T-P : 2-0-1	Credits: 3	Contact Hrs: 4 hrs./week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 42		Exam Duration: 3hrs

Content	Hrs
Chapter No. 1. Distributed System Models and Enabling Technologies Scalable Computing over the Internet, Technologies for Network-Based Systems, System Models for Distributed and Cloud Computing	04 hrs
Chapter No. 2. Virtual Machines and Virtualization of Clusters Implementation Levels of Virtualization, Virtualization Structures/Tools and Mechanisms, Virtualization of CPU, Memory, and I/O Devices, Virtual Clusters and Resources Management.	06 hrs

Chapter No. 3. Cloud Platform Architecture over Virtualized Data Centers Cloud Computing and Service Models, Architectural Design of Compute and Storage Clouds, Public Cloud Platforms.	06 hrs
Chapter No. 4. Cloud Programming and Software Environments Challenges and Opportunities in cloud application, architectural styles, workflows: co-ordination of multiple activities, MapReduce programming model.	06 hrs
Chapter No. 5. Cloud Resource Management Policies and mechanisms for resource management, Applications of control theory to task scheduling on a cloud, Stability of a two-level resource allocation architecture, Feedback control based on dynamic thresholds, Coordination of specialized autonomic performance managers.	08 hrs
Chapter No. 6. Cloud Resource Scheduling Resource bundling; combinatorial auctions for cloud resources, Scheduling algorithms for computing clouds. Fair queuing, Start-time fair queuing, Borrowed virtual time, Cloud scheduling subject to deadlines, Scheduling Map Reduce applications subject to deadlines.	06 hrs
Chapter No. 7. Cloud Security Cloud security risks, Security; the top concern for cloud users, Privacy; privacy impact assessment, Trust, Operating system security, Security of virtualization, Security risks posed by shared images, Security risks posed by a management OS, Xoar - breaking the monolithic design of the TCB, A trusted virtual machine monitor.	06 hrs

Text Book (List of books as mentioned in the approved syllabus)

1. Kai Hwang, Geoffrey C. Fox, Jack J. Dongarra, Distributed and Cloud Computing from Parallel Processing to the Internet of Things, 1, Elsevier, 2012
2. Dan C. Marinescu , Cloud Computing Theory and Practice, 1, Elsevier, 2013

References

1. RajkumarBuyya, Christian Vecchiola, S.ThamaraiSelvi , Mastering Cloud Computing, 1, McGraw Hil, 2013
2. Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, Cloud Computing, A Practical Approach, 1, McGraw Hil, 2010

Program: Master of Technology		
Course Title: **Software Engineering**		Course Code: **18ECSC712**
L-T-P: **2-0-1**	Credits: **3**	Contact Hrs: **3 hrs/week**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs: **42**	Exam Duration: **3 hrs**	

1	**Introduction to Software Engineering** Introduction to Software Engineering and A Generic view of process	**04 hrs**
2	**Process Models** Prescriptive Models, The waterfall model, Incremental process models, Evolutionary process models, Specialized process models, The Unified process. Agile view of process.	**06 hrs**
3	**Requirements engineering :**Requirements Engineering tasks, Initiating Requirements Engineering Process Eliciting Requirements, Elicitation Work Products ,Developing Use-Cases , Analysis Model, Negotiating Requirements and Validating requirements.	**05 hrs**
4	**Design Engineering** Design within the context of SE, Design process and design quality, Design concepts, The design Model, Pattern based software design, Architectural design: Software Architecture, Data design, Architectural styles and patterns, Architectural design,	**04 hrs**
5	**Overview of object-oriented concepts**	**06 hrs**

	Unified Modeling Language (UML). Class Model, State Model and Interaction Models: Use case, sequence and activity diagrams.	
6	**Object Oriented System Design** Reuse Plan, Breaking a system into sub-systems and organizing. Allocation of sub-systems to hardware and software. High Level Class Design: Design Optimization, Adjustment of Inheritance and Organizing a class design.	**07 hrs**
7	**Testing Strategies:** A strategic approach to software testing, Test strategies for conventional software, validation testing, system testing. Testing tactics: White box testing, basis path testing, control structure testing, black box testing, testing for specialized environments, architectures and applications.	**05 hrs**
8	**Project Management and Metrics:** Management spectrum, The people, product, process , metrics in the process and project domains, soft ware measurements, metrics for software quality. Project Estimation: Observations on estimation, the project planning process , software scope and feasibility , resources, software project estimation, Decomposition techniques, empirical estimation models	**05 hrs**

References:

1. Roger S Pressman, Software Engineering A practitioner Approach, Seventh Edition, McGrawHill International Edition, 2009
2. Blaha M, Rumbaugh, Object Oriented Modeling and Design with UML, Second, Pearson, 2008
3. Ian Sommerville, Software Engineering, Seventh Edition, Pearson education, 2004.
4. Ali Bahrami, Object Oriented System Development using U M Languages, Mc-Grawhill, 2008

Course Content

Course Code: **18ECSC713**	Course Title: **Image and Video Processing**	
L-T-P : 2-0-1	Credits: 3	Contact Hrs: : **4 hrs/week**
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 42		Exam Duration: 03

Content	Hrs
1. Fundamentals of Image processing and Image Transforms: Basic steps of Image processing system sampling and quantization of an Image – Basic relationship between pixels. Image Transforms: 2 D Discrete Fourier Transform, Discrete Cosine Transform (DCT), Discrete Wavelet transforms.	07
2. Image Enhancement: Spatial Domain methods: Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial filters, Sharpening Spatial filters. Frequency Domain methods: Basics of filtering in frequency domain, image smoothing, image sharpening, selective filtering.	08
3. Image Analysis: Spatial feature extraction, Transform features, Edge detection Boundary Extraction, Boundary representation, Region representation, Moment representation, Structure, Shape features, Texture, Scene matching & detection, Image segmentation and Classification Techniques.	**08**
4.Basics of Video Processing: Analog video, Digital Video, Time varying Image Formation models : 3D motion models, Geometric Image formation, Photometric Image formation, sampling of video signals, filtering operations	**07**

5. 2D Motion Estimation: Optical flow, pixel based motion estimation, Block matching algorithm, Mesh based motion Estimation, global Motion Estimation, Region based motion estimation, multi resolution motion estimation.	**06**
6. Video Segmentation and Tracking : Change detection, Spatiotemporal change detection, Motion segmentation, Motion tracking in video : Rigid object tracking and articulated object tracking	**06**

Text Books

1. R. C. Gonzalez and R. E. Woods, “Digital Image Processing,” 3rd edition, Pearson Education(Asia) Pte. Ltd/Prentice Hall of India, 2009.
2. M. Tekalp, “Digital Video Processing”, 2nd edition, Prentice Hall, USA, 2015.

References

1. Anil K. Jain, “Fundamentals of Digital Image Processing," Pearson Education (Asia) Pte. Ltd./Prentice Hall of India, 2004.
2. Alan C Bovik “ Essential Guide to Video Processing”, AP Elsevier publication, 2009
3. Z. Li and M.S. Drew, “Fundamentals of Multimedia,” Pearson Education (Asia) Pte. Ltd 2004.

Course Content

Course Code: 18ECSC711	Course Title: Machine Learning	
L-T-P : 2-0-1	Credits: 3	Contact Hrs: 3 per week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 42		Exam Duration: 3 Hrs

Content	Hrs
Chapter- 1: Introduction & Data Pre-Preprocessing Introduction to data mining, Introduction to Machine Learning, Applications of Machine Learning, Major tasks in data preprocessing - data reduction, data transformation and data Discretization, data cleaning and data integration.	8
Chapter - 2: **Mining Frequent Patterns, Associations and Correlations: Concepts and Methods** Basic Concepts, Efficient and Scalable Frequent Item set Mining Methods, finding interesting Patterns, Pattern Evaluation Methods, Applications of frequent pattern and associations, Advanced Frequent Pattern Mining- Frequent Pattern and Association Mining: A Road Map, Mining Various Kinds of Association Rules. Pattern Mining in Multilevel, Multidimensional Space.	7
Chapter- 3: Supervised Learning: Classification Model Evaluation and Selection, Techniques to Improve Classification Accuracy: ensemble Methods; Bayesian belief networks, Introduction to perceptron learning, Back propagation algorithm.	8
Chapter- 4: Unsupervised Learning: Cluster Analysis Partitioning methods, Hierarchical Methods, Density based methods, Outlier Detection.	7
Chapter- 5: Regression Analysis ANOVA, Linear Discriminant Analysis, Support Vector Machines	6

Chapter- 6: Reinforcement Learning Introduction to Reinforcement Learning (RL), Sequential Decision Problems, Passive RL, Active RL, Generalization in RL, Applications of RL.	6

Text Books (List of books as mentioned in the approved syllabus)

1. Jiawei Han, MichelineKamber, and Jian Pei, Data Mining: Concepts and Techniques, 3rd, Morgan Kaufmann, 2011
2. Pang-Ning, Michael Steinbach, Vipin Kumar, Introduction to Data Mining, Pearson Education, 2007

References

1. Ian H. Witten, Eibe Frank, Mark A. Hall, Data Mining - Practical Machine Learning Tools and Techniques, 3rd, Elsevier Inc, 2011
2. M. H. Dunham, “Data Mining: Introductory and Advanced Topics”, Pearson Education. 2008.

Program: III Semester Bachelor of Engineering (Electronics & Communication Engineering)			Teaching Hours
Course Title: Engineering Design		**Course Code: 17EECF201**	
L-T-P: 0-0-3	**Credits: 3**	**Contact Hours: 03 Hrs/week**	
ISA Marks: 80	**ESA Marks: 20**	**Total Marks: 100**	
Teaching Hours:	**Examination Duration: 2 Hrs**		
PART A			
Planning Introduction to Engineering Design, Problem Definition, Design attributes Gantt Chart, Design Objectives, Design Specifications			**02**
Conceptual Design Functional Analysis, Concept generation, Concept Evaluation			**03**
System Level Design Product Architecture, Configuration Design, Parametric Design			**03**
Detail Design Sub-system Design, Design Verification			**03**
PART B			
OrCAD Functional simulation of basic Analog and Digital application circuits using OrCAD eCAD tool			**01**
Schematic Capture of the reference design using using OrCAD eCAD tool.			**01**
Layout Design of the reference design using using OrCAD eCAD tool.			**01**
Creation of Symbols/Cell/Part			**01**
LabVIEW Introduction to LabVIEW and functional simulation of basic Analog and Digital application circuits in LabVIEW			**01**
Functional Simulation of the circuit for selected problem statement			**01**
Co-simulation of the circuit for selected problem statement.			**01**

Semester: IV

Course Title: **Product Realization**	Course Code: 17EECF203
Total Contact Credits: **2** **(0-0-2)**	Duration of SEE Credits: -
ISA Marks: 80	ESA Marks: 20

Week #	Particulars	Template #	Venue
Week 1 and Week 2	➢ Introduction to Prototyping ➢ Defining- Specifications, Part Drawings, Assembly Drawings, PCB Layout, Wireframe , Pseudocode, BOM, Process Plan, Fabrication and Test Plan Validation ➢ IOT Workshop		Studio Engagement
Week 3	➢ Identifying sub-assemblies (minimum of 3) ➢ Selection of materials for all the parts and joining techniques		Makers Space/
Week 4	➢ Process plan ➢ Identifying the proper machines and tools required for prototyping. ➢ Preparing of raw materials for prototyping. ➢ Plan and procure the bought out parts.		
Week 5	➢ Fabricate the parts for sub assembly 1		
Week 6	➢ Fabricate the parts for sub assembly 2		
Week 7	➢ Fabricate the parts for sub assembly 3		
Week 8	➢ Assemble the sub assemblies and check for interference and functionality		
Week 9	➢ Test the functional prototype using proper identified test methods.		

Text Books (List of books as mentioned in the approved syllabus)

5. Clive L Dym and Patrick Little, "Engineering Design: A Project Based Introduction", John Wiley &Sons
6. Yousef Haik, "Engineering Design Process", Cengage Learning India Private Limited, NewDelhi

Week 10	➢ Analyse the test results ➢ System modification		
Week 11	➢ Final concluding review ➢ Product catalogue		Studio/ Makers Space

References

1. Pahl, G., Beitz, W., Feldhusen, J. and Grote ; "Engineering Design-A Systematic Approach" by, K.-H- Springer; 3rd ed. 2007

Course Title: **Embedded Intelligent Systems**		Course Code: 17EECE310
L-T-P: 0-0-3	Credits: 3	Contact Hrs: **6hrs/week**
ISA Marks: 80	ESA Marks: 20	Total Marks: 100
Teaching Hrs: 60	Exam Duration: 3 hrs	

	Unit - I	
1	**Basics of embedded systems** Linux Application Programming, System V IPC, . Linux Kernel Internals and Architecture , Kernel Core , Linux Device Driver Programming, Interrupts & Timers , Sample shell script, application program, driver source build and execute	**10 hrs**
2	**Heterogeneous computing** Basics of heterogeneous computing with various hardware architectures designed for specific type of tasks, Advanced heterogeneous computing with a. Introduction to Parallel programming b.GPU programming (OpenCL). Open standards for heterogeneous computing (Openvx) , Basic OpenCL examples - Coding, compilation and execution	**12 hrs**
	Unit - II	
3	**ML Frameworks with the target device** Caffe, tensorflow, TF Lite machine learning frameworks & architecture ,Model parsing, feature support and flexibility ,Supported layers , advantages and disadvantages with each of these frameworks, Android NN architecture overview , Full stack compilation and execution on embedded device	**16 hrs**
4	**Model Development and Optimization** Significance of on device AI ,Quantization , pruning, weight sharing, Distillation ,Various pre-trained networks and design considerations to choose a particular pre-trained model ,Federated Learning , Flexible Inferencing	**8 hrs**
	Unit - III	
5	**Android Anatomy** Android Architecture ,Linux Kernel , Binder , HAL Native Libraries , Android Runtime, Dalvik Application framework , Applications, IPC	**8 hrs**

Text Books

1. Linux System Programming , by Robert Love , Copyright © 2007 O'Reilly Media
2. Heterogeneous Computing with OpenCL, 2nd Edition by Dana Schaa, Perhaad Mistry, David R. Kaeli, Lee Howes, Benedict Gaster , Publisher: Morgan Kaufmann

Reference Books:

1. Deep Learning , MIT Press book ,Goodfellow, Bengio, and Courville's
2. Beginning Android , by Wei-Meng Lee , Publisher: Wrox , O'Reilly Media

Scheme for End Semester Assessment (ESA)

UNIT	Experiments to be set of 10 Marks Each	Chapter Numbers	Instructions
I	Project Examination	1,2,3,4,5	Project implementation and demonstration 20 marks

Laboratory Title: **C Programming (for Diploma)**	Lab. Code:
Total Hours: 20	Duration of Exam: 02
ESA Marks: 20	Total ISA. Marks: 80

Experiment wise plan

1. **List of experiments/jobs planned to meet the requirements of the course.**

Expt./Job No.	Experiment/job Details	No. of Lab. Session/s per batch (estimate)	Marks/Experiment
1.	Write a C program to perform addition , subtraction , multiplication and division of two numbers .	01	8.00
2.	Write a C program to i) Identify greater number between two numbers using C program. ii) To check a given number is Even or Odd .	01	8.00
3.	Write a C program to i) To find the roots of a quadratic equation. ii) Find the factorial of given number.	01	8.00
4.	Write a C program to i) To find the sum of n natural numbers. ii) Print the sum of 1 + 3 + 5 + 7 + + n	01	8.00
5.	Write a C program to i) Print the pattern . * * * * * * * * * * * * * * * ii) Print the pattern 1 1 2 1 2 3 1 2 3 4 1 2 3 4 5	01	8.00

6.	Write a C program to To test whether the given character is Vowel or not. (using switch case)	01	8.00
7.	Write a C program to To accept 10 numbers and make the average of the numbers using one dimensional array.	01	8.00
8.	Write a C program to Find out square of a number using function.	01	8.00
9	Write a C program to To find the summation of three numbers using function.	01	8.00
10	Write a C program to Find out addition of two matrices.	01	8.00

1. **Materials and Resources Required:**

Text Book

1. Programming in ANSI C, E Balagurusamy

Program: IV Semester Bachelor of Engineering (Electronics & Communication Engineering)			Lab+ Teaching Hours
Course Title: Data Structures Application Lab		Course Code: 18EECC210	
L-T-P: 0-0-2	Credits: 2	Contact Hours: 4Hrs/week	
ISA Marks: 80	ESA Marks:20	Total Marks: 100	
Teaching + Lab. Hours: 48 Hrs	Examination Duration:2 Hrs		

1.	**Hashing** Hash, Hash function, Hash Table, Collision resolution techniques, Hashing Applications	12Hrs
2.	**Trees** Computer representation, Tree properties, Binary Tree properties, Binary search trees properties and implementation, Tree traversals, AVL tree, 2-3 Tree	20Hrs
3.	**Graphs** Computer representation, Adjacency List, Adjacency Matrix, Graph properties, Graph traversals	16Hrs

Book

1. Data Structures A Psedocode Approach with C, Richard F. Gilberg & Behrouz A. Forouzan, second edition, CENGAGE Learning.

2. Data Structures Using C. Author, Aaron M. Tenenbaum. Publisher, Pearson Education.

Course Title: **CMOS ASIC Design**	Course code: 18EECE420	
L-T- P: 0-0-3	Credits: 03	Contact Hrs: 06hrs/week
CIE Marks: 100	SEE Marks: 00	Total Marks: 100
Teaching Hrs: 16hrs Lab Hrs: 24 hrs		

Chapter No. 1. Introduction: Design of combinational and sequential logic gates in CMOS. Layout and characterization of standard cells. Verilog for representing gate level netlists.	8 hrs
Chapter No. 2. Timing Analysis: Sequential circuit timing and static timing analysis. Cell and net delays and cross-talk. Rationale and implementation of scan chains for testing standard-cell based logic circuits. Timing Verification: Setup Timing Check, Hold Timing Check, Timing across Clock Domains	10hrs
Chapter No. 3: Physical design Physical design of standard-cell based CMOS ASICs: scan insertion, placement, and clock tree synthesis and routing. Netlist transformations at each step of the physical design process. Net parasitic and parasitic extraction. Use of PLLs for clock generation and de-skew.	12 hrs
Chapter No. 4. Standard Data formats: Standard data formats for representing technology and design: LEF, Liberty, SDC, DEF and SPEF. Clock gating and power gating for reduction of device power consumption. Design for reliability: electro- migration, wire self heat and ESD checks and fixes.	6 hrs
Chapter No. 5. Packaging An overview of package design and implementation and system level timing.	4 hrs

Reference Books:

1. The Design & Analysis of VLSI Circuits, L. A. Glassey & D. W. Dobbepahl, Addison Wesley Pub Co. 1985.
2. H. Bhatnagar, Advanced ASIC Chip Synthesis Using Synopsys Design Compiler Physical Compiler and PrimeTime, 2nd edition, 2001.
3. Static Timing Analysis for Nanometer Designs A Practical Approach, J. Bhasker • Rakesh Chadha, ? Springer Science+Business Media, LLC 2009

Tools: Cadence Innovous, Encounter

Course Title: **Physical Design-Analog**	Course code: 18EECE419	
L-T- P: 0-0-3	Credits: 03	Contact Hrs: 06hrs/week
CIE Marks: 100	SEE Marks: 00	Total Marks: 100
Teaching Hrs: 16hrs Lab Hrs: 24 hrs		

Chapter No 1. Standard cell Layout creation Layout Practice Sessions (DRC/LVS Dirty layout), Understanding verification errors, Error debugging skills, Hands on experience of using layout editor, Quality of the layout, Half DRC rules, Mega module creation.	8 hrs
Chapter No 2. Analog layout Importance of performance in Analog layout, Importance of floor planning and placement, Attributes need to be taken care during routing stage, Introduction to DRC, LVS, Density and RCX.	8 hrs
Chapter No 3. Matching and Guard rings, Matching: Introduction to mismatch concepts, Causes for mismatch, Types of mismatch, Rules for matching, Activities. Guard ring : What is guard ring, Usage of guard ring	6 hrs
Chapter No 4. Reliability issues Introduction to failure mechanism, Causes of reliability issues, Process enhancement techniques and Layout considerations to reduce reliability issues	8 hrs
Chapter No 5. Physical design of amplifier and buffer Applying the studied concepts and doing layout, Prioritising the constraints given, Quality checks, Buddy reviews and implementations, Documentation	10 hrs

Reference:

The Art of Analog Layout – Alan Hastings

CMOS IC layout – Dan Clien

IC Layout Basics – Chris saint and Judy saint

Course Code: **19EECE322 / 19EECE422**	Course Title: **Introduction to Deep Learning**	
L-T-P: **2-0-1**	Credits: **3**	Contact Hrs: **4**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs: **42**		Exam Duration: **3 hrs**

Content	**Hrs**
Unit - 1	
Chapter 1: Introduction to Deep Learning: What is Deep Learning?, Applications of deep learning, Differences between machine learningand deep learning, Basics of Neural Networks, Supervised Learning with Neural Networks, Logistic regression as a neural network, Computation graph, shallow neural networks, Deep neural networks. Introduction to metric tensors and tensorflow, Basic programs in tensorflow.	8 hrs
Chapter 2: Hyper-Parameter Tuning, Regularization and Optimization: Basics of Hyper-parameters, Regularization, Need for regularization, dropout regularization, gradient checking, mini-batch gradient descent, exponentially weighted averages and its biascorrection, Gradient descent with decay, Adam's optimization algorithm, The problem of localminima, weight initialization in neural networks, Normalizing activations in a network, Fitting Batch norm into a network, Softmax regression, Softmax classifier.	8 hrs
Unit - 2	
Chapter 3: Convolutional Neural Networks Introduction to Computer Vision and Image Processing, 2D Convolutions, Strided convolution,convolution over volume, One layer of a convolution network, ReLu and pooling, Example of aConvNet, Classic CNN Networks, ResNet architecture, Inception Networks, Transfer learning,Data Augmentation, Residual networks, Object Localization, Landmark and object detection, Convolutional implementation of sliding windows, YOLO algorithm, Car detection algorithm using YOLO, One shot learning, Face recognition algorithm.	12 hrs
Chapter 4: Recurrent Neural Networks Backpropogation through time, RNN model, Types of RNN, Vanishing gradients with RNN,Gated Recurrent Unit, LSTM, Bidirectional RNN, Deep RNN, basics of NLP and Concept ofword embedding, speech recognition.	04 hrs
Unit - 3	
Chapter 5: Unsupervised Deep Learning Concepts of Unsupervised deep learning, RBM (Restricted Boltzman Machine) and auto encoders, structure of Auto encoders, collaborative filtering with RBM, Deep belief networks.	10 hrs

Text Books

- Deep Learning, Ian Goodfellow, Yoshua Bengio and Aaron Courville, MIT Press, http://www.deeplearningbook.org, 2016.
- Neural Networks and Deep Learning by Michael Nielsen.

References

- Deep Learning with Python, Francois Chollet, by Manning Publications, 2018.
- Deep Learning by Microsoft Research
- Deep Learning Tutorial by LISA lab, University of Montreal

Laboratory Title: **Senior Design Project**	Lab. Code:**20EECW401**
Credit : 0-0-6 Total Hours: 70**hours/week**	Duration of exam: **2 hours**
Total Exam Marks: **100**	ISA Marks: **50**

Application Areas are,

- Smart City
- Connected Cars
- Home Automation
- Health care
- Smart energy
- Automation of Agriculture

Guide lines for selection of a project:

- The project needs to encompass the concepts learnt in the previous semesters, so that the student will learn to integrate, the knowledge base acquired to provide a solution to the defined problem statement of the project work.
- Student can select a project which leads to a product or model or prototype.
- Time plan: Effort to do the project should be between 60-70Hrs per team, which includes self-study of an individual member (80-100 Hrs) and team work (40-50hrs).
- Learning overhead should be 20-25% of total project development time.

Criteria for group formation:

- 3-4 students in a team.
- Role of teammates: Team lead and members.

Allocation of Guides and Mentors for the projects:

Every Project batch will be allocated with one faculty.

Details of the project batches:

- Number of faculty - members: 50
- Number of students:3-4 students in a team.

Role of a Guide

The primary responsibility of the guide is to help students to understand the meaning and need of various stages in the implementation of the project. At every stage of the project development, guide should help towards its successful completion as per the predefined standards.

How student should carry out a project:

- Define the problem.
- Specify the requirements.
- Specify the design in the understandable form (Block Diagram, Flowchart,Algorithm,etc).
- Analyze the design and identify hardware and software componentsseparately.
- Select appropriate simulation tool and development board for the design.
- Implement the design.
- Optimize the design and generate the results.
- Result representation and analysis.
- Prepare a document and presentation.

Report Writing

- The format for report writing should be downloaded from ftp://10.3.0.3/projects
- The report needs to be shown to guide and committee for each review.
-

Evaluation Scheme

- Internal semester assessment (ISA)
- Evaluation is done based on the evaluation rubrics given in Table 1
- Project shall be reviewed and evaluated by the concerned Guide for 50% of the marks.
- Project shall be evaluated by the review committeefor 50% of the marks.

Course Code: 20EECE406	Course Title: AUTOSAR	
L-T-P: 3-0-0	Credits: 3	Contact Hrs: 40
CIA Marks: 50	SEE Marks: 50	Total Marks: 100
Teaching Hrs: 40		Exam Duration: 3 hrs

Content	Hrs
Unit - 1	
Chapter No. 1: AUTOSAR Fundamentals Evolution of AUTOSAR – Motivations and Objectives AUTOSAR consortium – Stake holders – work Packages, AUTOSAR Partnership, Goals of the partnership, Organization of the partnership, AUTOSAR specification, AUTOSAR Current development status, BSW Conformance classes: ICC1, ICC2, ICC3, and Drawbacks of AUTOSAR.	8 hrs
Chapter No. 2: AUTOSAR layered Architecture AUTOSAR Basic software, Details on the various layers , Details on the stacks Virtual Function Bus (VFB) Concept Overview of AUTOSAR Methodology , Tools and Technologies for AUTOSAR AUTOSAR Application Software Component (SW-C) ,Types of SW-components AUTOSAR Run Time Environment (RTE): RTE Generation Process: Contract Phase, Generation Phase, MCAL, IO HW Abstraction Layer, Partial Networking, Multicore, J1939 Overview, AUTOSAR Ethernet, AUTOSAR E2E Overview , AUTOSAR XCP, Metamodel , From the model to the process , Software development process.	7 hrs
Unit - 2	
Chapter No. 3: Methodology of AUTOSAR and Communication in AUTOSAR CAN Communication, CAN FD, CANape, Application Layer and RTE, intra and inter ECU communication, Client-Server Communication, Sender-Receiver, Communication, CAN Driver, Communication Manager (ComM), Overview of Diagnostics Event and Communication Manager	10 hrs
Chapter No. 4: Overview about BSW constituents BSW Constituents: Memory layer, COM and Services layer, ECU abstraction, AUTOSAR, Operating system, Interfaces: Standard interface, AUTOSAR standardized interface, BSW-RTE interface,(AUTOSAR interface), BSW-ECU hardware interface, Complex device drivers and BSW module configuration, AUTOSAR Integration.	5 hrs
Unit - 3	
Chapter 5: MCAL and ECU abstraction Layer Microcontroller Drivers, Memory drivers: on-chip and off chip drivers, IO drivers(ADC, PWM, DIO), Communication drivers: CAN driver, LIN drivers, Flexrfay	5 hrs
Chapter 6: Service Layer	5 hrs

Diagnostic Event Manager, Function inhibits Manager, Diagnostic communication manager, Network management, Protocol data unit router, Diagnostic log and trace unit, COMM manager.	

Text Books (List of books as mentioned in the approved syllabus)

Ronald K. Jurgen, Infotainment systems, 2007, SAE International, 2007

Laboratory Title: **Project Work**	Lab. Code:**20EECW402**
Credit : 0-0-11 Total Hours: **22 hours/week**	Duration of exam: 2
Total Exam Marks: ISA : 50	ESA Marks: **50**

Application Areas are,

- Smart City
- Connected Cars
- Home Automation
- Health care
- Smart energy
- Automation of Agriculture

Guide lines for selection of a project:

- The project needs to encompass the concepts leant in a subject/s studied in the previous seven semesters, so that the student will learn to integrate, the knowledge base acquired to provide a solution to the defined problem statement of the project work.
- Student can select a project which leads to a product or model or prototype.
- Time plan: Effort to do the project should be between 120-150 Hrs per team, which includes self-study of an individual member (80-100 Hrs) and team work (40-50hrs).
- Learning overhead should be 20-25% of total project development time.

Criteria for group formation:

- 3-4 students in a team.
- Role of teammates: Team lead and members.

Allocation of Guides and Mentors for the projects:

Every Project batch will be allocated with one faculty.

Details of the project batches:

- Number of faculty members : 64
- Number of students:3-4 students in a team-46 Teams
- Internship Students:93

Role of a Guide

The primary responsibility of the guide is to help students to understand the meaning and need of various stages in the implementation of the project. At every stage of the project development, guide should help towards its successful completion as per the predefined standards.

How student should carry out a project:

- Define the problem
- Specify the requirements
- Specify the design in the understandable form (Block Diagram, Flowchart,Algorithm,etc)
- Analyze the design with hardware and software components saparately.
- Select appropriate simulation tool and development board for the design.
- Implement the design
- Optimize the design and generate the results
- Result representation and analysis
- Prepare a document and presentation.

Report Writing

- The format for report writing should be downloaded from ftp://10.3.0.3/projects
- The report needs to be shown to guide and committee for each review.

Evaluation Scheme

Internal semester assessment (ISA)

Evaluation is done based on the evaluation rubrics given in Table 1

- Project shall be reviewed and evaluated by the concerned Guide for 50% of the marks.
- Project shall be evaluated by the review committee for 50% of the marks.

Course Title: Internship- Project	Course Code: 20EECW494
L-T-P: 0-0-11	Duration of ESA: 2hr
ESA Marks: 50	ISA Marks: 50

Engineering graduates unlike graduates from other fields require a strong industry connect during the course. This experience is provided through industry internships during VIII Semester of the program. Internships make students more competitive in the job market. During internship the student gains competency while working on live projects meeting all the deadlines related to project work. The students of the VIII semester are permitted to opt for full-time Industry Internship. Students having placement offers usually undergo internship at their respective industries, while others choose industry, based on their competency in consultation with the department.

The implementation details and impact of internships in the department are discussed below.

The internship has 2 mandatory components; i) Internship Training, and ii) Internship – Project.

- Internship Training: Industry offers training in learning tools/ framework / programming language / Industrial practices to carry out the Internship project.
- Internship-Project: Industry assigns a well-defined problem statement for the project and provides an industry mentor to execute the project. The University guide in consultation with Industry Guide reviews the project progress at regular intervals using Skype/ Webex or personal visit to the industry.

At the end of the Internship, student has to submit Internship Training Report & Internship Project report to the University. Contents of the Reports shall be decided in consultation with Industry Guide. Industry shall issue Internship Certificate to student-intern.

The expectations from most of the problem statements were either to develop a subsystem of a bigger system or development of a relatively smaller system itself. Students developed either a working prototype or proof of concept as part of their project work. Students worked on simulation projects as well.

KLE Technological University — Creating Value Leveraging Knowledge	School of Electronics & Communication Engineering **PG – VDES**

Course Title: Principles and Practices of Engineering Education		**Course Code:** 15ECRC701
L-T-P: 2-0-1	**Credits: 3**	**Contact Hours: 3**
ISA Marks: 50+100	**ESA Marks: 50**	**Total Marks: 200**
Teaching Hours: 40	**Examination Duration: 3 hrs**	

1. **Fundamental Principles of Teaching and Learning**	**8 Hours**
2. **Learning Styles and Theories**	**8 Hours**
3. **Instructional Design Models and Technology Enhanced Learning**	**8 Hours**
4. **Assessment and Evaluation**	**8 Hours**
5. **Engineering Learning Modules**	**8 Hours**
Text Books	
Reference Books:	

Program: VLSI Design & Embedded Systems		
Course Title: Data Structures using C		**Course Code:** 17EVEC701
L-T-P: 0-0-1	**Credits: 1**	**Contact Hours: 2**
ISA Marks: 80	**ESA Marks: 20**	**Total Marks: 100**
Teaching Hours: 25	**Examination Duration: 3 hrs**	

Chapter 01:C language features Pointers revisited, Strings, Structures – Basics, Structures and functions, Arrays of structures, Pointers to structures, Self Referential Structures, Unions and bit fields, Files.	5 Hrs
Chapter 02:Stacks and Queues Definition, Representation and Applications of stack. Definitions, representation and applications of linear, circular, queues, multiple queues, priority queue. Recursion	5 Hrs
Chapter 03:Lists Linked lists, singly, doubly, circular lists, definitions, representations. Implementation of list operations, applications – polynomial addition, addition of long integers. Linked stacks, Linked Queues	5 Hrs 5 Hrs
Chapter 04:Trees Binary trees – Definitions, traversals (recursive and iterative versions), Building and searching, Threaded Binary trees, Trees and their applications Exchange sorts, Selection and tree sorts, Merge and radix sorts	5 Hrs
Text Book 1. Aaron M. Tenenbaum, et al, Data Structures using C, II Edition, PHI, 2006 2. Horowitz, Sahani, Anderson-Feed, Fundamentals of Data Structures in C, II Edition, University, 2008 **References** 1. E Balaguruswamy, The ANSI C programming Language, II Edition, PHI, 2010 2. Yashavant Kanetkar, Data Structures through C, II Edition, BPB public, 2010 3. Richard F. Gilberg, Behrouz A. Forouzan , Data Structures: A Pseudocode Approach With C, II Edition, Course Tec, 2009	
Lab: **1.** Programs on Pointer concepts. **2.** Programs on string handling functions, structures union And bit-files. **3.** Programming on files	

4. Programming on stacks data structures **5.** Programs on implementation of different queue data structures. **6.** Programs on implementation of different types of Linked lists **7.** Programs on Implementation of trees **8.** Programs to implement different sorting techniques. **9.** Programming on graph **10.** Programming on hashing tables **11.** Design and implement stack queue data structures **12.** Design and implement linked list data structures **13.** project	

Program: VLSI Design & Embedded Systems		
Course Title: Analog and Digital Circuits		**Course Code:** 17EVEC702
L-T-P: 2-0-1	**Credits: 3**	**Contact Hours: 4**
ISA Marks: 50+100	**ESA Marks: 50**	**Total Marks: 200**
Teaching Hours: --	**Examination Duration: 3 hrs**	

Applications of theorems. RLC Circuits Combinational circuits and Sequential circuits Case study Devices: Diodes, MOSFETs. Diode circuits: clipping, clamping, rectifier. Design of BJT and MOSFET single-and multi-stage amplifiers, Feedback amplifier, Oscillator, Op-amp linear & non linear applications.	8 Hrs
<u>Digital Circuits</u> Combinational Circuits: Adder, encoder & decoder, MUX& DEMUX, Comparator. Sequential Circuits: Latches, Flip Flops, Shift Registers, Design of Synchronous counters and Asynchronous counters.	8 Hrs
<u>Conventional control systems</u>: R-H Stability criterion, Root locus, Bode plots and Nyquist stability criterion. **Tools: Simulink, MATLAB, Proteus, Pspics, Cadence, LabView, Microcap, OrCAD**	8 Hrs

Reference Books:

1. A.S. Sedra & K.C. Smith, Microelectronic Circuits, 5th Edition, Oxford Univ. Press, 1999
2. Jacob Millman and Christos Halkias, Integrated Electronics, McGraw Hill,
3. John M Yarbrough, Digital Logic Applications and Design, Thomson Learning, 2001
4. David A. Bell, Electronic Devices and Circuits, 4th edition, PHI publication, 2007
5. Grey, Hurst, Lewis and Meyer, Analysis and design of analog integrated circuits, 4th edition.
6. Charles H Roth, Jr; Fundamentals of Logic Design, Thomson Learning, 2004.
7. Zvi Kohavi, Switching and Finite Automata Theory, 2ed, TMH
8. Ogata, Modern Control Theory, 4th ed, PHI.

Lab:

<u>Analog Electronics Lab</u>

1. Study & analyze Diode Clipping and Clamping (single/double ended) circuits.
2. Implement the RLC circuit to study the transient response.
3. Design an Amplifier using MOSFET and determine its gain, input & output impedance.
4. To implement an amplifier with negative feedback & show the effect of negative feedback on input impedance; output impedance & gain of the amplifier using MOSFET.
5. Study of transformer-less Class B push pull power amplifier and determination of its conversion efficiency
6. Design an amplifier for an unity gain and high input impedance using MOSFET. Suggest suitable techniques to increase the input impedance and verify the same.

<u>Digital Circuits lab</u>

1. Design and implement BCD adder and Subtractor using 4 bit parallel adder
2. Design and implement n bit magnitude comparator using 4- bit comparators
3. Design and implement Ring and Johnson counter using shift register.
4. Design and implement 8 bit ALU.

Tools: Simulink, Proteus, Pspics, Cadence, LabView, Microcap, OrCAD, MATLAB.

Program: I Semester Master of Technology (VLSI Design & Embedded Systems)		**Teaching Hours**
Course Title: Principle of Embedded Systems	**Course Code: 17EVEC703**	

L-T-P: 0-0-2	Credits: 2	Contact Hours: 4 Hrs/week	
ISA Marks: 80	ESA Marks: 20	Total Marks: 100	
Teaching Hours: 42 Hrs	Examination Duration: 3 hrs		
1. Introduction to embedded system: Introduction, Classification of Embedded System, Major Application Areas, Purpose of Embedded System. Characteristics and quality attributes of Embedded Systems, Design Metric and Optimizing the metrics.			**06 Hrs**
2. Typical Embedded Systems: Core of Embedded System-processor fundamentals, up vs uc, risc vs cisc, vonneumann vs Harvard, 8051 controller architecture and programmer model, Memory, Sensor and Actuators, Communication Network, Embedded Firmware			**08 Hrs**
3. Low Level programming Concepts: Addressing Modes, Instruction Set and Assembly Language programming(ALP), Developing, Building, and Debugging ALP's			**08 Hrs**
4. Middle Level Programming Concepts: Cross Compiler, Embedded C language implementation, programming, & debugging, Differences from ANSI-C, Memory Models, Use of directives, Functions, Parameter passing and return types			**02 Hrs**
5. On-Chip Peripherals Study, Programming, and Application: Ports: Input/Output, Timers & Counters, UART, Interrupts			**08 Hrs**
6. External Interfaces Study, Programming and Applications : LEDS, Switches(Momentary type, Toggle type), Seven Segment Display: (Normal mode, BCD mode, Internal Multiplexing & External Multiplexing), LCD (8bit, 4bit, Busy flag, custom character generation), Keypad Matrix, Stepper Motor, DC Motor			**10 Hrs**

Text Books

1. Introduction to Embedded Systems 1E by Shibu K V.
2. Kenneth J. Ayala ; "The 8051 Microcontroller Architecture, Programming & Applications" 2e, Penram International, 1996 / Thomson Learning 2005
3. Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinlay; "The 8051 Microcontroller and Embedded Systems – using assembly and C "- PHI, 2006 / Pearson, 2006

References

1. Embedded System Design: A Unified Hardware/Software Introduction – Frank Vahid, Tony Givargis, John Wiley & Sons, Inc.2002
2. Predko ; "Programming and Customizing the 8051 Microcontroller" –, TMH
3. Raj Kamal, "Microcontrollers: Architecture, Programming, Interfacing and System Design", Pearson Education, 2005

<table>
<tr><td colspan="3">Program: I Semester Master of Technology (VLSI Design & Embedded Systems)</td><td rowspan="5">Teaching Hours</td></tr>
<tr><td colspan="2">Course Title: RISC Architectures</td><td>Course Code: 17EVEC705</td></tr>
<tr><td>L-T-P: 3-0-1</td><td>Credits: 4</td><td>Contact Hours: 3 Hrs/week</td></tr>
<tr><td>ISA Marks: 50+100</td><td>ESA Marks: 50</td><td>Total Marks: 200</td></tr>
<tr><td>Teaching Hours: 46 Hrs</td><td>Examination Duration:</td><td></td></tr>
<tr><td colspan="3">1. The 32 bit RISC Architecture:
The Acorn RISC machine, Architectural inheritance, Architecture of ARM7TDMI, ARM programmers model, ARM development tools, 3 stage pipeline ARM organization, ARM instruction execution.</td><td>06 Hrs</td></tr>
<tr><td colspan="3">2. 32 bit Instruction set:
Data processing instruction, Branch instruction, Load store instruction, Software interrupt instruction, Program status register instruction, Conditional execution, Example programs, 16bit Instruction set-The Thumb programmer model, ARM-Thumb interworking, other branch instructions, Data processing instructions, Single/Multiple register load store instruction, Stack operation, Software interrupt instructions, example programs.</td><td>06 Hrs</td></tr>
<tr><td colspan="3">3. Exception Handling:
Introduction, Interrupts, error conditions, processor exception sequence, the vector table, Exception handlers, Exception priorities, Procedures for handling exceptions.</td><td>04 Hrs</td></tr>
<tr><td colspan="3">4. Memory Hierarchy Design:
Cache basics, Miss rate and penalty, Cache Hierarchy, Memory Organizations, Memory Hierarchy.</td><td>06 Hrs</td></tr>
<tr><td colspan="3">5. Pipelining:
Linear pipeline processor, Nonlinear pipeline processor, Instruction pipeline design, Branch handling techniques, Arithmetic pipeline design, Computer arithmetic principles, Static arithmetic pipeline, Multifunctional arithmetic pipeline.</td><td>08 Hrs</td></tr>
<tr><td colspan="3">6. Cortex M4 :
Functional description, programmer’s model, memory protection unit, nested vectored interrupt controller.</td><td>06 Hrs</td></tr>
<tr><td colspan="3">7. Multi-Core Architectures :
Introduction to Intel Architecture, How an Intel Architecture System works, Basic Components of the Intel Core 2 Duo Processor: The CPU, Memory Controller, I/O Controller.</td><td>07 Hrs</td></tr>
<tr><td colspan="3">8. Current Trends in Intel Architectures and Applications :
Seminar on current trends in Intel Architectures</td><td>03 Hrs</td></tr>
</table>

Text Books

1. "ARM System- on-Chip Architecture" by 'Steve Furber', LPE, Second Edition.
2. "ARM Assembly Language fundamentals and Techniques" by William Hohl, CRC press, 2009.
3. D. A. Patterson and J. L. Hennessey "Computer Organization and Design", Morgan , Kaufmann,2002
4. H. Jonathan Chao and Bin Liu, "High performance switches & routers", Wiley Interscience, 2007.
5. Kai Hwang, " Advanced Computer Architecture – TMH – 1993
6. Web resources for Example Architectures of INTEL and Texas Instruments: http:/ /download.intel.com/design/intarch/papers/321087.pdf

References

1. Kai Hwang, Faye A. Briggs, Computers Architecture and Parallel Processing – MGH – 1985
2. David E Culler, Jaswinder Pal Singh, Anoop Gupta "Parallel Computer Architecture", Harcourt Asia Pte Ltd 2000
3. Stalling W." Computer Organization and Architecture- Designing for performance" PHI,2005
4. D. Sima,T. Fountain, P.Kasuk," Advanced Computer Architecture-A Design Space Approach" Addisson Wesley,1997.
5. M. J. Flynn,"Computer Architecture, Pipelined And Parallel Processing", Narosa Publications, 1998.

List of Experiments:

1. Write an ALP to verify data transfer w.r.t memory to achieve following
   i. 8 bit data transfer
   ii. 16 bit data transfer
   iii. 32 bit data transfer
2. Write an ALP for Tables and lists to do following:
   i. Add an entry to a list
   ii. Remove an element from the queue
3. Write an ALP to pass parameters to a subroutine.
   i. Ascending order
   ii. Descending order
4. Write a 'C' program & demonstrate an interfacing of Alphanumeric LCD 2X16 panel to LPC2148Microcontroller
5. Write a 'C' program & demonstrate concept of Interrupts interface to LPC2148 Microcontroller.
6. Write a 'C' program & demonstrate an interfacing of DAC to LPC2148 Microcontroller.
7. Write a 'C' program & demonstrate an interfacing of UART to LPC2148 Microcontroller.
8. Write a 'C' program & demonstrate an interfacing of ADC to LPC2148 Microcontroller.
9. Write a 'C' program & demonstrate an interfacing of RTC to LPC2148 and read time, date and year.
10. Write a 'C' program & demonstrate interface I2C to LPC2148
11. Develop a code for college bell system. (Use the following interfaces LCD, RTC and Buzzer).

Reference Books

1. "ARM System- on-Chip Architecture" by 'Steve Furber", LPE, Second Edition.
2. "Embedded Systems- Architecture, Programming and Design" by Raj Kamal, TMH
3. Dr. K.V.K.K. Prasad, "Embedded/Real-time systems: concepts, Design & Programming", published by dreamtech press.

Manual

1. LPC2148 datasheet by NXP.
2. LPC2148 board manual by ALS, Bangalore.

Program: Digital Electronics		**Teaching Hours**
Course Title: Electronic System Design	**Course Code: 17EVEC707**	

L-T-P: 0-0-3	**Credits: 3**	**Contact Hours:6 Hrs/week**	
ISA Marks: 100	**ESA Marks:**	**Total Marks: 100**	
Teaching Hours: 25 Hrs	**Examination Duration: --**		
To level specifications, Block level specifications, Timing of micro architecture, Verification and test plan, Schematic capture			05 Hrs
Simulation, Advanced simulation, Signal Integrity			05 Hrs
PCB layout- Floor planning, component pre planning, PCB printing- 2 layer			05 Hrs
Functionality and performance check, Failure analysis, Validation and system integration			05 Hrs
System Analysis			05 Hrs

References

1. A. S Sedra and KC Smith, Microelectronic circuits, Oxford, 1998.
2. G.L. Ginsberg, Printed Circuit Design, McGraw Hill, 1991.

Program: VLSI Design & Embedded Systems		
Course Title: Automotive Electronics		**Course Code:** 17EVEC708
L-T-P: 3-0-1	**Credits: 4**	**Contact Hours: 5**
ISA Marks: 50+100	**ESA Marks: 50**	**Total Marks: 200**
Teaching Hours: 40	**Examination Duration: 3 hrs**	

Chapter No. 1. Automotive Fundamentals Overview Introduction to Automotive Industry and Modern Automotive Systems Vehicle classifications and specifications need for electronics in automobiles, Application areas of electronics in the automobiles Four Stroke Cycle, Engine Control, Ignition System, Spark plug, Spark pulse generation, Ignition Timing, Drive Train, Transmission, Brakes, Steering System.	8Hrs
Chapter No. 2. Sensors and Actuators Oxygen (O2/EGO) Sensors, Throttle Position Sensor (TPS), Engine Crankshaft Angular Position (CKP) Sensor, Magnetic Reluctance Position Sensor, Engine Speed Sensor, Ignition Timing Sensor, Hall effect Position Sensor, Optical Crankshaft Position Sensor, Manifold Absolute Pressure (MAP) Sensor Strain gauge, Engine Coolant Temperature (ECT) Sensor, Knock Sensor, Throttle angle sensor, Fuel Injector Actuator, Ignition Actuator	7Hrs
Chapter No. 3. Electronic Engine Control Engine parameters, variables, Engine Performance terms, Electronic Fuel Control System, Electronic Ignition control, Idle sped control, EGR Control	5Hrs
Chapter No. 4. Vehicle Motion Control and Safety Systems Cruise Control, Antilock Brake System (ABS), Electronic Steering Control, Power Steering, Traction Control, Electronic Stability Program.	6Hrs
Chapter No:5. Automotive communication protocols Overview of Automotive communication protocols : CAN, LIN .	3Hrs
Chapter No. 6. Advanced Driver Assistance Systems (ADAS) Lane Departure Warning, Collision Warning, Automatic Cruise Control, Pedestrian Protection, Headlights Control, Connected Cars technology and trends towards Autonomous vehicles.	5Hrs
Chapter No. 7. Automotive safety standards ISO26262 and Diagnostics Functional Safety: Need for safety standard-ISO 26262, safety concept, safety process for product life cycle, safety by design, validation. Fundamentals of Diagnostics: Basic wiring system and Multiplex wiring system, Preliminary checks and adjustments, Self-diagnostic system. Fault finding and corrective measures, OBD & off board diagnostic.	6Hrs

Text books:

1. Denton.T – Automobile Electrical and Electronic Systems, Edward Arnold publication, 1995.

References:

1. William T.M – Automotive Electronic Systems, Heiemann Ltd., London ,1978.
2. Nicholas Navet – Automotive Embedded System Handbook, CRC Press, 2009.
3. BOSCH Automotive Handbook, Wiley Publications, 8th Edition, 2011.
4. Co-Verification of hardware & software for ARM SoC Design – Jason.R.Andrews, Newnes Publications, 2004.
5. Hardware Software co-design of embedded systems, F.Balarin, Kluwer Academic Oublishers, 1987.

Lab:

1. Demonstration of cut section modules: Engine, Transmission , Steering, Braking, Suspension - Automobile dept.
2. Electronic engine control system: Injection and Ignition control system Transmission trainer modules
3. Modeling an engine Vehicle model simulation with Simulink using PI CONTROLLER
4. Basic gate logic simulation and modeling using Simulink and realization on the hardware platform.
5. Seat belt warning system simulation and modeling using Simulink and realization on the hardware platform. Vehicle speed control based on the gear input simulation and modeling using Simulink and realization on the hardware platform.
6. Throttle control modeling and simulation using Simulink and realization on the hardware platform.
7. Accelerator pedal interfacing software modeling and simulation using Simulink and realization on the hardware platform.
8. Develop matlab code for stepper motor control and convert it to Simulink model and port it to embedded hardware

Program: II Semester Master of Technology (VLSI Design & Embedded Systems)			Teaching Hours
Course Title: Real Time Embedded System		Course Code: 17EVEC709	
L-T-P: 3-0-1	Credits: 4	Contact Hours: 3 Hrs/week	
ISA Marks: 50+100	ESA Marks: 50	Total Marks: 200	
Teaching Hours: 45 Hrs	Examination Duration:		
UNIT I			
1. Building blocks: Real Time System, Types, Real Time Computing, Design Issue, Sample Systems, Hardware Requirements- Processor in a system, System Memories, System I/O, De-bouncing, Other Hardware Devices (A/D, D/A, USART, Watchdog Timers, Interrupt Controllers). Device Drivers, Interrupt Servicing Mechanism & Interrupt Latency.			**12 Hrs**
2. Advanced Processors: Automotive Grade Processors: AEC-Q100 qualification, Qorivva 32-bit Microcontrollers, MPC577XK for ADAS, AURIX from Infineon, Tricore Architecture, Renasas RL78/D1x (Automotive Only)			**10 Hrs**
UNIT II			
3. Real Time Operating System: Interrupt driven systems, foreground/background systems, full featured rtos, POSIX, buffering data, mailboxes, critical regions, semaphores, event flags & signals, deadlock, process stack management, dynamic allocation.			**04 Hrs**
4. Case Studies: Mucos/ VX Works Functions – System level, task service, time delay, memory allocation, semaphore, mailbox, queue. Example systems: Coding for Automatic chocolate vending machine using MUCOS & Coding for sending application layer byte streams on a TCP/IP Network using Vx Works.			**06 Hrs**
UNIT III			
5. Process of Embedded System Development: Development process, requirements engineering, design, implementation, integration & testing, packaging, configuration management, managing embedded system development, embedded system fiascos.			**08 Hrs**
6. Current trends, ethical & environmental issues The students shall give seminars on current trends in the field of RTES, ethical, & environmental issues.			**05 Hrs**

Text Books

1. Philip. A. Laplante, “Real-Time Systems Design and Analysis- an Engineer’s Handbook”- Second Edition, PHI Publications.
2. Rajkamal, “Embedded Systems: Architecture, Programming and Design”, Tata McGraw Hill, New Delhi, 2003.
3. Dr. K.V.K K Prasad, “Embedded Real Time Systems: Concepts Design and Programming”, Dreamtech Press New Delhi, 2003.

References

1. Joseph Yiu, “The Definitive guide to ARM CORTEX –M3 & CORTEX-M4 Processors”, Elsevier, Newnes, 2014.
2. Steve Furber “ARM System –on – Chip Architecture” Second Edition, Pearson Education
3. David E. Simon, “An Embedded software primer”, Pearson Education, 1999..
4. David A. Evesham, “Developing real time systems – A practical introduction”, Galgotia Publications, 1990
5. William Hohl, “ARM Assembly Language Fundamentals & Techniques”, CRC Press
6. C. M. Krishna, “Real Time Systems” MGH, 1997
7. Jane W.S. Liu, “Real-Time Systems”, Pearson Education Inc., 2000

Course Code: 17EVEC710	Course Title: **Advanced Digital Logic Design**
L-T-P: 1-0-3	Credits: 4
ISA Marks: 50+100	ESA Marks: 50
Teaching Hrs: 40	

Chapter No. 1. Digital Integrated Circuits Moore's law, Technology Scaling, Die size growth, Frequency, Power dissipation, Challenges in digital design, Design metrics, Cost of Integrated circuits, ASIC , Evolution of SoC ASIC Flow Vs SoC Flow, SoC Design Challenges. Introduction to CMOS Technology, PMOS & NMOS Operation, CMOS Operation principles, Characteristic curves of CMOS, CMOS Inverter and characteristic curves, Delays in inverters, Buffer Design, Power dissipation in CMOS, CMOS Logic, Stick diagrams and Layout diagrams. Setup time, Hold Time, Timing Concepts.	10 hrs
Chapter No. 2. Digital Building Blocks Basic Gates, Universal Gates, nand & nor Implementations. Decoder, encoder, code converters, Priority encoder, multiplexer, demultiplexer, Comparators, Parity check schemes, Multiplexer, De-multiplexer, Pass Transistor Logic, application of multiplexer as a multi-purpose logical element. Asynchronous and synchronous up-down counters, Shift registers. FSM Design, Mealy and Moore Modelling, Adder & Multiplier concepts, Memory Concept	10 hrs
Chapter No. 3. Logic Design Using Verilog Evolution & importance of HDL, Introduction to Verilog, Levels of Abstraction, Typical Design Flow, Lexical Conventions, Data Types Modules, Nets, Values, Data Types, Comments, arrays in Verilog, Expressions, Operators, Operands, Arrays, memories, Strings , Delays , parameterized designs Procedural blocks, Blocking and Non-Blocking Assignment, looping, flow Control, Task, Function, Synchronization, Event Simulation. Need for Verification, Basic test bench generation and Simulation	12 hrs
Chapter No. 4. Principles of RTL Design Verilog Coding Concepts, Verilog coding guide lines: Combinational, Sequential, FSM. General Guidelines, Synthesizable Verilog Constructs, Sensitivity List, Verilog Events, RTL Design Challenges, Clock Domain Crossing. Verilog modelling of combinational logic and sequential logic	8 hrs
Chapter No. 5. Design and simulation of Architectural building blocks Basic Building blocks design using Verilog HDL: Arithmetic Components – Adder, Subtractor, and Multiplier design, Data Integrity – Parity Generation circuits, Control logic – Arbitration, FSM Design – overlapping and non-overlapping Mealy and Moore state machine design	10 hrs

Reference Books:

1. Digital Design by Morris Mano M, 4th Edition
2. Verilog HDL: A Guide to Digital Design and Synthesis by Samir Palnitkar, 2nd Edition
3. Principles of VLSI RTL Design: A Practical Guide by Sapan Garg, 2011 Tools: 1. NC Verilog, NC Sim, CVER + GTKWave, VCSMX, Modelsim for Verilog 2. Microwind for layout.

Course Code: 17EVEC711	**Course Title: Testing & IC Characterization**	
L-T-P: 3-0-1	**Credits: 4**	**Contact Hrs: 5 hrs/week**
ISA Marks: 50+100	**ESA Marks: 50**	**Total Marks: 200**
Teaching Hrs: 40		**Exam Duration: 03 hrs**

Content	**Hrs**
CHAPTER NO. 1. VERIFICATION CONCEPTS Concepts of verification, importance of verification, Stimulus vs Verification, functional verification, test bench generation, functional verification approaches, typical verification flow, stimulus generation, direct testing, Coverage: Code and Functional coverage, coverage plan.	10 hrs
CHAPTER NO. 2. SYSTEM VERILOG – LANGUAGE CONSTRUCTS System Verilog constructs - Data types: two-state data, strings, arrays: queues, dynamic and associative arrays, Structs, enumerated types. Program blocks, module, interfaces, clocking blocks, modports.	10 hrs
CHAPTER NO. 3. SYSTEM VERILOG – CLASSES & RANDOMIZATION SV Classes: Language evolution, Classes and objects, Class Variables and Methods, Class instantiation, Inheritance, and encapsulation, Polymorphism. Randomization: Directed Vs Random Testing. Randomization: Constraint Driven Randomization.	12 hrs
CHAPTER NO. 4. SYSTEM VERILOG – ASSERTIONS & COVERAGE Assertions: Introduction to Assertion based verification, Immediate and concurrent assertions. Coverage driven verification : Motivation, Types of coverage, Cover Group, Cover Point, Cross Coverage, Concepts of Binning and event sampling.	8 hrs
CHAPTER NO. 5. BUILDING TESTBENCH LAYERED TESTBENCH ARCHITECTURE. INTRODUCTION TO UNIVERSAL VERIFICATION METHODOLOGY, OVERVIEW OF UVM BASE CLASSES AND SIMULATION PHASES IN UVM AND UVM MACROS. UNIFIED MESSAGING IN UVM, UVM ENVIRONMENT STRUCTURE, CONNECTING DUT- VIRTUAL INTERFACE	10 hrs

REFERENCES:

1. SYSTEM VERILOG LRM
2. CHRIS SPEAR, GREGORY J TUMBUSH - SYSTEMVERILOG FOR VERIFICATION - A GUIDE TO LEARNING THE TESTBENCH LANGUAGE FEATURES - SPRINGER, 2012
3. STEP-BY-STEP FUNCTIONAL VERIFICATION WITH SYSTEMVERILOG AND OVM BY SASAN IMAN SIMANTIS INC. SANTA CLARA, CA SPRING 2008 TOOLS: 1. NC VERILOG, NC SIM, VCSMX FOR SYSTEM.

Course Code: **17EVEE701**	Course Title: **Image and Video Processing**		Teaching Hrs: **40 Hrs**
L-T-P: **2-0-1**	Credits: **3**		Contact Hrs: **4 Hrs/week**
ISA Marks: **50+100**	Exam Duration: **3Hrs**	ESA Marks: **50**	Total Marks: **200**

1	**Introduction**: 2D systems, Mathematical Preliminaries- FT, Z-transform, Optical and Modulation Transfer Functions (OTF and MTF). Matrix theory, Image perception: Light, Luminance, Brightness, Contrast, MTF of the visual system, Visibility function, Monochrome Vision Models, Fidelity criteria, Color Representation, Color Vision Models, Temporal Properties of Vision.	2 hrs
2	**Image sampling and Quantization:** 2D Sampling theory, Quantization, Optimal Quantizer, Compander and Visual Quantization.	2 hrs
3	**Image Transforms:** 2D orthogonal and unitary transforms, DFT, DCT, Harr, KLT	4hrs
4	**Image Enhancement**: Histograms Modeling, Spatial operations, Transform operations, Multispectral Image Enhancement,	4hrs
5	**Image Filtering and Restoration:** Image Observation Models, Inverse and Weiner filtering , Frequency Domain Filters. Smoothing Splines and Interpolation.	4hrs
6	**Basics of Video:** Analog Video, Digital Video	2 hrs
7	**Two dimensional motion estimation:** Optical flow methods**,** Block based methods, Bayesian methods**.**	7 hrs

Text books

1. Jain, A.K., Fundamentals of Digital Image Processing, 3rd Edision, Pearson Education (Asia) 2013
2. A. Murat Tekalp, Digital Video processing Pearson Education (Asia) Pte. Ltd.
3. Li and, Z. Drew, M.S. Fundamentals of Multimedia, Pearson Education (Asia) Pte. Ltd,. 2010.

References books

1. Gonzalez, Rafael C., Woods, Richard E. and Eddins Steven L., Digital Image Processing Using Matlab, Pearson Education (Asia) Pvt. Ltd.,
2. Al. Bovik, Essential guide to Video Processing, Academic Press

Implementation:

Implementation assignments are designed using opencv/c++ to explore the concepts like

1. Image enhancement techniques
2. Image transforms.
3. Image restoration technique
4. Develop an image processing application to assist
    a. ADAS
    b. Agriculture
    c. Defense
    d. Health Care
    e. Surveillance and Forensics
    f. Remote sensing
5. Track an object in video
6. Optimal use of surveillance video

Program: VLSI Design & Embedded Systems		
Course Title: Digital Control Systems		**Course Code:** 17EVEE702
L-T-P: 2-0-1	**Credits: 4**	**Contact Hours: 5**
ISA Marks: 50+100	**ESA Marks: 50**	**Total Marks: 200**
Teaching Hours: 40	**Examination Duration: 3 hours**	

1. Introduction to digital control: Introduction, Discrete time system representation, Mathematical modeling of sampling process, Data reconstruction.	4hrs
2. Modeling discrete-time systems by pulse transfer function: Z-transform, Mapping of Z-plane to z-plane, Pulse transfer function , Pulse transfer function of closed loop system, Sampled signal flow graph.	3hrs
3. Time response of discrete systems: Transient and steady state responses, Time response parameters of a prototype second order system.	5hrs
4. Stability analysis of discrete time systems: Jury stability test, Stability analysis using bi-linear transformation.	5hrs
5. Design of sampled data control systems: Root locus method, Controller design using root locus, Root locus based controller ,design using MATLAB, Nyquist stability criteria, Bode plot.	5hrs
6. Deadbeat response design :Design of digital control systems with deadbeat response, Practical issues with deadbeat response design, Sampled data control systems with deadbeat response.	6hrs
7. Discrete state space model: Introduction to state variable model, Various canonical forms, Characteristic equation, state transition matrix, solution to discrete state equation.	2hrs
8. Controllability, observability and stability of discrete state space models: Controllability and observability, Lyapunov stability theorem.	5hrs
9. State feedback design: Pole placement by state feedback, Set point tracking controller, Full order observer, Reduced order observer.	5hrs

References:

1. B. C. Kuo,Digital Control Systems, Oxford University Press, 2/e, Indian Edition, 2007.
2. K. Ogata, Discrete Time Control Systems, Prentice Hall, 2/e, 1995.
3. M. Gopal,Digital Control and State Variable Methods, Tata Mcgraw Hill, 2/e, 2003.
4. G. F. Franklin, J. D. Powell and M. L. Workman, Digital Control of Dynamic Systems,

Course Code: 17EVEE703	Course Title: **Standard Cell Design and Layout**

L-T-P: 2-0-1	Credits: 3	Contact Hrs:
ISA Marks: 50+100	ESA Marks: 50	Total Marks: 200
Teaching Hrs: 50		Exam Duration: 3 hrs

Chapter No. 1. Introduction IC design flows. Use of standard cell elements vs. custom design and Gate array paradigms. Introduction to memory types and construction of memory elements.	15 hrs
Chapter No. 2. Standard cell library composition and usage Types of standard cell elements. Logical and functional elements, primitives and complex macros. Sequential elements and register files. (Flip flop and latch design). Data path elements. Library size vs. usage in standard flows. Drive strength and cell families. Layout of library elements – single height, double height cells. Power Management cells.	17hrs
Chapter No. 3. Standard cell characterization Usage of standard cells by various tools. Information needed at each stage of design flow. Characterization parameters, setup and runs across PVT corners. Library representation formats. (Gate level simulation, synthesis, timing, layout, timing, LVS, DRC)	18 hrs
References: Standard cell and memory library documentation by Vendors 90nm EDK library	

Program: VLSI Design & Embedded Systems		
Course Title: Low Power VLSI Circuits		**Course Code:** 17EVEE704
L-T-P: 2-0-1	**Credits: 4**	**Contact Hours:4**
ISA Marks: 50+100	**ESA Marks: 50**	**Total Marks: 200**
Teaching Hours: 40	**Examination Duration: 3 hours**	

1: Introduction to low power VLSI design: Need for Low Power VLSI Chips, sources of power dissipation. Device and Technology impact on Low Power, dynamic power dissipation in CMOS. Power Estimation.	6Hrs
2: Power analysis: Simulation Power Analysis, Spice circuits simulator, gate level logic simulator, Probabilistic power analysis	5Hrs
3: A new CMOS driver model for transient analysis and power dissipation analysis, low power design of off-chip drivers and transmission lines: a branch and bound approach.	5Hrs
4: Different levels of power optimization Low Power Design; circuit Level, logic Level, Low Power Architecture.	7Hrs
5: Floor plan design with low power considerations, optimal drivers of high-speed low power ics, retiming sequential circuits for low power	5Hrs
6: Clock Distribution: Low Power Clock distribution, single driver versus distributed buffers. Power management: Power & performance management,switching activity reduction, parallel architecture.	4Hrs
7:Algorithmic level methodologies for power reduction: Algorithm and architectural level methodologies- algorithmic level analysis & optimization, architecture level estimation and synthesis, Current trends	8Hrs

Text Books

1. Gary K. Yeap, "Practical Low Power Digital VLSI Design", KAP, 2002.
2. Rabaey, Pedram, "Low power design methodologies" Kluwer Academic, 1997.

Reference Books:

1. A. Chandrakasan and R. Brodersen, "Low Power CMOS Design".
2. Sung - Mo Kang & Yosuf Leblebici, "CMOS Digital Integrated Circuits: Analysis and Design", TMH, 2003 (Third Edition).
3. Laung-Terng Wang, Charles E. Stroud, Nur A. Touba, "System-on-chip Test Architectures", 2008.
4. Kaushik Roy, Sharat Prasad, "Low-Power CMOS VLSI Circuit Design" Wiley, 2000.

Program: VLSI Design & Embedded Systems		
Course Title: Analog and Mixed mode VLSI Circuits		Course Code: 17EVEE705
L-T-P: 2-0-1	Credits: 3	Contact Hours: 6
ISA Marks: 50	ESA Marks: 50	
Teaching Hours: 50	Examination Duration: 3 hours	Total Marks: 100

1. Introduction to CMOS analog circuits, MOS transistor DC and AC small signal parameters from large signal model, Common source amplifier with resistive load, diode load and current source load, Source follower, Common gate amplifier, Cascode amplifier, Frequency response of amplifiers.	12 hrs
2. Current source/sink/mirror, Matching, Wilson current source, Widlar current source and Regulated Cascode current source, Differential amplifier.	08 hrs
3. Op-Amp: CMOS Op-Amp, Compensation of Op-Amp,Design of two stage Op-Amp.	06 hrs
4. Basic Current reference, and Voltage (Bandgap) reference circuits, OPAMP based references, Current mode bandgap reference.	06 hrs
5. Bidirectional analog switch, Sample and Hold circuit, Basic Comparator architecture, non-idealities (offset error, bandwidth consideration), Dynamic comparator, Sense amplifier, Current Mode Logic(Buffer and Latch)	08 hrs
6. Data Converter Fundamentals, DAC architectures and ADC architectures	10 hrs

Text Books

1. Phillip. E. Allen, Douglas R. Holberg, "CMOS Analog circuit Design" Oxford University Press, 2002.
2. Baker, Li, Boyce, "CMOS: Circuit Design, Layout and Simulation", Prentice Hall of India, 2000

Reference Books

1. N. Weste and K. Eshranghian, Principles of CMOS VLSI Design, Addison Wesley. 1985.
2. J. Rabaey, Digital Integrated Circuits: A Design Perspective, Prentice Hall India, 1997
3. B Razavi 'Design of Analog CMOS Integrated Circuits' First Edition McGraw Hill 2001

Lab:

1. Design and implement Common source MOS amplifier with resistive load, diode load and current source load.
2. Design and implement a Cascode amplifier.
3. Design and implement a Simple current mirror
4. Design and implement a Differential amplifier
5. Design and implement a Operational amplifier
6. Design and implement a basic comparator
7. Design and implement a R-2R DAC

Program: III Semester Master of Technology (VLSI Design & Embedded Systems)			Teaching Hours
Course Title: Embedded Software Design		Course Code: 17EVEC801	
L-T-P: 0-0-3	Credits: 3	Contact Hours: 6 Hrs/week	
ISA Marks: 80	ESA Marks: 20	Total Marks: 100	
Teaching Hours: 40 Hrs	Examination Duration:		
1. Introduction To Real-Time Operating Systems: Introduction to OS, Introduction to real time embedded system- real time systems, characteristics of real time systems, and the future of embedded systems. Introduction to RTOS, key characteristics of RTOS, its kernel, components in RTOS kernel, objects, scheduler, services, context switch, Scheduling types: Preemptive priority-based scheduling, Round-robin and preemptive scheduling.			08 Hrs
2. Tasks, Semaphores and Message Queues:: A task, its structure, A typical finite state machine, Steps showing the how FSM works. A semaphore, its structure, binary semaphore, mutual exclusion (mutex) semaphore, Synchronization between two tasks and multiple tasks, Single shared-resource-access synchronization, Recursive shared-resource-access synchronization. A message queue, its structure, Message copying and memory use for sending and receiving messages, Sending messages in FIFO or LIFO order, broadcasting messages.			08 Hrs
3. Typical RTOSs: Study of VX works, RT Linux and Android OS and comparisons. Real time programming using RTX/free RTOS. Applications and Common Design Problems: Embedded RTOS for Image Processing & Control Systems, and common problems encountered in these applications.			04 Hrs
4. Introduction to embedded linux: Embedded Linux overview: Development-Kernel architectures and device driver model-Embedded development issues-Tool chains in Embedded Linux-GNU Tool Chain (GCC,GDB, MAKE, GPROF & GCONV)- Linux Boot process			02 Hrs
5. Boot sequence-System loading, sys linux, Lilo, grub-Root file system-Binaries required for system operation-Shared and static Libraries overview-Writing applications in user space-GUI environments for embedded Linux system			02 Hrs
6. File system in Linux: File system Hierarchy-File system Navigation -Managing the File system –Extended file systems-INODE-Group Descriptor-Directories-Virtual File systems-Performing File system Maintenance -Locating Files –Registering the File systems-Mounting and Un-mounting –Buffer cache-/proc file systems-Device special files			08 Hrs
7. Program design and Analysis : Components of Embedded system: State machines; stream oriented programming and circular buffers, queues. Models of programs: data flow graph and control flow graphs, Assembly, linking and loading. Basic compilation techniques: Statement translation, procedures, data structures. Program optimization: Expression simplification, dead code elimination, procedure inlining, loop transformations, register allocation, scheduling, instruction selection, interpreters and JIT compilers. Program level performance analysis, software performance optimization, program level energy and power analysis, analysis and optimization of program size. Program validation and testing: Clear box testing, black box testing, evaluating function tests.			08 Hrs

Text Books

1. Qing Li with Caroline Yao, “Real-Time Concepts for Embedded Systems”, Published by CMP Books,2011
2. Dr. K.V.K.K. Prasad, “Embedded/Real-time systems: concepts, Design & Programming”, published by dreamtech press .
3. “Embedded Systems- Architecture, Programming and Design” by Raj Kamal, TMH

References

1. Philip.A.Laplante, “Real Time System Design and Analysis”, Prentice Hall of India, 3rd Edition, April 2004.
2. “Programming embedded systems” in C and C++ Micheal Barr orielly

List of Experiments:

1. Write a ‘C’ program & demonstrate concept of Task Scheduling.
2. Write a ‘C’ program & demonstrate concept of Semaphore.
3. Write a ‘C’ program & demonstrate concept of Mailbox.
4. Write a ‘C’ program & demonstrate concept of S/W Interrupts.
5. Write a ‘C’ program & demonstrate concept of interrupts.
6. Write a ‘C’ program & demonstrate concept of Inter Task Communication.

Reference Books

1. Dr. K.V.K.K. Prasad, “Embedded/Real-time systems: concepts, Design & Programming”, published by dreamtech press.

Manual

1. LPC2148 datasheet by NXP.

LPC2148 board manual by ALS, Bangalore.

Course Code: 17EVEC802	Course Title: **Advanced Digital logic Verification**	
L-T-P: 1-0-3	Credits: 4	Contact Hrs: 6hrs/week
ISA Marks: 50+100	ESA Marks: 50	Total Marks: 200
Teaching Hrs: 50		Exam Duration: 3 hrs

Chapter No. 1. Verification Concepts Concepts of verification, importance of verification, Stimulus vs Verification, functional verification, test bench generation, functional verification approaches, typical verification flow, stimulus generation, direct testing, Coverage: Code and Functional coverage, coverage plan.	10 hrs
Chapter No. 2. System Verilog – Language Constructs System Verilog constructs - Data types: two-state data, strings, arrays: queues, dynamic and associative arrays, Structs, enumerated types. Program blocks, module, interfaces, clocking blocks, modports.	10 hrs
Chapter No. 3. System Verilog – Classes & Randomization SV Classes: Language evolution, Classes and objects, Class Variables and Methods, Class instantiation, Inheritance, and encapsulation, Polymorphism. Randomization: Directed Vs Random Testing. Randomization: Constraint Driven Randomization.	12 hrs
Chapter No. 4. System Verilog – Assertions & Coverage Assertions: Introduction to Assertion based verification, Immediate and concurrent assertions. Coverage driven verification : Motivation, Types of coverage, Cover Group, Cover Point, Cross Coverage, Concepts of Binning and event sampling.	8 hrs
Chapter No. 5. Building Testbench Layered testbench architecture. Introduction to Universal Verification Methodology, Overview of UVM	10 hrs

Base Classes and simulation phases in UVM and UVM macros. Unified messaging in UVM, UVM environment structure, Connecting DUT- Virtual Interface	
References: 1. System Verilog LRM 2. Chris Spear, Gregory J Tumbush - SystemVerilog for verification - a guide to learning the testbench language features - Springer, 2012 **3.** Step-by-Step Functional Verification with SystemVerilog and OVM by Sasan Iman SiMantis Inc. Santa Clara, CA Spring 2008 Tools: 1. NC Verilog, NC Sim, VCSMX for System.	

Program: III Semester Master of Technology (VLSI Design & Embedded Systems)			**Teaching Hours**
Course Title: Internet of Things		**Course Code: 17EVEE801**	
L-T-P: 2-0-1	**Credits: 3**	**Contact Hours: 5 Hrs/week**	
ISA Marks: 50+100	**ESA Marks: 50**	**Total Marks: 200**	
Teaching Hours: 25 Hrs	**Examination Duration:**		

1	**Introduction to Internet of Things (IoT)** Definition & Characteristics of IoT, Things in IoT, IoT protocols, IoT functional blocks, communication models and APIs.	**04 hrs**
2	**IoT Architecture** Enabling technologies: Sensors, Zigbee, Bluetooth, IoT ecosystem, Data Link protocols: IEEE 802.15.4e, IEEE 802.11.ah, DASH7, Low Power Wide Area Network (LoRaWAN).	**04 hrs**
3	**Network protocols** Routing Protocol for Low-Power and Lossy Networks (RPL), cognitive RPL (CORPL), Channel-Aware Routing Protocol (CARP), Low power Wireless Personal Area Networks (LoWPAN).	**04 hrs**
4	**Application and Security protocols** Message Queue Telemetry Transport (MQTT), MQTT for Sensor Networks, Secure MQTT, Advanced Message Queuing Protocol (AMQP), Constrained Application Protocol (CoAP), OPC UA, 6LoWPAN), Routing Protocol for Low-Power and Lossy Networks (RPL).	**04 hrs**
5	**IoT Platforms Design Methodology** IoT Design Methodology, Case Study on IoT System for Weather Monitoring etc., Basic building blocks of an IoT device, Raspberry Pi, interface (serial, SPI, I2C), IoT Operating Systems: Contiki, RIOT.	**04 hrs**
6	**Programming with Raspberry Pi** XML, JSON, SOAP and REST-based approach, WebSocket protocol.	**04 hrs**
7	**IoT prototyping** Business models, example applications: Case studies on Home automation, Cities, Environment, Energy, Agriculture, Health with emphasis on data analytics and security.	**06 hrs**

Text Books:

1. Arshdeep Bahga, Vijay Madisetti “Internet of Things (A Hands-on-Approach)” Universities Press- 2014.
2. Olivier Hersent, David Boswarthick, Omar Elloumi, “The Internet of Things: Key Applications and Protocols” John Wiley & Sons – 2012.

Reference Books:

1. Subhas Chandra Mukhopadhyay “Internet of Things Challenges and Opportunities” Springer- 2014.

Lab:

1. Programming with Raspberry Pi
2. Cloud service interface for data storage and retrieval
3. Performance analysis of Data link protocols, routing and application protocols
4. Open Ended Experiment with focus on data analytics and security

Course Code: 17EVEE802	Course Title: AUTOSAR	
L-T-P : 2-0-1	Credits: 3	Contact Hrs: 3 Hours
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 40		Exam Duration: 3

Content	**Hrs**
Unit - 1	
Chapter No. 1: AUTOSAR Fundamentals Evolution of AUTOSAR – Motivations and Objectives AUTOSAR consortium – Stake holders – work Packages, AUTOSAR Partnership, Goals of the partnership, Organization of the partnership, AUTOSAR specification, AUTOSAR Current development status, BSW Conformance classes: ICC1, ICC2, ICC3, and Drawbacks of AUTOSAR.	8 hrs
Chapter No. 2: AUTOSAR layered Architecture AUTOSAR Basic software, Details on the various layers , Details on the stacks Virtual Function Bus (VFB) Concept Overview of AUTOSAR Methodology , Tools and Technologies for AUTOSAR AUTOSAR Application Software Component (SW-C) ,Types of SW-components AUTOSAR Run Time Environment (RTE): RTE Generation Process: Contract Phase, Generation Phase, MCAL, IO HW Abstraction Layer, Partial Networking, Multicore, J1939 Overview, AUTOSAR Ethernet, AUTOSAR E2E Overview , AUTOSAR XCP, Metamodel , From the model to the process , Software development process.	7 hrs
Unit - 2	
Chapter No. 3: Methodology of AUTOSAR and Communication in AUTOSAR CAN Communication, CAN FD, CAN in Automation, CANape, Application Layer and RTE, intra and inter ECU communication, Client-Server Communication, Sender-Receiver, Communication, CAN Driver, Communication Manager (ComM), Overview of Diagnostics Event and Communication Manager	10 hrs
Chapter No. 4: BSW Development and Integration BSW Constituents: Memory layer, COM and Services layer, ECU abstraction, AUTOSAR, Operating system, Interfaces: Standard interface, AUTOSAR standardized interface, BSW-RTE interface,(AUTOSAR interface), BSW-ECU hardware interface, Complex device drivers and BSW module configuration, AUTOSAR Integration.	5 hrs
Unit - 3	
Chapter No. Chapter 5: Infotainment Systems in Automobiles Infotainment Systems Fundamentals: Radio, Multimedia, and Navigation: Introduction to In Vehicle Infotainment (IVI) systems, Use of operating systems in IVI , GENIVI Alliance, Tuner: AM/FM, XM/Sirrus, DAB/DMB, Software Defined Radio; Concepts of HD, radio, Ensemble, Traffic Announcements, Spread Spectrum, d. Multimedia: Types of Media; Music, Video, Podcasts, etc. Media management; Playback, Track Control, Metadata, Playlists, Categories, Trick play, Audio/Video Source Management, Navigation: Points of Interests, Routes, Waypoints, Dead Reckoning position, Traffic Info, GLONASS, GNSS, RTK, GPS, and SBAS/GBAS,INS f. Media types: CD, DVD, CDDA, USB, SDCARD, Media Formats:MP3, WMV, RealAudio/Video, QTP, Architecture – Design Patterns - Proxies, Adaptors, Interfaces, Singleton, Factory method	5 hrs
Chapter No. Chapter 6: Communication Systems in Automobiles Automotive & Consumer Electronic Communication Systems: Introduction to Bluetooth – Pairing, HFP, A2DP, PAN, PBAP, DUN, Concepts of MOST network, DLNA, AVB, Concepts of TCP/IP, Ethernet, WiFi, WiFi Direct, MyWiFi and CAN, Mirror link, Tethering	5 hrs

Text Book (List of books as mentioned in the approved syllabus) 1. Ribbens, Understanding of Automotive electronics, 6th Edition, Elsevier, 2003 2. Denton.T, Automobile Electrical and Electronic Systems, Elsevier, 3rd Edition, 2004 3. Denton.T, Advanced automotive fault diagnosis, 2000 **References** 1. Ronald K Jurgen, Automotive Electronics Handbook, 2nd Edition, McGraw-Hill, 1999 2. James D Halderman, Automotive electricity and Electronics, PHI Publication, 2000 3. Allan Bonnick, Automotive Computer Controlled Systems Diagnostic Tools and Techniques, Elsevier Science, 2001 4. Nicholas Navet , Automotive Embedded System Handbook , 2009	

Course Code: 17EVEE803	Course Title: ASIC Design	
L-T-P: 2-0-1	Credits: 4	Contact Hrs: 50
ISA Marks: 50+100	ESA Marks: 50	Total Marks: 200
Teaching Hrs: 50		Exam Duration: 3 hrs

Content	Hrs
Chapter No. 1. Introduction to ASIC ASIC types, design flow, economics of ASIC	8 hrs
Chapter No. 2. ASIC design library and Logic cell Transistor as register, transistor parasitic capacitance, Logic Effort, Data Path Elements, Adders, Multiplier, Sequential logic cells, I/O cell.	10 hrs
Chapter No. 3. Logic Synthesis and Simulation Logic synthesis, FSM synthesis, structural simulation, static timing analysis, delay models	10 hrs
Chapter No. 4. ASIC Construction Floor planning and placement and routing Physical Design, System Partitioning, Estimating ASIC size, partitioning methods.	10 hrs
Chapter No. 5. Floor planning and placement and routing Floor planning tools, I/O and power planning, clock planning, placement algorithms, iterative placement improvement, Time driven placement methods. Physical Design flow global Routing, Local Routing, Detail Routing, Special Routing, Circuit Extraction and DRC.	12 hrs

Text Books:

1. M.J.S .Smith, - “Application - Specific Integrated Circuits” – Pearson Education, 2003.
2. Randall L Geiger, Phillip E. Allen, “Noel K.Strader, VLSI Design Techniques for Analog and Digital Circuits”, McGraw Hill International Company, 1990.

References:

1. Jose E.France, Yannis Tsividis, “Design of Analog-Digital VLSI Circuits for Telecommunication and signal processing”, Prentice Hall, 1994.
2. Andrew Brown, - “VLSI Circuits and Systems in Silicon”, McGraw Hill, 1991.
3. S.D. Brown, R.J. Francis, J. Rox, Z.G. Uranesic, “Field Programmable Gate Arrays”- Kluwer Academic Publishers, 1992.
4. Mohammed Ismail and Terri Fiez, “Analog VLSI Signal and Information Processing “, McGraw Hill, 1994.
5. S. Y. Kung, H. J. Whilo House, T. Kailath, “VLSI and Modern Signal Processing”, Prentice Hall, 1985.

Course Code: **17EVEE804**	Course Title: **MEMS**	
L-T-P: **2-0-1**	Credits: 3	Contact Hrs: 40
ISA Marks: 50+100	ESA Marks: 50	Total Marks: 200
Teaching Hrs: 40		Exam Duration: 3 hrs

No	Content	Hrs
1	**Overview of MEMS and Microsystems** Evolution of Microsystems, Miniaturization, Applications, Working principles of Microsystems: Introduction to Micro-sensors, Micro-actuation, Example of MEMS with Micro-actuators – Airbag	5
2	**Micro-fabrication** Different structures used for MEMS devices (combination of Mechanical, electrical), How to create these structures	2
	Materials for MEMS and Microsystems: Silicon as a preferred material, Silicon compounds, GaAS, Quartz, Polymers, piezo-resistors; Machining processes (Bulk, Surface and LIGA processes). Unit processes in VLSI, Oxidation, Diffusion, Deposition, Etching, Photolithography	8
3	**Sensing Techniques and Examples:** PZR, PZE, and Capacitive sensing techniques, Modeling, Design and Analysis with example for each technique. Numerical problem for each technique.	10
4	**Case studies –** MEMS resonator, PZR accelerometer (Commercial)	5
5	**Scaling laws in miniaturization:** Introduction to scaling, scaling in geometry, electrostatic forces, EM forces, Electricity, Numerical problems.	4
6	**Modeling:** Modeling techniques: Mathematical modeling, Electrical modeling (Lumped modeling), Mechanical Modeling, MEMS CAD tools. MEMS as Inductor, Capacitor, Micro-Characterization.	6

Text Book:

"MEMS and Microsystems – Design and Manufacture", *Tai-Ran Hsu, TMH Edition*

References:

"*Micro system Design*", Stephen D. Senturia, Kluwer Academic Publishers, 2001.

			Teaching Hours
Program: Digital Electronics			
Course Title: Machine learning		**Course Code: 17EVEC705**	
L-T-P: 3-0-1	**Credits: 4**	**Contact Hours: 5 Hrs/week**	
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**	

Teaching Hours: 40 Hrs	**Examination Duration: 3 hrs**		
Chapter No. 1: Introduction Introduction What is Machine Learning? Applications of Machine Learning, Types of Machine Learning: Supervised, Unsupervised and Reinforcement learning, Dataset formats, Basic terminologies.			**05 Hrs**
Chapter No. 2: Supervised Learning Linear Regression, Logistic Regression Linear Regression: Single and Multiple variables, Sum of squares error function, The Gradient descent algorithm, Application, Logistic Regression, The cost function, Classification using logistic regression, one-vs-all classification using logistic regression, Regularization.			**10 Hrs**
Chapter No. 3: Supervised Learning: Neural Network Introduction to perception learning, Implementing simple gates XOR, AND, OR using neural network. Model representation, Gradient checking, Back propagation algorithm, Multi-class classification, Application- classifying digits, SVM.			**10 Hrs**
Chapter No. 4: Unsupervised Learning: Clustering Introduction, K means Clustering, Algorithm, Cost function, Application.			**05Hrs**
Chapter No. 5: Unsupervised Learning: Dimensionality reduction Dimensionality reduction, PCA- Principal Component Analysis. Applications, Clustering data and PCA.			**05Hrs**
Chapter No. 6: Machine Learning System Design Evaluating a hypothesis, Model selection, Bias and variance, error analysis, error metrics for skewed classes. Building a Model.			**05 Hrs**

Text Book (List of books as mentioned in the approved syllabus)

1. Tom Mitchell, Machine Learning, 1, McGraw-Hill. , 1997
2. Christopher Bishop, Pattern Recognition and Machine Learning, 1, Springer, 2007

References

1. Video lectures by : Andrew Ng, Co-founder, Coursera; Adjunct Professor, Stanford University; formerly head of Baidu AI Group/Google Brain https://www.coursera.org/learn/machine-learning#
2. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning : Data Mining, Inference and Prediction, 2, Springer, 2009

Implementation Assignments:

1. Assignments are designed to explore the concepts like
   - Supervise and unsupervised learning,
   - Clustering,
   - Regression and estimation
2. Motivate students to take up open challenges like Kaggle, walmart, ect
3. To explore different Machine Learning Tools/ Libraries.

Program: Digital Electronics		
Course Title: Advanced Computer Architecture		**Course Code:** 17EVEC801
L-T-P-SS: 4-0-0	**Credits: 4**	**Contact Hours: 4**
CIE Marks: 50	**SEE Marks: 50**	**Self Study : --**
Teaching Hours: 50	**Examination Duration: 3 hours**	**Total Marks: 100**

1. **Parallel Computers Models:** Introduction. State of Computing and classification of parallel Computers, Multiprocessors and multi computers. Multivector and SIMD Computers.	7 hrs
2. **Program properties:** Conditions of Parallelism Data & resource Dependences, H/W & S/W parallelism, Program partitioning, Scheduling Grain size & latency, program flow Mechanisms.	6 hrs
3. **System Interconnect Architecture:** Network Properties and routing, Static & dynamic interconnection networks, Multiprocessor system interconnects, Hierarchical bus systems, Crossbar switch, Multipart memory, Multistage & combining network.	5 hrs
4. **Advanced processors** : Advanced processor technology, instruction-set architectures, CISC scalar processors, RISC scalar processors, Superscalar processors, VLIW architectures, VLIW architectures.	6 hrs
5. **Pipelining**: Linear pipeline processor, Nonlinear pipeline processor, Instruction pipeline design, Branch handling techniques, Arithmetic pipeline design, Computer arithmetic principles, Static arithmetic pipeline, Multifunctional arithmetic pipeline	8 hrs
6. **Memory Hierarchy Design:** Cache basics, Miss rate and penalty, Cache Hierarchy, Memory Organizations, Memory Hierarchy	6 hrs
7. **Multiprocessor Architecture and Programming:** Symmetric shared memory architectures, Distributed shared memory architectures, Models of memory consistency, Cache coherence protocols (MSI, MESI and MOESI), Scalable cache coherence	6 hrs
8. **Scalable & multithreaded architecture :** Latency Hiding Techniques, Principles of multithreading, Scalable multithreadeded architectures	2 hrs
9. Introduction to Intel architectures Intel core Duo processor, CPU, Memory controller, I/O Controller	4 hrs

Text Books

1. Kai Hwang, Faye A. Briggs, “Computers Architecture and Parallel Processing” MGH – 1985
2. Kai Hwang, “ Advanced Computer Architecture – TMH – 1993
3. D. Sima,T. Fountain, P.Kasuk,” Advanced Computer Architecture-A Design Space Approach” Addisson Wesley,1997.
4. M. J. Flynn,”Computer Architecture, Pipelined And Parallel Processing”, Narosa Publications,1998

Reference Books:

1. Neil D. A. Patterson and J. L. Hennessey “Computer Organization and Design”, Morgan , Kaufmann,2002
2. Stalling W. ”Computer Organization and Architecture- Designing for performance” ,PHI,2005.
3. D.E. Culler and J.P.Singh “ Parallel Computer Architechure”, Harcourt Asia PTE Ltd,2000

Program: Digital Electronics		
Course Title: System Simulation & Modeling		**Course Code: 17EVEE 804**
L-T-P-SS: 4-0-0	**Credits: 4**	**Contact Hours: 4**
CIE Marks: 50	**SEE Marks: 50**	**Total Marks: 100**
Teaching Hours: 50	**Examination Duration: 3 hours**	

1. **Introduction:** Simulation Examples (ch1 and ch2)	4 hrs
2. **Statistical models:** Discrete distribution and continuous distribution and empirical distribution(ch5)	4 hrs
3. **Queuing models:** Characteristics, steady state behavior of finite and infinite population models, network of queues. (ch6)	5 hrs
4. **Random number generation, techniques and tests, random variate generation:** Inverse transform techniques, direct transformation, convolution methods, acceptance and rejection techniques (ch7 and ch8).	8 hrs
5. **Input modelling:** Parameter estimation, goodness fit test, multivariate and time series input models (ch9).	9 hrs
6. **Verification and Validation of Simulation models:** Model building, calibration and validation (ch10).	10 hrs
7. **Output analysis for single model:** Types, stochastic nature of output data, measure of performance of output data and estimation, output analysis for terminating simulations, output analysis of steady state simulation.	10 hrs

Text Books

1. "An .Jerry Banks, John S. Carson II, Barry L Nelson and David M. Nicol, " Discrete event system simulation", PHI, III edition 2005
2. **2.**Averill M. Law and W. David Kelton, "Simulation modelling and Analysis" , Tata McGraw-Hill, III edition.2003

Reference books

1. Raj Jain, The Art of Computer Systems Performance Evaluation, John Wiley and Sons, Inc., 1991.
2. Edward Lazowska, John Zahorjan, Scott Graham, and Kenneth Sevcik, Computer Systems Analysis Using Network Models, Prentice-Hall Inc., 1984.
3. Leonard Kleinrock, Queueing Systems Theory- Volume I, John Wiley and Sons, Inc., 1975.
4. Morris H. DeGroot and Mark J. Schervish, Probability and Statistics (Third Edition), Addision-Wesley, 2002

Program: VLSI Design & Testing		
Course Title: System on Chip		**Course Code: 17EVEC806**
L-T-P-SS: 4-0-0-0	**Credits: 4**	**Contact Hours: 4**
CIE Marks: 50	**SEE Marks: 50**	**Total Marks: 100**
Teaching Hours: 50	**Examination Duration: 3 hours**	

1. **Verification and Technology Options:** Overview of verification, challenges in verification of SOC, Simulation technologies, Static technologies, Formal technologies, Physical verification and analysis, comparing verification options.	10 hrs
2. **Verification Methodology:** Verification plans, Testbench creation, Testbench migration, Verification languages, Verification device test, System level verification, Verification IP Reuse, Verification approaches.	10 hrs
3. **System level Verification:** System design, System verification, Applying the system level testbench, System testbench migration, Bluetooth SOC.	10 hrs
4. **Static Netlist Verification:** Netlist verification, Bluetooth SOC arbiter, Equivalence checking, Equivalence checking methodology, RTL to RTL verification, RTL to Gate level netlist verification, Gate level netlist to Gate level, Static timing verification and analysis**.**	10 hrs
5. **SOC Testing:** Importance of system on chip testing, SOC test issues, FPGA Testing: Overview of FPGA, Testing approaches, BIST of programmable resources, Embedded processor based testing**.**	10 hrs

Text Books

1. Prakash Rashinkar, Peter Paterson, Leena Singh, " SOC Verification –Methodology and Techniques",

Springer 2000

2. Laung-Terng Wang, Charles E. Stroud, Nur A. Touba, “System-on-chip Test Architectures”, 2008.

Reference books

1. J-M. Berge, O. Levia, J. Rouillard: Hardware/Software Co-Design and Co-Verification, Kluwer, 1997.
2. M. L. Bushnell and V. D. Agrawal, Essential of Electronics Testing for Digital, Memory and Mixed-Signal Circuits, Kluwer Academic Publishers, 2001.
3. Thomas Kropf, “Introduction to Formal Hardware Verification”, Springer 1999.

Program: VLSI Design & Embedded Systems		
Course Title: Automotive Electronics and Communication		**Course Code:** 19EVEC701
L-T-P: 4-0-1	**Credits: 5**	**Contact Hours: 5 hrs**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hours: 50	**Examination Duration: 3 hrs**	

Chapter No: 1.Automotive Systems, Design cycle and Automotive industry overview Overview of Automotive industry, Vehicle functional domains and their requirements, automotive supply chain, global challenges. Role of technology in Automotive Electronics and interdisciplinary design. Introduction to modern automotive systems and need for electronics in automobiles and application areas of electronic systems in modern automobiles, Introduction to power train, Automotive transmissions system ,Vehicle braking fundamentals, Steering Control, ,Overview of Hybrid Vehicles, ECU Design Cycle : Types of model development cycles(V and A) , Components of ECU, Examples of ECU on Chassis, Infotainment, Body Electronics and cluster.	9 hrs
Chapter No: 2. Embedded system in Automotive Applications & Automotive safety systems Automotive grade microcontrollers: Architectural attributes relevant to automotive applications, Automotive grade processors ex: Renesas, Quorivva, and Infineon. EMS: Engine control functions, Fuel control, Electronic systems in Engines , Development of control algorithm for EMS, Look-up tables and maps, Need of maps, Procedure to generate maps, Fuel maps/tables, Ignition maps/tables, Engine calibration, Torque table, Dynamometer testing Safety Systems in Automobiles: Active and Passive safety systems: ABS, TCS, ESP, Brake assist, Airbag systems etc.	10 hrs
Chapter No: 3. Automotive Sensors and Actuators Sensor characteristics, Sensor response, Sensor error, Redundancy of sensors in ECUs, Avoiding redundancy, Smart Nodes, Examples of sensors: Accelerometer (knock sensors),wheel speed sensors, Engine speed sensor, Vehicle speed sensor, Throttle position sensor, Temperature sensor, Mass air flow (MAF) rate sensor, Exhaust gas oxygen concentration sensor, Throttle plate angular position sensor, Crankshaft angular position/RPM sensor, Manifold Absolute Pressure (MAP) sensor. Actuators: Engine Control Actuators, Solenoid actuator, Exhaust Gas Recirculation Actuator.	9 hrs
Chapter No: 4. Automotive communication protocols Overview of Automotive communication protocols : need for communication in Automotive, overview of vehicle network architecture, need for CAN in Automotive, CAN Bus logic ,CAN frame formats, CAN bus fault confinement, LIN , Flex Ray, MOST.	10 hrs
Chapter No: 5. Advanced Driver Assistance Systems (ADAS) and Functional safety standards Advanced Driver Assistance Systems (ADAS):Examples of assistance applications: Lane	7 hrs

Departure Warning, Collision Warning, Automatic Cruise Control, Pedestrian Protection, Headlights Control, Connected Cars technology and trends towards Autonomous vehicles. Functional Safety: Need for safety standard-ISO 26262, safety concept, safety process for product life cycle, safety by design, validation.	
Chapter No: 6. Diagnostics Fundamentals of Diagnostics: Basic wiring system and Multiplex wiring system, Preliminary checks and adjustments, Self-diagnostic system. Fault finding and corrective measures, Electronic transmission checks and Diagnosis, Diagnostic procedures and sequence, On board and off board diagnostics in Automobiles, OBDII, Concept of DTCs, DLC, MIL, Freeze Frames, History memory, Diagnostic tools, Diagnostic protocols: KWP2000 and UDS.	5 hrs

Text books:

2. William B. Ribbens, Understanding Automotive Electronics, 6, Newnes Publications, 2003
3. Denton.T , Automobile Electrical and Electronic Systems, Edward Arnold , 1995

References:

6. William T.M , Automotive Electronic Systems, Heiemann Ltd., London , 1978
7. Nicholas Navet , Automotive Embedded System Handbook, CRC Press , 2009

Lab:

9. Demonstration of cut section modules: Engine, Transmission , Steering, Braking, Suspension - Automobile dept.
10. Electronic engine control system: Injection and Ignition control system Transmission trainer modules
11. Modeling an engine Vehicle model simulation with Simulink using PI CONTROLLER
12. Basic gate logic simulation and modeling using Simulink and realization on the hardware platform.
13. Seat belt warning system simulation and modeling using Simulink and realization on the hardware platform. Vehicle speed control based on the gear input simulation and modeling using Simulink and realization on the hardware platform.
14. Throttle control modeling and simulation using Simulink and realization on the hardware platform.
15. Accelerator pedal interfacing software modeling and simulation using Simulink and realization on the hardware platform.
16. Develop matlab code for stepper motor control and convert it to Simulink model and port it to embedded hardware

Program: VLSI Design & Embedded Systems		
Course Title: AUTOSAR and Infotainment		Course Code: **19EVEE707**
L-T-P : 2-0-1	Credits: 3	Contact Hrs: 4
CIA Marks: 50	SEE Marks: 50	Total Marks: 100
Teaching Hrs: 24	Exam Duration: 3 hrs	

Chapter No. 1: AUTOSAR Fundamentals Evolution of AUTOSAR – Motivations and Objectives AUTOSAR consortium – Stake holders – work Packages, AUTOSAR Partnership, Goals of the partnership, Organization of the partnership, AUTOSAR specification, AUTOSAR Current development status, BSW Conformance classes: ICC1, ICC2, ICC3, and Drawbacks of AUTOSAR.	4 hrs
Chapter No. 2: AUTOSAR layered Architecture AUTOSAR Basic software, Details on the various layers , Details on the stacks Virtual Function Bus (VFB) Concept Overview of AUTOSAR Methodology , Tools and Technologies for AUTOSAR AUTOSAR Application Software Component (SW-C) ,Types of	4 hrs

SW-components AUTOSAR Run Time Environment (RTE): RTE Generation Process: Contract Phase, Generation Phase, MCAL, IO HW Abstraction Layer, Partial Networking, Multicore, J1939 Overview, AUTOSAR Ethernet, AUTOSAR E2E Overview , AUTOSAR XCP, Metamodel , From the model to the process , Software development process.	
Unit - 2	
Chapter No. 3: Methodology of AUTOSAR and Communication in AUTOSAR CAN Communication, Application Layer and RTE, intra and inter ECU communication, Client-Server Communication, Sender-Receiver, Communication, CAN Driver, Communication Manager (ComM), Overview of Diagnostics Event and Communication Manager	4 hrs
Chapter No. 4: BSW Development and Integration BSW Constituents: Memory layer, COM and Services layer, ECU abstraction, AUTOSAR, Operating system, Interfaces: Standard interface, AUTOSAR standardized interface, BSW-RTE interface,(AUTOSAR interface), BSW-ECU hardware interface, Complex device drivers and BSW module configuration, AUTOSAR Integration.	4 hrs
Chapter No. Chapter 5: Infotainment Systems in Automobiles Infotainment Systems Fundamentals: Radio, Multimedia, and Navigation: Introduction to In Vehicle Infotainment (IVI) systems, Use of operating systems in IVI , GENIVI Alliance, Tuner: AM/FM, XM/Sirrus, DAB/DMB, Software Defined Radio; Concepts of HD, radio, Ensemble, Traffic Announcements, Spread Spectrum, d. Multimedia: Types of Media; Music, Video, Podcasts, etc. Media management; Playback, Track Control, Metadata, Playlists, Categories, Trick play, Audio/Video Source Management, Navigation: Points of Interests, Routes, Waypoints, Dead Reckoning position, Traffic Info, GLONASS, GNSS, RTK, GPS, and SBAS/GBAS,INS f. Media types: CD, DVD, CDDA, USB, SDCARD, Media Formats:MP3, WMV, RealAudio/Video, QTP, Architecture – Design Patterns - Proxies, Adaptors, Interfaces, Singleton, Factory method	4 hrs
Chapter No. Chapter 6: Communication Systems in Automobiles Automotive & Consumer Electronic Communication Systems: Introduction to Bluetooth – Pairing, HFP, A2DP, PAN, PBAP, DUN, Concepts of MOST network, DLNA, AVB, Concepts of TCP/IP, Ethernet, WiFi, WiFi Direct, MyWiFi and CAN, Mirror link, Tethering	4 hrs
Text Books (List of books as mentioned in the approved syllabus) Ronald K. Jurgen, Infotainment systems, 2007, SAE International, 2007	

Course Title: Principles and Practices of Engineering Education		Course Code: 15ECRC701
L-T-P: 2-0-1	**Credits: 3**	**Contact Hours: 3**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hours: 40	**Examination Duration: 3 hrs**	

1. **Fundamental Principles of Teaching and Learning**	**8 Hours**
2. **Learning Styles and Theories**	**8 Hours**
3. **Instructional Design Models and Technology Enhanced Learning**	**8 Hours**
4. **Assessment and Evaluation**	**8 Hours**
5. **Engineering Learning Modules**	**8 Hours**

Program: Digital Electronics		
Course Title: Fault diagnoses and testing for VLSI circuits		**Course Code:** 15EDEC708
L-T-P: 4-0-0	**Credits: 4**	**Contact Hours: 4**
CIE Marks: 50	**SEE Marks: 50**	**Total Marks: 100**
Teaching Hours: 50	**Examination Duration: 3 hours**	

1. Threshold Logic: Introduction, Synthesis of threshold networks.	5 hrs
2. Reliable Design And Fault Diagnosis: Different types of Faults, Fault Detection in Combinational Circuits, Fault Location Experiments, Different approaches used in fault diagnosis of Combinational Circuits, Failure Tolerant Design, Quadded Logic.	15 hrs
3. Capabilities, Minimization and Transformation of Sequential Machines: Finite State Model (FSM) used in Machine design, Capabilities & Limitations of finite state machines, State equivalence and machine minimization, Simplification of incompletely specified machines.	10hrs
4. Structure of Sequential Machines: State Assignments Using Partitions, The Lattice of Closed Partitions, Reduction of the Output Dependency, Input Independence and Autonomous Clocks, Covers and Generation of Closed Partitions by State Splitting, Information Flow in Sequential Machines, Machine Decomposition.	10 hrs
5. State-Identification And Fault-Detection Fault detection / location Experiments, Machine Identification, Fault-Detection Experiments, Design of Diagnosable Machines, Second Algorithm for the Design of Fault-Detection Experiments, Fault-Detection Experiments for Machines, Which have no Distinguishing Sequences.	10 hrs

Text Books

1. Khohavi ZVI Switching and Finite Automata Theory, 2ed., TMH, 1999,

Reference Books:

2. Samuel Lee Digital Circuits & Logic Design, PHI, 1990

Program: Digital Electronics		
Course Title: Real Time Embedded System lab		**Course Code:** 15EDEP706
L-T-P: 0-0-1	**Credits: 1**	**Contact Hours: 2**
CIE Marks: 80	**SEE Marks: 20**	**Total Marks: 100**
Lab Hours: 20	**Examination Duration: 3 hours**	
Experiments		

I	Advanced Embedded Systems
1.	Use any EDA (Electronic Design Automation) tool to learn the Embedded Hardware Design and for PCB design.
2.	Familiarize the different entities for the circuit diagram design.
3.	Familiarize with the layout design tool, building blocks, component placement, routings, design rule checking etc.
II	Embedded Programming Concepts (RTOS)
4.	Create „n" number of child threads. Each thread prints the message " I"m in thread number …" and sleeps for 50 ms and then quits. The main thread waits for complete execution of all the child threads and then quits. Compile and execute in Linux.
5.	Implement the multithread application satisfying the following : i.Two child threads are crated with normal priority. ii.Thread 1 receives and prints its priority and sleeps for 50ms and then quits. iii.Thread 2 prints the priority of the thread 1 and rises its priority to above normal and retrieves the new priority of thread 1, prints it and then quits. iv The main thread waits for the child thread to complete its job and quits.
6.	Implement the usage of anonymous pipe with 512 bytes for data sharing between parent and child processes using handle inheritance mechanism.
7.	Test the program below using multithread application- i.The main thread creates a child thread with default stack size and name Child_Thread". ii. The main thread sends user defined messages and the message „WM_QUIT" randomly to the child thread. iii. The child thread processes the message posted by the main thread and quits when it receives the „WM_QUIT" message. iv. The main thread checks the termination of the child thread and quits when the child thread complete its execution. v. The main thread continues sending the random messages to the child thread till the „WM_QUIT" message is sent to child thread. vi. The messaging mechanism between the main thread and child thread is synchronous.

Program: Digital Electronics		
Course Title: Data Structure using C		**Course Code:** 17EDEC701
L-T-P: 0-0-1	**Credits: Audit**	**Contact Hours: 2**
ISA Marks: 80	**ESA Marks: 20**	**Total Marks: 100**
Teaching Hours: 25	**Examination Duration: -**	

Chapter 01:C language features Pointers revisited, Strings, Structures – Basics, Structures and functions, Arrays of structures, Pointers to structures, Self Referential Structures, Unions and bit fields, Files.	5 Hrs
Chapter 02:Stacks and Queues Definition, Representation and Applications of stack. Definitions, representation and applications of linear, circular, queues, multiple queues, priority queue. Recursion	5 Hrs

Chapter 03:Lists Linked lists, singly, doubly, circular lists, definitions, representations. Implementation of list operations, applications – polynomial addition, addition of long integers. Linked stacks, Linked Queues **Chapter 04:Trees** Binary trees – Definitions, traversals (recursive and iterative versions), Building and searching, Threaded Binary trees, Trees and their applications Exchange sorts, Selection and tree sorts, Merge and radix sorts	5 Hrs 5 Hrs 5 Hrs
Text Book 1. Aaron M. Tenenbaum, et al, Data Structures using C, II Edition, PHI, 2006 2. Horowitz, Sahani, Anderson-Feed, Fundamentals of Data Structures in C, II Edition, University, 2008 **References** 1. E Balaguruswamy, The ANSI C programming Language, II Edition, PHI, 2010 2. Yashavant Kanetkar, Data Structures through C, II Edition, BPB public, 2010 3. Richard F. Gilberg, Behrouz A. Forouzan , Data Structures: A Pseudocode Approach With C, II Edition, Course Tec, 2009	
Lab: **1.** Programs on Pointer concepts. **2.** Programs on string handling functions, structures union And bit-files. **3.** Programming on files **4.** Programming on stacks data structures **5.** Programs on implementation of different queue data structures. **6.** Programs on implementation of different types of Linked lists **7.** Programs on Implementation of trees **8.** Programs to implement different sorting techniques. **9.** Programming on graph **10.** Programming on hashing tables **11.** Design and implement stack queue data structures **12.** Design and implement linked list data structures **13.** project	

Program: Digital Electronics		
Course Title: Analog and Digital Circuits		**Course Code:** 17EDEC702
L-T-P: 2-0-1	**Credits: 3**	**Contact Hours: 4**
ISA Marks: 50+100	**ESA Marks: 50**	**Total Marks: 200**
Teaching Hours: 24	**Examination Duration: -**	

Applications of theorems. RLC Circuits Combinational circuits and Sequential circuits Case study Devices: Diodes, MOSFETs. Diode circuits: clipping, clamping, rectifier. Design of BJT and MOSFET single-and multi-stage amplifiers, Feedback amplifier, Oscillator, Op-amp linear & non linear applications. **<u>Digital Circuits</u>** Combinational Circuits: Adder, encoder & decoder, MUX& DEMUX, Comparator. Sequential Circuits: Latches, Flip Flops, Shift Registers, Design of Synchronous counters and Asynchronous counters. **<u>Conventional control systems</u>**: R-H Stability criterion, Root locus, Bode plots and Nyquist stability criterion. **Tools: Simulink, MATLAB, Proteus, Pspics, Cadence, LabView, Microcap, OrCAD**	8 Hrs 8 Hrs 8 Hrs

Reference Books: 1. A.S. Sedra & K.C. Smith, Microelectronic Circuits, 5th Edition, Oxford Univ. Press, 1999 2. Jacob Millman and Christos Halkias, Integrated Electronics, McGraw Hill, 3. John M Yarbrough, Digital Logic Applications and Design, Thomson Learning, 2001 4. David A. Bell, Electronic Devices and Circuits, 4th edition, PHI publication, 2007 5. Grey, Hurst, Lewis and Meyer, Analysis and design of analog integrated circuits, 4th edition. 6. Charles H Roth, Jr; Fundamentals of Logic Design, Thomson Learning, 2004. 7. Zvi Kohavi, Switching and Finite Automata Theory, 2ed, TMH 8. Ogata, Modern Control Theory, 4th ed, PHI.	
Lab: **<u>Analog Electronics Lab</u>** 1. Study & analyze Diode Clipping and Clamping (single/double ended) circuits. 2. Implement the RLC circuit to study the transient response. 3. Design an Amplifier using MOSFET and determine its gain, input & output impedance. 4. To implement an amplifier with negative feedback & show the effect of negative feedback on input impedance; output impedance & gain of the amplifier using MOSFET. 5. Study of transformer-less Class B push pull power amplifier and determination of its conversion efficiency 6. Design an amplifier for an unity gain and high input impedance using MOSFET. Suggest suitable techniques to increase the input impedance and verify the same. **<u>Digital Circuits lab</u>** 1. Design and implement BCD adder and Subtractor using 4 bit parallel adder 2. Design and implement n bit magnitude comparator using 4- bit comparators 3. Design and implement Ring and Johnson counter using shift register. 4. Design and implement 8 bit ALU. **Tools: Simulink, Proteus, Pspics, Cadence, LabView, Microcap, OrCAD, MATLAB.**	

Program: I Semester Master of Technology (Digital Electronics)			**Teaching Hours**
Course Title: Principles of Embedded Systems		**Course Code: 17EDEC703**	
L-T-P: 0-0-2	**Credits: 2**	**Contact Hours: 4 Hrs/week**	
ISA Marks: 80	**ESA Marks: 20**	**Total Marks: 100**	
Teaching Hours: 42 Hrs	**Examination Duration:**		
1. Introduction to embedded system: Introduction, Classification of Embedded System, Major Application Areas, Purpose of Embedded System. Characteristics and quality attributes of Embedded Systems, Design Metric and Optimizing the metrics.			**06 Hrs**
2. Typical Embedded Systems: Core of Embedded System-processor fundamentals, up vs uc, risc vs cisc, vonneumann vs Harvard, 8051 controller architecture and programmer model, Memory, Sensor and Actuators, Communication Network, Embedded Firmware			**08 Hrs**
3. Low Level programming Concepts: Addressing Modes, Instruction Set and Assembly Language programming(ALP), Developing, Building, and Debugging ALP's			**08 Hrs**
4. Middle Level Programming Concepts: Cross Compiler, Embedded C language implementation, programming, & debugging, Differences from ANSI-C, Memory Models, Use of directives, Functions, Parameter passing and return types			**02 Hrs**
5. On-Chip Peripherals Study, Programming, and Application: Ports: Input/Output, Timers & Counters, UART, Interrupts			**08 Hrs**

6. External Interfaces Study, Programming and Applications : LEDS, Switches(Momentary type, Toggle type), Seven Segment Display: (Normal mode, BCD mode, Internal Multiplexing & External Multiplexing), LCD (8bit, 4bit, Busy flag, custom character generation), Keypad Matrix, Stepper Motor, DC Motor	**10 Hrs**

Text Books

1. Introduction to Embedded Systems 1E by Shibu K V.
2. Kenneth J. Ayala ; “The 8051 Microcontroller Architecture, Programming & Applications” 2e, Penram International, 1996 / Thomson Learning 2005
3. Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinlay; “The 8051 Microcontroller and Embedded Systems – using assembly and C ”- PHI, 2006 / Pearson, 2006

References

1. Embedded System Design: A Unified Hardware/Software Introduction – Frank Vahid, Tony Givargis, John Wiley & Sons, Inc.2002
2. Predko ; “Programming and Customizing the 8051 Microcontroller” –, TMH
3. Raj Kamal, “Microcontrollers: Architecture, Programming, Interfacing and System Design”, Pearson Education, 2005

Program: Digital Electronics			**Teaching Hours**
Course Title: Fundamentals of signal processing		**Course Code: 17EDEC704**	
L-T-P: 3-0-1	**Credits: 4**	**Contact Hours: 5 Hrs/week**	
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**	
Teaching Hours: 40 Hrs	**Examination Duration: 3 hrs**		
Chapter No. 1. Introduction Definition of a signals and systems, classification of signals, basic operation on signals, elementary signals, Systems viewed as Interconnection of operation, properties of systems.			**08 Hrs**
Chapter No. 2. Time-Domain representation for LTI systems Convolution, Impulse response representation, convolution sum and convolution integral. Properties of impulse response representation.			**08 Hrs**
Chapter No. 3. Discrete Fourier Transforms Discrete Fourier Transforms (DFT): Frequency domain sampling and reconstruction of discrete time signals. DFT as a linear transformation, its relationship with other transforms. use of DFT in linear filtering, overlap-save and overlap-add method. Fast-Fourier-Transform (FFT) need for efficient computation of the DFT (i.e. FFT algorithms). Radix-2 FFT algorithm for the computation of DFT and IDFT: decimation-in-time and decimation-in-frequency algorithms. Composite FFT.			**08 Hrs**
Chapter No. 4. Design of digital filters Design of digital filters: Considerations and Characteristics of practical digital filters. Design of digital filters: symmetric and anti symmetric FIR filters, design of linear phase FIR filters using windowing method- Rectangular, Hamming, Hanning, Bartlet and Kaiser windows. Design of linear phase FIR filters using frequency sampling technique.			**08Hrs**
Chapter No. 5. Design of IIR filters from analog filters Design of IIR filters from analog filters: Approximation of derivative, Impulse invariance method, bilinear transformation. Characteristics of commonly used Analog Filters: Butterworth and Chebyshev filters. Frequency transformation in the digital domain			**08Hrs**

Text Books

1. Simon Haykin and Barry Van Veen, Signals and Systems, second, John Wiley & Sons, 2002
2. Proakis & Monalakis, Digital signal processing Principles Algorithms & Applications, 4th Edition, PHI, New Delhi, 2007

References

1. Alan V. Oppenheim, Alan S Willsky and S. Hamid Nawab, Signals and Systems, second, Pearson Education Asia, 1997

Implementation Assignments:

1. Implementation assignments are designed using Python. Ex:
   - Generate different elementary signals and perform mathematical operations on them.
   - Calculate N point DFT and find the cost of computation, justify the use of FFT algorithms to calculate DFT.
   - Design Filters (FIR/IIR) for given specifications.
2. Explore the feature of SDR to build signal processing applications like,
   - Noise cancellation
   - Audio file editing

Program: I Semester Master of Technology (Digital Electronics)			Teaching Hours
Course Title: Machine learning		Course Code: 17EDEC705	
L-T-P: 3-0-1	Credits: 4	Contact Hours: 5 Hrs/week	
ISA Marks: 50+100	ESA Marks: 50	Total Marks: 200	
Teaching Hours: 40 Hrs	Examination Duration: 3 hrs		
Chapter No. 1: Introduction Introduction What is Machine Learning? Applications of Machine Learning, Types of Machine Learning: Supervised, Unsupervised and Reinforcement learning, Dataset formats, Basic terminologies.			05 Hrs
Chapter No. 2: Supervised Learning Linear Regression, Logistic Regression Linear Regression: Single and Multiple variables, Sum of squares error function, The Gradient descent algorithm, Application, Logistic Regression, The cost function, Classification using logistic regression, one-vs-all classification using logistic regression, Regularization.			10 Hrs
Chapter No. 3: Supervised Learning: Neural Network Introduction to perception learning, Implementing simple gates XOR, AND, OR using neural network. Model representation, Gradient checking, Back propagation algorithm, Multi-class classification, Application- classifying digits, SVM.			10 Hrs
Chapter No. 4: Unsupervised Learning: Clustering Introduction, K means Clustering, Algorithm, Cost function, Application.			05Hrs
Chapter No. 5: Unsupervised Learning: Dimensionality reduction Dimensionality reduction, PCA- Principal Component Analysis. Applications, Clustering data and PCA.			05Hrs
Chapter No. 6: Machine Learning System Design Evaluating a hypothesis, Model selection, Bias and variance, error analysis, error metrics for skewed classes. Building a Model.			05 Hrs

Text Book (List of books as mentioned in the approved syllabus)

1. Tom Mitchell, Machine Learning, 1, McGraw-Hill. , 1997
2. Christopher Bishop, Pattern Recognition and Machine Learning, 1, Springer, 2007

References

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning : Data Mining, Inference and Prediction, 2, Springer, 2009

Implementation Assignments:

1. Assignments are designed to explore the concepts like
   - Supervise and unsupervised learning,
   - Clustering,
   - Regression and estimation
2. Motivate students to take up open challenges like Kaggle, walmart, ect

Program: I Semester Master of Technology (Digital Electronics)			Teaching Hours
Course Title: RISC Architectures		Course Code: 17EDEC706	
L-T-P: 3-0-1	Credits: 4	Contact Hours: 3 Hrs/week	
ISA Marks: 50+100	ESA Marks: 50	Total Marks: 200	
Teaching Hours: 46 Hrs	Examination Duration:		

1. The 32 bit RISC Architecture: The Acorn RISC machine, Architectural inheritance, Architecture of ARM7TDMI, ARM programmers model, ARM development tools, 3 stage pipeline ARM organization, ARM instruction execution.	**06 Hrs**
2. 32 bit Instruction set: Data processing instruction, Branch instruction, Load store instruction, Software interrupt instruction, Program status register instruction, Conditional execution, Example programs, 16bit Instruction set- The Thumb programmer model, ARM-Thumb interworking, other branch instructions, Data processing instructions, Single/Multiple register load store instruction, Stack operation, Software interrupt instructions, example programs.	**06 Hrs**
3. Exception Handling: Introduction, Interrupts, error conditions, processor exception sequence, the vector table, Exception handlers, Exception priorities, Procedures for handling exceptions.	**04 Hrs**
4. Memory Hierarchy Design: Cache basics, Miss rate and penalty, Cache Hierarchy, Memory Organizations, Memory Hierarchy.	**06 Hrs**
5. Pipelining: Linear pipeline processor, Nonlinear pipeline processor, Instruction pipeline design, Branch handling techniques, Arithmetic pipeline design, Computer arithmetic principles, Static arithmetic pipeline, Multifunctional arithmetic pipeline.	**08 Hrs**
6. Cortex M4 : Functional description, programmer's model, memory protection unit, nested vectored interrupt controller.	**06 Hrs**
7. Multi-Core Architectures : Introduction to Intel Architecture, How an Intel Architecture System works, Basic Components of the Intel Core 2 Duo Processor: The CPU, Memory Controller, I/O Controller.	**07 Hrs**
8. Current Trends in Intel Architectures and Applications :	**03 Hrs**

Seminar on current trends in Intel Architectures	

ext Books

1. "ARM System- on-Chip Architecture" by 'Steve Furber', LPE, Second Edition.
2. "ARM Assembly Language fundamentals and Techniques" by William Hohl, CRC press, 2009.
3. D. A. Patterson and J. L. Hennessey "Computer Organization and Design", Morgan , Kaufmann,2002
4. H. Jonathan Chao and Bin Liu, "High performance switches & routers", Wiley Interscience, 2007.
5. Kai Hwang, " Advanced Computer Architecture – TMH – 1993
6. Web resources for Example Architectures of INTEL and Texas Instruments: http:/ /download.intel.com/design/intarch/papers/321087.pdf

References

1. Kai Hwang, Faye A. Briggs, Computers Architecture and Parallel Processing – MGH – 1985
2. David E Culler, Jaswinder Pal Singh, Anoop Gupta "Parallel Computer Architecture", Harcourt Asia Pte Ltd 2000
3. Stalling W." Computer Organization and Architecture- Designing for performance" PHI,2005
4. D. Sima,T. Fountain, P.Kasuk," Advanced Computer Architecture-A Design Space Approach" Addisson Wesley,1997.
5. M. J. Flynn,"Computer Architecture, Pipelined And Parallel Processing", Narosa Publications, 1998.

List of Experiments:

1. Write an ALP to verify data transfer w.r.t memory to achieve following
   - i. 8 bit data transfer
   - ii. 16 bit data transfer
   - iii. 32 bit data transfer
2. Write an ALP for Tables and lists to do following:
   - i. Add an entry to a list
   - ii. Remove an element from the queue
3. Write an ALP to pass parameters to a subroutine.
   - i. Ascending order
   - ii. Descending order
4. Write a 'C' program & demonstrate an interfacing of Alphanumeric LCD 2X16 panel to LPC2148Microcontroller
5. Write a 'C' program & demonstrate concept of Interrupts interface to LPC2148 Microcontroller.
6. Write a 'C' program & demonstrate an interfacing of DAC to LPC2148 Microcontroller.
7. Write a 'C' program & demonstrate an interfacing of UART to LPC2148 Microcontroller.
8. Write a 'C' program & demonstrate an interfacing of ADC to LPC2148 Microcontroller.
9. Write a 'C' program & demonstrate an interfacing of RTC to LPC2148 and read time, date and year.
10. Write a 'C' program & demonstrate interface I2C to LPC2148
11. Develop a code for college bell system. (Use the following interfaces LCD, RTC and Buzzer).

Reference Books

1. "ARM System- on-Chip Architecture" by 'Steve Furber", LPE, Second Edition.
2. "Embedded Systems- Architecture, Programming and Design" by Raj Kamal, TMH
3. Dr. K.V.K.K. Prasad, "Embedded/Real-time systems: concepts, Design & Programming", published by dreamtech press.

Manual

1. LPC2148 datasheet by NXP.
2. LPC2148 board manual by ALS, Bangalore.

Program: Digital Electronics		**Teaching Hours**
Course Title: Electronic System Design	**Course Code: 17EDEC707**	

L-T-P: 0-0-3	**Credits: 3**	**Contact Hours:6 Hrs/week**	
ISA Marks: 100	**ESA Marks:**	**Total Marks: 100**	
Teaching Hours: 25 Hrs	**Examination Duration: --**		

To level specifications, Block level specifications, Timing of micro architecture, Verification and test plan, Schematic capture	05 Hrs
Simulation, Advanced simulation, Signal Integrity	05 Hrs
PCB layout- Floor planning, component pre planning, PCB printing- 2 layer	05 Hrs
Functionality and performance check, Failure analysis, Validation and system integration	05 Hrs
System Analysis	05 Hrs

References

1. A. S Sedra and KC Smith, Microelectronic circuits, Oxford, 1998.
2. G.L. Ginsberg, Printed Circuit Design, McGraw Hill, 1991.

Program: Digital Electronics		
Course Title: Automotive Electronics		**Course Code:** 17EDEC708
L-T-P: 3-0-1	**Credits: 4**	**Contact Hours: 5**
ISA Marks: 50+100	**ESA Marks: 50**	**Total Marks: 200**
Teaching Hours: 40	**Examination Duration: 3 hrs**	

Chapter No. 1. Automotive Fundamentals Overview Introduction to Automotive Industry and Modern Automotive Systems Vehicle classifications and specifications need for electronics in automobiles, Application areas of electronics in the automobiles Four Stroke Cycle, Engine Control, Ignition System, Spark plug, Spark pulse generation, Ignition Timing, Drive Train, Transmission, Brakes, Steering System.	8Hrs
Chapter No. 2. Sensors and Actuators Oxygen (O2/EGO) Sensors, Throttle Position Sensor (TPS), Engine Crankshaft Angular Position (CKP) Sensor, Magnetic Reluctance Position Sensor, Engine Speed Sensor, Ignition Timing Sensor, Hall effect Position Sensor, Optical Crankshaft Position Sensor, Manifold Absolute Pressure (MAP) Sensor Strain gauge, Engine Coolant Temperature (ECT) Sensor, Knock Sensor, Throttle angle sensor, Fuel Injector Actuator, Ignition Actuator	7Hrs
Chapter No. 3. Electronic Engine Control Engine parameters, variables, Engine Performance terms, Electronic Fuel Control System, Electronic Ignition control, Idle sped control, EGR Control	5Hrs
Chapter No. 4. Vehicle Motion Control and Safety Systems Cruise Control, Antilock Brake System (ABS), Electronic Steering Control, Power Steering, Traction Control, Electronic Stability Program.	6Hrs
Chapter No:5. Automotive communication protocols Overview of Automotive communication protocols : CAN, LIN .	3Hrs
Chapter No. 6. Advanced Driver Assistance Systems (ADAS) Lane Departure Warning, Collision Warning, Automatic Cruise Control, Pedestrian Protection, Headlights Control, Connected Cars technology and trends towards Autonomous vehicles.	5Hrs

Chapter No. 7. Automotive safety standards ISO26262 and Diagnostics Functional Safety: Need for safety standard-ISO 26262, safety concept, safety process for product life cycle, safety by design, validation. Fundamentals of Diagnostics: Basic wiring system and Multiplex wiring system, Preliminary checks and adjustments, Self-diagnostic system. Fault finding and corrective measures, OBD & off board diagnostic.	6Hrs

Text books:

1. Denton.T – Automobile Electrical and Electronic Systems, Edward Arnold publication, 1995.

References:

1. William T.M – Automotive Electronic Systems, Heiemann Ltd., London ,1978.
2. Nicholas Navet – Automotive Embedded System Handbook, CRC Press, 2009.
3. BOSCH Automotive Handbook, Wiley Publications, 8th Edition, 2011.
4. Co-Verification of hardware & software for ARM SoC Design – Jason.R.Andrews, Newnes Publications, 2004.
5. Hardware Software co-design of embedded systems, F.Balarin, Kluwer Academic Oublishers, 1987.

Lab:

1. Demonstration of cut section modules: Engine, Transmission , Steering, Braking, Suspension - Automobile dept.
2. Electronic engine control system: Injection and Ignition control system Transmission trainer modules
3. Modeling an engine Vehicle model simulation with Simulink using PI CONTROLLER
4. Basic gate logic simulation and modeling using Simulink and realization on the hardware platform.
5. Seat belt warning system simulation and modeling using Simulink and realization on the hardware platform. Vehicle speed control based on the gear input simulation and modeling using Simulink and realization on the hardware platform.
6. Throttle control modeling and simulation using Simulink and realization on the hardware platform.
7. Accelerator pedal interfacing software modeling and simulation using Simulink and realization on the hardware platform.
8. Develop matlab code for stepper motor control and convert it to Simulink model and port it to embedded hardware

Course Code: **17EDEC710**	Course Title: **Multimedia and Signal Processing**		Teaching Hrs: **40 Hrs**
L-T-P: **3-0-1**	Credits: **4**		Contact Hrs: **5 Hrs/week**
ISA Marks: **50+100**	Exam Duration: **3Hrs**	ESA Marks: **50**	Total Marks: 2**00**

1	**Introduction to Multimedia:** Multimedia and Hyper media, WWW, overview of multimedia software tools.	**02Hrs**
2	**Graphics and Image representation:** Graphics / Image data types, Popular file formats.	**02Hrs**
3	**Fundamental concepts in video:** Types of video signals, analog video, digital video.	**06Hrs**
4	**Basics of digital audio:** Digitization of sound, MIDI, Quantization and transmission of audio.	**05Hrs**
5	**Lossless compression algorithms:** Introduction, run-length coding, variable length coding, dictionary based coding, arithmetic coding, lossless image compression.	**05Hrs**
6	**Lossy compression algorithms:** Introduction, distortion measures, quantization, transform coding, wavelet based coding, wavelet packets, embedded zero tree of wavelet coefficients.	**06Hrs**
7	**Image compression standards:** The JPEG standard, The JPEG2000 standard, The JPEG-LS standard, Bi level image compression standard.	**06Hrs**
8	**Basics video compression techniques:** Overview, video compression based on motion compensation, H.261 .	**08Hrs**

Text books

1. Ze-Nian Li & Mark S Drew**, "**Fundamentals of multimedia**"**, Pearson Education, 2004.

References books

1. Ralf Steinmetz & Kalra Nahrstedt , "Multimedia: Computing, Communication & Applications", Pearson Education, 2004

2. K R Rao, Zoran S Bojkovic, Dragord A Milovanvic, Pearson education, "Multimedia communication systems: Techniques, Standards, & Networks",. Second Indian reprint, 2004.

Course Code: 17EDEC711	**Course Title: Data Communication**	
L-T-P: 3-0-1	**Credits: 4**	**Contact Hrs: 5 hrs/week**
ISA Marks: 50+100	**ESA Marks: 50**	**Total Marks: 200**
Teaching Hrs: 40		**Exam Duration: 03 hrs**

Content	**Hrs**
Chapter No. 1. Computer Networks and the Internet What is Internet? The Network Edge, the network Core,delay -loss—throughput in packet switched	06hrs

networks. Protocol layers (OSI layers) and their service models.	
Chapter No. 2. Application Layer Principles of network applications,the web and HTTP,DHCP, file transfer-FTP,electronic mail in the internet,DNS,peer-to-peer applications.	10hrs
Chapter No. 3. Transport Layer Introduction and transport-layer services-relationship between transport and network layers - overview of the transport layer in the internet, multiplexing and de multiplexing, connectionless transport: UDP, principles of reliable data transfer, connection oriented transport TCP, TCP congestion control.	08hrs
Chapter No. 4. Network layer Introduction, virtual circuit and datagram networks, what's inside router? The Internet protocol (IP): forwarding and addressing in the internet, routing algorithms, routing in the internet, broadcast and multi cast routing.	08hrs
Chapter No. 5. The link layer: Links, Access networks, and LANs Introduction to the link layer, error-detection and correction techniques, multiple access links and protocols, switched local area networks, link virtualization: A network as a link layer, data center networking.	08hrs

Text Book (List of books as mentioned in the approved syllabus)

1. Kurose & Ross, Computer Networking A Top-Down Approach, 6th editionPEARSON, 2013.

References

1. Larry L. Peterson & Bruce S. Davie, Computer Networks: A Systems Approach, 4th edition, Elsevier, 2004
2. Behrouz A. Forouzan, Data Communication and Networking, 4th edition, TMG, 2002

Lab:

1. Introduction to Hardware components and Ethernet LAN set up.
2. Introduction to socket programming
3. Implementation of FTP
4. Implementation of error control techniques.
5. Implementation of flow control ARQs
6. Introduction to Network operating system.
7. Subnet design
8. VLAN setup
9. OSPF and RIP configuration and performance analysis
10. eBGP and iBGP configuration and performance analysis

Text Book

1. Kurose & Ross, Computer Networking A Top-Down Approach, 6th editionPEARSON, 2013.

References

1. Cisco networking academy, https://www.netacad.com/
2. Juniper networking academy, https://learningportal.juniper.net/

Course Code: **17EDEE701**	Course Title: **Image and Video Processing**		Teaching Hrs: **40 Hrs**
L-T-P: **2-0-1**	Credits: **3**		Contact Hrs: **4 Hrs/week**
ISA Marks: **50+100**	Exam Duration: **3Hrs**	ESA Marks: **50**	Total Marks: **100**

1	**Introduction**: 2D systems, Mathematical Preliminaries- FT, Z-transform, Optical and Modulation Transfer Functions (OTF and MTF). Matrix theory, Image perception: Light, Luminance, Brightness, Contrast, MTF of the visual system, Visibility function, Monochrome Vision Models, Fidelity criteria, Color Representation, Color Vision Models, Temporal Properties of Vision.	2 hrs
2	**Image sampling and Quantization:** 2D Sampling theory, Quantization, Optimal Quantizer, Compander and Visual Quantization.	2 hrs
3	**Image Transforms:** 2D orthogonal and unitary transforms, DFT, DCT, Harr, KLT	4hrs
4	**Image Enhancement**: Histograms Modeling, Spatial operations, Transform operations, Multispectral Image Enhancement,	4hrs
5	**Image Filtering and Restoration:** Image Observation Models, Inverse and Weiner filtering , Frequency Domain Filters. Smoothing Splines and Interpolation.	4hrs
6	**Basics of Video:** Analog Video, Digital Video	2 hrs
7	**Two dimensional motion estimation:** Optical flow methods**,** Block based methods, Bayesian methods**.**	7 hrs

Text books

1. Jain, A.K., Fundamentals of Digital Image Processing, 3rd Edision, Pearson Education (Asia) 2013
2. A. Murat Tekalp, Digital Video processing Pearson Education (Asia) Pte. Ltd.
3. Li and, Z. Drew, M.S. Fundamentals of Multimedia, Pearson Education (Asia) Pte. Ltd,. 2010.

References books

1. Gonzalez, Rafael C., Woods, Richard E. and Eddins Steven L., Digital Image Processing Using Matlab, Pearson Education (Asia) Pvt. Ltd.,
2. Al. Bovik, Essential guide to Video Processing, Academic Press

Program: Digital Electronics		
Course Title: Digital Control Systems		**Course Code:** 17EDEE702
L-T-P: 2-0-1	**Credits: 4**	**Contact Hours: 5**
ISA Marks: 50+100	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hours: 40	**Examination Duration: 3 hours**	

1. Introduction to digital control: Introduction, Discrete time system representation, Mathematical modeling of sampling process, Data reconstruction. 2. Modeling discrete-time systems by pulse transfer function: Z-transform, Mapping of Z-plane to z-plane, Pulse transfer function , Pulse transfer function of closed loop system, Sampled signal flow graph. 3. Time response of discrete systems: Transient and steady state responses, Time response parameters of a prototype second order system. 4. Stability analysis of discrete time systems: Jury stability test, Stability analysis using bi-linear transformation. 5. Design of sampled data control systems: Root locus method, Controller design using root locus, Root locus based controller ,design using MATLAB, Nyquist stability criteria, Bode plot. 6. Deadbeat response design :Design of digital control systems with deadbeat response, Practical issues with deadbeat response design, Sampled data control systems with deadbeat response. 7. Discrete state space model: Introduction to state variable model, Various canonical forms, Characteristic equation, state transition matrix, solution to discrete state equation. 8. Controllability, observability and stability of discrete state space models: Controllability and observability, Lyapunov stability theorem. 9. State feedback design: Pole placement by state feedback, Set point tracking controller, Full order observer, Reduced order observer.	4hrs 3hrs 5hrs 5hrs 5hrs 6hrs 2hrs 5hrs 5hrs

References:

1. B. C. Kuo,Digital Control Systems, Oxford University Press, 2/e, Indian Edition, 2007.
2. K. Ogata, Discrete Time Control Systems, Prentice Hall, 2/e, 1995.
3. M. Gopal,Digital Control and State Variable Methods, Tata Mcgraw Hill, 2/e, 2003.
4. G. F. Franklin, J. D. Powell and M. L. Workman, Digital Control of Dynamic Systems,

Program: Digital Electronics		
Course Title: Multi Sensor Data Fusion		**Course Code:** 17EDEE703
L-T-P: 2-0-1	**Credits: 4**	**Contact Hours: 5**
ISA Marks: 50+100	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hours: 40	**Examination Duration: 3 hours**	

Chapter 1: **Fundamentals of Multi-sensor data Fusion system** Multi sensor data fusion strategies, formal framework, catastrophic fusion, Smart sensor, logical sensor, interface file system, sensor observation, sensor characteristics, sensor-sensor properties, Fusion node, simple fusion network, network topology.	**08 hours**
Chapter 2: Sensor modeling Mathematical modeling, Baye's Theorem, sensor modeling, sensor data normalization, Neural network approach.	**06 hours**
Chapter 3: State –Estimation techniques State-space approach: State-space representation, Time response of homogeneous systems: Kalman filtering: practical aspects of Kalman filtering, Applications	**06 hours**
Chapter 4: Representation Spatial-temporal transformation, geographical information system, common representation format, subspace methods, multiple training sets.	**06 hours**
Chapter 5: Spatial alignment Image registration, resample/interpolation, pair wise transformation, image fusion, mosaic image. .	**06 hours**
Chapter 6: Temporal alignment & Semantic alignment Dynamic time warping, dynamic programming, video compression, assignment matrix for semantic alignment, clustering algorithms	**06 hours**
Chapter 7: Data fusion: Bayesian Interface, Bayesian analysis, probability model, Posteriori distribution, Model selection, computation.	**06 hours**
Chapter 8: **Sensor management:** Hierarchical classification, sensor management techniques.	**06 hours**
Text Books: 1. H.B.Mitchell, "Multi Sensor Data Fusion, An Introduction" Springer,2007. 2. David L. Hall, Mathematical techniques in Multisensor data fusion, Artech House,Boston. 3. Madan Gopal, Digital control and state variables methods 2nd edition, PHI 4. Pattern Recognition and Machine Learning" by Christopher M. Bishop	

Program: III Semester Master of Technology (Digital Electronics)			**Teaching Hours**
Course Title: Embedded Software Design		**Course Code: 17EDEC801**	
L-T-P: 0-0-3	**Credits: 3**	**Contact Hours: 6 Hrs/week**	
ISA Marks: 80	**ESA Marks: 20**	**Total Marks: 100**	
Teaching Hours: 40 Hrs	**Examination Duration:**		

1. Introduction To Real-Time Operating Systems: Introduction to OS, Introduction to real time embedded system- real time systems, characteristics of real time systems, and the future of embedded systems. Introduction to RTOS, key characteristics of RTOS, its kernel, components in RTOS kernel, objects, scheduler, services, context switch, Scheduling types: Preemptive priority-based scheduling, Round-robin and preemptive scheduling.	**08 Hrs**
2. Tasks, Semaphores and Message Queues:: A task, its structure, A typical finite state machine, Steps showing the how FSM works. A semaphore, its structure, binary semaphore, mutual exclusion (mutex) semaphore, Synchronization between two tasks and multiple tasks, Single shared-resource-access synchronization, Recursive shared-resource-access synchronization. A message queue, its structure, Message copying and memory use for sending and receiving messages, Sending messages in FIFO or LIFO order, broadcasting messages.	**08 Hrs**
3. Typical RTOSs: Study of VX works, RT Linux and Android OS and comparisons. Real time programming using RTX/free RTOS. Applications and Common Design Problems: Embedded RTOS for Image Processing & Control Systems, and common problems encountered in these applications.	**04 Hrs**
4. Introduction to embedded linux: Embedded Linux overview: Development-Kernel architectures and device driver model-Embedded development issues-Tool chains in Embedded Linux-GNU Tool Chain (GCC,GDB, MAKE, GPROF & GCONV)- Linux Boot process	**02 Hrs**
5. Boot sequence-System loading, sys linux, Lilo, grub-Root file system-Binaries required for system operation-Shared and static Libraries overview-Writing applications in user space-GUI environments for embedded Linux system	**02 Hrs**
6. File system in Linux: File system Hierarchy-File system Navigation -Managing the File system –Extended file systems-INODE-Group Descriptor-Directories-Virtual File systems-Performing File system Maintenance -Locating Files –Registering the File systems-Mounting and Un-mounting –Buffer cache-/proc file systems-Device special files	**08 Hrs**
7. Program design and Analysis : Components of Embedded system: State machines; stream oriented programming and circular buffers, queues. Models of programs: data flow graph and control flow graphs, Assembly, linking and loading. Basic compilation techniques: Statement translation, procedures, data structures. Program optimization: Expression simplification, dead code elimination, procedure inlining, loop transformations, register allocation, scheduling, instruction selection, interpreters and JIT compilers. Program level performance analysis, software performance optimization, program level energy and power analysis, analysis and optimization of program size. Program validation and testing: Clear box testing, black box testing, evaluating function tests.	**08 Hrs**

Text Books

1. Qing Li with Caroline Yao, "Real-Time Concepts for Embedded Systems", Published by CMP Books,2011
2. Dr. K.V.K.K. Prasad, "Embedded/Real-time systems: concepts, Design & Programming", published by dreamtech press .
3. "Embedded Systems- Architecture, Programming and Design" by Raj Kamal, TMH

References

1. Philip.A.Laplante, "Real Time System Design and Analysis", Prentice Hall of India, 3rd Edition, April 2004.
2. "Programming embedded systems" in C and C++ Micheal Barr orielly

List of Experiments:

1. Write a 'C' program & demonstrate concept of Task Scheduling.
2. Write a 'C' program & demonstrate concept of Semaphore.
3. Write a 'C' program & demonstrate concept of Mailbox.
4. Write a 'C' program & demonstrate concept of S/W Interrupts.
5. Write a 'C' program & demonstrate concept of interrupts.
6. Write a 'C' program & demonstrate concept of Inter Task Communication.

Reference Books

1. Dr. K.V.K.K. Prasad, "Embedded/Real-time systems: concepts, Design & Programming", published by dreamtech press.

Manual

1. LPC2148 datasheet by NXP.

LPC2148 board manual by ALS, Bangalore.

Program: Digital Electronics		
Course Title: Automotive Communication		Course Code: 17EDEC802
L-T-P: 3-0-0	Credits: 3	Contact Hrs: 3
CIA Marks: 50	SEE Marks: 50	Total Marks: 100
Teaching Hrs: 40	Exam Duration: 3 hrs	

Content	**Hrs**
Chapter No. 1: Controller Area Network Introduction to CAN, Basic Concepts, Message Transfer, Frame Types, Message Validation, Error Handling, Fault Confinement, Bit Timing Requirements, Increasing Can Oscillator Tolerance, Protocol Modifications.	15 hrs
Chapter No. 2: Local Interconnect Network Overview of LIN protocol, LIN Workflow ,LIN Physical Layer ,LIN Communication, Synchronization of the LIN nodes, LIN Message & Scheduling, Message Types, Status & Network Management, Introduction to LIN slave diagnostics , Introduction to LIN slave configuration.	5 hrs
Chapter No. 3: Flexray Communication protocol Introduction to Fleray, Basic Concepts, Message Transfer, Static and dynamic data transmission, Flexray BUS, FlexRay controller states, Frame Types, Message Validation, Error Handling, Fault Confinement, Bit Timing Requirements, Fault tolerant and time triggered services implemented in hardware.	5 hrs
Chapter No. 4: Media oriented system transport protocol Technology background, MOST25, MOST50, MOST150, MOST topology, different masters in MOST	5 hrs

network, control channel, synchronous channel, asynchronous channel, MOST application frame work, addressing scheme, frame formats,	
Chapter No. Chapter 5: Keyword 2000 protocol Overview of KWP protocol, KWP Workflow , Physical topology ,message structure, frame format,	5 hrs
Chapter No. Chapter 6: SENT, I2C, SPI and UART Overview about SENT , I2C, SPI and UART, frame formats, application of I2C, SPI, SENT and UART in automotive.	5 hrs
Text Books (List of books as mentioned in the approved syllabus) Ronald K. Jurgen, Infotainment systems, 2007, SAE International, 2007	

Program: III Semester Master of Technology (Digital Electronics)			**Teaching Hours**
Course Title: Internet of Things		**Course Code: 17EDEE801**	
L-T-P: 2-0-1	**Credits: 3**	**Contact Hours: 5 Hrs/week**	
ISA Marks: 50+100	**ESA Marks: 50**	**Total Marks: 200**	
Teaching Hours: 25 Hrs	**Examination Duration:**		

1	**Introduction to Internet of Things (IoT)** Definition & Characteristics of IoT, Things in IoT, IoT protocols, IoT functional blocks, communication models and APIs.	**04 hrs**
2	**IoT Architecture** Enabling technologies: Sensors, Zigbee, Bluetooth, IoT ecosystem, Data Link protocols: IEEE 802.15.4e, IEEE 802.11.ah, DASH7, Low Power Wide Area Network (LoRaWAN).	**04 hrs**
3	**Network protocols** Routing Protocol for Low-Power and Lossy Networks (RPL), cognitive RPL (CORPL), Channel-Aware Routing Protocol (CARP), Low power Wireless Personal Area Networks (LoWPAN).	**04 hrs**
4	**Application and Security protocols** Message Queue Telemetry Transport (MQTT), MQTT for Sensor Networks, Secure MQTT, Advanced Message Queuing Protocol (AMQP), Constrained Application Protocol (CoAP), OPC UA, 6LoWPAN), Routing Protocol for Low-Power and Lossy Networks (RPL).	**04 hrs**
5	**IoT Platforms Design Methodology** IoT Design Methodology, Case Study on IoT System for Weather Monitoring etc., Basic building blocks of an IoT device, Raspberry Pi, interface (serial, SPI, I2C), IoT Operating Systems: Contiki, RIOT.	**04 hrs**
6	**Programming with Raspberry Pi** XML, JSON, SOAP and REST-based approach, WebSocket protocol.	**04 hrs**
7	**IoT prototyping** Business models, example applications: Case studies on Home automation, Cities, Environment, Energy, Agriculture, Health with emphasis on data analytics and security.	**06 hrs**

Text Books:

1. Arshdeep Bahga, Vijay Madisetti “Internet of Things (A Hands-on-Approach)” Universities Press- 2014.
2. Olivier Hersent, David Boswarthick, Omar Elloumi, “The Internet of Things: Key Applications and Protocols”

John Wiley & Sons – 2012.

Reference Books:

1. Subhas Chandra Mukhopadhyay "Internet of Things Challenges and Opportunities" Springer- 2014.

Lab:

1. Programming with Raspberry Pi
2. Cloud service interface for data storage and retrieval
3. Performance analysis of Data link protocols, routing and application protocols
4. Open Ended Experiment with focus on data analytics and security

Course Code: 17EDEE802	Course Title: AUTOSAR	
L-T-P : 2-0-1	Credits: 3	Contact Hrs: 3 Hours
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 40		Exam Duration: 3

Content	Hrs
Unit - 1	
Chapter No. 1: AUTOSAR Fundamentals Evolution of AUTOSAR – Motivations and Objectives AUTOSAR consortium – Stake holders – work Packages, AUTOSAR Partnership, Goals of the partnership, Organization of the partnership, AUTOSAR specification, AUTOSAR Current development status, BSW Conformance classes: ICC1, ICC2, ICC3, and Drawbacks of AUTOSAR.	8 hrs
Chapter No. 2: AUTOSAR layered Architecture AUTOSAR Basic software, Details on the various layers , Details on the stacks Virtual Function Bus (VFB) Concept Overview of AUTOSAR Methodology , Tools and Technologies for AUTOSAR AUTOSAR Application Software Component (SW-C) ,Types of SW-components AUTOSAR Run Time Environment (RTE): RTE Generation Process: Contract Phase, Generation Phase, MCAL, IO HW Abstraction Layer, Partial Networking, Multicore, J1939 Overview, AUTOSAR Ethernet, AUTOSAR E2E Overview , AUTOSAR XCP, Metamodel , From the model to the process , Software development process.	7 hrs
Unit - 2	
Chapter No. 3: Methodology of AUTOSAR and Communication in AUTOSAR CAN Communication, CAN FD, CAN in Automation, CANape, Application Layer and RTE, intra and inter ECU communication, Client-Server Communication, Sender-Receiver, Communication, CAN Driver, Communication Manager (ComM), Overview of Diagnostics Event and Communication Manager	10 hrs
Chapter No. 4: BSW Development and Integration BSW Constituents: Memory layer, COM and Services layer, ECU abstraction, AUTOSAR, Operating system, Interfaces: Standard interface, AUTOSAR standardized interface, BSW-RTE interface,(AUTOSAR interface), BSW-ECU hardware interface, Complex device drivers and BSW module configuration, AUTOSAR Integration.	5 hrs
Unit - 3	
Chapter No. Chapter 5: Infotainment Systems in Automobiles Infotainment Systems Fundamentals: Radio, Multimedia, and Navigation: Introduction to In Vehicle	5 hrs

Infotainment (IVI) systems, Use of operating systems in IVI , GENIVI Alliance, Tuner: AM/FM, XM/Sirrus, DAB/DMB, Software Defined Radio; Concepts of HD, radio, Ensemble, Traffic Announcements, Spread Spectrum, d. Multimedia: Types of Media; Music, Video, Podcasts, etc. Media management; Playback, Track Control, Metadata, Playlists, Categories, Trick play, Audio/Video Source Management, Navigation: Points of Interests, Routes, Waypoints, Dead Reckoning position, Traffic Info, GLONASS, GNSS, RTK, GPS, and SBAS/GBAS,INS f. Media types: CD, DVD, CDDA, USB, SDCARD, Media Formats:MP3, WMV, RealAudio/Video, QTP, Architecture – Design Patterns - Proxies, Adaptors, Interfaces, Singleton, Factory method	
Chapter No. Chapter 6: Communication Systems in Automobiles Automotive & Consumer Electronic Communication Systems: Introduction to Bluetooth – Pairing, HFP, A2DP, PAN, PBAP, DUN, Concepts of MOST network, DLNA, AVB, Concepts of TCP/IP, Ethernet, WiFi, WiFi Direct, MyWiFi and CAN, Mirror link, Tethering	5 hrs
Text Book (List of books as mentioned in the approved syllabus) 1. Ribbens, Understanding of Automotive electronics, 6th Edition, Elsevier, 2003 2. Denton.T, Automobile Electrical and Electronic Systems, Elsevier, 3rd Edition, 2004 3. Denton.T, Advanced automotive fault diagnosis, 2000 **References** 1. Ronald K Jurgen, Automotive Electronics Handbook, 2nd Edition, McGraw-Hill, 1999 2. James D Halderman, Automotive electricity and Electronics, PHI Publication, 2000 3. Allan Bonnick, Automotive Computer Controlled Systems Diagnostic Tools and Techniques, Elsevier Science, 2001 4. Nicholas Navet , Automotive Embedded System Handbook , 2009	

Program: III Semester Master of Technology (Digital Electronics)			**Teaching Hours 04 hrs**
Course Title: Multirate Signal Processing		**Course Code: 17EDEE803**	
L-T-P: 2-0-1	**Credits: 3**	**Contact Hours: 5 Hrs/week**	
ISA Marks: 50+100	**ESA Marks: 50**	**Total Marks: 100**	
Teaching Hours: 25 Hrs	**Examination Duration: 3 hrs**		

Chapter No. 1. Introduction Definition of a signals and systems, classification of signals, basic operation on signals, elementary signals, Systems viewed as Interconnection of operation, properties of systems.	**08 Hrs**
Chapter No. 2. Time-Domain representation for LTI systems Convolution, Impulse response representation, convolution sum and convolution integral. Properties of impulse response representation.	**08Hrs**
Chapter No. 3. Discrete Fourier Transforms Discrete Fourier Transforms (DFT): Frequency domain sampling and reconstruction of discrete time signals. DFT as a linear transformation, its relationship with other transforms. use of DFT in linear filtering, overlap-save and overlap-add method. Fast-Fourier-Transform (FFT) need for efficient computation of the DFT (i.e. FFT algorithms). Radix-2 FFT algorithm for the computation of DFT and IDFT: decimation-in-time and decimation-in-frequency algorithms. Composite FFT.	**08 Hrs**
Chapter No. 4. Design of digital filters Design of digital filters: Considerations and Characteristics of practical digital filters. Design of digital filters: symmetric and anti symmetric FIR filters, design of linear phase FIR filters using windowing method-Rectangular, Hamming, Hanning, Bartlet and Kaiser windows. Design of linear phase FIR filters using frequency sampling technique.	**08Hrs**

Chapter No. 5. Design of IIR filters from analog filters Design of IIR filters from analog filters: Approximation of derivative, Impulse invariance method, bilinear transformation. Characteristics of commonly used Analog Filters: Butterworth and Chebyshev filters. Frequency transformation in the digital domain	**08Hrs**

Text Books

3. Simon Haykin and Barry Van Veen, Signals and Systems, second, John Wiley & Sons, 2002
4. Proakis & Monalakis, Digital signal processing Principles Algorithms & Applications, 4th Edition, PHI, New Delhi, 2007

References

2. Alan V. Oppenheim, Alan S Willsky and S. Hamid Nawab, Signals and Systems, second, Pearson Education Asia, 1997

Implementation Assignments:

3. Implementation assignments are designed using Python. Ex:
   - Generate different elementary signals and perform mathematical operations on them.
   - Calculate N point DFT and find the cost of computation, justify the use of FFT algorithms to calculate DFT.
   - Design Filters (FIR/IIR) for given specifications.
4. Explore the feature of SDR to build signal processing applications like,
   - Noise cancellation
   - Audio file editing

Program: Digital Electronics			**Teaching Hours**
Course Title: Advanced Computer Architecture & Programming		**Course Code: 17EDEC801**	
L-T-P: 2-0-1	**Credits: 3**	**Contact Hours: 4 Hrs/week**	
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**	
Teaching Hours: 40 Hrs	**Examination Duration: 3 hrs**		
Chapter 1: Instructions: Representing Instructions in the Computer, ARM Addressing for 32-Bit Immediates and more complex addressing modes, Parallelism and Instructions: Synchronization, Translating and Starting a Program.			**05**

Chapter 2: Arithmetic for Computers Addition and Subtraction, Multiplication, Division, Floating Point, Parallelism and Computer Architecture: Associativity.	**05**
Chapter 3: The Processor: Introduction, Logic Design Conventions, Building a Datapath , A Simple Implementation Scheme, An overview of pipelining, Pipelined datapath and control, Data Hazards: Forwarding versus Stalling, Control hazards, Exceptions , Parallelism and advanced instruction level parallelism, Real Stuff: AMD opteron pipeline, Advance Topic: an introduction to describe and model a pipeline and more pipelining illustrations.	**10**
Chapter 4: Large and Fast: Exploiting Memory Hierarchy Introduction, The Basics of Caches , Measuring and Improving Cache Performance, Virtual Memory A Common Framework for Memory Hierarchies, Virtual machines, using a finite state machine to control a simple cache, Parallelism and memory hierarchy: cache coherence ,Advanced material: Implementing cache controllers, Real Stuff: AMD Opteron & Intel Nehalem Memory hierarchies	**10**
Chapter 5: Storage, Networks, and Other Peripherals Introduction , Dependability, Reliability and Availability, Disk Storage, Flash storage, Connecting Processors, Memory, and I/O Devices, Interfacing I/O Devices to the Processor, Memory and Operating System, I/O Performance Measures: Examples from Disk and File Systems, Designing an I/O System, Parallelism and I/O: Redundant arrays of inexpensive disks, Real Stuff: Sun firwe x4150 server, Advanced topics: Networks	**10**
Chapter 6: Multicores, Multiprocessors and Clusters Introduction, Difficulty of creating parallel processing programs, Shared memory multiprocessors Clusters and other message passing multiprocessors,Hardware multithreading,SISD, MIMD, SIMD, SPMD, and vector,Introduction to graphics processing units,Introduction to multiprocessor network topologies, Multiprocessor benchmarks, Roofline : A simple performance model, Real Stuff: Benchmarking four multicores using the roofline model.	**10**

Text Books:

1. Computer Organization and Design, The hardware/Software interface, ARM edition– David A. Patterson, John L.Hennessy. 4th edition,MK publishers,2009

Reference Books:

1. Computer Architecture and Organization- John P. Hayes, 3rd edition, McGraw-Hill, 1998

Program: Digital Electronics		
Course Title: AUTOSAR and Infotainment Systems		Course Code: **17EDEE801**
L-T-P : 2-0-1	Credits: 3	Contact Hrs: 4
CIA Marks: 50	SEE Marks: 50	Total Marks: 100
Teaching Hrs: 24	Exam Duration: 3 hrs	

Chapter No. 1: AUTOSAR Fundamentals Evolution of AUTOSAR – Motivations and Objectives AUTOSAR consortium – Stake holders – work Packages, AUTOSAR Partnership, Goals of the partnership, Organization of the partnership, AUTOSAR specification, AUTOSAR Current development status, BSW Conformance classes: ICC1, ICC2, ICC3, and Drawbacks of AUTOSAR.	4 hrs

Chapter No. 2: AUTOSAR layered Architecture AUTOSAR Basic software, Details on the various layers , Details on the stacks Virtual Function Bus (VFB) Concept Overview of AUTOSAR Methodology , Tools and Technologies for AUTOSAR AUTOSAR Application Software Component (SW-C) ,Types of SW-components AUTOSAR Run Time Environment (RTE): RTE Generation Process: Contract Phase, Generation Phase, MCAL, IO HW Abstraction Layer, Partial Networking, Multicore, J1939 Overview, AUTOSAR Ethernet, AUTOSAR E2E Overview , AUTOSAR XCP, Metamodel , From the model to the process , Software development process.	4 hrs
Unit - 2	
Chapter No. 3: Methodology of AUTOSAR and Communication in AUTOSAR CAN Communication, Application Layer and RTE, intra and inter ECU communication, Client-Server Communication, Sender-Receiver, Communication, CAN Driver, Communication Manager (ComM), Overview of Diagnostics Event and Communication Manager	4 hrs
Chapter No. 4: BSW Development and Integration BSW Constituents: Memory layer, COM and Services layer, ECU abstraction, AUTOSAR, Operating system, Interfaces: Standard interface, AUTOSAR standardized interface, BSW-RTE interface,(AUTOSAR interface), BSW-ECU hardware interface, Complex device drivers and BSW module configuration, AUTOSAR Integration.	4 hrs
Chapter No. Chapter 5: Infotainment Systems in Automobiles Infotainment Systems Fundamentals: Radio, Multimedia, and Navigation: Introduction to In Vehicle Infotainment (IVI) systems, Use of operating systems in IVI , GENIVI Alliance, Tuner: AM/FM, XM/Sirrus, DAB/DMB, Software Defined Radio; Concepts of HD, radio, Ensemble, Traffic Announcements, Spread Spectrum, d. Multimedia: Types of Media; Music, Video, Podcasts, etc. Media management; Playback, Track Control, Metadata, Playlists, Categories, Trick play, Audio/Video Source Management, Navigation: Points of Interests, Routes, Waypoints, Dead Reckoning position, Traffic Info, GLONASS, GNSS, RTK, GPS, and SBAS/GBAS,INS f. Media types: CD, DVD, CDDA, USB, SDCARD, Media Formats:MP3, WMV, RealAudio/Video, QTP, Architecture – Design Patterns - Proxies, Adaptors, Interfaces, Singleton, Factory method	4 hrs
Chapter No. Chapter 6: Communication Systems in Automobiles Automotive & Consumer Electronic Communication Systems: Introduction to Bluetooth – Pairing, HFP, A2DP, PAN, PBAP, DUN, Concepts of MOST network, DLNA, AVB, Concepts of TCP/IP, Ethernet, WiFi, WiFi Direct, MyWiFi and CAN, Mirror link, Tethering	4 hrs
Text Books 1. Ronald K. Jurgen, Infotainment systems, 2007, SAE International, 2007	

1.2.1 Syllabus of new courses introduced

Course Title: **Product Realization**	Course Code: 16EMEP205
Total Contact Credits: **0-0-2**	Duration of SEE Credits: -
ISA Marks: 80	ESA Marks: 20

Week #	Particulars	Venue
Week 1 and Week 2	➢ Introduction to Prototyping - Specifications, Part Drawings, Assembly Drawings, PCB Layout, Wireframe , Pseudocode, BOM, Process Plan, Fabrication and Test Plan Validation ➢ IOT Workshop	Studio Engagement
Week 3	➢ Identifying sub-assemblies ➢ Procurement of logistics for proof of concept testing. ➢ Selection of materials for all the parts and joining techniques ➢ Selection of UI and Core Component of Android	Makers Space/
Week 4	➢ Process plan ➢ Identifying the proper machines, tools and operations required for prototyping. ➢ Selection of appropriate raw materials for prototyping. ➢ Demonstrate breadboard prototype of entire electronics in the system. (To have tested electronic circuit for PCB design) ➢ UI implementation using XML	
Week 5	➢ Fabricate the parts for sub assembly ➢ Initiate schematic entry in PCB design software, also refine and optimize thesize of the board. ➢ UI implementation and validation	
Week 6	➢ Fabricate the parts for sub assembly ➢ Generate gerber files for the optimal PCB design. ➢ Android core component implementation and Unit Testing	
Week 7	➢ Fabricate the parts for sub assembly ➢ Fabricate PCB using MITS machine, solder components and test the design. ➢ Android core component implementation and Unit Testing	
Week 8	➢ Assemble the sub assemblies and check for interference and functionality	

	➢ Revisit PCB testing for increasing reliability of the design. (test to avoid/eliminate lose connections, dry soldering, andbad electronic components) ➢ Android core components integration and testing	
Week 9	➢ Test the functional prototype using proper identified test methods. ➢ Demonstrate working of fully functional PCB. ➢ Configuration of IoT Server	
Week 10	➢ Integratesubsystems for prototype testing. ➢ Analyse the test results ➢ System modification ➢ System integration	
Week 11	➢ Final concluding review ➢ Product catalog ➢ System Tesing.	Studio/ Makers Space

**** Templates to be provided for week wise activities.***

References

1. Pahl, G., Beitz, W., Feldhusen, J. and Grote ; "Engineering Design-A Systematic Approach" by, K.-H- Springer; 3rd ed. 2007

Course Code: 18EMEE303	Course Title: Turbo Machines	
L-T-P-SS: 3-0-0-0	Credits: 3	Contact Hrs: 3
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 3		Exam Duration: 3 hrs

Content	Hrs
Unit - I	
Chapter No. 1:Principles of Turbo Machinery Definition of turbo machine, Comparison with positive displacement machine, Classification; Application of first and second law to turbo-machines, Efficiencies. Dimensionless parameters and their physical significance, Effect of Reynolds number, Specific speed, Illustrative examples on dimensional analysis and model studies.	5
Chapter No. 2: Energy Exchange In Turbo Machine Euler Turbine equation, Alternate form of Euler turbine equation-components of energy transfer, Degree of reaction, General Analysis of a turbo machine-effect of blade discharge angle on energy transfer and degree of reaction, General analysis of centrifugal pumps and compressors-effect of blade discharge angle on performance, Theoretical head-capacity relationship.	5
Chapter No. 3 : General Analysis of Turbo Machines Axial flow compressors and pumps-general expression for degree of reaction, velocity triangles for different values of degree of reaction, General analysis of axial and radial flow turbines-utilization factor and degree of reaction, Condition for maximum utilization factor-optimum blade speed ratio for different types of turbines.	6
Unit -II	
Chapter No. 4: Compressible Flow Fundamentals Energy and momentum equations for compressible fluid flows, various regions of flows, reference velocities, stagnation state, velocity of sound, critical states, Mach number, critical Mach number, types of waves, Mach cone, Mach angle, effect of Mach number on compressibility.	5
Chapter No. 5: Centrifugal Compressors Stage velocity triangles, slip factor, power input factor, Stage work, Pressure developed, stage efficiency and surging, stalling and prewhirl. Expression for pressure ratio developed in a	6

stage, work done factor, efficiencies, Problems.	
Chapter No. 6: Axial flow Compressors Axial Flow Compressors: Basic operations, elementary theory, factors affecting stage pressure ratio, Blockage in the compressor annulus, degree of reaction, three-dimensional flow, design process, blade design, calculation of stage performance, compressibility effects, off-design performance**.**	5
Unit -III	
Chapter No. 7: Flow through Variable Area Ducts Isentropic flow through variable area ducts, T-s and h-s diagrams for nozzle and diffuser flows, area ratio as a function of Mach number, mass flow rate through nozzles and diffusers, effect of friction in flow through nozzles.	4
Chapter No. 8:Steam Turbines Classification, impulse –reaction stages, condition for maximum blade efficiency, stage efficiency. Compounding-need for compounding, method of compounding, impulse staging-condition for maximum utilization factor for multi stage turbine with equiangular blades, effect of blade and nozzle losses, Reaction turbine, Parson's reaction turbine.	4

Text Book

1. ShepherdD.G., Principals of Turbo Machinery, Macmillan Publishers,1st Edn.1964
2. Yadav R., (2007) 'Steam & gas turbines and power plant engineering', *Central Publishing House Allahabad*, Vol. 1,
3. S. M. Yahya, Turbines, Compressors & Fans,Tata McGraw Hill Co. Ltd., 2nd edition, 2002.
4. E Rathakrishnan, Gas Dynamics, PHI- 2nd edition, 2009.

References

1.Kadambi V. Manohar Prasad,An Introduction to Energy Conversion, Vol-III Turbo Machinery, New Age International, 1st Edn, 2006.

2.Saravanamutto H.I.H, Rogers G.F.C., Cohen H, Gas Turbine Theory, 5th edn., Pearson Education, 2006.

Course Code: 15EMEE417	Course Title: **Modern Trends in Manufacturing**	
L-T-P-SS:**3-0-0-0**	Credits:**3**	Contact Hrs: **50**
CIE Marks: **50**	SEE Marks: **50**	Total Marks: **100**
Teaching Hrs: **50**		Exam Duration: **3 Hours**

	Unit I	
No	**Contents**	**Hrs**
1	**Chapter No. 1: Systematic Approach for Manufacturing Strategy** Seven Losses Regarding Productivity and Profitability, Feasibility Study of Productivity Improvement, Four Levels of Manufacturing Strategy.	**4**
2	**Chapter No. 2:Management and productivity in Engineering** Definition of Engineering, Management and Management Engineering, Industrial Engineering and Productivity, Necessity of Facts and Work Measurement Productivity, Purpose of Productivity Improvement, Engineering Approach for Productivity, Three Levels of Improvement, Points of Successful Productivity, Relationship of Methods, Performance, and Utilization to Standard Time.	**8**
3	**Chapter No. 3: Concurrent Engineering** Introduction, importance of CE , building blocks of CE, Important factors in concurrent engineering process , communication models, benefits and its tools.	**3**
	Unit II	
4	**Chapter No. 4: Continuous process improvement** Introduction, Japanese concept of continuous improvement (kaizen), innovation concept of improvement, need for continuous improvement, tools for continuous improvement, steps in implementing continuous improvement, three pillars of continuous improvement, standardization, quality circles, suggestion systems, kaizen and management, kaizen umbrella, TPM, Six sigma, FMEA and discussion of few case studies.	**08**
5	**Chapter No. 5: Pull production systems** introduction to TPS, KANBAN system, difference between pull and push system, other types of kanban, kanban rules, adapting to fluctuation in demand through kanban, a detailed kanban system example, supplier kanban and sequence schedule for kanban.	**07**

Unit – III		
6	**Chapter No. 6: Quality Management Systems** Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System – Elements, Implementation of Quality System, Documentation, Quality Auditing, QS 9000, ISO 14000 –Concept, Requirements and Benefits.	**05**
7	**Chapter No. 6: Six sigma** Principles of Six sigma, project selection for six sigma, six sigma problem solving, design for six sigma, six sigma in service and small organization, six sigma and lean production, statistical thinking and application, statistical foundation, statistical methodology, design of experiments, analysis of variances.	**05**

Text Book:

1. Masaki Imai, 'KAIZEN', McGraw Hill International.
2. ShigeyasuSakamoto , "Beyond World-Class Productivity", Springer-Verlag London Limited 2010.
3. Dale H. Besterfield, "Total Quality Management", Pearson Education, Asia.

References:

1. Richard J. Schonberger, 'Japanese Manufacturing Techniques', The Free Press – Macmillan Publication.
2. James R. Evans and William M. Lindsay, 'The Management and Control of Quality'.

Course Code: **19EMEE302**	Course Title: **Advanced Statistics and Machine Learning**	
L-T-P : 0-0-3	Credits: 03	Contact Hrs: 06
ISA Marks: 80	ESA Marks: 20	Total Marks: 100
Teaching Hrs: 80		Exam Duration: 2 Hrs.

Content	Hrs
Unit - 1	
1. Introduction to Machine Learning Introduction to Supervised, Unsupervised, and Reinforcement Learning; Statistics for ML; Exploratory Data Analysis; Use of Python and working with CSV/XLS files. Python hands on: Installation, Introduction to Python libraries (Pandas, Numpy, matplotlib and so forth)	25 Hrs
Unit - 2	
2. Applied Statistics Statistics for ML; Data Wrangling; Exploratory Data Analysis; Visualization; Use of Python and working with CSV/DB Hands on: Preprocessing techniques	15 Hrs
3. Machine Learning Methods Introduction to ML Life Cycle; Regression – Predictive Modeling; Regularization; Feature Selection; Metrics for Prediction; Visualization;	18 Hrs
Unit - 3	
4. ML – Classification Introduction to Classification; Logistic Regression; Random Forests; Metrics for Classification; Visualization; Use of Python and DB	22 Hrs

Text Books (List of books as mentioned in the approved syllabus)

1. Trevor Hastie, Robert Tibshirani, and Jerome Friedman, "The Elements of Statistical Learning: Data Mining, Inference, and Prediction", Springer, 2017.
2. Roger D Peng, "R Programming for Data Science", Learnpub, 2015.

References

1. Geetha James, Trevor Hastie, Daniela Whitten, Robert Tibshirani, "An Introduction to Statistical Learning with Applications in R", Springer, 2017.
2. Andrew Ng, "Machine Learning Yearning", https://www.mlyearning.org/.
3. Michael Nielsen, "Neural Networks and Deep Learning", http://neuralnetworksanddeeplearning.com/.

Course Code: **19EMEE307**	Course Title: **Machine Learning Applications**	
L-T-P : 0-0-3	Credits: 03	Contact Hrs: 06
ISA Marks: 80	ESA Marks: 20	Total Marks: 100
Teaching Hrs: 80		Exam Duration: 2 Hrs.

Content	Hrs
Unit - 1	
1. Unsupervised Learning Refresher week, Introduction to Unsupervised Learning, Clustering Analysis: K-Means, K-Medoid, DBSCAN, Hierarchical Clustering.	18 Hrs
Unit - 2	
2. Introduction to Deep Learning Frame-Work Introduction to DL, Exploring the popular DL frameworks, Getting started with TensorFlow, Introduction to Keras, Setting up the environment.	15 Hrs
3. Introduction to Deep Neural Network (DNN) Introduction- What is Deep Learning, Why Deep Learning and Why now, Mathematical building blocks of NN, Examples on Regression, Classification.	21 Hrs
Unit - 3	
4. Deep Learning in practice Introduction to Convnets, Understanding Recurrent NN, Examples	12 Hrs

Text Books (List of books as mentioned in the approved syllabus)

1. Trevor Hastie, Robert Tibshirani, and Jerome Friedman, "The Elements of Statistical Learning: Data Mining, Inference, and Prediction", Springer, 2017.
2. Deep Learning, Ian Goodfellow, Yoshua Bengio et.al

References

1. Andrew Ng, "Machine Learning Yearning", https://www.mlyearning.org/.
2. Michael Nielsen, "Neural Networks and Deep Learning", http://neuralnetworksanddeeplearning.com/.
3. Deep Learning with Python, Francois Chollet

Course Code: 19EMEE301	Course Title: Vehicle Structure and Design Optimization	
L-T-P: 3-0-0	Credits: 3	Contact Hrs: 3 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 80		Exam Duration: 3 hrs

PART A (Study of Vehicle Structure)		
Sl. No.	**Content**	**Teaching Hours**
1	Brief explanation of different types of Loads and its effect; Different types of stresses- Static and Thermal, Different types of beams, Struts and Columns, thick and thin cylinders;	02
2	Understanding vehicle structure based on application; (e.g: 3box, load body and chassis)	04
3	Choices for Preparation of Virtual Model (1D, 2D, 3D representation);	03
4	Importance of Joinery;	02
5	Common performance measures for vehicle structures; (Stiffness, Modal, Durability)	03
6	Understanding Data and Assumptions; (e.g. nominal and tolerance, etc.)	02
7	Baseline data; (Initial collection of data which serves as a basis for comparison with the subsequently acquired data.)	02
8	Quality control in virtual environment;	03
9	Example case of static stiffness of BIW, Chassis; (BIW (short for Body in White) is a stage in automotive design and manufacturing. BIW refers to the body shell design of an automotive product such as cars. It is just a sheet metal welded structure. BIW will not have doors, engines, chassis or any other moving parts.)	05
10	Understanding effect of thermal loads on structure;	02
11	Understanding how to compute life based on stress results;	02
	Total-Theory	**30**
Hands on Session		
01	Demonstrate importance of geometric parameters on performance	05

	of structure	
02	Demonstrate importance of cross members on performance of structure	05
Total-Hands-on		**10**
TOTAL		**40**
PART B (Design Optimization)		
Sl. No.	**Content**	**Teaching Hours**
1	Optimization in the Design Process, Engineering Design Practice, Characteristics of Different Industries, CAE and the Design Cycle, The impact of optimization on CAE, What is an Optimum Design?, Optimization terminology in a nutshell, Finding an Optimum, Formulation of an Optimization problem;	02
2	What is optimization in the context of EV structure;	02
3	Different types of design optimization;	02
4	How to plan and approach giving design guidance;	02
5	What is concept level design guidance (generative designs);	03
6	How to handle design guidance at a detailed design stage;	03
7	Examples - design guidance for stiffness attribute;	04
8	Examples - design guidance for durability attribute;	04
9	What is MDO, its application; (Medium density overlay-MDO is produced with a high-quality thermosetting resin-impregnated fiber surface bonded to one or both sides under heat and pressure to create an exterior-grade plywood panel.)	02
10	Watch-outs during design guidance process;	02
11	Examples - design guidance for NV & crash attribute;	04
Total-Theory		**30**
Hands on Session		
01	Optimize front control arm of a vehicle for all its performance criteria. FAW up by 10%	05
02	Optimize B-Pillar for roof crush if GVW goes up by 20% due to electrification, Effect of wheel base increase on chassis stiffness and how to bring it back, Section optimization using morphing.	05
Total-Hands-on		**10**
TOTAL		**40**

PROJECTS:

Objective: To carry out Baseline Performance, Virtual Testing and Design Countermeasures	
Sl. No.	**Content**
01	Battery case for EV;
02	Motor compartment / Passenger compartment - improve performance;
Objective: To Provide design guidance	
Sl. No.	**Content**
01	Battery case for EV (Metal vs Composite);
02	Motor compartment / Passenger compartment - improve performance;

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Text Books/Reference Books:

1. Dr. N.K. Giri, Automotive Mechanics, 8th Edition,2008, Khanna Publication, New Delhi.
2. Practical Aspects of Structural Optimization, Altair University, 3rd Edition.
3. Robin Hardy, Iqbal Husain, "Electric and Hybrid Vehicles”. CRC Press, ISBN 0-8493-1466-6.
4. Ron Hodkinson and John Fenton, “Lightweight Electric/ Hybrid Vehicle Design”. SAE International
5. John M. Miller, Propulsion Systems for Hybrid Vehicles" Institute of Electrical Engineers, London, ISBN0 863413366.
6. Automobile Electrical and Electronic systems, Tom Denton, Third Edition, 2004, SAE International, SAE ISBN 0 7680 147 2, Society of Automotive Engineers. Inc 400 common wealth Drive, Warrendale, PA 15096-0001 USA.

Course Code:19EMEE401	Course Title: Dynamics & Durability of Vehicles	
L-T-P: 3-0-0	Credits: 3	Contact Hrs: 3 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 80		Exam Duration: 3 hrs

PART A
(Dynamics of Vehicles)

Sl. No.	Content	Teaching Hours
1	Introduction - Kinematics & Compliance in vehicles;	02
2	Introduction to Roads and Loads;	02
3	Introduction to Durability in industry;	02
4	Data and Assumptions for multi-body systems - quality control;	02
5	Loads mapping for downstream use with examples;	03
6	Example applications using Multi-Body Dynamic Systems;	03
7	Introduction - Flex Body;	02
8	Durability example with and without Flex body;	02
9	Control systems in Multi-Body;	02
Total-Theory		**20**
Hands on Session		
01	Build a 2/3 wheeler suspension system to carry out K&C	05
02	Build a 3 wheeler suspension system to carry out loads extraction for durability	05
Total-Hands-on		**10**
TOTAL		**30**

PROJECTS:

Objective: To carry out Dynamic and Durability of different chassis	
Sl. No.	**Content**
01	Compare durability of conventional ICE chassis with Electric version

PART B
(Durability of Vehicles)

Sl. No.	Content	Teaching Hours
1	Conduction, Convection, Steady state, Transient flows, Turbulence	02

	and its significance	
2	Importance of BTMS, Current state of thermal management in EV	02
3	Types of battery packs for xEV	02
4	Heat load calculation for battery packs	02
5	How to approach design assessment of power pack for thermal management	02
6	Importance of data & assumptions (includes baselining)	02
7	Example case of using AcuSolve to assess a design	04
8	How to improve the thermal performance of a power pack design	02
9	Importance of Drag co-eff for vehicles moving at high speeds	02
10	Fast assessment of A-Surface design for drag using VWT	02
11	Introduction to thermal management in electronic circuits	04
Total-Theory		**26**
Hands on Session		
01	Assume 2 different designs and compare the thermal performance	05
02	Prepare 2 vehicle designs (external surface) and compute drag	05
Total-Hands-on		**10**
TOTAL		**36**

PROJECTS:

Objective: To carry out to analyze then e heat produced during EV operation and streamline external airflow		
Sl. No.	**Content**	
01	Compute Delta T for a chosen EV battery pack	
02	Improve drag performance of a chosen external vehicle element	

Text Books/Reference Books:

1. Dr. N.K. Giri, Automotive Mechanics, 8th Edition,2008, Khanna Publication, New Delhi.
2. Practical Aspects of Structural Optimization, Altair University, 3rd Edition.
3. Robin Hardy, Iqbal Husain, "Electric and Hybrid Vehicles". CRC Press, ISBN 0-8493-1466-6.
4. Ron Hodkinson and John Fenton, "Lightweight Electric/ Hybrid Vehicle Design". SAE International
5. John M. Miller, Propulsion Systems for Hybrid Vehicles" Institute of Electrical Engineers, London, ISBN0 863413366.
6. Automobile Electrical and Electronic systems, Tom Denton, Third Edition, 2004, SAE International, SAE ISBN 0 7680 147 2, Society of Automotive Engineers. Inc 400 common wealth Drive, Warrendale, PA 15096-0001 USA.

Course Code: **19EMEE308**	Course Title: **Applications of Vibrations and Acoustics**	
L-T-P:**3-0-0**	Credits:**03**	Contact Hrs: 0**3**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs: **40**		Exam Duration: **03 Hours**

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Content	Hrs
Unit 1	
1. Response of Mechanical Systems to Vibrations and Shocks Characteristics of vibration and shock, response of linear mechanical systems to vibrations, response properties of non-linear systems, response of mechanical systems to stationary random vibrations, shock response and shock spectra, vibrations in structures.	**05**
2. Vibration Measuring Instrumentation and Techniques Introduction, displacement, velocity and acceleration transducers, smart sensors and transducers, electronic data sheets, selection of accelerometer, calibration and system performance checks, practical considerations in mounting accelerometers, sensor design technique (FEA), sensor selection, mounting, cabling practices and signal conditioning, sensor and signal analysis.	**05**
3. Fundamentals of Signal Analysis Data acquisition and processing, signal operations, frequency domain analysis, sampling of continuous time signals, Fast Fourier transform, FFT analyser setup, leakage and windowing, averaging, real-time analysis of stationary and transient signals.	**05**
Unit 2	
4. Vibration Monitoring and Analysis Techniques Transducer considerations, vibration data collection errors, time domain analysis, statistical descriptors of vibration signals, Lissajous pattern, frequency domain analysis, quefrency domain analysis, demodulation technique, advanced fault diagnostic techniques.	**05**
5. Modal Analysis Experimental aspects of modal testing, FRF data of SDOF and MDOF systems, Classical, OMA, ODS, SRS & FE Correlation, vibration and shock testing, examples of vibration and acoustics – automotive, aerospace and defence, engineering and white goods, research.	**05**

6. Vibration Control Introduction; Vibration Nomo graph and vibration criteria; Reduction of vibration at the source, Control of vibration; Control of natural frequencies, Introduction of damping, Vibration isolation for different types of foundation, Shock isolation, Active vibration control, Vibration absorbers: Undamped and damped dynamic vibration absorber.	**05**
Unit 3	
7. Fundamentals of Sound Sensor selection, measurement techniques, applications-environmental, product noise: sound power and sound pressure, noise source identification: intensity and acoustic holography, building acoustics, sound quality.	**05**
8. Standards for Noise and Vibration Standards for sensors, frequency analysis, sound level meter, sound power measurement, sound intensity measurement, vibration measurement, measurement of damping.	**05**

Text Book

1. C. Sujatha, Vibration and Acoustics, Tata McGraw-Hill Education, 2010
2. Bruel and Kjaer, Mechanical Vibration and Shock Measurements, Larsen & son, 2nd Edition, 1984.
3. M. L. Munjal, Noise and Vibration Control, World Scientific Publishing Co, Pvt. Ltd., 2013

Course Code: 16EMEC707	**Course Title: Research Methodology**	
L-T-P: 2-1-0	Credits: 3	Contact Hrs: 4hr/week
ISA Marks: 100	ESA Marks: --	Total Marks: 100
Teaching Hrs: 40		Exam Duration: 3 hrs

Research: Definition, Characteristics and Objectives; Types of Research, Research Methodology, Research Process, Literature Review, Review concepts and theories, Formulation of Hypothesis, Research design, Data collection, Processing and analysis of data collected, Interpretation of data, Computer and internet: Its role in research, Threats and Challenges to research, Writing a research paper, research project, Thesis, Research ethics, Citation methods and rules. Case studies	5hrs

Reference Books

1. Kothari C. R. "Research Methodology – Methods & Techniques", Vishwa Prakashan, A Division of New Age International Pvt. Ltd., 2008.
2. Ranjit Kumar, "Research Methodology – A step by step guide for Beginners", 3rd Edition, Pearson Edition, Singapore, 2011.
3. Dawson Catherine, "Practical Research Methods", UBS Publishers, New Delhi, 2002

Course Code: **15EESE802**		Course Title: **Sustainable Building Design**
L-T-P-S: **4-0-0-0**	Credits: **4**	Contact Hrs: **4 hrs/week**
CIE Marks: **50**	SEE Marks: **50**	Total Marks: **100**
Teaching Hrs: **40**		Exam Duration: **3 hrs**
1. Introduction: Sustainability and Building Design.		
Site planning: Site assessment, Site selection, Site analysis**,** site development and layout, sustainable urban drainage systems, flow attenuation		
2. Efficient water management and waste water treatment techniques Climate change and water conservation, the need for conservation, basic steps for reducing water consumption, Water conservation in landscape irrigation, Measures for reuse and conservation.		
3. Solid waste management: Introduction, guidelines for waste minimisation, Segregation of wastes, Resources recovery or recycling, Processing of waste.		
4. Passive solar design: Introduction, Thermal comfort, building physics, building design, building form, orientation, building components, Advanced soalr passive techniques, passive solar heating, passive cooling strategies, Day lighting, Factors for the design of day lighting, factors affecting daylight factor distribution. Innovative day lighting systems, Hybrid day lighting system.		
5. Building technologies: Traditional efficient building techniques, walling systems. Traditional stone masonry, Roofing systems, Doors and windows, High-rise masonry, curtain walls, pre-fabrication,		
6. Energy systems: units of lighting, lighting equipment, system design approach for energy-efficient lighting, Additional parameters for design approach for lighting, Approach for an energy efficient lighting system by sector, Energy conservation opportunities in existing lighting systems,		
7. Building Envelop: Domestic appliances, Non-domestic appliances, Heating ventilation and air conditioning systems, Use of renewable energy.		

Text Books

1. Sustainable building Design manual volume-2, sustainable building design practices, TERI, New Delhi, 2004.

References:

1. S.P. Sukhatme, Nayak J.K.,Solar Energy:Principles of Thermal Collection and Storage, Tata-Mc-Graw Hill Education, 2008
2. Garg & Prakash, H. P. Garg,Solar Energy:Fundamentals and Applications, Tata-Mc-Graw Hill Education, 2000
3. G.N. Tiwari, Solar Energy:Fundamentals, Design, Modelling and Applications, Alpha Science International Limited, 2002

Course Code:18EESP701		Course Title: **Energy System Lab**
L-T-P: 0-0-2	Credits: 2	Contact Hrs: 4 hr/week
ISA Marks: 80	ESA Marks: 20	Total Marks: 100
Teaching hrs: 24		Exam Duration: 02 hrs

Studies on : a. Operational experience on i) Pyranometer, ii) Sunshine recorder b. Measurement of temperature using Infrared Thermometers d. Measurement of illumination using Lux meter e. Exhaust gas analysis using gas analyzer **List of experiments** 1. Performance evaluation of a solar flat plate thermo-syphon water heating 2. Conversion efficiency of a solar flat plate forced solar water heating system 3. Conversion efficiency of a solar Concentrating water heating system 4. Determination of conversion efficiency of a solar air heating system 5. Study and analysis of a solar still / distillation plant 6. Performance estimation of photovoltaic water pumping system 7. Investigation on a solar dryer 8. Operational characteristics of P.V. Indoor lighting system 9. Determination of characteristics of a wind generator 10. Performance evaluation of solar cooker 11. P.V. System sizing exercise 12. Data acquisition system for monitoring of P.V system using LABVIEW s/w 13. Performance estimation of Solar fuel cell 14. Performance evaluation of vertical and horizontal axis wind turbine rotors.	24 hrs

Course Code:18EESP702	Course Title: **Industrial Instrumentation and Control Lab**	
L-T-P: 0-0-2	Credits: 2	Contact Hrs: 4 hr/week
ISA Marks: 80	ESA Marks: 20	Total Marks: 100
Teaching hrs: 24		Exam Duration: 02 hrs

1. **Control technologies** Local manual, remote electrical, Local pneumatic, Remote analog/digital 2. **Basic electrical and math concepts**: Applications to instruments, Electrical principles and symbols, Series/parallel circuits 3. **Pressure instrumentation & measurements**: Pressure measurement devices, U-tube manometer, bourdon gauge, bellows gauge, piezoelectric 4. **Temperature instrumentation and measurements** • Measurement devices and techniques, Bimetallic temperature measurement, Filled capillary and bulb, thermocouple, resistance temperature detector (RTD), thermistors, thermowells, infrared 5. **Flow Instrumentation and Measurements:** Flow measurement methods, Factors influencing flow measurement, Flow measurement devices: orifice plates, venturi tube, flow nozzle, elbow taps, pitot tube, magnetic flow meter (Mag meter), vortex shedding meter, turbine meter, target flowmeter, ultrasonic, variable area rotameter, coriolis meter 6. **Level instrumentation and measurements:** Level measurement methods: sight glass, differential pressure level measurement, bubbler, displacer level sensor, float level sensors, capacitance, radiation-based, radar and ultrasonic level sensors 7. **Manipulating the process**: Final control element, Actuators, valve positioners, I/P, valves • Variable frequency drives 8. **Controllers:** Control modes: proportional, integral, derivative, Tuning feedback controllers ¼ decay, Zeigler-Nichols, damped oscillation, Ratio, cascade and feed-forward control 9. **Control systems**: Overview of PLCs, DCS and SCADA systems **Hands-on Exercises**: Sensor checkout, Hookup to calibration stands, Transmitter calibration check, Program/tune controller, Set up of differential pressure, temperature, and other process-simulation devices, Checking current output with Volt-Ohm Mille-ammeter (VOM) & tracing around loop, Simulate and source 4-20mA-DC signals	24 hrs

Course Code:18EESP703	Course Title: **Process Modeling and Simulation Lab**	
L-T-P: 0-0-2	Credits: 2	Contact Hrs: 4 hr/week
ISA Marks: 80	ESA Marks: 20	Total Marks: 100
Teaching hrs: 24		Exam Duration: 02 hrs

MATLAB Analysis 1. Declination of earth, hour angle, day length, local apparent time. 2. Monthly average, hourly global and diffuse radiation on a horizontal surface and tilted Surfaces. 3. Power generation from a wind turbine, Variation of wind velocity and power with altitude. 4. Solution of ordinary differential eqations-4th order R K Method. 5. Solution of one-dimensional steady state heat conduction equation. 6. Solution of two-dimensional steady state PDE. 7. Solution of one-dimensional transient PDE. **Finite Element Analysis** 8. Two dimensional heat conduction. 9. One dimensional transient heat conduction. 10. Transient analysis of a casting process. **CFD Analysis** 11. Flow through a pipe bend. 12. Flow through a nozzle.	24 hrs

Course Code:18EESP704	Course Title: **IoT based Living Space Lab**	
L-T-P: 0-0-2	Credits: 2	Contact Hrs: 4 hr/week
ISA Marks: 80	ESA Marks: 20	Total Marks: 100
Teaching hrs: 24		Exam Duration: 02 hrs

1. Introduction to IoT, Automation, Arduino, Raspberry Pi and IoT.	24 hrs
2. Introduction to Arduino programming and interfacing with peripherals and sensors Motor, Servo motor, LDR, PIR sensor, ultrasonic sensor, DHT 11, MQ2 smoke sensor, LCD and RC522 RFID	
3. Wireless communication with Arduino: GSM Module, Ethernet Shield. Raspberry Pi and Raspbian operating system: Installing operating system ,Starting Raspberry Pi desktop and using Linux commands	
4. Connecting to the network: Wired networking and Wireless networking, Setting up static IP for raspberry pi, Remote accessing of Raspberry Pi	
5. Python programming with Raspberry Pi: Introduction to Python, Python commands and Python scripting for programming GPIO	
6. Interfacing of Arduino with Raspberry Pi: Programming Arduino from Raspberry Pi using IDE Programming Arduino from Raspberry Pi using Python	
7. Raspberry Pi as web server: Installing Apache Server	
8. Connecting Arduino and Raspberry Pi to cloud service: Uploading Arduino sensor data to cloud. Connecting Raspberry Pi to cloud and interfacing sensors	
9. Conduction Of Living Space Lab Experiments Design of IoT based weather DAQ system IoT based temperature data monitoring and DAQ IoT based humidity data monitoring and DAQ IoT based solar insolation data monitoring and DAQ IoT based wind speed data monitoring and DAQ	
10. Design of Energy management system IoT based SPV - Solar generation data monitoring IoT based Wind generation data monitoring IoT based SPV – Wind hybrid generation data monitoring	

Course Code:**19EESC703**	Course Title: **Computational Methods in Engineering Analysis**	
L-T-P: 3-1-0	Credits: 4	Contact Hrs: 5
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 40		Exam Duration: 3 hrs

1.Approximations and round off errors: Significant figures, accuracy and precision, error definitions, round off errors and truncation errors. Mathematical modelling and Engineering problem solving: Simple mathematical model, Conservation Laws of Engineering.	06 hrs
2.Roots of Equations: Bracketing methods-Graphical method, Bisection method, False position method, Newton-Raphson method, Secant Method. Multiple roots, Simple fixed point iteration.	06hrs
3.Roots of polynomial- Polynomials in Engineering and Science, Muller's method, Bairstow's Method Graeffe's Roots Squaring Method.	06 hrs
4.Numerical Differentiation and Numerical Integration: Newton –Cotes and Guass Quadrature Integration formulae, integration of Equations, Romberg integration, Numerical Differentiation Applied to Engineering problems, High Accuracy differentiation formulae.	06 hrs
5.System of Linear Algebraic Equations and Eigen Value Problems: Introduction, Direct methods, Cramer's Rule, Gauss Elimination Method, Gauss-Jordan Elimination Method, Triangularization method, Cholesky Method, Partition method, error Analysis for direct methods, iteration Methods.	06 hrs
6.Eigen values and Eigen Vectors: Bounds on Eigen Values, Jacobi method for symmetric matrices, Givens method for symmetric matrices, Householder's method for symmetric matrices, Rutishauser method for arbitrary matrices, Power method, Inverse power method.	05 hrs
7.Linear Transformation: Introduction to Linear Transformation, The matrix of Linear Transformation, Linear Models in Science and Engg.	05 hrs

Reference Books

1. Erwin Kreyszig , Advanced Engineering Mathematics, 10th Edition , Willely India, 2016.
2. S.S.Sastry, Introductory Methods of Numerical Analysis, PHI, 2005.
3. Steven C. Chapra, Raymond P.Canale, Numerical Methods for Engineers, TMGH, 4th Ed, 2002.
4. M K Jain, S.R.K Iyengar, R K. Jain, Numerical methods for Scientific and engg computation, New Age International, 2003.
5. Pervez Moin, Fundamentals of Engineering Numerical Analysis, Cambridge, 2010.
6. David. C. Lay, Linear Algebra and its applications, 3rd edition, Pearson Education, 2002.

Course Code: **16EMDC706**	Course Title: **Theory of Vibrations with Applications**	
L-T-P: **4:1:0**	Credits: 5	Contact Hrs: 4 / week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 50		Exam Duration: 180 min

No	Content	Hrs
1	**Review of Mechanical Vibrations** Undamped and damped free vibrations of single degree of freedom systems: Importance of the study of vibration, Classification, Free vibration of an undamped translational systems, Equation of motion and natural frequency of systems, Types of damping, Response of single degree freedom viscous damped systems, Logarithmic decrement, Systems with Coulomb damping.	**07**
2	**Harmonically Excited Vibration** Introduction, Response of a viscous damped system under harmonic force, Response of a system under the harmonic motion of the base, Relative motion, Response of a system under rotating and reciprocating unbalance, Vibration isolation, transmissibility and Force transmitted.	**06**
3	**Transient Vibrations of Single Degree of Freedom Systems** Impulse excitations, Arbitrary excitation, Laplace transform formulation, step input, Pulse Excitation, Shock response spectrum, Shock isolation.	**06**
4	**Multi Degree-of-Freedom Systems** Introduction, Two degree-of-freedom systems: Free vibration analysis of an un-damped system, Torsional system, Coordinate coupling. Influence Coefficients, Natural frequencies using Matrix Iteration Method, Fundamental frequency using Dunkerley's method and Rayleigh's Method, Torsional Systems, Standard Eigenvalue problem-Choleski decomposition.	**07**
5	**Vibration Control** Introduction; Vibration Nomo graph and vibration criteria; Reduction of vibration at the source, Control of vibration; Control of natural frequencies, Introduction of damping, Vibration isolation for different types of foundation, Shock isolation, Active vibration control, Vibration absorbers: Undamped and damped dynamic vibration absorber.	**06**
6	**Nonlinear Vibration** Introduction; Examples of nonlinear vibration problems-Simple pendulum, Mechanical chatter, Belt friction system, Variable mass system, Exact methods, Approximate analytical methods-Basic philosophy, Lindstedt s Perturbation method, Iterative method, Ritz-Galerkin method, Subharmonic and Superharmonic Oscillations, Systems with time-dependent coefficients (Mathieu equation), Stability of equilibrium states-Stability analysis, Classification of singular points, Limit cycles.	**06**
7	**Vibration Measurement and Condition Monitoring** Introduction, Transducers, Vibration pickups, Frequency measuring instruments. Signal analysis: Spectrum analyzers, Bandpass filter. Dynamic testing of machines and structures, Experimental modal analysis: Exciter, Transducer, Signal conditioner and analyzer. Machine condition monitoring and diagnosis: Vibration severity criteria,	**06**

	Machine maintenance techniques, Machine condition monitoring techniques, Vibration monitoring techniques.	
8	**Continuous Systems** Vibrating string, Longitudinal vibration of rods, Torsional vibration of rods, Euler's equation for beams.	**06**

Reference Book:

1. S. S. Rao, "*Mechanical Vibrations*", 5th edition, Pearson Education, 2011.
2. William T. Thomson, Marie Dillon Dahleh and Chandramouli Padmanabhan, "*Theory of Vibration with Applications*", 5th edition, Pearson Education, 2008.
3. S Graham Kelly, "*Mechanical Vibrations: Theory and applications*", Cengage Learning, 2012.
4. V. Dukkipti, J. Srinivas, "*Vibrations Problem Solving Companion*", Alpha Science International Ltd, 2005.
5. V. Ramamurti, "*Mechanical Vibration Practice with Basic Theory*" Narosa, 2000.

Course Code: **16EMDP702** Course Title: **Design Lab**

L-T-P: 0-0-2 Credits: 2.0 Contact Hrs: 4 hrs/week

ISA Marks: 80 ESA Marks: 20 Total Marks: 100

Teaching Hrs: 24 Sessions (2 Hours Each) Exam Duration: 3 Hours

No	**Experiment Title**	**Hours Required.**
1	Fabrication and mechanical testing of Polymer Composite Materials (PMC)	**14**
2	Machine condition monitoring includes 1. Spindle imbalance 2. Machine leveling	**04**
3	Real time collision detection system to detect 1. Collisions 2. Vibration over load	**04**
4	Preparation and fracture toughness of CT specimen	**02**

***Materials and Resources Required*:**

Books/References:

1. Robert M.Jones, "*Mechanics of Composite Materials",* McGraw Hill, Kogakusha Ltd.1998.
2. R. A. Caollacatt Chapman "Mechanical Fault Diagnosis and Condition Monitoring"- Chapman and Hall 1977.
3. Prashant Kumar, "*Elements of Fracture Mechanics*", Tata McGraw-Hill Education Pvt. Ltd. New Delhi, 2010.

Course Code: **16EMDC801**	Course Title: **Machine Tool Design and Analysis**	
L-T-P: 4-0-0	Credits: 4	Contact Hrs: 4 hrs / week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 50		Exam Duration: 180 min

No	Content	Hrs
1	**Chapter No. 1. Machine tool basics** Introduction to machine tools, Design of shafts, keys, splines, poly V-belts, gears. Calculation of forces in lathe and milling machines. Calculation of motor power for a given application. Theory of metal cutting. Standards for bought out items like cap screws, hex bolts, nuts, washers etc. Selection of preferred sizes, Renard series.	**10**
2	**Chapter No. 2. Elements of CNC** Steels, CI used in M/C tools & heat treatment of steels, Surface finish and methods of improving them. GD&T and how to represent them in drawings. Types of ball and roller bearings, Spindle assemblies of turning and VMC machines, IS standards for various Lathe and CNC milling standards. Design of spindles for rigidity, speed, lubrication etc	**10**
3	**Chapter No. 3. SQC & Testing of CNC** Cp, Cpk calculations and their importance in CNC machines. How to establish positioning and repeatability by JIS method. Elements of CNC machines and introduction to CNC machines. Testing of CNC lathes and VMC machines.	**07**
4	**Chapter No. 4. Selection of CNC elements** Ballscrews, LM guide ways-types, accuracy, and method of selection for CNC machines. Calculation of static and dynamic loads etc. Servomotors, spindle motors and selection of the same for a specific application. Principle of operation of incremental and absolute encoders	**06**
5	**Chapter No. 5. Hydraulics in CNC** Design of hydraulic system for a lathe. Introduction to X, Y and Z assembly and how to compensate for thermal expansion of ballscrews.	**07**
6	**Chapter No. 6. CNC assemblies** Headstock, axes table, Declamping mechanisms of a tool in VMC. Ergonomics and aesthetics of machine tool	**04**
7	**Chapter No. 7. Electrical & Electronics of CNC** Basic electronics for mechanical engineers. Electricals for mechanical engineers-explanation of switch gear elements used in machine tools. Reading electrical diagrams and design of electrical system for CNC machines. PLC programme and ladder logics.	**06**

Reference Book:

1. CMTI, Machine tool design hand book, Tata McGraw-Hill, 1982
2. HMT, Mechatronics, Tata McGraw-Hill, 1998
3. Fanuc, Fanuc drives, spindle motors and servo motors manual
4. Material prepared and compiled by Mechanical Engg dept,, KLE-Tech Hubballi-31, 2016.

Course Code: **17EMDP701**	Course Title: **Finite Element Analysis Lab**	
L-T-P: 0-0-1	Credits: 1	Contact Hrs: 2 hrs / week
ISA Marks: 80	ESA Marks: 20	Total Marks: 100
Teaching Hrs: 24		Exam Duration: 120 min

Content	Hrs
➢ Modeling of any automotive engine component using modeling software as two and three dimensional. ➢ Static analysis of above modelled component using different possible types of elements and materials. ➢ Non-Linear Analysis of 3D model created for any possible Nonlinearity criteria viz -Geometric, Material, and Contact. ➢ Dynamic Analysis of 3D model created by Modal or Harmonic or Transient for different Boundary Conditions. ➢ Thermal analysis of 3D model created. ➢ Fatigue Analysis & Fatigue life Prediction of created 3D model. ➢ Using theoretical concepts validation of the above analysis to be carried out. ➢ Report to be submitted in the prescribed format.	**24**

***Materials and Resources Required*:**

1. Nitin S. Ghokale, Sanjay Deshapande, Sanjeev Bedekar, "Practical Finite Element Analysis", Vikas Book house, Pune, 2008
2. Sham Tickoo, "Ansys Workbench 14.0 for Engineers and Designers-,A Tutorial Approach**"**, Dream Tech Press, 2013
3. Liu G. R. and Quek S. S., "The Finite Element Method" A practical Course, 2nd Edition, Elsevier, 2014.
4. http://148.204.81.206/Ansys/150/ANSYS%20Mechanical%20Users%20Guide.pdf
5. http://abaqus.software.polimi.it/v6.12/pdf_books/CAE.pdf

Course Code: **17EMDC708**	Course Title: **Research Methodology**	
L-T-P: 2-1-0	Credits: 3	Contact Hrs: 4 hrs / week
ISA Marks: 100		Total Marks: 100
Teaching Hrs:40		

Content	**Hrs**
Research: Definition, Characteristics and Objectives; Types of Research, Research Methodology, Research Process, Literature Review, Review concepts and theories, Formulation of Hypothesis, Research design, Data collection, Processing and analysis of data collected, Interpretation of data, Computer and internet: Its role in research, Threats and Challenges to research, Writing a research paper, research project, Thesis, Research ethics, Citation methods and rules. Case studies.	**24**

Reference Book:

1. Kothari C. R. “Research Methodology – Methods & Techniques”, Wishwa Prakashan, A Division of New Age International Pvt. Ltd., 2008.
2. Ranjit Kumar, “Research Methodology – A step by step guide for Beginners”, 3rd Edition, Pearson Edition, Singapore, 2011.
3. Dawson Catherine, “Practical Research Methods”, UBS Publishers, New Delhi, 2002.

Course Code:**19EMDC701**	Course Title: **Computational Methods in Engineering Analysis**	
L-T-P: 3-1-0	Credits: 4	Contact Hrs: 5
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 40		Exam Duration: 3 hrs

Contents	Hrs
1.Approximations and round off errors: Significant figures, accuracy and precision, error definitions, round off errors and truncation errors. Mathematical modelling and Engineering problem solving: Simple mathematical model, Conservation Laws of Engineering.	**06**
2.Roots of Equations: Bracketing methods-Graphical method, Bisection method, False position method, Newton- Raphson method, Secant Method. Multiple roots, Simple fixed point iteration.	**06**
3.Roots of polynomial- Polynomials in Engineering and Science, Muller's method, Bairstow's Method Graeffe's Roots Squaring Method.	**06**
4.Numerical Differentiation and Numerical Integration: Newton –Cotes and Guass Quadrature Integration formulae, integration of Equations, Romberg integration, Numerical Differentiation Applied to Engineering problems, High Accuracy differentiation formulae.	**06**
5.System of Linear Algebraic Equations and Eigen Value Problems: Introduction, Direct methods, Cramer's Rule, Gauss Elimination Method, Gauss-Jordan Elimination Method, Triangularization method, Cholesky Method, Partition method, error Analysis for direct methods, iteration Methods.	**06**
6.Eigen values and Eigen Vectors: Bounds on Eigen Values, Jacobi method for symmetric matrices, Givens method for symmetric matrices, Householder's method for symmetric matrices, Rutishauser method for arbitrary matrices, Power method, Inverse power method.	**05**
7.Linear Transformation: Introduction to Linear Transformation, The matrix of Linear Transformation, Linear Models in Science and Engg.	**05**

Reference Books:

1. Erwin Kreyszig , Advanced Engineering Mathematics, 10^{th} Edition , Willely India, 2016.
2. S.S.Sastry, Introductory Methods of Numerical Analysis, PHI, 2005.
3. Steven C. Chapra, Raymond P.Canale, Numerical Methods for Engineers, Tata Mcgraw Hill, 4^{th} Ed, 2002.
4. M K Jain, S.R.K Iyengar, R K. Jain, Numerical methods for Scientific and engg computation, New Age International, 2003.
5. Pervez Moin, Fundamentals of Engineering Numerical Analysis, Cambridge, 2010.
6. David. C. Lay, Linear Algebra and its applications, 3^{rd} edition, Pearson Education, 2002.

I Sem M. Tech. (Production Management)
Curriculum Content

Course Code: **17EPMC701**		Course Title: **Manufacturing Systems and Automation**
L-T-P**: 3-0-0**	Credits: **3**	Contact Hrs: **3 hrs/week**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs: **40 hrs**		Exam Duration: **3 hrs**

Introduction: Production system facilities, Manufacturing support systems, Automation in production system, Automation principles and strategies, Manufacturing operations, Basic elements of an automated system, Advanced automation functions, Levels of automation.

Material handling and identification technology: Considerations in material handling system design, 10 principles of material handling, Automated guided vehicle systems, Conveyor systems, Analysis of material transport system, Automated storage systems, Engineering analysis of storage system. Components of manufacturing systems, Single station automated cells, Applications and analysis of single station cells.

Flexible manufacturing systems: FMS components, FMS application and benefits, Quantitative analysis of flexible manufacturing systems.
Industrial control systems: Sensors, Actuators, Drives and other control system components. Electro-hydraulic and Electro-pneumatics in manufacturing automations
Machine vision systems: Importance of machine vision system in manufacturing automation.
Role of microcontrollers in manufacturing automation system: Microcontroller architecture, interfacing sensors and actuators with microcontroller for industrial automation, Microcontroller programming.
PLCs in manufacturing automation: Application of programmable logic controllers in manufacturing automation, PLC basic and advanced ladder logic programming using RsLogix and CoDeSys format, Usage of timers, counters, sequencing, and interlocking, latching, master control relay for developing programs for manufacturing automation. Temperature control, valve sequencing, conveyor belt control, control of a process etc
SCADA for Automation: Elements of SCADA, Benefits of SCADA, Applications, Types of SCADA systems, Features and functions of SCADA, Building applications using SCADA for manufacturing automation.

References:

1. Grover M.P., “Automation, Production Systems and Computer Integrated Manufacturing”, Pearson Education Asia.
2. Grover M.P., Weiss M. M., Nagel R.N. and Odrey N.G., “Industrial Robotics, Technology, Programming and Applications”, Mc Graw Hill Book Publications.
3. Krishna Kant, “Computer Based Industrial Control” PHI.
4. W. Bolton , “Programmable Logic Controllers” Fifth Edition, Elsevier
5. Vijay R. Jadhav, “Programmable Logic Controller”, Second Edition, Khanna Publishers.

I Sem M.Tech. (Production Management)
Curriculum Content

Course Code: **17EPMC702**		Course Title: **CNC Machining Technology and Additive Manufacturing**
L-T-P**: 4-0-0**	Credits: **4**	Contact Hrs: **4 hrs/week**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs: **50 hrs**		Exam Duration: **3 hrs**

Structure of CNC Machine Tools: Evolution of CNC Technology, CNC and DNC concept, classification of CNC Machines – turning centre, machining centre-features and applications, Automatic tool changers and Multiple pallet system, types of control systems, CNC controllers, characteristics, interpolators. CNC Machine building, structural details, configuration and design, guide ways –Friction, Anti friction and other types of guide ways, elements used to convert the rotary motion to a linear motion – Screw and nut, recirculating ball screw, rack and pinion, spindle assembly, torque transmission elements – gears, timing belts, flexible couplings, Bearings. Swarf removal and safety considerations

Drives and Tooling Systems: Spindle drives – DC shunt motor, 3 phase AC induction motor, feed drives – stepper motor, servo principle, DC and AC servomotors, Open loop and closed loop control, Tooling requirements for turning and machining centres, Qualified, semi qualified and preset tooling, coolant fed tooling system, work holding devices for rotating and fixed work parts, modular fixtures.

Feedback systems and Adaptive Control: Axis measuring system, Adaptive control with constraints (ACC), Adaptive control with optimization (ACO), Geometric adaptive control (GAC), Variable gain AC systems-stability problem, estimator algorithm, variable gain algorithm,

CNC Programming: G & M Codes, tool length compensation, cutter radius and tool nose radius compensation, do loops, subroutines, canned cycles, mirror image, parametric programming, machining cycles, programming for machining centre and turning centre, generation of CNC codes from CAM packages. Basics of APT

Additive manufacturing (AM) processes: AM based rapid prototyping (RP) Systems like Stereo-lithography, Fused Deposition Modeling (FDM), Selective Laser Sintering (SLS), Laminated Object Manufacturing (LOM), 3-D Printing, and LENS etc.

Role of additive manufacturing and rapid prototyping in product design and development: Solid modeling techniques for additive manufacturing with comparison, advantages and disadvantages, Process planning for rapid prototyping, STL file generation, Slicing and various slicing, procedures.

Accuracy issues in additive manufacturing: Properties of metallic and nonmetallic additive manufactured surfaces, Stress induced in additive manufacturing (AM) processes. Surface roughness problem in rapid prototyping, Part deposition orientation and issues like accuracy, surface finish, build time, support structure, cost etc.

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References:

1. Radhakrishnan P "Computer Numerical Control Machines", New Central Book Agency.
2. Rao P.N., "CAD/CAM", Tata McGraw-Hill Publishing Company Limited, New Delhi.
3. Pabla, B.S. & Adithan, M. "CNC Machines", New Age Publishers, New Delhi.
4. Warren. S. Seames, "Computer Numerical Control: Concepts and Programming", 4th edition, Delmar Thomson Learning Inc.
5. James Madison, "CNC Machining Hand Book", Industrial Press Inc.
6. Peter Smid, "CNC Programming Hand book", Industrial Press Inc., 2000
7. Chua, C.K., Leong, K.F., "Rapid Prototyping: Principles and Applications in Manufacturing", John Wiley and Sons Inc.
8. Hopkinson, N., Hague, R.J.M. and Dickens, P.M., "Rapid Manufacturing and Industrial Revolution for the Digital Age", John Wiley and Sons Ltd, Chichester.
9. Gebhardt, A., "Rapid Prototyping", Hanser Gardner Publications, Inc., Cincinnati.
10. Noorani, R., "Rapid Prototyping: Principles and Applications", John Wiley & Sons, Inc., New Jersey.

I Sem M.Tech. (Production Management)

Curriculum Content

Course Code: **17EPMC703**		Course Title: **Operations Management**
L-T-P**: 3-1-0**	Credits: **4**	Contact Hrs: **5 hrs/week**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs: **40 hrs**	Tutorial Hrs: **24 hrs**	Exam Duration: **3 hrs**

Overview of Operations Management: Functional sub systems of organizations, Systems concept of production, Types of production systems, Productivity, Strategic management.

Product Design and Analysis: New product development, Process Planning and Design, Value analysis and Value Engineering, Standardization, Simplification, Make or Buy decisions, Ergonomic considerations in Product design.

Capacity Planning and Investment Decisions: Capacity planning and strategies, Investment formulas and comparisons of alternatives.

Forecasting: Nature and use of forecasting, Measures of Forecasting, Factors affecting forecasting, Types and models of forecasting

Facility Location and Layout: Factors influencing plant location, location evaluation methods, Different types of lay outs for operations and production, arrangement of facilities within the department, CRAFT, ALDEP, CORELAP etc.

Aggregate Planning and Master Production Scheduling: Nature of aggregate planning, Methods of aggregate planning, Approaches to aggregate planning –graphical, empirical and optimization, Development of MPS, MRP-I and MRP-II.

Inventory Analysis and Control: ABC inventory systems, Inventory models, EOQ models for purchased and manufactured parts, lot sizing techniques.

Scheduling and Controlling: Objectives in scheduling, Major steps involved, Information systems linkages in production planning and control , Production control in repetitive, batch / flow shop and job shop scheduling environment - SPT, EDD, WMFT.

Project Planning and Management: Phases of project planning, Evolution of network planning techniques - Critical Path Method (CPM) and Project Evolution and Review Technique (PERT), Crashing of project network, Project scheduling with constrained resources –Graphical Evolution and Review Technique (GERT), Project monitoring, Line balance.

References

1. Vollman.T.E., “Manufacturing Planning & Control Systems”, McGraw-Hill.
2. Dilworth. B. James., “Operations Management – Design, Planning and Control for Manufacturing and services”, McGraw Hill Inc., New Delhi.
3. Bedworth D.D., “Integrated production control systems: management, analysis,design”, John Wiley & sons, New York
4. Panneerselvam. R., “Production and Operations Management”, Prentice Hall.
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Tutorial Exercises:

Forecasting, Facility location and layout, Aggregate Planning and MPS, Inventory Control, Scheduling and Controlling, Project Planning and Management

I Sem M.Tech. (Production Management)

Curriculum Content

Course Code: **17EPMP701**		Course Title: **Automation Lab**
L-T-P**: 0-0-1**	Credit: **1**	Contact Hrs: **2hrs/week**
CIE Marks: **80**	SEE Marks: **20**	Total Marks: **100**
Practical Hrs: **24 hrs**		

Laboratory Exercises:

- Non controller based applications
- Controller based applications
- Programming PLC system for small applications using CodeSys and RsLogix software
- Interfacing PLC system for analyzing industrial applications
- Building programs for manufacturing automation processes
- Building and analyzing circuits using electro hydraulics and electro pneumatics system.

I Sem M.Tech. (Production Management)
Curriculum Content

Course Code: **17EPMW701**		Course Title: **Mini Project I**
L-T-P**: 0-0-3**	Credit: **1**	Contact Hrs: **6hrs/week**
CIE Marks: **80**	SEE Marks: **20**	Total Marks: **100**
Practical Hrs: **72 hrs**		

Mini Project I: The Guide shall define the problem statement for the Project work. The student shall execute the Project within during the 1st semester. The student who has opted Mini Project I shall opt automation theme to carry out their work.

II Sem M. Tech. (Production Management)

Curriculum Content

Course Code: **17EPMC705**		Course Title: **Data Analytics**
L-T-P**: 3-1-0**	Credits: **4**	Contact Hrs: **5 hrs/week**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs: **40 hrs**	Tutorial Hrs: **24 hrs**	Exam Duration: **3 hrs**

Statistical Data Analysis: Data and Statistics- Review of Basic Statistical Measures-Probability Distributions-Testing of Hypotheses-Non Parametric Tests

Data Analysis I: Introduction – Basic concepts – Uni-variate, Bi-variate and Multi-variate techniques – Types of multivariate techniques – Classification of multivariate techniques – Guidelines for multivariate analysis and interpretation – Approaches to multivariate model building.

Data Analysis II: Simple and Multiple Linear Regression Analysis – Introduction – Basic concepts – Multiple linear regression model – Least square estimation – Inferences from the estimated regression function – Validation of the model.

Factor Analysis: Definition – Objectives – Approaches to factor analysis – methods of estimation – Factor rotation – Factor scores - Sum of variance explained – interpretation of results. Canonical Correlation Analysis - Objectives – Canonical variates and canonical correlation – Interpretation of variates and correlations

Data Analysis III: Multiple Discriminant Analysis - Basic concepts – Separation and classification of two populations - Evaluating classification functions – Validation of the model. Cluster Analysis – Definitions – Objectives – Similarity of measures – Hierarchical and Non – Hierarchical clustering methods – Interpretation and validation of the model.

Data Analysis IV: Conjoint Analysis – Definitions – Basic concepts – Attributes – Preferences – Ranking of Preferences – Output of Conjoint measurements – Utility - Interpretation. Multi Dimensional Scaling – Definitions – Objectives – Basic concepts – Scaling techniques – Attribute and Non-Attributes based MDS Techniques – Interpretation and Validation of models. Advanced Techniques – Structural Equation modeling.

References:

1. Joseph F Hair, Rolph E Anderson, Ronald L. Tatham & William C. Black, “Multivariate Data Analysis”, Pearson Education, New Delhi.
2. Richard A Johnson and Dean W. Wichern, “Applied Multivariate Statistical Analysis”, Prentice Hall, New Delhi.
3. David R Anderson, Dennis J Sweeney and Thomas A Williams, “Statistics for Business and Economics”, Thompson, Singapore.

II Sem M. Tech. (Production Management)

Curriculum Content

Course Code: **17EPMC707** Course Title: **Manufacturing Systems Simulation**

L-T-P**: 3-0-0**	Credits: **4**	Contact Hrs: **3 hrs/week**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs: **40 hrs**		Exam Duration: **3 hrs**

Principles of Modeling & Simulation: Basic Simulation Modeling, Systems – discrete and continuous systems, general systems theory, models of systems- variety of modeling approach, concept of simulation, simulation as a decision making tool, types of simulation, Principle of computer modeling- Monte Carlo simulation, Nature of computer modeling, limitations of simulation, area of application.

Random Number Generation: Random variables and their properties, Properties of random numbers, generation of Pseudo random numbers, techniques for generating random numbers, Various tests for random numbers-frequency test and test for Autocorrelation,

Random Variate Generation: Different techniques to generate random Variate: Inverse transform technique,-exponential, Normal, uniform, Weibull, direct transformation technique for normal and log normal distribution, convolution method and acceptance rejection techniques-Poisson distribution, **Statistical Techniques:** Comparison of two system designs, Comparison of several system designs – Bonferroni approaches to multiple comparisons for selecting best fit, for screening

Design and Evaluation of Simulation Experiments: Problem formulation, data collection and reduction , time flow mechanism, key variables, logic flow charts, starting condition, run size, experimental design consideration, output analysis, verification and validation of simulation models. **Simulation Languages:** Comparison and selection of simulation languages, study of any one simulation language.

Discrete Event Simulation: Concepts in discrete –event simulation, development of simulation models for queuing systems, production systems, inventory systems, maintenance and replacement systems, investment analysis and network, Programming for discrete event simulation, Case studies.

References:

1. Jerry Banks and John S Carson, Barry L Nelson, David M Nicol, "Discrete event system simulation", Prentice Hall, India.
2. Khoshnevi. B., "Discrete system simulation", McGraw Hill International.
3. Ronald G Askin and Charles R Standridge , "Modeling and analysis of manufacturing systems", John Wiley & Sons.
4. Gordon G , "System Simulation", Prentice Hall, India..
5. Thomas J Schriber., "Simulation using GPSS", John Wiley & Sons.
6. Shannon, R.E., "System Simulation – The art and science", Prentice Hall, India.
7. Averill Law & David M.Kelton , "Simulation, Modeling and Analysis", TMH.

II Sem M.Tech. (Production Management)

Curriculum Content

Course Code: **17EPMP703**		Course Title: **ERP Lab**
L-T-P**: 0-0-1**	Credit: **1**	Contact Hrs: **2hrs/week**
CIE Marks: **80**	SEE Marks: **20**	Total Marks: **100**
Practical Hrs: **24 hrs**		

- Introduction and selection criteria for ERP Packages, Survey of Indian ERP Packages
- Production Planning and Execution Module: - Exercises on production planning, machine scheduling, Material Requirement Planning, track daily production progress, production forecasting & actual production reporting with case studies.
- Supply Chain Management Module: - Exercises on Management of flow of products from manufacturer to consumer & consumer to manufacturer, demand & supply management, sales returns & replacing process, shipping & transportation tracking with case studies.
- Finance & Accounting module: - Exercises on Track of all account related transactions like expenditures, Balance sheet, account ledgers, budgeting, bank statements, payment receipts, tax management with case studies.
- Human Resource Module:- Exercises on Efficient management of human resources, employee information, track employee records like performance reviews, designations, job descriptions, skill matrix, time & attendance tracking. Payroll System, payment repots, travel Expenses & Reimbursement tracking. with case studies.

II Sem M.Tech. (Production Management)

Curriculum Content

Course Code: **17EPMP704**		Course Title: **Simulation Lab**
L-T-P**: 0-0-1**	Credit: **1**	Contact Hrs: **2hrs/week**
CIE Marks: **80**	SEE Marks: **20**	Total Marks: **100**
Practical Hrs: **24 hrs**		

Laboratory Exercises:

Development of simulation models for the following systems

- Queuing and Inventory systems, manufacturing system and service operations.
- Maintenance and replacement systems
- Job shop with material handling and FMS
- Exercises on real life problems using discrete event systems simulation software on product, process and FMS layouts.

II Sem M.Tech. (Production Management)
Curriculum Content

Course Code: **17EPMW702**		Course Title: **Mini Project II**
L-T-P**: 0-0-3**	Credit: **1**	Contact Hrs: **6hrs/week**
CIE Marks: **80**	SEE Marks: **20**	Total Marks: **100**
Practical Hrs: **72 hrs**		

Mini Project II: The Guide shall define the problem statement for the Project work. The student shall execute the Project within during the 2nd semester. The student who has opted Mini Project II shall opt automation theme to carry out their work.

I Sem M. Tech. (Production Management)
Curriculum Content

Course Code: **18EPMC702**		Course Title: **Engineering Data Management**
L-T-P**: 3-0-0**	Credits: **3**	Contact Hrs: **3 hrs/week**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs: **40 hrs**		Exam Duration: **3 hrs**

Introduction and Overview of Embedded Product Design: Background, Related Research and Research Problems, Structure of the Report, Design for Manufacture, Design of Embedded Products, Technical Design Disciplines and Document Management, Software Design, Electronics Design, Software-Hardware Co-Design, Mechanical design, Concurrent Engineering, Design Data Management, DFA and DFMA.

PDM Systems and Data Exchange: Product Data Management (PDM), State-of-the-art trends of PDM, Data Formats and Translators in Data Exchange, STEP (Standard for the Exchange of Product Model Data), CDIF (Case Data Interchange Format), SGML (Standard Generalized Markup Language).

PDM and SCM: PDM and Product Life Cycle, PDM Systems – Common Functionality, Product Structure and Document Management, System Architecture, Version Management, Configuration Selection, Concurrent Development, Build Management, Release Management, Workspace Management, Change Management.

Requirements of Design Data Management: Requirements for the Embedded Product's Design Data Management, Data Management, Process and Life-Cycle Management, Data Capture & Distribution, Support for Working Methods, Requirements for Enterprise-Level Design Data Management, Design Data Management Levels, The Design Data Management Features of Design Tools , Team-Level Design Data Management, Team-Level Design Data Management.

Analysis of Needs and Solutions: Comparison of Principles, Comparison of Key Functionalities, Requirements and Needs, Analysis, Different Scenarios in an Integrated Environment, Possible Integrations, Examples of integrations.

Product Data in PLM Environment: Relevance of Product Data in PLM, Product Data Across the Lifecycle, Tools to Represent Product Data, Data model diagrams, Reality in a Typical Company-Issues, Challenges and Objectives, Product Data Activities in the PLM Initiative-Product Data Improvement.

References:

1. Jukka Kaariainen, Pekka Savolainen,Jorma Taramaa & Kari Leppala, “Product Data Management (PDM) Design, exchange and integration viewpoints”, VTT- Technical research centre of Finland, 2000.
2. Rodger Burden “PDM: Product Data Management” Volume 1, Resource Publishing, 2003.
3. Annita Persson Dahlqvist et.al “PDM and SCM - similarities and differences”, The Association of Swedish Engineering Industries, 2001.

I Sem M. Tech. (Production Management)
Curriculum Content

Course Code: **18EPMC704**		Course Title: **Enterprise Resource Planning - I**
L-T-P**: 3-0-0**	Credits: **3**	Contact Hrs: **3 hrs/week**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs: **40 hrs**		Exam Duration: **3 hrs**

Introduction to ERP: Need for ERP, Characteristics and components of ERP, Suppliers of ERP, Integrated Management Information, Seamless Integration and Functional information system, Marketing, Accounting and Financial Management, Supply Chain Management, Resource Management, Integrated Data Model.

Business Functions and Business Processes: Functional Areas of Operation, Business Processes, A process view of business, Functional Areas and Business process of very small business. Marketing and Sales, Supply Chain Management, Accounting and Finance, Human Resources, Functional Area Information System

Business Process Reengineering: Need for reengineering, Reengineering Model, BPR Guiding principles , Business process reengineering and performance improvement, Enablers of BPR in Manufacturing, Collaborative Manufacturing, Intelligent manufacturing, Production Planning. BPR Implementation

Financial & Accounting Management: Differences between Financial accounting, Cost accounting and Management accounting, Basic finance – Concept of Cost Centre accounting, Cost – Volume – Profit Analysis, Cash Flow Analysis

Role of ERP in Purchasing: Features of purchase module, ERP Purchase System; Role of ERP in Sales and Distribution, Sub-Modules of the Sales and Distribution Module: Master data management, Order management, Warehouse management, Shipping and transportation, Billing and sales support, foreign trade, Integration of Sales and Distribution Module with Other Modules

Inventory Management: ERP inventory management system, Importance of Web ERP in Inventory Management, ERP Inventory Management Module and Sub-Modules of the ERP Inventory Management Module, Bill of Material, Safety stock, Lot number/Batch number, Inventory valuation methods

Material Requirement Planning: Product structure and Bill of Materials (BOM), MRP concept, MRP calculations, Lot sizing in MRP, capacity requirement planning, MRP-II, MRP Exercises

Production and Supply Chain Management Information Systems: Role of ERP in CAD/CAM, MRP, Closed Loop MRP, MRP-II, Manufacturing and Production Planning Module of an ERP System, Distribution Requirements Planning (DRP); ERP Approach to Production Planning, MRP to ERP.

References

1. Ellen Monk , Bret wagner "Concepts in Enterprise Resource planning" Third Edition Course Technology.
2. R.Radha Krishnan " Business Process Reengineering PHI , New Delhi.
3. Garg V. K. and Venkatakrishna N. K., "Enterprise Resource Planning: Concepts and Practices", PHI, New Delhi.
4. Sadagopan S., "Enterprise Resource Planning: A Managerial Perspective", Tata McGraw Hill, New Delhi.
5. Pauline Weetman, "Financial and Management Accounting: An Introduction", Pearson Education Limited.
6.

I Sem M.Tech. (Production Management)
Curriculum Content

Course Code: **18EPMP701** Course Title: **Collaborative Design - Modeling Lab**
L-T-P**: 0-0-5** Credits: **5** Contact Hrs: **10 hrs/week**
ISA Marks: **80** ESA Marks: **20** Total Marks: **100**
Practical Hrs: **120 hrs** Exam Duration: **2 hrs**

User Interface Platform:

Understand the user interface, Connect to the PLM platform, Access your Dashboard, Use the Tags for searching content, Share various documents with other users through, 3DSpace, Use standard menus and commands, Import new data and export to required file formats, Search for a 3D data using different methods, Explore and open 3D data, Manipulate the tree, Filter data

Sketcher: Exercises on sketch tools, profile tool bar and constraint tool bar.

Part Design: Exercise on 3D models using pad, slot, shaft, groove, hole, rib and stiffener commands, cut revolve etc.

Generative Shape Design (GSD): Exercises using GSD to generate complicate surfaces using sub tool bars

Sheet Metal: Setting sheet metal parameters, bend extremities tab, creating the base wall, creating the wall on edge, creating extrusions etc.

Assembly Design: Assembly design work bench Bottom-Up and Top-Down assembly approaches invoking existing components into assembly work exercise to demonstrate Top-Down assembly approach.

Drafting: Converting existing 3D models into 2D drawings with all relevant details, sectional views etc.

Data Exchange and Collaborative Lifecycle:

Import and export different file formats, manage the Mastership of imported objects, Create a new product structure, Use different sections of the Action bar effectively, Manage the changes in a product structure, Save the product structure in the database

Design Review:
Create a design review, add markups to it, Create slides, and add markers, Create sections and measures, Export sections and measures, compare 3D Objects and 2D Drawings

References

Companion Courses – https://companion.3ds.com/

I Sem M. Tech. (Production Management)
Curriculum Content

Course Code: **18EPMP702**		Course Title: **PLM Functional Lab**
L-T-P**: 0-0-3**	Credits: **3**	Contact Hrs: **6 hrs/week**
ISA Marks: **80**	ESA Marks: **20**	Total Marks: **100**
Practical Hrs: **72hrs**		Exam Duration: **2 hrs**

Collaboration and Approvals:

Illustrate the structure of PLM Business Process Services, Create and manage your folders, Create workflows, Identify and manage your assigned tasks, Subscribe to various objects and events, Report and resolve issues in objects, Create, track and organize your documents

IP Classification:

Need of IP Classification, Create different types of libraries and their related hierarchies, Create and manage documents and parts, classify the library objects based on their features, Use the Classification functionality

Engineering Bill of Material:

Create parts and specifications, Create and edit Bill of Materials, Create a Change Request to make the changes in a part or a specification, Complete Change Orders and Change Actions to implement the changes, Review and release the parts

Project Management Fundamentals:

Create programs and projects, Assign members to a project, Add tasks and assign project members to the tasks, Create folders for managing project documents, Create process flow for tasks, Review the status of programs and projects, Exchange and view projects data using Microsoft Project Integration

Project Management Advanced:

Document the various risk areas of a project and track them, Create and manage the resource requirements for a project, Create budgets and benefits to monitor the financials of a project, Track the time spent on a project using time sheets, Create calendars for the projects, Identify the quality factors of a project and monitor them, Create an assessment to measure the project's health, Use dashboards to monitor the status of your projects

Project Execution:

Manage the project schedule, Record risks for tasks, Create and submit timesheets

References

1. Companion Courses – https://companion.3ds.com/
2. Antti Saakasvuori, Anselmi Immonen, "Product Lifecycle Management" - Springer, 1st Edition, 2003.

I Sem M.Tech. (Production Management)
Curriculum Content

Course Code: **18EPMP703**		Course Title: **ERP Functional Lab**
L-T-P**: 0-0-3**	Credits: **3**	Contact Hrs: **6hrs/week**
ISA Marks: **80**	ESA Marks: **20**	Total Marks: **100**
Practical Hrs: **72 hrs**		Exam Duration: **2 hrs**

Selection Criteria for ERP Packages: Survey of Indian ERP Packages

Financial Accounting: Basic Finance – Chart of accounts, Journal entries, Journal vouchers, Exchange rates; Banking (In and Out); Debit and Credit note

Master Data Management: Item master; Business partner master – Customer, vendor; Pricing; Tax

Supply chain Management

Sales: Sales quotation, Sales order, Delivery, Return, Invoice (A/R)

Purchase: Purchase quotation, Purchase order, Return, GRN, Invoice (A/P)

Production: Assembly BOM, Production order, Goods issue, Goods receipt

Reports: Generation of reports for various functions

III Sem M.Tech. (Production Management)

Curriculum Content

Course Code: **18EPMC707**		Course Title: **Project Feasibility and Analysis**	
L-T-P**: 3-1-0**	Credits: **4**		Contact Hrs: **5 hrs/week**
ISA Marks: **50**	ESA Marks: **50**		Total Marks: **100**
Teaching Hrs: **50 hrs**			Exam Duration: **3 hrs**

Planning Overview: Capital budgeting and Allocation, Strategic planning.

Market and Demand Analysis: Situational analysis, Demand forecasting and Uncertainties in demand forecasting.

Technical Analysis: Material inputs and utilities, Product mix, Plant capacity and Location, Environmental aspects, Project charts and layouts.

Financial Estimates and Projections: Means of finance, Estimates of sales and production, Working capital requirement and its financing, Profitability projections, projected cash flow statements. Project risk analysis: Sources, Measures and Perspectives on risks, Sensitivity analysis, Scenario analysis, Break-even analysis, Simulation analysis, Decision tree analysis, managing risk.

Sustainability in Project Management: Inter-relating life cycles, The impact of sustainability on project management processes, Measuring and reporting projects

References:

1. Prasanna Chandra, "Projects: Planning, Analysis, Financing, Implementation and Review", Tata McGraw-Hill Publishing Company Limited, New Delhi.
2. Nicholas J. M. and Steyn H. "Project Management for Business, Engineering and Technology: Principles and Practice", Elsevier.
3. Harold R. Kerzner, "Project Management: A Systems Approach to Planning, Scheduling, and Controlling", Wiley, New York.

II Sem M.Tech. (Production Management)

Curriculum Content

Course Code: **18EPME706** Course Title: **Robust Design Optimization**
L-T-P**: 3-0-0** Credits: **3** Contact Hrs: **3 hrs/week**
ISA Marks: **50** ESA Marks: **50** Total Marks: **100**
Teaching Hrs: **40 hrs** Exam Duration: **3 hrs**

Robust Design Overview: Taguchi's approach to quality and quality loss function, noise factors and average quality loss, exploiting non linearity, classification of parameters

Analysis of variance: No-Way ANOVA, One-Way ANOVA, Two-Way ANOVA and Three-Way ANOVA

Two Level Experiments: Two factor factorial design, model adequacy checking and estimating model parameters, 2^2 full factorial design, 2^3 full factorial design, 2^k full factorial design and Two level fractional factorial design, General 2^{k-p} fractional factorial design.

Steps in Robust Design: Identification of process and its main function, Noise factors and testing conditions, Control factors and their levels, Matrix experiment and data analysis plan, Conducting the experiment and data analysis, Verifying experiment and future plan.

Signal to Noise Ratios: Comparison of the quality of two process conditions, Relationship between Signal to Noise Ratio and quality loss after adjustment, Identification of a scaling factor, Signal to Noise Ratios for static problems, Signal to Noise Ratios for dynamic problems, Analysis of ordered categorical data.

Taguchi Inner and Outer arrays: Orthogonal arrays and fractional factorial designs, Parameter design and tolerance design, Analysis of inner/outer array experiment, Alternative inner/outer orthogonal array experiments.

Constructing orthogonal arrays: Dummy level technique, Compound factor method, Linear graphs and Interaction assignment, Modification of linear graphs, Column merging method, Branching design.

References:

1. Montgomery, D. C., "Design and Analysis of Experiments", John Wiley & Sons.
2. Khuri A. I. and Cornell J. A. "Response Surfaces: Designs and Analyses, Marcel Dekker, Inc., New York.
3. Myers R. H., Montogomery, D. C. and Anderson-Cook C. M. "Response Surface Methodology: Process and Product Optimization Using Designed Experiments", John Wiley & sons, Inc., New York.
4. Mason R. L., Gunst, R. F., Hess J. L., "Statistical design and Analysis of Experiments With Applications to Engineering and SISAnce", John Wiley & sons, Inc., New York.
5. Phadke M. S., "Quality Engineering using Robust Design", Prentice Hall PTR Englewood Cliffs, New Jersy.
6. Ross P. J., "Taguchi Techniques for Quality Engineering", McGraw -Hill International.

II Sem M. Tech. (Production Management)

Curriculum Content

Course Code: **18EPMP704**		Course Title: **Product Automation Lab**
L-T-P**: 0-0-4**	Credits: **4**	Contact Hrs: **8 hrs/week**
ISA Marks: **80**	ESA Marks: **20**	Total Marks: **100**
Practical Hrs: **96 hrs**		Exam Duration: **2 hrs**

Knowledge Based Engineering:

- Customize the tree to display knowledge ware features
- Create parametric models
- Embed design knowledge in the models
- Automate the design and modification processes
- Create design configurations using design tables

HTML:
Tags, Attributes and Elements, Links, Images, Tables, Forms
CSS: CSS basics, styles, CSS syntax

JavaScript:
JavaScript Output, JavaScript Statements, JavaScript Syntax, JavaScript Variables, JavaScript Operators, JavaScript Arithmetic, JavaScript Strings, JavaScript Events, JavaScript Loop, JavaScript Objects, JavaScript functions.

Python:
Python programming skills using data structures and constructs, python programming skills using functions and packages.

References:

Companion Courses – https://companion.3ds.com/

II Sem M.Tech. (Production Management)
Curriculum Content

Course Code: **18EPMP705**		Course Title: **PLM Technical Lab**
L-T-P**: 0-0-3**	Credits: **4**	Contact Hrs: **6 hrs/week**
ISA Marks: **80**	ESA Marks: **20**	Total Marks: **100**
Lab Hrs: **72 hrs**		Exam Duration: **2 hrs**

Variant Management Essentials & Product Architect:

Create the product structure, Define product portfolios based on product roadmaps, Create and manage product configurations and design variants, Use Enterprise Changes to track and release features, Generate BOMs

Traceable Requirements Management Essentials:

Capture requirements from MS Word and MS Excel documents, Create requirements and requirement specifications, Allocate requirements to products and models, Create test cases and use cases, Create revision and multiple versions of requirements, Generate traceability reports

Platform Management and Baseline Behavior:

Create collaborative spaces and users, Assign required access rights to different users, Explore the Control widget and its related features, Configure PLM platform to add additional features as per requirements

Data Model Customization Essentials:

Describe Unified Typing concepts, Create Subtypes and add attributes to it, Create Specialization, Customer and Deployment Extensions, Create Unique Keys, Create Specialization and Deployment Packages

Web Based Customization:

Use MQL to set up the schema, Create and maintain a web application based on UI configurable components, Configure automatic business rules (triggers, notifications) and automatic object naming, Execute advanced MQL commands needed for administration, Extend the application with JSP

References

1. Companion Courses – https://companion.3ds.com/
2. Stark John, "Product Lifecycle Management: 21st Century Paradigm for Product Realization", Springer, Third Edition, 2015
3. Antti Saakasvuori, Anselmi Immonen, "Product Lifecycle Management" - Springer, 1st Edition, 2003.

II Sem M. Tech. (Production Management)

Curriculum Content

Course Code: **18EPMP706**		Course Title: **ERP Technical Lab**
L-T-P**: 0-0-3**	Credits: **3**	Contact Hrs: **6 hrs/week**
ISA Marks: **80**	ESA Marks: **20**	Total Marks: **100**
Practical Hrs: **72 hrs**		Exam Duration: **2 hrs**

Financial Accounting (Advanced): Fixed assets, Budget, Cost center accounting

MRP: Sales forecast, MRP run, Order recommendation

Admin and Technical: Application installation (APP and DB), System initialization, Set-up, Technical Enhancement – UI, Report – Query generation, Crystal report, Print layout design, Basics of Integration

Reports: Generation of reports for various functions

III Sem M. Tech. (Production Management)
Curriculum Content

Course Code: **18EPMC801** Course Title: **Manufacturing Execution Systems**
L-T-P**: 3-1-0** Credits: **4** Contact Hrs: **5 hrs/week**
ISA Marks: **50** ESA Marks: **50** Total Marks: **100**
Teaching Hrs: **50 hrs** Exam Duration: **3 hrs**

Enterprise and Enterprise Integration: Enterprise and its characteristics, Strategic Planning, Feedback Loops, Time Definitions, Business Processes, Manufacturing Processes, Enterprise Integration, Horizontal Integration and Interoperability, Vertical Integration and Temporal Gap, Digitalization, Standards (ISO 15704)

Manufacturing Execution Systems and its Functionalities: Manufacturing Execution Systems (MES), MES Functionalities, MES Models, Manufacturing Operations Management (MOM), Functional Control Model, MES in Discrete Industry, MES in Process Industry, Standards (IEC 62264, IEC 61512, VDI 5600)

Process and Data Modeling: Enterprise Modeling, Process Modeling, Business Process Modeling Language (BPMN), Sankey Diagram, Entity-Relationship Diagrams, ARIS (ARchitecture for integrated Information Systems), Integrated Definition for Function Modelling (IDEF), Event-Driven Process Chain (EPC), Data Modeling, Data Flow Diagrams (DFDs), Unified Modeling Language (UML), Business to Manufacturing Markup Language (B2MML)

Data Collection: Process Analysis, Process Modeling, Data Modeling, Data Flow Diagrams (DFDs), Communication Patterns, Technologies, OPC (OLE for Process Control)

Traceability And Tracking: Tracing, Traceability, Enterprise Entities, Forward and Backward Traceability, Traceability Granularity, Tracking, Tracking Approaches, Regulations (GMP, US FDA, EudraLex)

PERFORMANCE MEASUREMENT: Performance Measurement, Performance Management, Performance Measurement System and Characteristics, Key Performance Indicators (KPIs), Overall Equipment Effectiveness (OEE), Metrics Maturity Model, KPI Effectiveness, Process Improvement, Standards (ISO 22400, VDMA 66412)

Managerial Accounting: Managerial Accounting, Cost Assignment Techniques, Cost Hierarchal Levels, Activity Drivers, Standard Cost, Actual Cost, Job Costing, Process Costing, Activity-Based Costing (ABC), Time-Driven ABC (TDABC), Resource Consumption Accounting (RCA), Cost of Poor Quality (COPQ)

Real-Time Enterprise: Real-Time Enterprise (RTE), Event-Driven Architecture (EDA), Events, Complex Event Processing (CEP)

Industry 4.0: Industry 4.0, Challenges, Industrial Internet of Things (IIoT), Reference Architecture for Industry 4.0, Cyber-Physical Systems (CPS), Cyber-Physical Production Systems (CPPS), Smart Product, Smart Manufacturing, Smart Logistics, Smart Services

Business Analytics and Business Intelligence, Blockchain: Knowledge Management, Case-Based Reasoning (CBR), Big Data, Decision Analytics, Descriptive Analytics, Predictive Analytics, Prescriptive Analytics, Bitcoin and Blockchain, Merkle Tree, Blockchain Types, Scope and Application of Blockchain in Manufacturing

References:

1. Sachin Karadgi, "A Reference Architecture for Real-Time Performance Measurement," Springer, 2014.
2. Opher Etzion, Peter Niblett, "Event Processing in Action," Manning, 2011.
3. Roger Wattenhofer, "The Science of the Blockchain," CreateSpace Independent Publishing Platform, 2016.
4. Bruce Silver, "BPMN Method and Style - With BPMN Implementer's Guide," Cody-Cassidy Press, 2011.
5. Charles T. Horngren, George Foster, Srikant M. Datar, Madhav V. Rajan, Chris Ittner, "Cost Accounting: A Managerial Emphasis," Prentice Hall, 13th Edition, 2008.
6. Wood C. Douglas (Editor), "Principles of Quality Costs: Financial Measures for Strategic Implementation of Quality Management," ASQ, 4th Edition, 2013.
7. Gary Cokins, "Activity-Based Cost Management: An Executive's Guide," Wiley, 2001.
8. Robert S. Kaplan, Robin Cooper, "Cost & Effect: Using Integrated Cost Systems to Drive Profitability and Performance," Harvard Business Review Press, 3rd edition, 1997.
9. ISO 15704: Industrial Automation Systems—Requirements for Enterprise-Reference Architectures and Methodologies, 2000.
10. IEC 62264: Enterprise-Control System Integration. Multi—part standard.
11. IEC 61512: Batch Control. Multi—part standard.
12. ISO 22400–2: Automation Systems and Integration—Key Performance Indicators for Manufacturing Operations Management, Multi—part standard.
13. VDI 5600 Part 1: Manufacturing execution systems (MES), 2007.
14. OPC Foundation: OPC unified architecture specification part 1: overview and concepts, http://www.opcfoundation.org/.
15. MESA, MES Explained: A high level vision, white paper number 6, 1997.GMP
16. WHO Good Practices for Pharmaceutical Quality Control Laboratories, WHO Technical Report Series, No. 957, 2010.
17. Mike Bourne, Pippa Bourne, Handbook of Corporate Performance Management, Wiley, 2011.

II Sem M. Tech. (Production Management)

Curriculum Content

Course Code: **19EPMW701**		Course Title: **Mini Project**
L-T-P**: 0-0-3**	Credits: **3**	Contact Hrs: **6 hrs/week**
ISA Marks: **80**	ESA Marks: **20**	Total Marks: **100**
Teaching Hrs: **72 hrs**		Exam Duration: **2 hrs**

Mini Project: The Guide shall define the problem statement for the Project work. The student shall execute the Project within three months duration during the 2nd semester. The student who has opted Mini Project shall opt either ERP or PLM theme to carry out their work.

Course Code: 18EEEC301 **Course Title: Linear Integrated Circuits**

L-T-P: 3-0-0 Credits: 3 Contact Hrs: 40

CIE Marks: 50 SEE Marks: 50 Total Marks: 100

Teaching Hrs: 40 Exam Duration: 3 hrs

Chapter No.	Unit-I	
1	**Current Mirrors** Current Mirror circuits and Modeling, Figures of merit (output impedance, voltage swing), Widlar, Cascode and Wilson current Mirrors, Current source and current sink.	05 Hrs
2	**Basic OPAMP architecture** Basic differential amplifier, Common mode and difference mode gain, CMRR, 5-pack differential amplifier, 7-pack operational amplifier, Slew rate limitation, Instability and Compensation, Bandwidth and frequency response curve	06 Hrs
3	**OPAMP characteristics** Ideal and non-ideal OPAMP terminal characteristics, Input and output impedance, output Offset voltage, Small signal and Large signal bandwidth.	04 Hrs
	Unit-II	
4	**OPAMP with Feedback** OPAMP under Positive and Negative feedback, Impact Negative feedback on linearity, Offset voltage, Bandwidth, Input and Output impedances,Follower property, Inversion property	05Hrs
5	**Linear applications of OPAMP** DC and AC Amplifiers, Voltage Follower, Summing, Scaling and Averagingamplifiers (Inverting, Non-inverting and Differential configuration), Integrator, Differentiator, , Currentamplifiers, Instrumentation amplifier,Phase shifters, Voltage to current converter, Phase shift oscillator, Weinbridge oscillator, Active Filters –First and second order Low pass & High pass filters.	10 Hrs
	Unit-III	
6	**Nonlinear applications of OPAMP** Crossing detectors (ZCD. Comparator),Schmitt trigger circuits, Monostable & Astable multivibrator, Triangular/rectangular wave generators, Waveform generator, Voltage controlled Oscillator,Precisionrectifiers, Limiting circuits.Clamping circuits, Peak detectors, sample and hold circuits, Log and antilog amplifiers, Multiplier and divider Amplifiers, Voltage Regulators.	10 Hrs

Text Books

1 Sedra and Smith, "Microelectronics ", 5th edition , Oxford University Press.

2 Ramakant A. Gayakwad, "Op - Amps and Linear Integrated Circuits", 4th edition, PHI.

Reference Books:

1 Robert. F. Coughlin &Fredrick F. Driscoll, "Operational Amplifiers and Linear Integrated Circuits", PHI/Pearson, 2006.

2 James M. Fiore, "Op - Amps and Linear Integrated Circuits", Thomson Learning, 2001

3 Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", TMH, 3e, 2005

4 David A. Bell, "Operational Amplifiers and Linear IC's", 2nd edition, PHI/Pearson, 2004

Laboratory Title: Control System Lab **Lab. Code: 18EEEP302**
Total Hours: 32 **Duration of Exam: 02**
Total Exam Marks: 20 **Total ISA. Marks: 80**

Category: Demonstration	**Total Weightage: 10.00 No. of lab sessions: 2.00**
Expt./ Job No.	**Experiment/job Details**
1	Demonstration of heat tank simulator without controller using Labview Interactive learning model
2	Demonstration of temperature control of liquid tank simulator using Labview Interactive learning model
Category: Exercises	**Total Weightage: 40.00 No. of lab sessions: 5.00**
Expt./ Job No.	**Experiment/job Details**
1	Time response specifications of second order system
2	Frequency response of second order system
3	P,PI and PID controllers-effect on plant step response
4	Lag and Lead Compensators- determination of frequency response
5	Determination of Phase and Gain margin
Category: Structured Enquiry	**Total Weightage: 30.00 No. of lab sessions: 4.00**
Expt./ Job No.	**Experiment/job Details**
1.	Each batch consisting of 4 students work on a given design problem- To employ MATLAB to design compensator/controller for a system to meet given specifications and analyze the performance by simulating the time and frequency responses. To submit a technical report (consisting of objectives, specifications set, list of assumptions, design formulation, design calculations, simulation results, design validation)

Course Code: 18EEEE301 **Course Title: Object Oriented Programming with C++**
L-T-P: 3-0-0 Credits: 3 Contact Hrs: 3
ISA Marks: 50 ESA Marks: 50 Total Marks: 100
Teaching Hrs: 40 Exam Duration: 03 hrs

Content	Hrs
Unit - 1	
Chapter 01: Introduction Principles of Object Oriented Programming, Procedure oriented and Object oriented Programming, Basic Concepts of OOP, Benefits and Applications of OOP, Beginning with C++, Simple C++ program, C++ with classes, Structure of C++ program, Creating, compiling and linking C++ programs.	4 hrs
Chapter 02: Classes and Objects Structures and Classes, Specifying a Class, Defining Member functions, C++ program with class, Access Specifiers, Scope Resolution Operators, Inline functions, Static Data Members, Static Member Functions, Friend Functions.	7 hrs
Chapter 03: Constructors and Destructors Introduction, Parameterized Constructors, Multiple Constructors, Copy Constructor, Dynamic Constructor, Destructors, Dynamic allocation of objects - new and delete operators.	4 hrs
Unit - 2	
Chapter 04: Inheritance Introduction, Defining Derived Classes, Types of Inheritance, Virtual Base Classes, Abstract Classes, Constructors in Derived Classes, Nesting of Classes.	6 hrs
Chapter 05: Virtual Functions and Polymorphism Pointers to objects, this pointer, Pointers to Derived classes, Virtual Functions. Pure Virtual Functions.	5 hrs
Chapter 06: Exception Handling Basics, Exception Handling Mechanism, Throwing, Catching and Rethrowing Exceptions.	4 hrs
Unit - 3	
Chapter 07: Function Overloading, Operator Overloading Function Overloading, Overloading Constructors, Defining operator Overloading, Unary and Binary operator overloading, Rules for overloading operators.	5 hrs
Chapter 08: Templates, STL Class Templates, Function Templates, Overloading of Template functions, Components of STL, Containers, Iterators, Application of Container Classes.	5 hrs

Text Books (List of books as mentioned in the approved syllabus)

1. E.Balagurusamy, Object Oriented Programming with C++, 4th edition, Tata McGrawHill, 2008
2. Herbert Schildt, C++ The Complete Reference, Fourth Edition, Tata McGrawHill, 2003

References

1. Yashavant P. Kanetkar, Let Us C++, 1st, BPB Publications,

Course Title: Digital System Design using Verilog | **Course Code: 18EEEP303**
L-T-P: 0-0-2 | **Credits: 2** | **Contact Hours: 4Hrs/week**
ISA Marks: 80 | **SEA Marks:20** | **Total Marks: 100**
Teaching + Lab. Hours: 48 Hrs | **Examination Duration: 2 Hrs**

1.	Chapter No. 1. Architecture of FPGA Architecture of FPGS: Spartan 3, What Is HDL, Verilog HDL Data Types and Operators.	4hrs
2.	Chapter No. 2. Data Flow Descriptions Highlights of Data-Flow Descriptions, Structure of Data-Flow Description, Data Type – Vectors, Testbench.	6 hrs
3.	Chapter No. 3. Behavioral Descriptions Behavioral Description highlights, structure of HDL behavioral Description, The VHDL variable –Assignment Statement, sequential statements, Tasks and Functions	10 hrs
4.	Chapter No. 4. Structural Descriptions Highlights of structural Description, Organization of the structural Descriptions, Binding, state Machines, Generate, Generic, and Parameter statements	10 hrs
5.	Chapter No. 5:Finite State Machine: Moore Machines, Mealy Machines	4hrs
6.	Chapter No. 6:Timing Issues in Digital Circuits: Setup Time Constraints, Hold Time Constraints, Static Time analysis, Critical Path, Clock Skew.	6hrs
7.	Chapter No. 7. Advanced HDL Descriptions File operations in Verilog, Memories: RAM, ROM, Block Memories(Xilinx IP)	8hrs

Course Code: 18EEEP301 **Title: Data Structure Using C Lab**
L-T-P: 0-0-3 **Credits:3** **Contact Hrs: 4 hrs/week**
CIE Marks: 80 SEE Marks: 20 **Total Marks: 100**
Teaching Hrs: 48hrs **Exam Duration: 3 hrs**

Chapter No.	**Unit-I**	
1	**Programming on pointer concepts**: Pointer concepts,1D and 2D arrays, pointers to functions, memory management functions	02+02 Hrs
2	**Programming on string handling functions using pointers, structures, bit-fields**: Perform string handling functions like String length, String concatenate, Strings compare, String copy and Strings reverse, Implementing Structures, union and bit-field.	02+02 Hrs
3	**Programming on files:** Open, Close, Read, Write and Append the file.	02+02 Hrs
4	**Programming on stack data structures and applications:** Insert delete and display an integer in a stack, Conversion from Infix to postfix & Infix to Prefix, Recursion.	02+02 Hrs
5	**Programming on queue data structures:** Insert at rear end ,delete at front end and display the integers in queue, Deque and circular queue.	02+02 Hrs
6	**Programming on linked lists:** Insert, delete and display a node in Singly Linked List, Doubly Linked List and Circular Linked List.	06+03 Hrs
7	**Programming on trees:** Perform various operations on binary trees, find max, min value in a binary search trees, find the height of a tree, count nodes in a tree, delete a node in a tree.	02+02 Hrs
8	**Programming on sorting:** Merge sort, Quick sort, Heap sort, Shell sort, Radix sort**.**	02+02 Hrs
9	**Programming on graphs:** Compare Breadth First Sort Sort, and Depth First Sort	02+02 Hrs
10	**Programming on hashing tables:** Implement different methods of hash tables.	02+02 Hrs
11	**Open ended experiment:** Implement given Data structures.	02+02 Hrs

Text Books

1 Horowitz, Sahani, Anderson-Feed, “Fundamentals of Data Structures in C”, 2ed,Universities Press, 2008
2 Aaron M. Tenenbaum , “Data Structures Using C”, Pearson Education India, 2003
3 Richard F. Gilberg, Behrouz A. Forouzan “Data Structures: A Pseudocode Approach With C”, 2nd Edition , Course Technology, Oct 2009.

Reference Books:

1 E Balaguruswamy, “The ANSI C programming Language”, 2ed., PHI, 2010.
2 Yashavant Kanetkar, “Data Structures through C”, BPB publications 2010

Course Code: 19EEEC401 **Course Title: Power System Modeling, Operation & Control**

L-T-P: 3-0-0	Credits: 3	Contact Hrs: 40
CIE Marks: 50	SEE Marks: 50	Total Marks: 100
Teaching Hrs: 40		Exam Duration: 3 hrs

Chapter No.	**Unit-I**	
1	**Formation of network matrices :**Multi-port power system representation, performance equations in bus frame of reference, definitions of Network models Y_{bus} and Z_{bus}, Primitive element representations, primitive performance equations,. Formation of Ybus by method of Inspection, Introduction to graph theory-definitions of terms, Bus incidence matrix, Ybus by the method of singular transformation, Examples on Ybus formation by singular transformation (with no mutual coupling) and Inspection method, Zbus building algorithm-addition of uncoupled branches and links, modification of Zbus for changes in elements not mutually coupled, Examples on Zbus formation	8 hrs
2	**Optimal load dispatch :** Importance and objective of economic load dispatch, Fuel cost and Incremental fuel cost, Optimal load allocation between plants neglecting transmission losses, Examples on optimal load allocation with and without generation constraints, Optimal load allocation considering transmission losses, General transmission loss formula, Examples.	7 hrs
	Unit-II	
3	**Load flow analysis :**Importance of Power flow, Classification of busses, General steps in load flow analysis, Off-nominal ratio tap changing ratio transformer representation. Bus voltage solution by Gauss and Gauss-Seidel methods without PV buses, Handling PV buses in Gauss-Seidel method, N-R load flow model in polar coordinates, formation of NR Jacobian, Introduction to FDLF load flow model, Comparison of Gauss-Seidel, NR and FDLF load flow methods, Examples on one iteration of load flow solution.	8 hrs
4	**Load frequency control :**Introduction to load frequency control problem, Working principle of speed governor, Model of isolated power system area –block diagram representation, Expression for steady-state frequency deviation, Parallel operation of generators –expression for operating frequency and load sharing,, two area load frequency control, steady-state operation of multi-area system under free governor operation, Examples on load sharing between areas.	7 hrs
	Unit-III	
5	**Reactive power and voltage control :** Power flow through a line, Relation between voltage, power and reactive power at a node, Brief descriptions of methods of voltage control-by injection of reactive power and tap changing transformer. Generator reactive power control by AVR-simplified AVR system model, AVR response.	5 hrs
6	**Power System Simulations:** Simulation of automatic generation control, simulation of small signal stability of a SMIB power system, Transient stability simulation of SMIB power system using trapezoidal integration, simulation of classical economic load dispatch Algorithm	5 hrs

Text Books

1 Stagg and El-Abid, Computer Methods in power system analysis, First Edition, Mc-Graw Hill, 1968

2 Kothari and Nagarath, Modern power system analysis, 3rd Edition, Tata McGraw Hill, 2004

Reference Books:

1 P. Kundur, Power system stability and control, First Edition, Tata McGraw Hill, 2007

2 Hadi Sadat, Power System analysis, Ed. First Edition, Tata McGraw Hill, 2002

3 A.R. Bergen and Vijay Vittal, Power system analysis, Ed. First Edition, Pearson Ed, 2009

Course Code: 19EEEE401 L-T-P: **3- 0- 0**
Course Title: **Flexible AC Transmission System (FACTS)** CIE Marks: **50**
Teaching Hrs: **40 hrs** SEE Marks: **50**

	UNIT I	Hrs
1.	**FACTS: Concept and General System Considerations:** Transmission Interconnection, Flow of power in AC system, Limits of loading capability, Power flow and dynamic stability consideration of a Transmission Interconnection, Relative importance of controllable parameters, and Basic types of FACTS controllers, Brief description and Definitions of FACTS controllers, Perspective: HVDC or FACTS	10 hrs
2.	**Voltage Sourced Converters:** Basic Concepts, Single Phase Full Wave Bridge Converter Operation, Single phase Leg operation, Three Phase Full Wave Bridge Converter, Transformer Connection for 12 pulse operation	05 hrs
	UNIT II	
3.	**Current Sourced Converters:** Basic concepts, Three phase full wave diode rectifier, Thyristor based converter Rectifier operation with gate turn ON, Current sourced converter with turn OFF devices, Current sourced versus Voltage sourced converter.	05 hrs
4.	**Objectives of Series and Shunt Compensation:** Objective of Shunt Compensation, Methods of Controllable VAR Generation, Static VAR Compensators SVC STATCOM, Objective of Series Compensation, Static Series Compensators, GCSC, TSSC, TCSC and SSSC	10 hrs
	Unit – III	
5.	**Static Voltage, Phase Angle Regulators:** Objectives of Static Voltage and Phase Angle Regulators, Approach to Thyristor Controlled Voltage and Phase Angle Regulators, TCVR and TCPAR,	05hrs
6.	**Combined Compensators:** Unified Power Flow Controller UPFC and Interline Power Flow Controller IPFC.	05hrs

Text Book:
1. Narain G. Hingorani, and Laszlo Gyugyi., "*Understanding FACTS*", IEEE Press, Standard Publishers Distributors, Delhi, 200, ISBN 81 86308 79 2.

References Book:
1. K. R Padiyar, "*FACTS controllers in Power Transmission and Distribution",* New Age International Publishers, New-Delhi, 2007, ISBN 978 81 224 2142 2.

Course Code: 19EEEO401 **L-T-P:3-0-0**
Course Title: Wind and PV Electrical Energy Systems **CIE: 50 Marks**
Teaching Hours: 42 **SEE: 50 Marks**

1.	**Introduction to Wind Energy Systems** Historical development of wind power, types of wind turbines, power in the wind.	**2 hrs**
2.	**Wind Turbine generators** Impact of tower height, maximum rotor efficiency, wind turbine generators, importance of variable rotor speeds, pole changing induction generators, multiple gear boxes, variable slip induction generators, indirect grid connection systems.	**5 hrs**
3.	**Average power in the wind** Discrete wind histogram, wind power probability density functions, Weibull and Rayleigh statistics, average power in the wind with Rayleigh statistics. Annual energy using average turbine efficiency, wind farms.	**8 hrs**
	Unit–II	
4.	**Specific wind turbine performance calculations** Aerodynamics, idealized wind turbine power curve, optimizing rotor diameter and generator rated power, wind speed cumulative distribution function, using real power curves with Weibull statistics, using capacity factor to estimate energy produced.	**5 hrs**
5.	**PV materials and electrical characteristics** Introduction, generic PV cell, cells to modules to arrays, PV I-V curve at STC, impacts of temperature and insolation on I-V curve, shading impacts on I-V curve	**5 Hrs**
6.	**PV systems** Introduction, current-voltage curves for loads, grid connected systems, grid connected PV system economics, stand-alone PV systems, PV power water pumping	**5 Hrs**
	Unit -III	
7.	**The solar resource** Solar spectrum, earth’s orbit, altitude angle of the sun, solar position at any time of day, sun path diagrams, solar time and civil time, sun rise and sun set, clear sky direct beam radiation.	**5 Hrs**
8.	**Insolation and its measurement** Total insolation on a solar collecting surface, monthly clear sky insolation, solar radiation measurements, average monthly insolation.	**5 Hrs**

Text Book

1. Gillbert M Masters, Renewable and efficient Electric Power Systems, Wily Interscience, New Jersey, 2004.

References:

1. B. H. Khan, Non Conventional Energy Resources, TMH Publishers, New Delhi , 2006.

Course Code: 19EEEE402 **Course Title: Embedded Linux**

L-T-P: 0-0-3	Credits: 03	Contact Hrs: 03
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 40		Exam Duration: 03 hrs

Content	Hrs
Unit - 1	
Chapter 01: Introduction to Embedded Linux: A Brief History of Linux -Benefits of Linux -Acquiring and Using Linux -Examining Linux Distributions - Devices and Drives in Linux-Components: Kernel, Distribution, Sawfish, and Gnome.	4 hrs
Chapter 02: Overview of Embedded Linux: Overview: Development-Kernel architectures and device driver model- Embedded development issues-Tool chains in Embedded Linux-GNU Tool Chain (GCC,GDB, MAKE, GPROF & GCONV)- Linux Boot process.	5 hrs
Chapter 03: System Management and user interface: Boot sequence-System loading, sys linux, Lilo, grub-Root file system-Binaries required for system operation-Shared and static Libraries overview-Writing applications in user space-GUI environments for embedded Linux system.	5 hrs
Unit - 2	
Chapter 04: File system in Linux: File system Hierarchy-File system Navigation -Managing the File system –Extended file systems-INODE-Group Descriptor-Directories-Virtual File systems- Performing File system Maintenance -Locating Files –Registering the File systems- Mounting and Unmounting –Buffer cache-/proc file systems-Device special files.	6 hrs
Chapter 05: Configuration: Configuration, Compilation & Porting of Embedded Linux-Examining Shells -Using Variables -Examining Linux Configuration Script Files -Examining System Start-up Files -Creating a Shell Script.	4 hrs
Chapter 06: Process management and Inter process communication: Managing Process and Background Processes -Using the Process Table to Manage Processes -Introducing Delayed and Detached Jobs - Configuring and Managing Services - Starting and Stopping Services -Identifying Core and Non-critical Services -Configuring Basic Client Services -Configuring Basic Internet Services –Working with Modules. IPC-Benefits of IPC- Basic concepts-system calls-creating pipes-creating a FIFO-FIFO operations-IPC identifiers-IPC keys-IPCS commands- Message queues-Message buffer-Kernel Ring Buffer semaphores-semtools-shared memory semtools- signals-sockets.	8 hrs
Unit - 3	
Chapter 07: Linux device drivers: Devices in Linux- User Space Driver APIs- Compiling, Loading and Exporting- Character Devices- Tracing and Debugging- Blocking and Wait Queues- Accessing Hardware- Handling Interrupts- Accessing PCI hardware- USB Drivers- Managing Time- Block Device Drivers- Network Drivers- Adding a Driver to the Kernel Tree.	8 hrs

Text Books (List of books as mentioned in the approved syllabus)

1. Embedded Linux – Hardware, Software and Interfacing - Craig Hollabaugh, Addison-Wesley Professional, 2002
2. Embedded / Real-Time Systems: Concepts, Design and Programming Black Book, New ed (MISL-DT) Paperback – 12 Nov 2003.

References

3. Building Embedded Linux Systems, Karim Yaghmour, First edition, April 2003.
4. Embedded Linux- John Lombardo, Newriders.com

Course Code: 19EEEE301 **Course Title: CMOS VLSI Circuits**

L-T-P: 3-0-0 Credits: 3 Contact Hrs: 40

ISA Marks: 50 ESA Marks: 50 Total Marks: 100

Teaching Hrs: 40 Exam Duration: 3 hrs

Content	Hrs
Unit – 1	
Chapter No. 1. Introduction to VLSI and IC fabrication technology VLSI Design Flow, Semiconductor Technology - An Overview, Czochralski method of growing Silicon, Introduction to Unit Processes (Oxidation, Diffusion, Deposition, Ion-implantation), Basic CMOS technology - Silicon gate process, n-Well process, p-Well process, Twin-tub Process, Oxide isolation.	06 hrs
Chapter No. 2. Electronic Analysis of CMOS logic gates DC transfer characteristics of CMOS inverter, Beta Ratio Effects, Noise Margin, MOS capacitance models. Transient Analysis of CMOS Inverter, NAND, NOR and Complex Logic Gates, Gate Design for Transient Performance, Switch-level RC Delay Models, Delay Estimation, Elmore Delay Model, Power Dissipation of CMOS Inverter, Transmission Gates & Pass Transistors, Tristate Inverter.	14 hrs
Unit – 2	
Chapter No. 3. Design of CMOS logic gates Stick Diagrams, Euler Path, Layout design rules, DRC, Circuit extraction, Latch up – Triggering Prevention.	06 hrs
Chapter No. 4. Designing Combinational Logic Networks Gate Delays, Pseudo nMOS, Clocked CMOS, Dynamic CMOS Logic Circuits, Dual-rail Logic Networks: CVSL, CPL.	08 hrs
Unit – 3	
Chapter No. 5. VLSI Design Flow Structured Design Strategies: Hierarchy, Regularity, Modularity, Locality, SDEF Layout Flow, Case Study IC tape out.	06 hrs

Text Books (List of books as mentioned in the approved syllabus)

1. John P. Uyemura, Introduction to VLSI Circuits and Systems, 1, Wiley, 2007
2. Neil Weste, David Harris & Ayan Banerjee, CMOS VLSI Design, 3, Pearson Ed, 2005
3. Sung-Mo Kang & Yusuf Leblebici, CMOS Digital Integrated Circuits: Analysis and Design, 3, Tata McGra, 2007

References

1. Wayne, Wolf, Modern VLSI design: System on Silicon, 3, Pearson Ed, 2005
2. Douglas A Pucknell and Kamran Eshraghian, Basic VLSI Design, 3, PHI, 2005
3. Phillip. E. Allen, Douglas R. Holberg, CMOS Analog circuit Design, 1, Oxford University, 2002

Course Code: 19EEEE302 **Course Title: Battery Management Systems**
L-T-P: 3-0-0 **Credits: 3** **Contact Hrs: 40**
ISA Marks: 50 **ESA Marks: 50** **Total Marks: 100**
Teaching Hrs: 40 **Exam Duration: 3 hrs**

Content	Hrs
Unit – 1	
Chapter No. 1. Introduction: Introduction to electric vehicle & hybrid electric vehicle, types of batteries and their specific applications, Lithium-ion battery fundamentals: Battery Operation, Battery Construction, Battery Chemistry, Safety, Longevity, Performance, and Integration.	03 hrs
Chapter No. 2. Battery Models: Battery Models, Overview, self-Discharge Modeling, Thevenin Equivalent Circuit, Hysteresis, Coulombic Efficiency, Nonlinear Elements, parameter identification using SOC/OCV.	04hrs
Chapter No. 3. BMS (Black-box approach): Need for BMS, Typical inputs, typical outputs and typical functions Battery management system network in a typical electric vehicle.	02 hrs
Chapter No. 4. BMS Architectures: Monolithic, Distributed, Semi-Distributed, Connection Methods, Additional Scalability, Battery Pack Architectures.	02 hrs
Chapter No. 5. System Control: Contactor Control, Soft Start or Precharge Circuits, Control Topologies, Contactor Opening Transients, Chatter Detection, Economizers, Contactor Topologies, Contactor Fault Detection.	04 hrs
Unit – 2	
Chapter No. 6. Data acquisition (Measurement): Cell voltage, current and temperature measurement, Synchronization of Current and Voltage.	05 hrs
Chapter No. 7. Battery Management System Functionalities: CC/CV Charging Method, Target Voltage Method, Constant Current Method, Thermal Management, and Operational Modes.	03 hrs
Chapter No. 8. Charge Balancing(Cell balancing): Charge Balancing Strategies, Balancing Optimization, Charge Transfer Balancing, Flying capacitor.	05 hrs
Chapter No. 9. SoC Estimation: Columb counting, SoC corrections, OCV measurements, temperature compensation.	02 hrs
Unit – 3	
Chapter No. 10. BMS communications: Overview, Network Technologies ,I2C/SPI, RS-232 and RS-485 134, Local Interconnect Network, CAN 136 ,Ethernet and TCP/IP, Modbus, FlexRay, Network Design.	05 hrs
Chapter No. 11. Battery Safety: Functional Safety, Hazard Analysis, Safety Goals, Safety Concepts and Strategies, Reference Design for Safety.	05hrs

Text Books

1. Phillip Weicker *"A Systems Approach to Lithium-Ion Battery Management"* 2013, Artech house publisher

Laboratory Title: **Power Electronics & Drives Laboratory** Lab. Code: **19EEEP302**

Total Hours: **24** Duration of SEE Hours: 3

SEE Marks: **20** CIE Marks: **80**

Category: Demonstration	
Expt./ Job No.	**Experiment / Job Details**
1	Forward and Flyback DC-DC Converter
2	Single phase full bridge inverter
3	Half controlled Rectifier feeding R and RL load
4	Introduction to STEmbed Model based design and C-code generation for Power Electronics & Drives Application using TI's DSPs.
Category: Exercise	
Expt./ Job No.	**Experiment / Job Details**
1	Three phase full bridge controlled rectifier fed DC motor drive.
2	Fully controlled bridge rectifier feeding R and RL load
3	VSI based open loop volts/hertz control of three phase induction motor drive.
4	ADC, PWM pulse Generation and PI Controller design for PE and Drives application using STEmbed and TI's DSPs.
Category: Structured Enquiry	
Expt./ Job No.	**Experiment / Job Details**
1	To design, simulate and experimentally verify given drive system to meet defined specifications.

Course Title: Signals and Systems **Course Code:19EEEC205**
L-T-P: 3-0-0 **Credits:3** **Contact Hours: 3Hrs/week**
ISA Marks: 50 **SEA Marks:50** **Total Marks: 100**
Teaching Hours: 40 Hrs **Examination Duration: 3 Hrs**

1.	**Chapter No. 1. Introduction and Classification of signals:** Definition of signal and systems. Sampling of analog signals, Continuous time and discrete time signal, Classification of signals as even, odd, periodic and non-periodic, deterministic and non-deterministic, energy and power. Elementary signals/Functions: exponential, sine, impulse, step and its properties, ramp, rectangular, triangular. Operations on signals: Amplitude scaling, addition, multiplication, differentiation, integration, time scaling, time shifting and time folding. Systems: Definition, Classification: linear and nonlinear, time variant and invariant, causal and non-causal, static and dynamic, stable and unstable, invertible.	8hrs
2.	**Chapter No. 2. Time domain representation of LTI System:** Definition of impulse response, convolution sum, convolution integral ,computation of convolution sum using graphical method for unit step to unit step, unit step to exponential, exponential to exponential, unit step to rectangular and rectangular to rectangular only. Properties of convolution.	7hrs
3.	**Chapter No. 3. Fourier Representation of Periodic Signals:** Fourier Representation of Periodic Signals: Introduction to CTFS and DTFS, definition, properties and basic problems.	5hrs
4.	**Chapter No. 4. Fourier Representation of aperiodic Signals:** FT representation of aperiodic CT signals, definition, FT of standard CT signals, Properties and their significance. FT representation of aperiodic discrete signals DTFT, definition, DTFT of standard discrete signals, Properties and their significance, Impulse sampling and reconstruction: Sampling theorem and reconstruction of signals.	10hrs
5.	**Chapter No. 5: Z-Transforms:** Introduction, the Z-transform, properties of the Region of convergence, Properties of the Z-Transform, Inversion of the Z-Transform, Implementation of discrete time of LTI systems.	10hrs

<u>Text Book</u>

Simon Haykin and Barry Van Veen, Signals and Systems –2nd Edition, John Wiley, 2004 .

Course Title: Construction Engineering & Management Laboratory		**Course Code: 15ECVP306**
L-T-P: 0-0-1	**Credits: 1**	**Contact Hours: 2 Hrs/ week**
ISA Marks: 80	**ESA Marks: 20**	**Total Marks: 100**
Teaching Hours: 30	**Examination Duration: 3 Hrs**	

1. Introduction to Primavera P6
2. Develop a Work Break-down Structure (WBS) for a residential building of 3 storey.
3. Create and add activities to the WBS and assign relationships as per the logic of the precedence diagram for the residential building. Determine the duration of the project.
4. Apply constraints and filters to the developed activities to develop two-week, one-month and three-month look-ahead schedule.
5. Develop different roles and resources in the resource library and assign to the various activities along with their unit rates.
6. Develop the cost-loaded schedule and create baseline of the project.
7. Perform earned value analysis to track and monitor the project.
8. Conduct simulations in Microsoft Visio process simulator to determine most efficient excavation cycles on large scale projects.
9. Conduct Monte-Carlo simulation in Microsoft Excel to perform risk analysis for the project.

Reference Books:

1. Kim Heldman & William Heldman, *Microsoft Excel for Project managers 2007*.
2. P. Harris, *Planning and Scheduling Using Primavera P6 2010*.

Course Title: Construction Simulation Practice **Course Code: 17ECVP301**
L-T-P: 0-0-1 **Credits: 1** **Contact Hours: 2 Hrs/ week**
ISA Marks: 80 **ESA Marks: 20** **Total Marks: 100**
Teaching Hours: 30 **Examination Duration: 3 Hrs**

Preamble:

Through the courses in the preceding semesters (3rd, 4th and 5th), the students are studying the basics of many courses in the fields of construction engineering and management, structural engineering, geotechnical engineering, environmental engineering and transportation engineering. This course aims to bridge the gaps between theoretical concepts learned in classroom and their practical applications in the industry.

Course will be delivered through a series of site visits and guest lecturers from industry experts.

Deliverables:

Student group will be given a hypothetical site where in their job profile will be of a project manager. Guest lecturers from project managers and site engineers will provide the necessary tools and work cultures on the site, which the students have to apply to their project.

The students will learn the following concepts as practiced in the field:

1. Roles and responsibilities of various stakeholders involved like the owner, architect, structural consultant and the general contractor.
2. The material procurement process – quality and cost negotiation process. Costs involved in using RMC or procurement of raw materials to produce concrete on site etc.
3. Labour cost negotiations, roles and responsibilities, basic amenities to be provided and person-hour tracking.
4. Safety protocol followed in the jobsite.
5. Process of material delivery on the job site and coordination with the accounts department.
6. Technical problems encountered during execution – For example, deep well located during excavation – design changes to be made, concrete strength failure after 28 days – what measures to be taken, errors during surveying of the building, honeycombing or bulging of concrete etc.
7. Tracking of the progress – both time and cost. Creating of monthly progress reports.
8. Equipment management – renting vs owning, maintenance.
9. Roles and responsibilities on the project manager, site engineers, supervisors, safety officers.
10. Store management.
11. On site testing and third party testing – advantages and disadvantages.

12. Site layout for optimum utilization of construction space.
13. Reconciliation of materials like formwork, steel etc.

The student team will submit a comprehensive report about the management of a construction site and the difficulties and solutions employed to their sites and present their case.

References books:

1. Kumar Neeraj Jha, *Construction Project Management: Theory and Practice*, 2ed., Edition, Pearson Publications, 2015.
2. Robert. L Peurifoy and William B. Ledbetter, *Construction planning and Equipment& methods*, Tata McGraw Hill Pvt. Ltd, New Delhi, 3ed., 2010.
3. Ursula Kuehn, *Integrated Cost and Schedule Control in Project Management*, 2ed.,2011.

Course Code: **18ESEP701** Course Title: **Structural Simulation Laboratory**
L-T-P**: 0-0-1** Credits: **1** Contact Hrs: 2**hrs/week**
ISA Marks: **80** ESA Marks: **20** Total Marks: **100**
Teaching Hrs: **24hrs** Exam Duration: **3 hrs**

List of experiments/jobs planned to meet the requirements of the course.

1. Introduction to ABAQUS modeling, material properties, meshing and element types.
2. Introduction to Loading, Boundary conditions and post processing.
3. Analysis of member forces in beams
4. Analysis of member forces in beams with surface interaction
5. Analysis of member forces and deflections in truss
6. Analysis of stress concentrations near the geometric imperfections
7. Analysis for member forces in portal frames.

Materials and Resources Required:

1. ABAQUS Benchmark manual 6.11.
2. ABAQUS release notes 6.13.
3. ABAQUS Example problem manual, Volume I (Statics and dynamics)
4. ABAQUS Example problem manual, Volume II (Other Applications and Analyses)
5. ABAQUS Verification manual

Course Content

Course Code: **15ESEC801**		Course Title: **Advanced Material Science**
L-T-P**: 3-0-0**	Credits: **3**	Contact Hrs: **3 hrs/week**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs: **40 hrs**		Exam Duration: **3 hrs**

Unit – I

1. Structure of Concrete

Structure of aggregate phase & hydrated cement paste, mechanism of hydration, hydration products & micro structure, voids in cement paste, water in hydrated cement paste, properties of HCP, Transition zone in concrete. **08 hrs**

2.Special Conncretes

Fibre reinforced concrete, Carbon fibers, carbon nanotubes. Repair of Concrete structures, grouting shortcreting and guniting Epoxy resins, CFRP and GFRP sheets. **07 hrs**

Unit – II

1. Introduction to composite material

Introduction to materials, traditional materials, development, properties, strength of and mechanical properties of materials , introduction, definition, classification and characteristics of composite materials - fibrous composites, laminated composites, particulate composites **05 hrs**

2. Fiber, matrices and their application

Fiber, matrices and their application - Different types of fibers and matrices. Polymer composites, metal composites and ceramic composites, Application of composites in different industries. **05 hrs**

6. An overview of Nanoscience & Nanotechnology

Historical background – nature, scope and content of the subject multidisciplinary aspects – industrial, economic and societal implications, Experimental techniques and Methods **06 hrs**

Introduction to Nanomaterials- Carbon Nanotubes , synthesis and purification – filling of nanotubes , mechanical and physical properties – applications

Unit – III

7. Introduction to nano-composite

Nano composite polymer matrix, nano composite ceramic matrix, nano composite metal matrix Applications in engineering, future scope of nano-composite, research. **05 hrs**

8.Safety and environmental aspects

Safety and environmental aspects of nano-materials, future challenge, cost optimization and fabrication process of nano composite materials **04 hrs**

Text Book:

1. Mehta, P. K., *Concrete: Microstructure, Properties, and Materials*, 4ed., McGraw-Hill Education: New York,, 2014.
2. A.M. Neville, *Properties of Concrete*, Longmans, 4th Edition, 1995
3. Hull D. and Clyne T.W., *Introduction to Composite Materials*, Cambridge University Press, 2ed, 1996.
4. Pradeep T., *NANO: The Essentials – Understanding Nanoscience and Nanotechnology*, 1ed., Tata McGraw-Hill Education Pvt. Ltd, New Delhi, 2017

References:

1. Sidney Mindess and J. Frances Young, *Concrete*, PH NJ, 1981.
2. IS: 10262 -2007 Code of Practice for Concrete Mix Design.
3. ACI 318-2005, Code of practice for reinforced concrete structures
4. Ventra M.,Evoy S., Heflin J.R., *Introduction to Nanoscale Science and Technology [Series: Nanostructure Science and Technology]*, Springer (2006).
5. Chawla K.K., *Composite Material : Science and Engineering*, 3ed., Springer, 2012.
6. Linda Williams & Wade Adams, *Nanotechnology Demystified*, McGraw-Hill Company Inc, New York, 2007.
7. Johns R.M., *Mechanics of Composite Materials*, 2ed., CRC Press, 2015.

Course Code: **20ESEC701** Course Title: **Earthquake Resistant Design of structures**
L-T-P**: 4-1-0** Credits: **5** Contact Hrs: **6 hrs/week**
ISA Marks: **50** ESA Marks: **50** Total Marks: **100**
Teaching Hrs: **54 hrs** Exam Duration: **3 hrs**

Unit – I

1. Engineering Seismology **10 hrs**

Introduction, Reid's elastic rebound theory, Theory of plate tectonics; Seismic waves; Earthquake size – Intensity, Magnitude, Isoseismal map, Energy released in an earthquake; Local site effects; Seismicity of India; Classification of earthquakes.

2. Earthquake Load Specification

Response spectra, Design response spectrum; Equivalent static method; Response spectrum method; Time history analysis **12 hrs**

Unit – II

3.Design of Plan Asymmetric Buildings **10 hr**

Effect of plan asymmetry; Centre of mass, Centre of rigidity, Static eccentricity, dynamic eccentricity, accidental eccentricity; Design eccentricity; Design forces in asymmetric buildings; Seismic code analysis of buildings without locating centres of rigidity

4.Earthquake Resistant Design of Masonry Buildings **08 hrs**

Elastic properties of structural masonry; Lateral load analysis of masonry building

Unit – III

5.Design of Reinforced concrete buildings for earthquake resistance **08 hrs**

Load combinations, Ductility and energy absorption in buildings. Confinement of concrete for ductility, design of columns and beams for ductility, ductile detailing provisions as per IS1893. Structural behavior, design and ductile detailing of shear walls.

6. Techniques for Earthquake Resistance **04 hrs**

Base Isoloation, Passive and active control systems

References

1. Agarwal P. and Shrikhande M., *Earthquake Resistant Design of Structures*, Pentice-Hall of India Pvt. Ltd., New Delhi, 2011.
2. Chopra, A.K., *Dynamics of Structures*, 4ed., Prentice-Hall of India Pvt. Ltd., New Delhi, 2011.

3. Duggal, S.K., *Earthquake Resistant Design of Structures,* Oxford University Press, New Delhi, 2013.

IS Codes

1. IS:1893-2016 (Part 1), Criteria for Earthquake Resistant Design of Structures, Bureau of Indian Standards, New Delhi, 2016.
2. IS:13920-2016, Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces, Bureau of Indian Standards, New Delhi, 2016.
3. IS:4326-2013, Earthquake Resistant Design and Construction of Buildings – Codeof Practice, Bureau of Indian Standards, New Delhi, 2013

Course Title: Fire Resistance of Structures **Course Code:** 20ESEE701

L-T-P: 4-0-0 **Credits: 4** **Contact Hours: 3 Hrs/ week**

ISA Marks: 50 **ESA Marks: 50** **Total Marks: 100**

Teaching Hours: 40	**Examination Duration: 3 Hrs**

Unit I	
1.Introduction Overview, Fire Safety in Buildings, Fire Safety Objectives, Process of Fire Development, Fire Resistance, Controlling Fire Spread, Building Construction for Fire Safety.	**03 hrs**
2. Fire and Heat transfer Fuels, Combustion, Fire Initiation, t-squared fires, Heat Transfer.	**04 hrs**
3.Room Fires and Fire Severity Pre flashover, Flashover and Post flashover fires, Fire Severity and Fire Resistance, Equivalent Fire Severity.	**04 hrs**
4. Fire Resistance Introduction, Fire Resistance Tests, Listings, Fire Resistance by Calculation, Fire Resistance of Assemblies.	**03 hrs**
Unit II	
5. Design of Structures Exposed to Fire Overview of design of structures at normal temperature, Structural Design in Fire Condition, Material properties in fire, Design of individual members exposed to fire, Design of structural assemblies exposed to fire.	**10 hrs**
6. Design of Concrete Structures Exposed to Fire Behavior of concrete structures exposed to fire, Concrete and Reinforcing temperatures, Mechanical properties of concrete at elevated temperatures, Design of concrete members exposed to fire.	**08 hrs**
Unit III	
7. Design of Steel Structures Exposed to Fire Behavior of steel structures exposed to fire, Steel temperatures, Protection systems, Mechanical properties of steel at elevated temperatures, Design of steel members exposed to fire.	**08 hrs**

Text Books

1. Andrew H. Buchanan, *Structural Design for Fire Safety*, John Wiley and Sons, LTD, 2006.
2. John A. Purkiss, Long-Yuan Li, *Fire Safety Engineering Design of Structures*, CRC Press Taylor and Francis group Boca Raton, 2014.

Reference Books:

1. Yong Wang, Ian Burgess, Frantisek Wald, Martin Gillie, *Performance Based Fire Engineering of Structures*, CRC Press Taylor and Francis Group Boca Raton, 2013.
2. Naotake Noda, Richard B. Hetnarski, Yoshinobu Tanigawa, Thermal Stresses, Taylor and Francis group, New York, 2003.
3. EN 1992-1-1 Eurocode 2: Design of concrete structures - Part 1-2

Course Title: Structural Health Monitoring		Course Code: 20ESEE701
L-T-P: 4-0-0	Credits: 4	Contact Hours: 4 Hrs/ week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hours: 40		Examination Duration: 3 Hrs

Unit I	
1.Introduction Factors affecting Health of Structures, Causes of Distress, Regular Maintenance. Concepts, Various Measures, Structural Safety in Alteration.	**08 hrs**
2. Structural Audit Assessment of Health of Structure, Collapse and Investigation, Investigation Management, Assessment by NDT techniques, SHM Procedures.	**08 hrs**
Unit II	
4. Static Field Testing Types of Static Tests, Simulation and Loading Methods, Behavioral / Diagnostic tests - Proof tests, Sensor systems and hardware requirements, Static Response Measurement- strain gauges, LVDTs, dial gauges - case study	**08 hrs**
5. Dynamic Field Test Types of Dynamic Field Test, Stress History Data, Dynamic Response Methods, Forced vibration method, Impact hammer and shaker testing, Hardware for Data Acquisition Systems, Network of sensors, Data compression techniques, Remote Structural Health Monitoring.	**08 hrs**
Unit III	
6. Introduction To Retrofitting and Repairs Of Structures Introduction to retrofitting of structures, Retrofitting of structural elements, Techniques, Material used for retrofitting, Case Studies, piezo–electric materials and other smart materials, electro–mechanical impedance (EMI) technique, adaptations of EMI technique.	**08 hrs**

Text Books

1. Structural Health Monitoring Daniel Balageas, Claus-Peter Fritzen and Alfredo Güemes, John Wiley-ISTE, London, 2006.
2. Health Monitoring of Structural Materials and Components - Methods with Applications, Douglas E Adams, John Wiley & Sons, New York, 2007.

Reference Books:

1. “Structural Health Monitoring and Intelligent Infrastructure”, Vol.-1, J.P. Ou, H. Li and Z. D. Duan, Taylor & Francis, London, 2006.
2. Structural Health Monitoring with Wafer Active Sensors, Victor Giurglutiu, Academic Press Inc., 2007

FMTH0303-3.0

Laboratory Plan

Semester: V

Year: **2018 - 19**

Laboratory Title: **OOP and Python Practice**	Lab Code: **16EARP305**
Total Hours: **22**	Duration of ESA: 2 hours
ISA Marks: **80**	ESA Marks: **20**

Experiment wise Plan

List of experiments/jobs planned to meet the requirements of the course.

Category: Demonstration		**Total Weightage: 20**		**No. of lab sessions: 2**
Expt./ Job No.	**Experiment / Job Details**	**No. of Lab Session(s) per batch (estimate)**	**Marks / Experiment**	**Correlation of Experiment with the theory**
1	Write programs using the concept of OOP (C++/Java) Language Fundamentals and concept of command line arguments.	1	10	
	Learning Objectives: The students should be able to: 1. Demonstrate how to compile and run a program in command prompt. 2. Write programs using operators and control statements. 3. Write programs for accepting command line arguments and process them in program. 4. Demonstrate how to compile and run a Java program using different IDE's like eclipse, Net beans etc.			Object Oriented Programming -I
2	Write programs using the concept of arrays, Strings and String Buffer class and exception Handling.	1	10	
	Learning Objectives: The students should be able to: 1. Write programs using different types of arrays and strings. 2. Write a program to catch different types of exceptions.			Object Oriented Programming -I

	3. Demonstrate how the String Buffer is used in a program.			
Category: Exercise		**Total Weightage: 20**		**No. of lab sessions: 2**
3	Develop a swing based GUI using swing components and containers and connect it to database .	1	10	Object Oriented Programming -I
	Learning Objectives: The students should be able to: 1. Develop a GUI using swing components and containers. 2. Demonstrate how to insert, update and retrieve data from a database by using a simple swing based program. 3. Demonstrate the procedure of database connection.			
4	Write programs using the concept of Generic class, Inheritance, Interface and Package.	1	10	
	Learning Objectives: The students should be able to: 1. Write a program to create base class and derived class and demonstrate the inheritance concept using the same program. 2. Write a program to create interface and demonstrate how to use the interface for other programs also. 3. Use the built in packages to write programs for defined task. 4. Create the user packages and demonstrate how to use the user package in other programs or other classes. 5. Demonstrate how to create parameterized constructors and how to use different types of access specifies in a program.			Object Oriented Programming -I
Category: Exercise		**Total Weightage: 30**		**No. of lab sessions: 3**
Expt./ Job No.	**Experiment / Job Details**	**No. of Lab Session(s) per batch (estimate)**	**Marks / Experiment**	**Correlation of Experiment with the theory**
5	Write a program using the concepts of python scripting elements python constructs, data structures.	1	10	Python programming-II

	Learning Objectives: The students should be able to: 1. Demonstrate how to compile and run a program in command prompt. 2. Write programs using operators and control statements. 3. Write programs for accepting command line arguments and process them in program. 4. Demonstrate how to compile and run a python program using different IDE's like anaconda ,ipython etc.			
6	Write programs using the concept of functions, modules, packages and regular expressions	1	10	Python programming-II
	Learning Objectives: The students should be able to: 1. Write programs using functions and modules. 2. Write a program to use packages and regular expressions			
7	Write a python program to use the language scripting elements and constructs, data structures, and repository of standard library, to develop real world applications.	1	10	Python programming-II
	Learning Objectives: The students should be able to: 1. Write a program using scripting elements and data structures. 2. Create the user packages and demonstrate how to use the user package in other programs or other classes. 3. Write a program to create interface and demonstrate how to use the interface for other programs also			
Category: Structured Enquiry		**Total Weightage: 10**		**No. of lab sessions: 3**
Expt./ Job No.	**Experiment / Job Details**	**No. of Lab Session(s) per batch (estimate)**	**Marks / Experiment**	**Correlation of Experiment with the theory**
8	Solving a Maze: Program a robot to solve a maze by finding the goal position in	2	10	

	the maze starting from a starting position. You will need a data structure to keep track of positions found in the maze that are yet to be explored, starting with positions around the starting position. You will compare the maze solutions found using a Stack versus a Queue for storing unexplored positions.			
	Learning Objectives: The students should be able to: 1. Select fundamentals concepts of object oriented programming concepts/python, based on the problem scenario to implement programs.			Object Oriented Programming –I/ Python programming-II
Category: Open Ended		**Total Weightage: 20**		**No. of lab sessions: 2**
Expt./ Job No.	**Experiment / Job Details**	**No. of Lab Session(s) per batch (estimate)**	**Marks / Experiment**	**Correlation of Experiment with the theory**
9	Implement a project using C++/Java/python concepts, for automation and robotics applications. (FOR SEE)	2	20	
	Learning Objectives: The students should be able to: 1. Use the C++/Java/python concepts to implement the project. 2. Select the appropriate tool/software to implement the project. 3. Write a technical report using IEEE standard. 4. Present the technical report for the implemented project. 5. Demonstrate the learning experiences of working in a team.			Object Oriented Programming –I/ Python programming-II

Laboratory Plan

FMTH0303-3.0

Semester: V

Year: **2018-2019**

Laboratory Title: **DBMS Practice**	Laboratory Code 16EARP306
Total Contact Hours: **48**	Duration of ESA: 3 Hours
Total ISA Marks: **80**	Total ESA Marks: **20**

Experiment wise Plan

List of experiments/jobs planned to meet the requirements of the course.

Category: Demonstration		**Total Weightage: 10**		**No. of lab sessions: 1**
Expt./ Job No.	**Experiment / Job Details**	**No. of Lab Session(s) per batch (estimate)**	**Marks / Experiment**	**Correlation of Experiment with the practice**
1	Preparing an ER diagram for given database	1	10	Basic Knowledge of data base design
	Learning Objectives: The students should be able to 1. Demonstrate how structure of a database can be expressed graphically by an ER diagram. 2. Demonstrate how to represent attributes, relationships among entity sets, link attribute to entity sets and entity sets to relationships			
Category: Exercise		**Total Weightage: 10**		**No. of lab sessions: 1**
2	Execute basic SQL queries on a given database. (DDL, DML, DCL commands)	1	10	DDL, DML, DCL commands

	Learning Objectives: The students should be able to: 1. Demonstrate how to use DDL, DML and DCL commands on a database. 2. Demonstrate how to specify different types of constraints on a table while creating a table.			
Category: Structured Enquiry		**Total Weightage: 60**		**No. of lab sessions: 10**
Expt./ Job No.	**Experiment / Job Details**	**No. of Lab Session(s) per batch (estimate)**	**Marks / Experiment**	**Correlation of Experiment with the theory**
3	Execute nested, correlated queries using exist, like, union, intersection and joins on a given database.	2	10	Nested queries
	Learning Objectives: The students should be able to: 1. Write SQL queries to retrieve the required data, using correlated queries, nested queries, joins, and using keywords exist, like, union and intersection. 2. Demonstrate how to join two tables using different types of joins and use keywords exist, like, union, and intersection to retrieve data.			
4	Execute SQL queries on - group by, having clauses and aggregate functions on a given database to retrieve the required data.	2	20	Nested queries using clauses-group by, having &aggregate functions.
	Learning Objectives: The students should be able to: 1. Write SQL queries using group by, having clauses and aggregate functions to retrieve the required data.			
5	Specifying views in SQL	2	10	Views of SQL
	Learning Objectives: The students should be able to 1. Write SQL queries to create & update Views			
6	Design a database for the given schema using normalization concept and execution of given	2	10	Normalization-1NF,2NF,3NF & BCNF

	queries on the database and execution of queries.			
	Learning Objectives: The students should be able to: 1. Design the database for the given schema using normalization concepts and use the given RDBMS software and implement the database.			
7	Design a database for the given specifications & implement the database and write and execute the queries for the given statements.	2	10	Basic Knowledge of data base design, DDL, DML, DCL commands
	Learning Objectives: The students should be able to: 1. Draw the ER diagram for a given specifications. 2. Design a database based on the specifications given and create tables by specifying different types of constraints on database and write SQL queries for given statements and execute them. 3. Select the proper RDBMS software to implement the database.			
Category: Open Ended		**Total Weightage: 20**		**No. of lab sessions:**
Expt./ Job No.	**Experiment / Job Details**	**No. of Lab Session(s) per batch (estimate)**	**Marks / Experiment**	**Correlation of Experiment with the theory**
8	Implement a project using Java/database management systems concepts, for automation and robotics applications. (FOR ESA)		20	
	Learning Objectives: The students should be able to: 1. Use the java /database management concepts to implement the project. 2. Select the appropriate tool/software to implement the project. 3. Write a technical report using IEEE standard. 4. Present the technical report for the implemented project. 5. Demonstrate the learning experiences of working in a			

	team.	

Course Content

<table>
<tr><td colspan="2">Course Code: 16EARE403</td><td colspan="2">Course Title: Machine learning and ROS</td></tr>
<tr><td>L-T-P: 3-0-0</td><td>Credits: 3</td><td colspan="2">Contact Hrs: 40</td></tr>
<tr><td>ISA Marks: 50</td><td>ESA Marks: 50</td><td colspan="2">Total Marks: 100</td></tr>
<tr><td>Teaching Hrs: 40</td><td></td><td colspan="2">Exam Duration : 3 hours</td></tr>
<tr><td colspan="3">Content</td><td>Hours</td></tr>
<tr><td colspan="4">UNIT – 1</td></tr>
<tr><td colspan="3">Chapter 1:Introduction to Robot operating system
ROS concepts, creating ROS packages writing a minimal ROS publisher, compiling ROS nodes, running ROS nodes, examining running minimal publisher node, scheduling node timing, writing a minimal ROS subscriber compiling and running minimal subscriber, minimal subscriber and publisher node summary writing ROS nodes more ROS tools: catkin simple, ROSlaunch, simplifying cmakelists.txt with catkin simple automating starting multiple nodes viewing output in a ROS console recording and playing back data with ROSbag.</td><td>5 hrs</td></tr>
<tr><td colspan="3">Chapter 2:Messages, Classes and Servers in ROS
Defining custom messages, ROS services- service messages, ROS service nodes, manual interaction with ROS services, example ROS service client, running, example service and client, using C++ classes in ROS creating library modules in ROS, introduction to action servers and action clients- creating an action server package, defining custom action-server messages, designing an action client
running the example code, introduction to parameter server.</td><td>5 hrs</td></tr>
</table>

Chapter 3: **Introduction to machine learning** Introduction Machine Learning ,Well posed learning problem, Types of learning, supervised learning ,unsupervised learning and reinforcement learning, Learning Associations, Designing of learning system, perspectives & issues in machine learning, Concept learning task, concept learning search, Find-S: Finding a maximally specific hypotheses, version spaces & candidate elimination algorithm, Remarks - version spaces & candidate elimination algorithm, inductive bias.	5 hrs
UNIT – 2	
Chapter 4: Computational learning theory and decision tree learning Motivation, Estimating hypotheses accuracy, Basics of sampling theory, general approach for deriving confidence intervals, comparing learning algorithm. Probably learning an approximately correct hypothesis, sample complexity for finite hypnosis spaces, sample complexity for infinite hypothesis spaces, instance based learning-K nearest neighbor learning, locally weighted regression, Representation, decision tree algorithm, hypotheses space search in decision tree algorithm inductive bias in decision tree algorithm, issues in DTL, Bayesian decision theory classification.	8 hrs
Chapter 5:Kernel methods and Graphical models Embedding's into feature spaces, the kernel trick, Multiple kernel learning, Kernel dimensionality reduction Canonical Cases for Conditional Independence, Example Graphical Models, Naive Bayes' Classifier, Hidden Markov Model, Linear Regression, d-Separation Belief Propagation, Linkage–Based clustering algorithms-means and other cost minimization clustering.	7 hrs
UNIT – 3	
Chapter 6:Reinforcement Learning The learning task,Q-learning,Nondeterministic rewards & actions, temporal difference learning, generalizing from examples, relationship to dynamic programming.	5 hrs
Chapter 7: Artificial neural network Biological motivation, neural network representations, and appropriate problems for neural network learning, perceptron's, multilayer networks and the back propagation, algorithm, an illustrative example: face recognition	5 hrs

Course Content

Course Code: 16EARE401	Course Title: Measurement Systems	
L-T-P: 3-0-0	Credits: 3	Contact Hrs: 40 hours
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 40		Duration of ESA: 3 Hrs

Content	**Hrs**
Unit – I	
Chapter No. 1. Introduction to Measurement Systems Need for study of Measurement Systems, Classification of Types of Measurement Applications, Computer-Aided Machines and Processes, Functional Elements of an Instrument , Active and Passive Transducers , Analog And Digital Modes of Operation , Null and Deflection Methods , Input-Output Configuration of Instruments and Measurement Systems, Static Characteristics and Static Calibration, Dynamic Characteristics.	5 hrs
Chapter No. 2. Sensors and Signal conditioning Sensor characterization, Relations between physical quantities, Sensor Classification, Specifications, Error reduction techniques, Loading errors, Signal conditioning processes, The operational amplifier, Filtering, Wheatstone bridge, Pulse modulation.	5 hrs
Chapter No. 3. Motion Measurement Fundamental Standards, Relative Displacement: Translation and Rotational, Relative Velocity: Translation and Rotational, Relative-Acceleration Measurements, Displacement Pickups, Velocity Pickups, Acceleration Pickups, Calibration and Vibration Pickups, Jerk	5 hrs

Pickups.	
Unit – II	
Chapter No. 4. Force, Torque, and Shaft Power Measurement Standards and Calibration, Basic Methods of Force Measurement, Characteristics of Elastic Force Transducers, Torque measurement on Rotating shaft, Shaft Power Measurement (Dynamometers), Vibrating Wire Force Transducers.	5 hrs
Chapter No. 5. Pressure & Sound Measurement Standards and Calibration, Basic Methods of Pressure Measurement, Deadweight Gages and Manometers, Elastic Transducers, Vibrating-Cylinder and Other Resonant Transducers, Dynamic Testing of Pressure-Measuring Systems, High-Pressure Measurement, Low-Pressure Measurement, Sound Measurement.	5 hrs
Chapter No. 6. Flow and Temperature Measurement Local Flow Velocity, Magnitude and Direction, Gross Volume Flow Rate, Standards and Calibration of Temperature Measurement, Thermal-Expansion methods, Thermoelectric Sensors, Electrical-Resistance Sensors, Junction Semiconductor Sensors, Digital Thermometers, Radiation Methods.	5 hrs
Unit – III	
Chapter No.7. Data Acquisition Systems Data conversion devices, Signal sampling and aliasing, Sampling theorem, Quantization, Encoding, Digital to analog conversion methods, Analog to digital conversion methods, Sample & Hold circuit, Flash ADC, Successive approximation ADC, Dual slope ADC, Sigma Delta ADC, Multiplexers.	5 hrs
Chapter No. 8. Transmission and Recording of Data Cable Transmission of Analog Voltage and Current Signals, Cable Transmission of Digital Data, Fiber-Optic Data Transmission, Analog Voltmeters and Potentiometers, Electrical Instruments, Digital Voltmeters and Multimeters, Signal Generation, Electromechanical XT and XY Recorders, Fiber Optic Sensors.	5 hrs

Course Content

Course Code: 17EARC304	Course Title: Measurement Systems	
L-T-P: 3-0-0	Credits: 3	Contact Hrs: 40 hours
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 40		Duration of ESA: 3 Hrs

Content	Hrs
Unit – I	
Chapter No. 1. Introduction to Measurement Systems Need for study of Measurement Systems, Classification of Types of Measurement Applications, Computer-Aided Machines and Processes, Functional Elements of an Instrument , Active and Passive Transducers , Analog And Digital Modes of Operation , Null and Deflection Methods , Input-Output Configuration of Instruments and Measurement Systems, Static Characteristics and Static Calibration, Dynamic Characteristics.	5 hrs
Chapter No. 2. Sensors and Signal conditioning Sensor characterization, Relations between physical quantities, Sensor Classification, Specifications, Error reduction techniques, Loading errors, Signal conditioning processes,	5 hrs

The operational amplifier, Filtering, Wheatstone bridge, Pulse modulation.	
Chapter No. 3. Motion Measurement Fundamental Standards, Relative Displacement: Translation and Rotational, Relative Velocity: Translation and Rotational, Relative-Acceleration Measurements, Displacement Pickups, Velocity Pickups, Acceleration Pickups, Calibration and Vibration Pickups, Jerk Pickups.	5 hrs
Unit – II	
Chapter No. 4. Force, Torque, and Shaft Power Measurement Standards and Calibration, Basic Methods of Force Measurement, Characteristics of Elastic Force Transducers, Torque measurement on Rotating shaft, Shaft Power Measurement (Dynamometers), Vibrating Wire Force Transducers.	5 hrs
Chapter No. 5. Pressure & Sound Measurement Standards and Calibration, Basic Methods of Pressure Measurement, Deadweight Gages and Manometers, Elastic Transducers, Vibrating-Cylinder and Other Resonant Transducers, Dynamic Testing of Pressure-Measuring Systems, High-Pressure Measurement, Low-Pressure Measurement, Sound Measurement.	5 hrs
Chapter No. 6. Flow and Temperature Measurement Local Flow Velocity, Magnitude and Direction, Gross Volume Flow Rate, Standards and Calibration of Temperature Measurement, Thermal-Expansion methods, Thermoelectric Sensors, Electrical-Resistance Sensors, Junction Semiconductor Sensors, Digital Thermometers, Radiation Methods.	5 hrs
Unit – III	
Chapter No.7. Data Acquisition Systems Data conversion devices, Signal sampling and aliasing, Sampling theorem, Quantization, Encoding, Digital to analog conversion methods, Analog to digital conversion methods, Sample & Hold circuit, Flash ADC, Successive approximation ADC, Dual slope ADC, Sigma Delta ADC, Multiplexers.	5 hrs
Chapter No. 8. Transmission and Recording of Data Cable Transmission of Analog Voltage and Current Signals, Cable Transmission of Digital Data, Fiber-Optic Data Transmission, Analog Voltmeters and Potentiometers, Electrical Instruments, Digital Voltmeters and Multimeters, Signal Generation, Electromechanical XT and XY Recorders, Fiber Optic Sensors.	5 hrs

Course Content

Course Code: **17EARC305**	Course Title: **Machine learning and ROS**	
L-T-P: 3-0-0	Credits: 3	Contact Hrs: 40
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 40		Exam Duration : 3 hours

Content	Hours
UNIT – 1	
Chapter 1:Introduction to Robot operating system ROS concepts, creating ROS packages writing a minimal ROS publisher, compiling ROS nodes, running ROS nodes, examining running minimal publisher node, scheduling node timing, writing a minimal ROS subscriber compiling and running minimal subscriber, minimal subscriber and publisher node summary writing ROS nodes more ROS tools: catkin simple, ROSlaunch, simplifying cmakelists.txt with catkin simple automating starting multiple nodes viewing output in a ROS console recording and playing back data with ROSbag.	5 hrs
Chapter 2:Messages, Classes and Servers in ROS Defining custom messages, ROS services- service messages, ROS service nodes, manual interaction with ROS services, example ROS service client, running, example service and client, using C++ classes in ROS creating library modules in ROS, introduction to action servers and action clients- creating an action server package, defining custom action-server messages, designing an action client running the example code, introduction to parameter server.	5 hrs
Chapter 3: **Introduction to machine learning** Introduction Machine Learning ,Well posed learning problem, Types of learning, supervised learning ,unsupervised learning and reinforcement learning, Learning Associations, Designing of learning system, perspectives & issues in machine learning, Concept learning task, concept learning search, Find-S: Finding a maximally specific hypotheses, version spaces & candidate elimination algorithm, Remarks - version spaces & candidate elimination algorithm, inductive bias.	5 hrs
UNIT – 2	
Chapter 4: Computational learning theory and decision tree learning Motivation, Estimating hypotheses accuracy, Basics of sampling theory, general approach for deriving confidence intervals, comparing learning algorithm. Probably learning an approximately correct hypothesis, sample complexity for finite hypnosis spaces, sample complexity for infinite hypothesis spaces, instance based learning-K nearest neighbor learning, locally weighted regression, Representation, decision tree algorithm, hypotheses space search in decision tree algorithm inductive bias in decision tree algorithm, issues in DTL, Bayesian decision theory classification.	8 hrs

Chapter 5:Kernel methods and Graphical models Embedding's into feature spaces, the kernel trick, Multiple kernel learning, Kernel dimensionality reduction Canonical Cases for Conditional Independence, Example Graphical Models, Naive Bayes' Classifier, Hidden Markov Model, Linear Regression, d-Separation Belief Propagation, Linkage–Based clustering algorithms-means and other cost minimization clustering.	7 hrs
UNIT – 3	
Chapter 6:Reinforcement Learning The learning task,Q-learning,Nondeterministic rewards & actions, temporal difference learning, generalizing from examples, relationship to dynamic programming.	5 hrs
Chapter 7: Artificial neural network Biological motivation, neural network representations, and appropriate problems for neural network learning, perceptron's, multilayer networks and the back propagation, algorithm, an illustrative example: face recognition	5 hrs

Course Content

Course Code: 17EARC301	Course Title: Object Oriented Programming and Database Management Systems	
L-T-P: 4-0-0	Credits: 3	Contact Hrs: 50
ISA Marks: 50	ESA Marks: 50	Total Marks: 50
Teaching Hrs: 50		Exam Duration: 3 hrs

Content	Hrs
Unit - I	
Chapter 1 Introduction to Software Development Lifecycle and Unified Modeling Language: Software Development Lifecycle, SDLC Models, Requirement Modeling Framework, Computer Communication Methods Unified Modeling Language (UML): UML Building Blocks, UML Diagrams - Class Diagram, Object Diagram, Component Diagram, UML Modeling Types, UML Basic Notations, UML-SysML, Using the Tools, Testing the Solution, Coding the Solution, Case Studies - Modeling the Sequence Diagram for the Plant Operation, Modeling the Control Strategy Action	6
Chapter 2 Data Modeling using the ER Model: Using High-Level Conceptual Data Models for Database Design, An Example Database Application, Entity Types, Entity Sets, Attributes and Keys, Relationship Types, Relationship Sets, Roles and Structural Constraints, Weak Entity Types, Refining the ER Design, Relationship Types of Degree Higher than Two, ER Diagrams, Naming Conventions and Design Issues	6
Chapter 3 Introduction to Object-Oriented Programming - I: Introduction to .NET Environment, The Java Virtual Machine, Variables and Data Types, Conditional and Looping Constructs, Arrays, Fields and Methods, Constructors, Overloading Methods, Garbage Collection, Nested Classes, Simple Inheritance, Multilevel Inheritance, Overriding, Overloading, Defining Interfaces, Implementing Interfaces, Polymorphism, Abstract Classes, Access Control, Access Modifiers, Access Protection	8
Unit - II	
Chapter 4 Object-Oriented Programming - II: Final Classes, Final Variables and Methods, Finalizer Method: finalise (), Exception Handling, Fundamentals of Exception Handling, Exception Types, Constructors and Methods in Throwable Class, Java's Built-in Exceptions, Unchecked and Checked Exception, Creating Your Own Exception Sub-Classes	4
Chapter 5 Object-Oriented Programming - III: Features of Python Variables, Operators and Branching, Core elements of Programs - Bindings, Strings, Input/Output, IDEs, Control Flow and Iteration, Functions - Decomposition and Abstraction, Functions and Scope, Keyword Arguments, Specifications, Lists, Tuples, Sets, Mutation, Aliasing, Cloning, Functions as Objects, Dictionaries, Example with a Dictionary, Fibonacci and Dictionaries, Global Variables, Classes and Inheritance: Object-Oriented Programming, Class Instances, Methods Classes, Examples, Hierarchies	10
Chapter 6 Introduction to Database Management Systems: Introduction to DBMS with an example, Characteristics of Database Approach, Actors on and Behind the Scene,	6

Advantages and Disadvantages of using DBMS, Data models, Schemas and Instances, Three-Schema Architecture and Data Independence, Database Languages and Interfaces, Database System Environment	
Unit - III	
Chapter 7 Relational Data Model and SQL: Relational Model Concepts, Relational Model Constraints and Relational Database Schemas, Update Operations, Transactions and Dealing with Constraint Violations, SQL Data Definition and Data Types, Specifying Basic Constraints in SQL, Schema Change Statements in SQL, Insert, Delete and Update Statements in SQL, Specifying Constraints as Assertion and Trigger, Indexing Techniques, Views in SQL, Basic Queries in SQL, More Complex SQL Queries, Informal Design Guidelines for Relation Schemas, Functional Dependencies, Normal Forms Based on Primary Keys, General Definitions of Second and Third Normal Forms, Boyce-Codd Normal Form	5
Chapter 8 Object-Relational Databases and Semantic Modeling Approach: Overview of Object Database Concepts, Object-Relational Features: Object Database Extensions to SQL, The ODMG Object Model and the Object Definition Language ODL, Object Database Conceptual Design, The Object Query Language OQL, Semantic Introduction to Databases, Semantic Modeling, Semantic Binary Schemas, Schema Quality Criteria, Subschemas and User views, Transaction Processing Concepts	5

Laboratory Plan **FMTH0303-3.1**

Semester: V *Year: 2019-20*

Laboratory Title: Object-Oriented Programming and Database Management Systems Lab	*Lab. Code*: 17EARP301
Total Hours: 24	*Duration of Exam*: 2 hrs
Total Exam Marks: 100	*Total ISA. Marks*: 80

Experiment-wise plan

1. ***List of experiments/jobs planned to meet the requirements of the course.***

Category: Demonstration ***Total Weightage: 35*** ***No. of lab sessions: 7***

Learning Outcomes:

The students should be able to:

1. *Design and model using UML diagrams and ER models.*
2. *Demonstrate how to compile and run a program in JAVA, Python, and .NET environment.*
3. *Write programs using class, inheritance, and other fundamentals of OOP.*
4. *Write SQL statements concerning data manipulation using retrieving, inserting, updating, and deleting commands.*
5. *Write packages/procedure for manipulating data and triggers to enhance data retrieval.*

Expt./Job No.	***Experiment/job Details***	***No. of Lab. Session/s per batch (estimate)***	***Marks/ Experiment***	***Correlation of Experiment with the theory***
1	SysML - Getting used to tool, use case, creating class diagram, sequence diagram, and state diagram.	*1*	*5*	*Introduction to Software Development Lifecycle and Unified Modeling Language*
2	Creating ER models considering different relationship and attributes.	*1*	*5*	*Data Modeling using the ER Model*
3	Write programs in Java or .NET using the concept of OOP like arrays, strings, functions, overloading, and exception handling.	*1*	*5*	*Introduction to Object-Oriented Programming - I*
4	Write programs in JAVA or .NET using the concept of a generic class, inheritance,	*1*	*5*	*Object-Oriented*

	interface, and package.			*Programming - II*
5	Write programs in PYTHON using the concept of generic classes, inheritance, interface, and package.	*1*	*5*	*Object-Oriented Programming - III*
6	Write SQL statements related to data manipulation, like insert, delete, and update.	*1*	*5*	*Relational Data Model and SQL*
7	Write statements to create views, procedures, packages, and indexing for fast retrieval.	*1*	*5*	*Relational Data Model and SQL*

Category: Exercises ***Total Weightage: 20*** ***No. of lab sessions: 2***

Learning Outcomes:

The students should be able to:

1. *Design and model using UML diagrams.*
2. *Implement classes in JAVA or .NET environment.*
3. *Compile and build JAR/DLL files.*
4. *Design and mode ER models for different scenarios.*
5. *Construct a database schema with data manipulation SQL statement, a proper procedure in place, and create triggers for fast data retrieval.*

Expt./Job No.	***Experiment/job Details***	***No. of Lab. Session/s per batch (estimate)***	***Marks/Experiment***	***Correlation of Experiment with the theory***
1	*Develop a class diagram concerning sensor, actuators and controls, implement these classes, and build JAR/DLL files.*	*1*	*10*	*Introduction to Software Development Lifecycle and Unified Modeling Language* *Introduction to Object-Oriented Programming - I* *Object-Oriented Programming - II* *Object-Oriented Programming - III*
6.	*Develop an ER model and construct a database schema for a given manufacturing scenario.*	*1*	*10*	*Data Modeling using the ER Model*

				Relational Data Model and SQL *Relational Data Model and SQL*

Category: Structured Enquiry ***Total Weightage: 25*** ***No. of lab sessions: 2***

Learning Outcomes:

The students should be able to:

1. *Design, develop and implement application utilizing previously developed JAR/DLL files.*
2. *Store data from the application into the database.*
3. *Design, development and implement the user interface for visualization of data from the database.*

Expt./Job No.	***Experiment/job Details***	***No. of Lab. Session/s per batch (estimate)***	***Marks/ Experiment***	***Correlation of Experiment with the theory***
1.	*Implement a project which utilizes previously generated JAR/DLL files and database schema to store data from automation devices and control the actuators. Additionally, proper checks have to be implemented and with necessary visualization.*	*2*	*25*	

Category: Open Ended ***Total Weightage: 20*** ***No. of lab sessions: 2***

Learning Outcomes:

The students should be able to:

1. *Use the OOP concepts to implement the project.*
2. *Use database concept to implement the project*
3. *Select the appropriate tool/software to implement the project.*
4. *Write a technical report using a predefined template.*
5. *Present the technical report of the implemented project.*
6. *Demonstrate the learning experiences of working in a team.*

Expt./Job No.	***Experiment/job Details***	***No. of Lab. Slots per batch (estimate)***	***Marks/ Experiment***	***Correlation of Experiment with the theory***
1.	*Implement a project using C++/Java/python/DB concepts, for automation and robotics applications.*	*2*	*20*	

Course Content

Course Code: 17EARE301	Course Title: **Artificial intelligence for autonomous systems**		
L-T-P: 3-0-0	Credits: 3	Contact Hrs: 40	
ISA Marks: 50	ESA Marks: 50	Total Marks: 100	
Teaching Hrs: 40		Exam Duration : 3 hours	

Content	Hours
UNIT – 1	
Chapter 1: **Introduction to Artificial intelligence and autonomous systems** Foundation of artificial intelligence, robotics and the AI approach, Semi-autonomous control, Seven areas of AI**,** The Concept of Rationality The Nature of Environments, The Structure of Agents, Problem-Solving Agents, Searching for Solutions, Uninformed Search Strategies, Informed Search Strategies, Knowledge representation in AI, knowledge based agents, propositional logic, predicate calculus, inference rules	5hrs
Chapter 2: Robotic software architectures Subsumption architecture, Three-layer architecture, Pipeline architecture, Hierarchical Paradigm- Attributes of the Hierarchical Paradigm, Reactive Paradigm-Attributes of Reactive Paradigm , Hybrid Deliberative/Reactive Paradigm-Attributes of Hybrid Paradigm, Architectural Aspects, Managerial Architectures-Autonomous Robot Architecture (AuRA), Sensor Fusion Effects (SFX), State-Hierarchy Architectures, Model-Oriented Architectures, Interleaving Deliberation and Reactive Control.	5 hrs.
Chapter 3: Biological Foundations of the Reactive Paradigm Agency and computational theory , Animal Behaviors, Reflexive behaviors , Coordination and Control of Behaviors, Innate releasing mechanisms ,Concurrent behaviors ,Perception in Behaviors , Action-perception cycle ,Two functions of perception Gibson: Ecological approach , Neisser: Two perceptual systems , Schema Theory , Behaviors and schema theory , Principles and Issues in Transferring Insights to Robots	5 hrs
UNIT – 2	
Chapter 4: Capturing intelligence - Designing a reactive implementation with common sensing techniques for robotics perception Behaviors as Objects in OOP, Steps in Designing a Reactive Behavioral System, Case Study: Unmanned Ground Robotics Competition, Assemblages of Behaviors, Logical sensors, Behavioral Sensor Fusion, Designing a Sensor Suite, Proprioceptive Sensors, Proximity Sensors, Computer Vision, Range from Vision, Case Study: Hors d'Oeuvres, Anyone?	8 hrs
Chapter 5: Multi-agents and navigation in robotics Heterogeneity, Control, Cooperation, Emergent Social Behavior, Topological Path Planning, Relational Methods, Associative Methods, Case Study of Topological Navigation with a Hybrid Architecture	7 hrs

UNIT – 3	
Chapter 6:Localization and Map Making Sonar Sensor Model,Bayesian,Conditional probabilities ,Conditional probabilities , Updating with Bayes' rule ,Dempster-Shafer Theory ,Shafer belief functions Belief function for sonar Dempster's rule of combination Weight of conflict metric,HIMM sonar model and Comparison of Methods ,Example computations ,Performance Errors due to observations from stationary robot ,Tuning ,Localization ,Continuous localization and mapping ,Feature-based localization Exploration ,Frontier-based exploration ,Generalized Voronoi graph methods **.**	6hrs
Chapter 7: Deep learning and natural language processing Deep Learning Improvement of the Deep Neural Network Vanishing Gradient Over fitting Computational Load. Language models, text classification, information retrieval	4 hrs

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Course Content

Course Code: 17EARE304	Course Title: Digital System Design and FPGA programming	
L-T-P: 3-0-0	Credits: 3	Contact Hrs: 50
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 50		Exam Duration: 3 hrs

Content	Hrs
Unit – 1	
Chapter No. 1. Review of Logic Design Fundamentals: Combinational logic, Boolean algebra and algebraic Simplification Karnaugh maps, designing with NAND and NOR gates, hazards in combinational circuits, flip-flops and latches, Mealy sequential circuit design, design of a Moore sequential circuit, equivalent states and reduction of state tables, sequential circuit timing, tristate logic and busses. Advanced Design Issues: Meta-stability, Noise Margins, Power, Fan-out, Timing Considerations, Brief overview of programmable logic devices, simple programmable logic devices (SPLDs), complex programmable logic devices (CPLDs), field-programmable gate arrays (FPGAs),	9 hrs
Chapter No. 2. Introduction to State Machine Charts and Microprogramming: State machine(SM) charts, derivation of SM charts, realization of SM charts, implementation of the dice game, microprogramming,: Design Examples	6 hrs
Unit – 2	
Chapter No. 3. Designing with Field Programmable Gate Arrays: Implementing functions in FPGAs, implementing functions using Shannon's decomposition, carry chains in FPGAs, cascade chains in FPGAs, examples of logic blocks in commercial FPGAs, dedicated memory in FPGAs, dedicated multipliers in FPGAs, cost of programmability, FPGAs and One-Hot state assignment	7 hrs
Chapter No. 4. Modeling and design with HDL Basic Concepts, Dataflow Descriptions, Behavioral Descriptions ,Structural Descriptions, Design examples, Timing and Delays, BCD to 7-Segment Display Decoder, BCD Adder, 32-Bit Adders, Traffic Light Controller, Shift-and-Add Multiplier, Array Multiplier. **Introduction to Verilog and VHDL**: Data Types, Modeling Concepts, Task and Functions, Specify Block and Timing Checks , Architecture study of popular FPGA families	8 hrs
Unit – 3	
Chapter No. 5. Testing and Verification What is Verification, what is a Test bench, The Importance of Verification, Convergence Model, What Is Being Verified, Functional Verification Approaches, Testing Versus Verification, Design and Verification Reuse, Cost of Verification	5 hrs
Chapter No. 6 Case studies on FPGA technologies in Automation and Robotics applications I. Robotic Car from Georgia Institute of Technology II. Robotic Controller: ASIC versus FPGA III. Expanding a robot's life: Low power object recognition via FPGA-based DCNN deployment IV. FPGA-powered parallel, pipelined vision algorithms	5 hrs

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Course Content

Course Code: 17EARE304	Course Title: Digital System Design and FPGA programming	
L-T-P: 3-0-0	Credits: 3	Contact Hrs: 50
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 50		Exam Duration: 3 hrs

Content	**Hrs**
Unit – 1	
Chapter No. 1. Review of Logic Design Fundamentals: Combinational logic, Boolean algebra and algebraic Simplification Karnaugh maps, designing with NAND and NOR gates, hazards in combinational circuits, flip-flops and latches, Mealy sequential circuit design, design of a Moore sequential circuit, equivalent states and reduction of state tables, sequential circuit timing, tristate logic and busses. Advanced Design Issues: Meta-stability, Noise Margins, Power, Fan-out, Timing Considerations, Brief overview of programmable logic devices, simple programmable logic devices (SPLDs), complex programmable logic devices (CPLDs), field-programmable gate arrays (FPGAs),	9 hrs
Chapter No. 2. Introduction to State Machine Charts and Microprogramming: State machine(SM) charts, derivation of SM charts, realization of SM charts, implementation of the dice game, microprogramming,: Design Examples	6 hrs
Unit – 2	
Chapter No. 3. Designing with Field Programmable Gate Arrays: Implementing functions in FPGAs, implementing functions using Shannon's decomposition, carry chains in FPGAs, cascade chains in FPGAs, examples of logic blocks in commercial FPGAs, dedicated memory in FPGAs, dedicated multipliers in FPGAs, cost of programmability, FPGAs and One-Hot state assignment	7 hrs
Chapter No. 4. Modeling and design with HDL Basic Concepts, Dataflow Descriptions, Behavioral Descriptions ,Structural Descriptions, Design examples, Timing and Delays, BCD to 7-Segment Display Decoder, BCD Adder, 32-Bit Adders, Traffic Light Controller, Shift-and-Add Multiplier, Array Multiplier. **Introduction to Verilog and VHDL**: Data Types, Modeling Concepts, Task and Functions, Specify Block and Timing Checks , Architecture study of popular FPGA families	8 hrs
Unit – 3	
Chapter No. 5. Testing and Verification What is Verification, what is a Test bench, The Importance of Verification, Convergence Model, What Is Being Verified, Functional Verification Approaches, Testing Versus Verification, Design and Verification Reuse, Cost of Verification	5 hrs
Chapter No. 6 Case studies on FPGA technologies in Automation and Robotics applications I. Robotic Car from Georgia Institute of Technology II. Robotic Controller: ASIC versus FPGA III. Expanding a robot's life: Low power object recognition via FPGA-based DCNN deployment IV. FPGA-powered parallel, pipelined vision algorithms	5 hrs

Laboratory Plan

FMTH0303-3.1

Semester: VII

Year: 2020-21

Laboratory Title: Project	Lab Code: 18EARW401
Total Hours: 30	Duration of Exam: 3 Hrs
Total ESA Marks: 50	Total ISA. Marks: 50
Lab. Plan Author: Sachin Karadgi	Date: 10-Sep-2021
Checked By: Arunkumar C Giriyapur	Date: 10-Sep-2021

Prerequisites:

Subjects learnt up to VI semester.

Course Outcomes-CO

At the end of the course student will be able to:

1. Carry out market survey, do need analysis and identify suitable problems.
2. Write a project proposal, which will involve developing a complete solution for the identified problem from the real world.
3. Apply the principles of engineering design to plan and manage the project.
4. Apply suitable design processes and develop the best possible solution.
5. Develop proof of concepts and models for verification.
6. Prepare production drawings, bill of materials and process plans.

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Course Articulation Matrix: Mapping of Course Outcomes (CO) with Program outcomes (PO)

Laboratory (Course) Title: **Project**   Laboratory (Course) code: 18EARW401   Semester: VII   Year: 2020-21

Course Outcomes (CO) / Program Outcomes (PO)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
1. Carry out market survey, do need analysis and identify suitable problems.	**H**	**H**												
2. Write a project proposal, which will involve developing a complete solution for the identified problem from the real world.		**H**	**H**		**M**					**H**				
3. Apply the principles of engineering design to plan and manage the project.			**H**											
4. Apply suitable design processes and develop the best possible solution.			**H**		**M**		**M**							
5. Develop proof of concepts and models for verification.			**H**											
6. Prepare production drawings, bill of materials and process plans.			**H**							**H**				

Degree of compliance   **L**: Low   **M**: Medium   **H**: High

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Competency addressed in the Course and corresponding Performance Indicators

Competency	Performance Indicators
1.3 Demonstrate competence in engineering fundamentals	1.3.1 Apply elements of mechanical engineering principles and laws to solve problems
1.3 Demonstrate competence in engineering fundamentals	1.3.2 Apply basic electrical and electronics engineering principles and laws to solve problems
1.3 Demonstrate competence in engineering fundamentals	1.3.3 Apply computer programming skills to solve problems by building algorithms ,flow charts and debugging
1.4 Demonstrate the competence in engineering knowledge appropriate to automation and robotics program	1.4.1 Apply discipline specific laws and principles to solve an interdisciplinary engineering problem
2.1 Demonstrate an ability to identify and characterize an engineering problem	2.1.1 Identifies known and unknown information, uncertainties, and biases when presented with a complex ill-structured problem
2.1 Demonstrate an ability to identify and characterize an engineering problem	2.1.3 Identifies all relevant constraints and requirements and formulate an accurate description of the problem
2.2 Demonstrate an ability to formulate a solution plan and methodology for an engineering problem	2.2.2 Partitions problems, processes or systems into manageable elements for the purposes of analysis, modelling or design.
2.2 Demonstrate an ability to formulate a solution plan and methodology for an engineering problem	2.2.3 Selects appropriate analysis tools and applies those proficiently to implement the model/solution
3.2 Demonstrate an ability to generate a diverse set of alternative design solutions	3.2.1 Apply formal idea generation tools to develop multiple engineering design solutions
3.2 Demonstrate an ability to generate a diverse set of alternative design solutions	3.2.2 Build models, prototypes, etc., to develop diverse set of design solutions
3.2 Demonstrate an ability to generate a diverse set of alternative design solutions	3.2.3 Identify the suitable criteria for evaluation of alternate design solutions
5.1 Demonstrate an ability to identify/ create modern engineering tools, techniques and resources	5.1.1 Identify modern engineering tools, techniques and resources for engineering activities
7.1 Demonstrate an understanding of the impact of engineering and industrial practice on social, environmental and economic contexts	7.1 1 Identify risks/impacts in the life-cycle of an engineering product or activity
10.3 Demonstrate the ability to integrate different modes of communication	10.3.1 Create engineering-standard figures, reports and drawings to complement writing and presentations

E.g.: 1.2.3: Represents program outcome ‘1’, competency ‘2’ and performance indicator ‘3’.

Program: Biotechnology		
Course Title: Biological Data Analysis		**Course Code: 18EBTE402**
L-T-P: 3-0-0	**Credits: 3.0**	**Contact Hours: 03 Hours/Week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hours: 40	**Examination Duration: 03 Hours**	

Unit I

1.Introduction to Basic statistics:

Strategy of Experimentation, History of the Design of Experiments, Basic Principles of DOE:

Randomization, Replication, Blocking, Multi-factor Designs, Confounding; Steps for Planning, Conducting and Analyzing an Experiment, Typical applications of Experimental design, Basic Principles, Guidelines for Designing, Concepts of random variable, probability, density function,cumulative distribution function. Concept of confidence level. Statistical Distributions: Normal, Log Normal &Weibull distributions. Hypothesis testing, Probability plots.

04 Hours

2. Screening Design:

Introduction, Terminology: factors, levels, interactions, treatment combination, Orthogonal array, PB design, analysis of PD design, Numericals. **05 Hours**

3.Full Factorial Design:

Basic Definitions and Principles, The Advantage of Factorials, The Two-Factor Factorial Design, Statistical Analysis of the Fixed Effects Model, Model Adequacy Checking, Estimating the Model Parameters, Concept of the General Factorial Design, 2^k Factorial Design, The 2^2Design, The 2^3 Design, The General 2^k Design. **07 Hours**

Unit II

4. Response surface methods:

Introduction, Central composite design, Box Behnken design, importance of counter and surface plots. **05 Hours**

5. R Programming Basics:

Overview of R programming, Environment setup with R Studio, R Commands, Variables and Data Types, Control Structures, Vectors, Factors, Functions, Matrices, Arrays and Lists. **06 Hours**

6. Interfacing:

Interfacing R to other languages, Parallel R, Basic Statistics: Linear Model, Generalized Linear models, Non-linear models, Time Series, Autocorrelation and Clustering. **05 Hours**

Unit III

7. Introduction to Bioconductor for Sequence Data:

Sequencing Resources, Ranges Infrastructure, DNA /amino acid sequence from FASTA files, Reads from FASTQ files, Aligned Reads from BAM files, Called Variants from VCF files, Genome Annotations from BED, WIG, GTF files. **04 Hours**

8. Biological Data Analysis:

Preparing count matrices, The DESeq, DataSet, sample information, and formula design, exploratory analysis and visualization, Differential expression analysis, Plotting results, Annotating and exporting results **04 Hours**

Text Books:

1. R for Everyone: Advanced Analytics and Graphics: b y Jared P. Lander Addison Wesley Data & Analytics Series, 2013.

2. Design and analysis of experiments" by D.C. Montgomery, 7th edition John Wiley and sons, NewYork

Reference Books:

1. A Little Book of R for Bioinformatics: by Avril Coghlan, Release 0.1

2. Das. M.M. and Giri N.C. : - Design and Analysis of Experiments

Scheme for End Semester Assessment (ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter numbers	Instructions
I	3 Questions to be set of 20 Marks Each	1, 2,3	Solve Any 2 out of 3
II	3 Questions to be set of 20 Marks Each	4,5,6	Solve Any 2 out of 3
III	2 Questions to be set of 20 Marks Each	7,8	Solve Any 1 out of 2

Program: Biotechnology		
Course Title: Bioprocess Modeling and Simulation		Course Code: 18EBTE401
L-T-P: 3-0-0	Credits: 3.0	Contact Hours: 03 Hours/Week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hours: 40	Examination Duration: 03 Hours	

Unit I

1.Introduction to modeling:

Introduction, Mathematical Modeling of Bioprocess Engineering System, General Aspects of the Modeling Approach, General Modeling Procedure: Fundamentals uses of mathematical model, scope of coverage, principles of formulation; Fundamental Laws of Modeling: continuity equation, energy equation with examples **05 Hours**

2.Fundamental Laws of Modeling:

Equation of motion, transport equation, equation of state, phase and chemical equilibrium, chemical kinetics; Lumped and distributor parameters with examples **05 Hours**

3. Mathematical models of Biochemical Engineering Systems:

Modeling of Batch reactors, modeling of CSTR, Numericals. Plug flow reactor, Fluidized bed reactor, Reactors used in effluent treatments, packed bed reactor. **05 Hours**

Unit II

4. Use of MATLAB in Process Simulation:

Basics-Data analysis-curve fittings, Numerical integration, Euler and fourth order RungeKutta method, Input and Output in MATLAB. Solving problems using MATLAB by numerical integration, Euler and fourth order Runge Kutta methods. Simulation of CSTR and Batch Reactor, Simulation of Plug flow reactor. **10 Hours**

4.Introduction to Process Design:

Steps involved in process design, Process flow diagram structure and hierarchical approach, importance of Material and Energy balance, selection of unit operations,

05 Hours

Unit III

5.Introduction to process simulation software

Bioprocess design with example: Process Description, Specifying Process Sections, Specifying Equipment Sharing, Initialization of Reaction Operations, Process Analysis, Cost Analysis and Economic Evaluation, Environmental Impact.

05 Hours

6. Use of Super Pro in Process Simulation:

Components and mixtures, Physical and Chemical properties of components, material and energy balance simulation, adding unit operation, scheduling the unit process, process cost estimation, sizing of the unit operation.Case study: Monoclonal antibody production, Enzyme production

05 Hours

Text Books:

1.Luyben W.L., Process Modeling Simulation and Control for Chemical Engineers., McGraw Hill, 1988.

2. Pauline M. Doran, "Bioprocess Engineering Calculation", Blackwell Scientific Publications.

Reference Books:

1. Kenneth J. Beers. "Numerical Methods for Chemical Engineering Applications in MATLAB®", Massachusetts Institute of Technology, Cambridge University press 2007 edition.

2. Bailey and Ollis, "Biochemical Engineering Fundamentals", 2 nd ed.,McGraw Hill, 1986.

Scheme for End Semester Assessment (ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter numbers	Instructions
I	3 Questions to be set of 20 Marks Each	1, 2	Solve Any 2 out of 3
II	3 Questions to be set of 20 Marks Each	3,4	Solve Any 2 out of 3
III	2 Questions to be set of 20 Marks Each	5,6	Solve Any 1 out of 2

Program: Biotechnology		
Course Title: Quality Assurance & Regulations		Course Code: 18EBTE403
L-T-P: 3-0-0	Credits: 3.0	Contact Hours: 03 Hours/Week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hours: 40	Examination Duration: 03 Hours	

Unit I

1. Introduction

Introduction to Quality and Quality Regulation, Validation and Regulatory Affairs in Bio (Pharmaceutical) Manufacturing: An Introduction to FDA Operations & Industry Compliance Regulations, The Fundamentals of Regulatory Compliance with respect to Good Clinical Practice (GCP), Good Manufacturing Practice (GMP) & Good Laboratory Practice (GLP).

06 Hours

2. Quality and Quality Management

Terms Relating to Quality Management System, Quality Policy, Quality Objectives, Quality Planning, Quality Control, Quality Assurance, Quality Improvement, Continual Improvement, Effectiveness, Efficiency; Relating to Process and Product, Quality Characteristics; Terms Relating to Conformity, Non-Conformity, Defect, Preventive Action, Corrective Action, Rework, Repair, Scrap, Concession, Deviation Permit, Release; Terms Relating to Documentation.

10 Hours

Unit II

3. Process Validation

Definition and concept of validation, An introduction to process validation, Validation and Qualification, IQ, OQ and PQ. A Review of Prospective, Concurrent, Retrospective Validation Calibration and performance evaluation. Validation of Water & Thermal Systems, including HVAC Facilities & Cleaning Validation. Validation septic Processes, Computer software validation in pharmaceuticals (CSV).

10 Hours

4. Analytical Method Validation

FDA and ICH guidelines. Analytical method validation, Specificity, Linearity, Accuracy, Precision, Limits of detection (LOD) and quantification (LOQ), Minimum detectable amount (MDA), Sample stability and method robustness, System suitability, Statistical process control for HPLC, Troubleshooting out-of-control systems, Case studies, Validation of Analytical Methods.

06 Hours

Unit III

5. Quality Standards

Introduction, ISO 9000 Series of Standards, Management Responsibility, Quality System, Contract Review, Design Control, Document and Data Control, Control of Quality Records, Internal Quality Audits, Training, Servicing, Environmental Management System.

04 Hours

6. Implementation and Regulation

Role of QC and QA in Bio/Pharmaceutical organization, Quality System, Contract Review, Design Control, Document and Data Control, Product Identification and Traceability, Process Control, Control of Quality Records, Internal Quality Audits, Training.

04 Hours

Text Books:

1. Pharmaceutical Process Validation by Robert Nash and Alfred Wachter, Marcel Dekker. Publisher: Marcel Dekker Inc. 2011.
2. Good Manufacturing Practices for Pharmaceuticals: A Plan for Total Quality Control From Manufacturer to Consumer, Sidney J. Willig, Publisher: Marcel Dekker Inc. 2005.

Reference Books:

1. Validation of Pharmaceutical Processes: Sterile Products, Frederick J. Carlton (Ed.) and James Agalloco (Ed.), Marcel Dekker, 2008.
2. Validation Standard Operating Procedures: A Step by Step Guide for Achieving Compliance in the Pharmaceutical, Medical Device, and Biotech Industries, Syed Imtiaz Haider, Saint Lucie Press, 2004.

Scheme for End Semester Assessment (ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter numbers	Instructions
I	3 Questions to be set of 20 Marks Each	1, 2	Solve Any 2 out of 3
II	3 Questions to be set of 20 Marks Each	3,4	Solve Any 2 out of 3
III	2 Questions to be set of 20 Marks Each	5,6	Solve Any 1 out of 2

Program: Biotechnology		
Course Title: Bioethics, Safety & IPR		**Course Code:19EBTE401**
L-T-P: 3-0-0	**Credits: 3.0**	**Contact Hours: 03 Hours/Week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hours: 40	**Examination Duration: 03 Hours**	

Unit I

1. Perceptions about Biotechnology: Biotechnology and social responsibility, Positive & negative perceptions of Biotechnology, Public acceptance issues, surveys, areas of public concern for Biotechnology. Socio, ethical, economic and legal aspects of Biotechnology. Public education & Biotechnology. **05Hours**

2. Bioethics: Legality, morality, and ethics, Principles of bioethics: autonomy, human rights, beneficence, justice, equity, etc. Expanding scope of ethics from Biomedical practice to Biotechnology, ethical conflicts in Biotechnology. **05 Hours**

3. Biosafety concept and issues : Rational vs. subjective perception of risks and benefits, Hazards of BT , relationship between risk and hazard, Ethical implications of biotechnology products and techniques, **05 Hours**

Unit II

4. National and International Regulations: Cartagena protocol, OECD consensus documents and Codex Alimentarius; Indian regulations – EPA act and rules, guidance documents, regulatory framework – RCGM, GEAC, IBSC and other regulatory bodies; category of rDNA experiments; field trails – biosafety research trials – standard operating procedures - guidelines of state governments; GM labeling – Food Safety and Standards Authority of India (FSSAI) **10Hours**

5. Biosafety & Management: Laboratory associated Biosafety practices, assessment of biohazard, Biosafety levels,. Risk analysis and assessment, Containment levels-physical, biological containments,. Good manufacturing practice and Good lab practices (GMP and GLP). **05 Hours**

Unit III

6. Intellectual Property rights: Introduction to history of GATT, WTO, WIPO and TRIPS; Introduction to IPR, Types of IP: Patents, Trademarks, Copyright, Design & Related Rights. Plant variety protection, Traditional knowledge, breeders rights, Geographical indications, Biodiversity and farmers rights. Patenting in biotechnology, case studies. **05 Hours**

7. Food, Agri and Pharma Sector: The GM-food debate and biosafety assessment procedures

for biotech foods including transgenic food crops, case studies- Golden Rice and Flav Savr Tomatto. Biosafety assessment of pharmaceutical products such as drugs/vaccines etc. Biosafety issues in Clinical Trials. **05 Hours**
Text Books 1.Bioethics & Biosafety- Sateesh MK, I.K.International Publishing House 2.Intellectual Property rights on Biotechnology – Singh K, BCIL, New Delhi. 3.Biotechnology: Expanding Horizons - B D Singh, Kalayani Publishers, 2010
Reference Books: **1.** Bioethics & Biosafety – R. Rallapalli & Gita Bali, APH publication, 2007 **2.** Safety considerations for Biotechnology-Paris, OECD publications

Scheme for End Semester Assessment (ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter numbers	Instructions
I	3 Questions to be set of 20 Marks Each	1,2,3	Solve Any 2 out of 3
II	3 Questions to be set of 20 Marks Each	4,5	Solve Any 2 out of 3
III	2 Questions to be set of 20 Marks Each	6,7	Solve Any 1 out of 2

Program: Biotechnology		
Course Title: Industrial Waste Management		Course Code: 19EBTO401
L-T-P: 3-0-0	Credits: 3.0	Contact Hours: 03 Hours/Week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hours: 40	Examination Duration: 03 Hours	

Unit I

1 Introduction

Introduction to waste management, general outline of waste management, Importance of waste management in industries. **04Hours**

2 Waste Water Treatment

Waste water characteristics: Physical, Chemical and Biological characteristics. Chemical Oxygen Demond (COD) and Biochemical Oxygen Demond (BOD). Introduction to physical and chemical waste water treatment methods. Biological wastewater treatment methods: Aerobic suspended growth treatment processes (Activated Sludge Process, aerared lagoons etc), Aerobic attached growth treatment processes (Trickling Filter). Anaerobic treatment. **11Hours**

Unit II

3. Solid Waste Management

Basic aspects, Generation of industrial solid wastes, general composition of Municipal solid waste, On site handling, storage and processing, Collection of solid wastes. Solid waste processing techniques and equipments. Recovery of biological conversion products from solid waste such as composting and anaerobic digestion. Disposal of solid wastes. **09Hours**

4. Control of Air Pollution

Sources and classification of air pollutants, Effects of air pollution on human health, animals and plants. Sampling procedures, Control of air pollution by equipments, odour combaitment techniques, Air pollution Legislation and Regulation. **06Hours**

Unit III

5. Bioremediation

Introduction, Uses of bacteria for bioremediation, bioremediation of aromatic and aliphatic hydrocarbons, PCB dechlorination, immobilization techniques for bioremediation, biosorption & bioaccumulation, genetic engineering of microbes for bioremediation. Phytoremediation-plants capable of assimilating heavy metals. **05Hours**

6. EM Technology

Introduction, Important organisms: Photosynthetic bacteria, Lactobacillus, yeast; their roles, Formulation of EM Mixture, Use of EM technology for treating industrial wastes – case studies. **05Hours**
Text Books: 1. **Wastewater Engineering**-Metcalf and Eddy. McGraw-Hill International Edition.1991 2. **Solid Wastes**-George Tchobanoglous, Hilary Theisen and Rolf Eliassen. McGraw Hill Kogakusha,Ltd.
Reference Books: **1. Basic Biotechnology** by Colin Ratledge, Cambridge Pub. 2001 **2. Air Pollution** – M.N.Rao and H.V.N Rao.Tata Mc Grew Hill.

Scheme for End Semester Assessment (ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter numbers	Instructions
I	3 Questions to be set of 20 Marks Each	1,2	Solve Any 2 out of 3
II	3 Questions to be set of 20 Marks Each	3,4	Solve Any 2 out of 3
III	2 Questions to be set of 20 Marks Each	5,6	Solve Any 1 out of 2

Program: Biotechnology		
Course Title: Bioprocess Plant Design and Economics		Course Code: 18EBTE301
L-T-P: 3-0-0	Credits: 3.0	Contact Hours: 03 Hours/Week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hours: 40	Examination Duration: 03 Hours	

Unit I

1. Introduction to Process Design Development

Design project procedure, design information from the literature and other sources of information, flow diagrams, preliminary design, and comparison of different processes, Equipment design and specialization, factors affecting the investment. **06Hours**

2. General Design Considerations

Marketability of the product, availability of technology, Health and safety hazards, raw materials, human resources, loss prevention Environmental protection and utilities, site characteristics, plant location, plant layout, plant operation and control, utilities, structural design, storage, materials handling, materials and fabrication Selection, optimum design and design strategy. Waste disposal, physical treatment, chemical treatment and biological treatment, govt. regulations and other legal restrictions, community factors. Safety and hazard control measures.

10 Hours

Unit II

3. Cost Analysis and Manufacturing Cost

Cost Analysis: Factors involved in project cost estimation. Cash flow diagrams for the industrial operation, Cumulative cash position, factors affecting the Investment and production cost, Different methods employed for the estimation of the capital investment. Estimation of equipment cost by sixth tenth rule, Cost index. Marshall and swift installed – equipment indexes, Engineers News-Record construction index, Nelson –Farrar refinery construction index. and Chemical Engineering plant cost index Manufacturing Costs: Direct Production costs, indirect cost and fixed charges (including depreciation, taxes, insurance, rental costs etc.)

10 Hours

4. Bioprocess Economics:

Economic analysis for the production of following Products.(Historical Perspective, Fermentation Technology, Recovery of product and process economics of following products)

- High volume, low value products. (Citric acid, Ethanol and Amino acids etc)
- Medium volume, medium value products.(Antibiotics, Crude Enzymes and Vitamins etc)
- Low volume, high value products. (MAb, purified Enzymes and Therapeutic proteins etc)

06 Hours

Unit III

5. Profitability Analysis and Optimization Technique

i) Importance of profitability analysis in investment decision making. Different Methods for calculating the profitability. Minimum Acceptable Rate of return. Methods that Do not consider Time value of money. **04 Hours**

ii) General procedure to find the optimum conditions, factors affecting the optimization, comparison of analytical and graphical methods. Linear programming, Simultaneous Equations and dynamic programming **04 Hours**

Text Books:

1. Peters and Timmerhaus, Plant Design and Economics for Chemical Engineers, McGraw Hill 5th edition, 2004.
2. Chemical Engineering plant design, Frank C Vilbrandt and Charles E Dryden , McGraw Hill 4th edition, 1959

Reference Books:

1. Rudd and Watson, Strategy of Process Engineering, Wiley, 1987.
2. Backhurst, J.R And Harker, J. H - Process Plant Design, Heieman Educational Books, (1973).
3. Biochemical Engineering Fundamentals, James E Baily David F Oillis. McGraw-Hill 2nd International Edition

Scheme for End semester assessment (ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter numbers	Instructions
I	3 Questions to be set of 20 Marks Each	1, 2	Solve Any 2 out of 3
II	3 Questions to be set of 20 Marks Each	3,4	Solve Any 2 out of 3
III	2 Questions to be set of 20 Marks Each	5	Solve Any 1 out of 2

Program: Biotechnology		
Course Title: Environmental Biotechnology		**Course Code: 18EBTE404**
L-T-P: 3-0-0	**Credits: 3.0**	**Contact Hours: 03 Hours/Week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hours: 40	**Examination Duration: 03 Hours**	

Unit I

1. Introduction

Issues and scope of Environmental Biotechnology, Environment and Biotechnology, Areas of applications for Biotechnology. Microbes and Environment, Genetically modified organisms and Legislation. **03 Hours**

2. Waste Water Treatment

Sources of water pollution, Waste water characteristics: Physical, Chemical and Biological characteristics. Chemical Oxygen Demond (COD) and Biochemical Oxygen Demond (BOD). Introduction to physical and chemical waste water treatment methods. Biological wastewater treatment methods: Aerobic suspended growth treatment processes (Activated Sludge Process, aerared lagoons etc), Aerobic attached growth treatment processes (Trickling Filter, Rotating Biological contactors), Anaerobic suspended growth treatment processes- contact digestors, packed column reactors, UASB. **12 Hours**

Unit II

3. Solid waste Management

Basic aspects, Generation of solid wastes, general composition of Municipal solid waste, On site handling, storage and processing, Collection of solid wastes. Solid waste processing techniques and equipments. Recovery of biological conversion products from solid waste such as composting, sanitary landfilling, recycling, vermicomposting, incineration. Solid waste management for energy recovery-Biogas production, processing of lignocellulosic waste biomass for ethanol production

10 Hours

4. Bioremediation

Uses of bacteria for bioremediation, bioremediation of aromatic and aliphatic hydrocarbons, PCB dechlorination, immobilization techniques for bioremediation, biosorption & bioaccumulation, genetic engineering of microbes for bioremediation. Phytoremediation-plants capable of assimilating heavy metals **05 Hours**

Unit III

5.Bioleaching

Bioleaching using microbes, role of Thiobacilli, direct & indirect bioleaching, copper extraction by leaching, dump leaching **05 Hours**

6. Environmental Impact Assessment

Introduction, Scope and history of EIA, Need of Environmental Impact assessment. Stakeholder

and public involvement, Identification and quantification of environmental effects and Environmental Impact statement (EIS) **05 Hours**
Text Books: 1. Metcalf and Eddy, Wastewater Engineering, International Edition, McGraw-Hill, 1991 2. George Tchobanoglous, Hilary Theisen and Rolf Eliassen, Solid Wastes, McGraw Hill Kogakusha
Reference Books: 1. Colin Ratledge, Basic Biotechnology , Cambridge Pub, 2001 2. Indu Shekhar Thakur, Environmental Biotechnology, IK Pub, 2006 3. Pradipta Kumar Mohapatra, Environmental Biotechnology, IK Pub, 2006

Scheme for End Semester Assessment (ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter numbers	Instructions
I	3 Questions to be set of 20 Marks Each	1,2	Solve Any 2 out of 3
II	3 Questions to be set of 20 Marks Each	3,4	Solve Any 2 out of 3
III	2 Questions to be set of 20 Marks Each	5,6	Solve Any 1 out of 2

Program: Biotechnology		
Course Title: Bio-business & Entrepreneurship		Course Code: 20EBTE402
L-T-P: 3-0-0	Credits: 3.0	Contact Hours: 3 hours/week
ISA Marks:50	ESA Marks:50	Total Marks:100
Teaching Hours:40	Examination Duration:3 hrs	

Unit-I

1. Entrepreneurship

Concept of Entrepreneurship - Development of Entrepreneurship; Stages in entrepreneurial process; Role of entrepreneurs in Economic Development; Characteristics of successful Entrepreneur, Classification of Entrepreneurs, Myths of Entrepreneurship, Entrepreneurial Development models, Entrepreneurial development cycle, Problems faced by Entrepreneurs. Entrepreneurship in India: Small scale industries: Definition; Characteristics; Need and rationale. Objectives; Scope; Introduction to bio-business, from the Indian context, SWOT analysis of bio-business.

10 hours

2. Social Responsibilities of Business

Meaning of Social Responsibility, Social Responsibilities of Business towards Different Groups, Social Audit, Business Ethics and Corporate Governance Institutional Support for Business Enterprises: Introduction, Policies & Schemes of Central Level Institutions, State Level Institutions.

05 hours

Unit-II

3. Entrepreneurship opportunity in biotechnology

Business opportunity, Essential requirement, marketing strategies, schemes, challenges and scope-with case studies on entrepreneurship opportunities in different domains of Biotechnology (Agri biotechnology, industrial Biotechnology, food biotechnology, Biopharma, Nutraceuticals. etc).

05 hours

4. Project management, technology management and startup schemes

Meaning of Project; Project Identification; Project Selection; Project Report; Need and Significance of Report; Contents; Formulation; Guidelines by Planning Commission for Project report; Network Analysis; Errors of Project Report; Project Appraisal. Identification of business opportunities: Market Feasibility Study; Technical Feasibility Study; Financial Feasibility Study & Social Feasibility Study.

10 hours

Unit-III

5. Startup Schemes

Building Biotech business challenges in Indian context-biotech partners (BIRAC, DBT, Incubation centers. Etc.), operational biotech parks in India. Indian Company act for Bio business-schemes and subsidies. Patent expiry and Entrepreneurship opportunity, Principles of Technology leasing, licensing and transfer, Business incubation support schemes, Successful startups-case study.

05 hours

6. Funding Opportunities

Startup schemes in Indian government Sources of Funding for startups. Crowd funding, Self-funding, Venture Capitalists, Angel Investment. Banking support for startup business. Types of companies: Sole proprietorship company, Partnership company, Private Limited, Limited company etc.

05 hours

Text Books:

1. Principles of Management – P. C.Tripathi, P.N. Reddy – Tata McGraw Hill,
2. Entrepreneurship Development - S.S.Khanka - S.Chand & Co.
3. Project Management by Sahni, Ane Books.

Reference books

1. Management Fundamentals - Concepts, Application, Skill Development - Robers Lusier - Thomson
2. Project Management for Business & Technology, Nicholas, PHI.

Scheme for End Semester Assessment (ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter numbers	Instructions
I	3 Questions to be set of 20 Marks Each	1,2	Solve Any 2 out of 3
II	3 Questions to be set of 20 Marks Each	3,4	Solve Any 2 out of 3
III	2 Questions to be set of 20 Marks Each	5,6	Solve Any 1 out of 2

Program : Architecture		
Course Title: Elective – Vernacular Architecture		**Course Code: 15AATE201**
L-S-P: 0-2-0	**Credits: 2**	**Contact Hours: 2**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hours: 32	**Examination Duration: NA**	

UNIT I:

Introduction and Definitions.

Review of Vernacular Architecture in different parts of India in context to the Lifestyle and culture, House forms, climate, materials and construction techniques prevailing in these regions.

UNIT II:

Study of Vernacular styles of North and North East, North West, South India.

UNIT III:

Case study and documentation

Case study of a house form to collect data regarding lifestyle and culture, climate, materials, construction techniques and documentation of the same.(1field,book or net study)

Note – assignments, Seminars and a portfolio of the documentation of case study for evaluation.

Text Books:

NIL

Reference Books:

1. Paul Oliver (Ed), Encyclopedia of Vernacular Architecture of the world, vol 1,2,3,
2. Fletcher Bannister: History of Architecture
3. Rappoport Amos: History and Precedent of Environmental Design
4. Rappoport Amos: House Form and Culture
5. Rappoport Amos: Meaning of the built environment
6. Paul Oliver (Ed), Encyclopedia of Vernacular Architecture of the world, vol 1,2,3, Cambridge University press,Cambridge, 1977.
7. Bernard Rudofsky Architecture without architects.
8. Paul Oliver: Dwellings. Cambridge University press, Cambridge, 1977.
9. Galion and Eisner, 'Urban Pattern': City planning and Design. Ed, Van Nostrand Reinhold, New York, 1986.

Scheme for Semester End Examination (ESA)

Term work. Documented measure drawing portfolio

Program : Architecture		
Course Title: Elective – Photography		**Course Code: 15AATE202**
L-S-P: 0-2-0	**Credits: 2**	**Contact Hours: 2**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hours: 32	**Examination Duration: NA**	

UNIT I:

1. Introduction

a. Introduction to Architectural Photography
b. Theory of Photography
c. Understanding Light, aperture, Shutter speed and ISO
d. Types of Camera, Lens, and other accessories.

UNIT II:

2. Composition.

a. Understanding composition like rule of third, S- curve, balance etc..
b. Shooting Out-doors and In-doors
c. Colour management and post editing using software's
d. Camera Tricks to create special effect photography.
e. Analysis of Photographs.

UNIT III:

3. Documentation of Architectural buildings and interiors

a. Importance and use of architectural journalism
b. Documentation methods.
c. Presentation and compilation of Images and text.
d. Printing.

Text Books:

NIL

Reference Books:

1) Better photography monthly magazine
2) Basic photography for dummies

Scheme for Semester End Examination (ESA)

Assignments, Checking of Portfolio of Term Work / Viva.

Program : Architecture		
Course Title: Elective – Space, Culture & Architecture		**Course Code:** 15AATE203
L-S-P: 0-2-0	**Credits: 2**	**Contact Hours: 2**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hours: 32	**Examination Duration: NA**	

UNIT I:

Introduction to Space, Culture & Architecture

Sociological theories and cultural theories in relation to architecture Critical thinking – its basis and intent

UNIT II:

Study and analysis of few Important Architectural Spaces of Cultural Significance

Study and Documentation of Cultural Landscape.

UNIT III:

Research Paper on Space, Culture & Architecture

Text Books:

NIL

Reference Books:

1) J Habraken *Sociologic of space*
2) Rappopport Amos*: House Form and Culture*

Program: Architecture		
Course Title: Elective – Digital Rendering		**Course Code: 17AATE204**
L-T-P:0-0-1	**Credits: 1**	**Contact Hours: 2**
ISA Marks:50	**ESA Marks:50**	**Total Marks:100**
Teaching Hours:28	**Examination Duration: NA**	
Unit I **Digital Rendering Techniques** Rendering techniques of plans, elevations & sections using digital tool.		
Unit II **Detail Rendering** Adding details like human figures, furniture, trees, vehicles etc.		
Unit III **Publish to various media** Various print and web file formats		
Text Books		
Reference Books: Online tutorials		

Scheme for Semester End Examination (ESA)

Assignments, Checking of Portfolio of Term Work / Viva.

Program : Architecture		
Course Title: Elective – Space Making		**Course Code:** 15AATE205
L-S-P: 0-2-0	**Credits: 2**	**Contact Hours: 2**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hours: 32	**Examination Duration: NA**	

UNIT I:

Introduction to different space making elements.

Understanding and appreciating different space perceptions.

UNIT II:

Study and analysis of few Important Architectural Spaces with different parameters

UNIT III:

Understanding contemporary approaches in space making.

Understanding of the term space formation and its importance in Architecture.

Text Books:

Nil

Reference Books:

1) Space making elements by Yatin Pandya.
2) J Habraken *Sociologic of space*

Program : Architecture		
Course Title:Elective-Sustainable Development of Living CulturalHeritage		**Course Code: 15AATE301**
L-S-P: 0-2-0	**Credits: 1**	**Contact Hours: 2**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hours: 32	**Examination Duration: NA**	

UNIT I:

Definition of Cultural Heritage ,Cultural Landscape, Monuments & site(UNESCO operational guidelines)

Documentation of the Heritage Site

Need for conservation of living cultural heritage sites .

Values & Ethics in heritage conservation

Charters

UNIT II:

Mapping

Analysis

Draft Proposals and report

UNIT III:

Final proposal and report

Text Books:

NIL

Reference Books:

1. Bernard Rudofsky, *Architecture without Architects* .a short introduction to Non-Pedigreed Architecture. Academy Edition London
2. Enrico Guidon,*Primitive Architecture*
3. Christian NorbergShulz, *Genius Locii*
4. Alexander Christopher *;Urban Pattern*
5. Alexander Christopher*: Timeless way of Building*

6. Feilden Bernard, *Guidelines for Conservation ,A technical manual* 7. *Jacobs,J* (1961) The Death and Life of Great American Cities, NewYork,Random House. 8. *Lynch,K* (1981) A Theory of Good City Form, MIT Press 9. UNESCO Operational Guidelines 2012 10. UNESCO Nomination Dossier manual 2012 11.UNESCO paper series
Website: *ICOMOS* , ICCROM , UNESCO
Project Report,,Place Making " A Synthesis of Professional Practice & Case studies about better living Environment , RUDI (Resource of Urban Design Information)

Scheme for Semester End Examination (ESA)

Checking of Portfolio of Term Work / Viva

Program : Architecture		
Course Title:Elective-ADVANCE COMPUTERS - I		**Course Code: 15AATE302**
L-S-P: 0-1-0	**Credits: 1**	**Contact Hours: 2**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hours: 32	**Examination Duration: NA**	

UNIT I:

1. Introduction Raster and Vector graphics.
2. Introduction color modes and pixels.
3. Introduction typography, animation, video and sound.

UNIT II:

1. Introduction Adobe indesign software
2. Page layout tools and commands in adobe indesign software

UNIT III:

1 Interactive tools commands in adobe indesign software

1. Various export file formats

Text Books: Nil

Reference Books:

Online tutorials

Scheme for Semester End Examination (ESA)

Checking of Portfolio of Term Work / Viva

Program : Architecture		
Course Title:Elective-Productive landscape		**Course Code: 15AATE303**
L-S-P: 0-1-0	**Credits: 1**	**Contact Hours: 2**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hours: 32	**Examination Duration: NA**	

UNIT I:

- Introduction to different types of productive landscape in interior and exterior spaces of building.
- Study of Different methods of productive landscape.
- Basics of different types of grow mediums, soil and plants.

UNIT II:

- Maintaining, pest and disease control of plants
- Water management and Fertilizers for the good health and food production of plants
- Organic and sustainable methods of growing plants in small spaces

UNIT III:

- Introduction to vertical farming.
- Literature and Case study.

Text Books: Nil

Reference Books:

1. Blane Alan, Landscape Construction and detailing B T Batsford Ltd, London 1996.
2. Laurie, Michael, An introduction to Landscape, II Ed, Prentice Hall, New Jersey, 1986

Website:

Project Report

Scheme for Semester End Examination (ESA)

Checking of Portfolio of Term Work / Viva

Program : Architecture		
Course Title:Elective- Hands on workshop		**Course Code: 15AATE304**
L-S-P: 0-1-0	**Credits: 1**	**Contact Hours: 2**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hours: 32	**Examination Duration: NA**	

UNIT I:

- Introduction to different types of hands on projects
- Case study and literature study of the selected project.
- Data collection and material study of the project.

UNIT II:

- Development and execution of the project with hands on experience.
- Continual development and real time design and material application on scaled models and life scale models.

UNIT III:

- Hands on execution with improvements and Documentation of the project from start to finish.

Text Books: Nil

Reference Books:

1. Ching, Francis DK, Architecture: Form, Space and Order, 2nd ed.VanNostrand Reinhold, New York, 1999
2. Visual Intelligence: How We Create What We See by Donald D. Hoffman (Author) Publisher: W W Norton & Co Ltd; New Ed edition (29 Feb 2000)
3. Building Construction Hand book:By R Chudly& R Greeno,BullerworthHeinemann,New-Delhi.

Website:

Project Report

Scheme for Semester End Examination (ESA)

Checking of Portfolio of Term Work / Viva

Program: Architecture		
Course Title: Elective - DIGITAL 3D		Course Code: 15AATE305
L-T-P 0-0-2	Credits: 2	Contact Hours: 28
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hours: 28 hrs	Examination Duration: 2hrs	
Unit I 1. Understanding the Basics of Rhino 2. Working with the tools for design 3. Basic modeling using tools in Rhino		
Unit II 1. Understanding the Basics of Grasshopper 2. Working with the tools for design 3. Basic modeling using tools in Grasshopper 4. Simulating Rhino design with Grasshopper		
Unit III 1.Presenting the modeled design using the software knowledge		
Text Books - NIL		
Reference Books: - NIL		

Scheme for Semester End Examination (ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter numbers	Instructions
I	8 designs of Rhino models	1	To be completed in class hours
II	8 designs of Grasshopper models	2	To be completed in class hours
III	8 simulation designs	3	To be completed in class hours

Program: Architecture		
Course Title: Elective – Architecture Film Making - I		Course Code: 15AATE407
L-T-P:0-0-1	Credits: 1	Contact Hours: 2
ISA Marks:50	ESA Marks:50	Total Marks:100
Teaching Hours:32	Examination Duration: NA	

Unit I

Film Pre-production

Introduction to Architectural film making concepts, story board, screenplay and planning.

Unit II

Film Production

Introduction to video shooting using various devices.

Unit III

Film Post-Production

Video post-production techniques like editing, titles, sub titles, narration and rendering.

Text Books

Reference Books: Online tutorials

Scheme for Semester End Examination (ESA)

Assignments, Checking of Portfolio of Term Work / Viva.

Program : Architecture		
Course Title: SUSTAINABLE DEVELOPMENT OF LIVING HERITAGE-II		**Course Code: 15AATE408**
L-S-P: 0-2-0	**Credits: 2**	**Contact Hours: 2 hrs.**
ISA Marks: 50 marks	**ESA Marks: 50 marks**	**Total Marks: 100**
Teaching Hours: 32	**Examination Duration: NA**	

UNIT I:

Definition of Cultural Heritage, Cultural Landscape, Monuments & site (UNESCO operational guidelines)
Documentation of the Heritage Site
Need for conservation of living cultural heritage sites.
Values & Ethics in heritage conservation
Charters

UNIT II:

Mapping
Analysis
Draft Proposals and report

UNIT III:

1. Final proposal and report

Text Books: Nil

References :
Nil

Scheme for Semester End Examination (ESA)

Assignments, Checking of Portfolio of Term Work / Viva.

Program : Architecture		
Course Title: Transit Oriented Development		**Course Code: 15AATE409**
L-S-P: 0-2-0	**Credits: 2**	**Contact Hours: 2 hrs.**
ISA Marks: 50 marks	**ESA Marks: 50 marks**	**Total Marks: 100**
Teaching Hours: 32	**Examination Duration: NA**	

Course contents:

Unit-I:

Introduction to Transit Oriented Development

Theories and Principals of TOD

Examples of TOD

Unit-II

Study, Analysis and Design of an identified area along a transit Corridor using Principles of TOD and Infrastructure

Unit-III

Research Paper on any one principal or component of Transit Oriented Development

Sessional Work (Internal semester assessment)

Assignmnets

Scheme for Semester End Examination (ESA)

Assignments, Checking of Portfolio of Term Work / Viva.

Mode of assessment:

Checking of Portfolio of Term Work / Viva

References:

Nil

Program : ARCHITECTURE		
Course Title: ARCHITECTURAL LIGHTING		**Course Code: 15AATE410**
L-S-P: 0-2-0	**Credits: 2**	**Contact Hours: 2**
CIE Marks: 50	**SEE Marks: 50**	**Total Marks:**
Teaching Hours: 32	**Examination Duration:**	

UNIT I:

1. The history of architectural lighting
2. Basics of Lighting Design
3. Terminology and units
4. Types of Light and light sources
5. Control gear and control equipment

UNIT II:

6. Light – Qualities and features
7. Controlling light
8. Luminaries
9. Lighting design
10. Lighting design and analysis tools

UNIT III:

8. Exercise: Design of Lighting for a sample space.

Text Books: NIL

Reference Books:

- Handbook of Lighting Design by RudigerGanslandt and Harald Hofmann
- Lighting Design Basics by Mark Karlen
- Designing With Light: The Art, Science and Practice of Architectural Lighting Design by Jason Livingston.
- The Architecture of Light (2nd Edition): A textbook of procedures and practices for the Architect, Interior Designer and Lighting Designer.

Program : Architecture		
Course Title: ELECTIVE-Architecture and Human Behavior		**Course Code: 15AATE502**
L-S-P: 0-18-0	**Credits: 2**	**Contact Hours: 24**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hours: 384	**Examination Duration: Nil**	

Course contents:

UNITI:

IntroductiontoBehavioralandEnvironmentalPsychology.

EvolutionofHumanBehavior.

InteractionofManandenvironment,Manandbuiltformsandstudyofpsychologyofspaces.

Methodsandprocessofstudyinghumanpsychologyinthecontextof Architecture.

UNITII:

TheHuman–NatureinterfacethroughthemediumofBiophilicDesign.

NatureinSpace–StudyofVisualConnectionwithNature,Non-VisualConnectionwithNature,Non-Rhythmic SensualStimuli,Thermal/AirflowVariability,PresenceofWater,DynamicandDiffusedLight,ConnectiontoNatural Systems.

NaturalAnalogues–StudyofBiomorphicformsandPatterns,MaterialConnectiontoNature,ComplexityandOrder

NatureoftheSpace–StudyofProspect,Refuge,Mystery,Risk/Peril

UNITIII:

BuildingSystems

Roomuse,geometry&meaning,hiddenbehavioralassumptions,adjacencies,verticalbypass &horizontalbypass,variousstagesinthedesignofbuildingsubsystems.

Building–BehavioralInterface

Geometryofspaces,theirmeaning&connotations,Socialorganizationofbuildings, Behavioralassumptionsintheplanningofnewtownsandneighborhoods,borrowedspace.

BehavioralDesign

Processorganizationchart,affinitymatrices,pictograms:behavioraldesignprocessmodel, designcontext,activity/adjacencyrelationship,evaluationchart,Areausefrequency program,simultaneoususe,communityutilizationmap,occupancyloadprofile,defensible space,EDRAetc.,

UrbanEnvironment

Patternsofactivityintimeandspace,theecologyofaneighborhoodparkandplayground, cross-culturalissues,social&psychologicalissuesintheplanningofnewtowns, environmentalperceptionsandmigration,awarenessandsensitivitytoopenspaces, environmentalcognition.

Mode of assessment : Stage wise reviews **(**internal and external) for ISA and External Jury for ESA

TextBooks:

1.Burnette,C.(1971).Architectureforhumanbehaviour.PhiladelphiaChapter:AIA.
2.Canter,D.andLee,T.(1974).Psychologyandthebuiltenvironment.NewYork:HalsteadPress.
3.Christopher,A.etal.(1977).APatternLanguage.NewYork:OxfordUniversityPress.
4.Clovis,H.(1977).BehaviouralArchitecture.McGrawHill.
5.Lynch,K.(1973).Theimageofacity.Cambridge:MIT._
6.Sanoff,H.(1991).VisualResearchMethodsinDesign.NewYork:JohnWiley&Sons._
7.Zeisel,J.(1984).Enquirybydesign:ToolsforEnvironment-BehaviourResearch.Cambridge: CambridgeUniversityPress.
8.Zeisel,J.andEberhard,J.P.(2006).InquirybyDesign-Environment/Behaviour/Neurosciencein Architecture,Interiors,LandscapeandPlanning.NewYork:W.W.Norton&Company.
9:EvolutionandHumanBehaviour:DarwinianPerspectivesontheHumanConditionbyJohnCartwright

Reference:

1:BuiltEnvironmentPsychology:AcomplexaffairofbuildingsanduserbyMr.SafiullaKhan,IntegralUniversity,India.

2:ArchitecturalPsychology–STJanitius,St.John'sCollege,Bangalore

3:SpacesofSocialInfluencebyAnnaPGawlikowska

4:PsychologyofArchitecturebyW.BroVictorGPopow
5:BehavioralArchitecture–SPAVijaywada

Program : ARCHITECTURE		
Course Title: DOCUMENTATION AND TECHNICAL WRITING		**Course Code: 15AATE505**
L-S-P: 0-2-0	**Credits: 2**	**Contact Hours: 2**
CIE Marks: 50	**SEE Marks: 50**	**Total Marks: 100**
Teaching Hours: 32	**Examination Duration:**	

Course contents:

UNIT I:

Documentation and Technical Writing

Introduction to Documentation And Technical Writing

Various process of Documentation media or technique

Monographs and Magazine Formats

UNIT II:

Effective Writing Skills

Dissertation / Thesis Report Writing

Compiling of Ideas and Thoughts generated during Design Process

UNIT III:

Research Paper / Article

Research paper / Article on any architect showcasing his design philosophy and architectural works

Scheme for Internal semester assessment(ISA)

Assignments in the form of Portfolio.

Scheme for Semester End Assessment (ESA)

Term work Evaluation

Mode of Assessment: Field work attendance , Assignment

Text Books:NIL

Reference : NIL

Program: Architecture		
Course Title: Elective – Adobe Illustrator		**Course Code: 15AATE506**
L-T-P:0-0-1	**Credits: 1**	**Contact Hours: 2**
ISA Marks:50	**ESA Marks:50**	**Total Marks:100**
Teaching Hours:28	**Examination Duration: NA**	

Unit I

Graphic Designs
Create everything from gorgeous print, web and mobile graphics to logos, icons, brochures, flyers, posters etc.

Unit II

Typographic Designs

Design typographic designs and add effects, manage styles, and edit individual characters

Unit III

Publish artwork to various media
Publish illustrations anywhere, including printed pieces, presentations, websites, blogs, and social media.

Text Books

Reference Books: Online tutorials

Scheme for Semester End Examination (ESA)

Assignments, Checking of Portfolio of Term Work / Viva.

Program:		
Course Title: Elective -Art Appreciation		**Course Code:** 18AATE201
L-S-P: 0-2-0	**Credits: 01**	**Contact Hours:02**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hours: 02	**Examination Duration: NA**	

Unit I

Various art forms

Scope in the various works of arts

Unit II

Analysis & aesthetic judgment

Expression of individual /society values

Unit III

Personal reaction to works in the art

Text Books: NA

Reference Books:

1. Books on architectural Design
2. *Architectural Periodicals*
3. *Art Periodicals*

Program : Architecture		
Course Title: Elective – Human Centered Design - I		**Course Code: 18AATE202**
L-S-P: 0-1-0	**Credits: 1**	**Contact Hours: 2**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hours: 32	**Examination Duration: NA**	

Course contents

Understanding Design as a very old human capability that has been forgotten by the mainstream educational system and traditionalist alike. A modern human activity that can help the products, services and policies of the future within the constraints of our contexts.

UNIT I:

What is Design? Multiple Dimensions of Design, Processes and Applications What is Human Centered Design? 1 Looking: Observing Human Experience 2 Understanding: Analyzing challenges and opportunities 3 Making: Envisioning Future Possibilities

UNIT II:

HCD to identify problem.

UNIT III:

Field Work, Define, Ideate, Prototype (Concept design, Detailed Design) ,Test, Feedback

Scheme for Internal semester assessment (ISA)

Field work Ideation, Concept design, Final Design Periodic reviews presentations of finding , concerns, Development stage of product and justification

Scheme for End Semester Assessment (ESA)

Final Report Prototype design

Mode of assessment :

Field work attendance

Assignment

Text Books:NIL

Reference Books:

1. Harold Nelson: The Design Way Intensions /Compositions/Value
2. John Heskett :Toothpics and Logos
   Objects/Communication/Environments/Identities/Systems/Contexts/Future
3. Klaus Krippendorff:The Semantic Turn ,Meaning of Artifact in :Use/Language/Life Cycle/Ecology

Program:		
Course Title: Elective –ARCHITECTUTAL PAINTING		**Course Code:** 18AATE206
L-S-P: 0-2-0	**Credits: 01**	**Contact Hours:02**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hours: 02	**Examination Duration: NA**	

Unit I

Nature and Object: Study of two or three natural and geometric forms in pencil with light and shade from a fixed point of view. Natural forms like plants, vegetables, fruits and flowers, etc., are to be used. Geometrical forms of objects like cubes, cones, prisms, cylinders and spheres should be used.

Unit II

Painting Composition:

Simple exercises of basic design in variation of geometric and rhythmic shapes in geometrical and decorative designs and colours to understand designs as organised visual arrangements.

Unit III

Portfolio Assessment:

Five selected nature and object study exercises in any media done during the session including minimum of two still life exercises.

Text Books: NA

Reference Books:

1) **Heritage of Indian Art.-Dr.Vasudevsharan Agarwal.**
2) **Hindustani Masavri- Dr.AnisFarooqi**

2015-16

15ECAP706	Rich Internet Application Lab.

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Program: MASTER OF COMPUTER APPLICATIONS		
Course Title: Rich Internet Applications Lab.		**Course Code: 15ECAP706**
L-T-P : 0-1-1	**Credits: 2**	**Contact Hours: 4 hrs**
CIE Marks: 80	**SEE Marks: 20**	**Total Marks: 100**
Teaching Hours: 48hrs	**Examination Duration: 3Hrs.**	

1)a) Write the program which describes Boolean data type.
b) Write the program which describes integer, float and string data type.
c) Write the program for type casting of different data type

2) Find the biggest of 2 numbers.
Find the biggest of 3 numbers.
Check whether a number is positive or negative.
Find the biggest of two numbers using ternary operator.
Check whether the given number is odd or even.
Find the factorial of a number (while loop)
Reverse the digit (Use do while)
Find the sum of the digits (Use for loop)
Display the Fibonacci series for a particular limit.(Use for loop)
Check the given letter is vowel or not.
3) Create an associative array with book details and display it in a table.
Write a program to create an array and try with all array functions.
4) Find the length of a string
Create a form with one text field and submit buttons for string length, string, reverse, uppercase, lowercase, string replace . Display the result according to it.
5) Write a program of function passing a two values and add the two values in the function.
Write a program of function showing with return value.
Create a registration form which contains fields name, Roll No, Gender and a submit button. All the details should be displayed in the server page when the user clicks the submit button.
Write a program to check whether the given number is prime or not.
6) Create Cookie, store a value "Ram" in the cookie.
Write a program of Cookie showing expire of cookie
7) Write a program to display the contents of a file(use fread, fgets, fgetc)
Write a program to create a file and write contents to it
Write a program to append data to an existing file.

Write a program to upload a file and display the contents in server.

8) Write a program for cinema ticketing. All the age should be over 12 years, if less than,dont

allow to get ticket.(apply the exception handling

9) Write a PHP code to connect MySql Database.

Write a PHP code to select data,delete data and update data with MySqli.

Working with MVC framework(joomla) using PHP and MySql.

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2016-17	

15ECAP801	Software Design Lab

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Program: MASTER OF COMPUTER APPLICATIONS		
Course Code: **15ECAP801**	Course Title: **Software Design Lab.**	
L-T-P: **0-0-1**	Credits: **1**	Contact Hrs: **2**
ISA Marks: **80**	ESA Marks: **20**	Total Marks: **100**
Teaching Hrs: **24**		Exam Duration: **3 Hours**

1.SIMPLE PROGRAMS

Identify the various classes and attributes and bring out UML class diagram, and a sequence diagram.

1. Triangle of binary numbers

2. Triangle of numbers

3. Sum of series

4.Sorting string Keyboard input/Command line input

5. Average of *n* numbers

6. Prime number checking

7. Factorial - recursion

8. Fibonacci numbers – recursio

2. GRID LINES

Specification: Grid with two sets of horizontal and vertical lines using Rumbhaugh approach.

Write a java program to create a window and draw horizontal and vertical lines to form a grid.

High level design: Define a subclass of Fram class and draw horizontal parallel linesand vertical lines to form the grid. Create an object of this class and display it.

Detailed level design: user interface specifications: the window contains grid of horizontal and vertical lines.

For this we define a GUI class called Ruled derived from Frame class of java swing library.

Content of window: parallel vertical and horizontal lines are drawn inside the window to form the grid. use the print( ) to draw the grid.

3.GRID WITH TWO SETS OF DIAGONAL LINFS

a) Identify the various use cases and actors involved and represent the user view of the system.

b) Identify the various classes and attributes and bring out a class diagram, and a sequence diagram.

Write a program to create a window and draw two sets of diagonal parallel lines crossing each other. Device the following and then implement.

(a) High level design

(b) Detail level design

(c) User interface specification.

4. OOA AND OOD USING UML-I

In the employee referral process, the HR head of the region where a vacancy exists informs employees of that region and other regional HR heads. The other regional HR heads inform employees by putting up a notice informing them about the vacancy. The employees send on their recommendations to the regional HR head of the region where a vacancy exists. The regional HR head then matches the skills of these candidates with the skills required for the vacant position and short lists them. An interview schedule is drawn up and the short listed candidates are informed. Based on the interview proceedings, interview details are updated and all the selected candidates are given offer letter. The candidate informs the HR (head where the vacancy exists) either by accepting or declining the offer letter. When a candidate referred by an employee joins the organization, the employee who has referred the candidate is paid a bonus.

a) Identify the various use cases and actors involved and represent the user view of the system.

b) Identify the various classes and attributes and bring out a class diagram, and a sequence diagram.

5. OOAAND OOD USING UML-II

UML class representation: Design and implement a student class with the following attributes:

i) Registration no. ii) Name of a student iii) marks in subject-l iv) marks in subject-2 v) marks in subject-3 vi) Total marks. The total of 3 subject marks must be calculated only when the student passes in all the 3 subjects. The pass marks for each subject is 50. If a candidate fails in anyone of the subjects his total marks must be declared as 0. Using these conditions write a constructor for this class. Write a method display Student ( ) to display the details of student object. In the main method create an array of 3 student objects and display the object details.

a) Identify the various use cases and actors involved and represent the user view of the system.

b) Identify the various classes. and attributes and bring out a class diagram, and a Sequence diagram.

6. OOA AND OOD USING UMLIII

Consider the student class defined in the problem 2. Assume that a student studies 6 subjects. Each subject has a title, passing minimum marks, and maximum marks. Design the class representation using UML notations and write a java program to define student class including the subject as attribute. Design specifications: A student studies 6 subjects. Each subject has a subject code, title, passing minimum marks, maximum marks. The following table shows the sample data:

Subject code	Title	Passing Min	Max. Marks
CS401	java prog.	50	100
CS406	ASW lab	18	50
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You must first define a class called subject. For every student there is an array of 6 subjects. Since every student in this example will study only the same subjects, we declare it as static. The student class will have the following attribute: Registration no., name, subject array, marks array, result array, and total.

a) Identify the various use cases and actors involved and represent the user view of the system.

b) Identify the various classes and attributes and bring out a class diagram, and a sequence diagram.

7. OOA AND OOD USING UML-IV

A class called Television has the following attributes: 1) Make 2) Screen Size 3) Purchase Date 4) Color/B&W. Define a class television. Define a method for displaying the attribute values of a T. V. Represent this problem specification using UML class notations and write a Java program for the same. The television class should be designed with the required attributes. The main method should be written to test methods of television class. For example display TV ( ) method may be used to print the attributes of television class.

a) Identify the various use cases and actors involved and represent the user view of the system.

b) Identify the various classes and attributes and bring out a class diagram, and a sequence diagram.

8.SPECIFICATIONS: BANK INTEREST COMPUTATION

Consider the following attributes: P=Principal,R = rate of interest, N = number of years SI = simple interest A = amount

Design UML class called Deposit with the above five attributes. In the constructor, calculate interest (SI) and amount. Implement the above specification using Java Programming Language.

9. OOA AND OOD USING RAUMBHAG AND UML VI:

In a bank the customer opens an account and in that account he/she deposits money. So the entities are:

A customer can have several accounts and an account can be spent as a joint account by several customers. In the customer class, the address of the customer is constructed as an object of a class called Address. Write the UML class diagram consisting Customer class and Address class. In the Account class, there is an attribute called users. This is an integer attribute. It tells no. of users of the account. If the account is a joint account by 5 persons, the value of users = 5. If it is a single user account, users = 1.

Write the UML class diagrams for account

The Account number is Longtype. Cust ( ) is an array of length = users. If the users = 5, Cust( ) is of length 5. Another attribute of the Account is an object of Deposit class. Write the UML class diagram for Deposit.

Test case:

Object	User id	Fname	Lname	DOB	Add	Phone no
name						

Address:

Object	Street	City	State	Country	Pin code
Name					

Deposit: Principle P = ?No. of years *n* = ?Rate of interest =?

Account: Account object: al

AccountNo:

Customer object:

No. of users:

Deposit object: dl

Sample Output

AccountNo:

Customer ID:

First Name:

Last Name:

DOB:

Address:

Phones:

Customer ID:

First Name:

Last Name:

DOB:

Address:

Phones:

No of users:

Deposit:

Principle:

Rate of interest:

No of years:

Simple interest:

Amount:

10. OOA AND OOD USING BOOCH AND UML-VII

Consider the object COLLEGE of Mini project. For the entire given specifications in the problem construct the following UML diagrams.

Specifications: In a college of Computer Science there are computer laboratories and equipments. Develop a system to Create the college as an object and display the contents.

(1) Class diagram(2) Object diagram(3) Interaction diagrams (4)Sequence & b)Collaboration (5) Deployment diagram.

11. OOA AND OOD USING UML VIII

C library information system:

A library lends books and magazines to members, who are registered in the system. Also, it handles the purchase of new titles for the library. Popular titles are bought in multiple copies. Old books and Magazines are removed when they are out of date or in poor condition. A member can reserve a book or magazine that is not currently available in the library, so that when it is returned or purchased by the library, that person is notified. The library can easily create, replace and delete information about the titles, members, loans and reservations in the system.

For the above problem specification devise the following UML diagrams:

1. Use case diagram 2. Class diagrams 3. State transition diagram 4. Sequence diagram 5. Collaboration diagram 6. Activity diagram 7. Component diagram 8. Deployment diagrams

12.OOA AND OOD USING UML IX

Develop the product using java programming Language. Write UML diagram for Railway Reservation System. Develop the product using java programming language. and devise the following UML diagrams:

1. Use case diagram 2. Class diagrams 3. State transition diagram 4. Sequence diagram 5. Collaboration diagram 6. Activity diagram 7. Component diagram 8. Deployment diagrams

EvaluationScheme

1. **In Semester Assessment (ISA) : Continuous Internal Assessment for 80 Marks.**

2. **End Semester Assessment (ESA) for 20 Marks.**
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15ECAE901	Internet of Things

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Program: MASTER OF COMPUTER APPLICATIONS		
Course Code: **15ECAE901**	Course Title: **Internet of Things**	
L-T-P:**3-0-1**	Credits: **4**	Contact Hrs: **5**
ISA Marks-Theory: **50** +Lab: **100**	ESA Marks: **50**	Total Marks: **200**
Teaching Hrs: **50+ 24**		Exam Duration: **3 Hours**

No	**Content**	**Hrs**
	Unit I	
1	**Chapter No. 1.Introduction to Internet of Things (IoT)** Definition & Characteristics of IoT, Physical Design of IoT: IoT protocols, Logical Design of IoT: IoT functional blocks, communication models and APIs.	**6 Hrs**
2	**Chapter No. 2. IoT Enabling Technologies** Wireless Sensor Networks, Cloud Computing, Big Data Analytics, Communication Protocols, Embedded Systems, IoT Levels and Deployment Templates.	**7 Hrs**
3	**Chapter No. 3. Domain specific IoTs** Home Automation ,Cities, Environment ,Energy, Retail, Logistics, Agriculture, Industry ,Health and Lifestyle	**7 Hrs**
	Unit II	
4	**Chapter No. 4. IoT Platforms Design Methodology** IoT Design Methodology, Case Study on IoT System for Weather Monitoring.	**5 Hrs**
5	**Chapter No. 5. IoT systems – Logical design using Python** Introduction to Python, Data types, data structures, Control of flow, functions modules, packages, file handling, data/time operations, classes, Python packages - JSON, XML, HTTPLib, URLLib, SMTPLib.	**8 Hrs**
6	**Chapter No. 6. IoT Physical Devices and Endpoints** Basic building blocks of an IoT device, Exemplary device: Rasyberry Pi, interface (serial, SPI, I2C), Programming Rasyberry Pi with Python.	**7 Hrs**
	Unit – III	
7	**Chapter No. 7. IoT Physical Servers & Cloud Offerings** Introduction to Cloud Storage models and communication APIs ,Webserver – Web server for IoT, Cloud for IoT, Python web application framework, Designing a RESTful web API	**5 Hrs**

8	**Chapter No. 8. Case Studies Illustrating IoT Design** Home Automation-smart lighting, home intrusion detection, Cities-smart parking.	**5 Hrs**

Text Book:

1. Arshdeep Bahga and Vijay Madisetti, "Internet of Things - A Hands-on Approach", Universities Press, 2015

References:

1. Matt Richardson & Shawn Wallace, "Getting Started with Raspberry Pi", O'Reilly (SPD), 2014

IoT Practices

Expt No.	***Brief description about the experiment***	***Slots***
	DEMONSTRATION	
1	Introduction to preparing the OS for Raspberry Pi	1
2	Introduction to Shell basic for Raspberry Pi	
3	Introduction to GPIO Input/output	1
4	Introduction GPIO using Python	1
5	Introduction to Python and SPI	1
	EXERCISE	
6	Creating a Shell scripts for Hook up circuit.	1
7	Implementing PHP and AJAX Calls.	1
8	Working with SPI Protocol.	1
9	Creating Web interface for ADC	1
10	Creating GPIO using Python	1
11	Working with SPI using Python	1
	STRUCTURED ENQUIRY	

12	Design and Develop flow control using Raspberry pi kit	2

Evaluation Scheme

1. Assessment

Assessment	Theory	Lab.
ISA- 1	25	100
ISA- 2	25	
ESA	50	00
Total	**100**	**100**

2. End Semester Assessment (ESA) Pattern:

UNIT	8 Questions to be set of 20 Marks each	Chapter Nos.	Instructions
I	3 Questions to be set of 20 Marks Each	1,2	Any 2 questions are to be answered
II	3 Questions to be set of 20 Marks Each	3,4	Any 2 questions are to be answered
III	2 Questions to be set of 20 Marks Each	5	Any 1 question is to be answered

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15ECAC711	PHP Programming

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Program: MASTER OF COMPUTER APPLICATIONS		
Course Code: **15ECAC711**	Course Title: **PHP Programming**	
L-T-P: **4-0-0**	Credits: **4**	Contact Hrs: **4**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs: **50**		Exam Duration: **3 Hours**

No	Content	Hrs

	Unit I	
1	**Chapter No. 1- Introducing PHP** History, Unique features, Basic development concepts , Creating your first PHP script, Writing & running the script, Understanding the scripts , Handling script errors	**4 Hrs**
2	**Chapter No. 2- Using variables & operators** Storing data in variables, Understanding PHP's data types, Setting & checking variable data types, Using constants, Manipulating variables with operators, Handling form input	**4 Hrs**
3	**Chapter No. 3- Controlling Program Flow** Writing Simple Conditional Statements, Writing More Complex Conditional Statements , Combining Conditional Statements, Repeating actions with loops, Working with string & numeric functions	**3 Hrs**
4	**Chapter No. 4- Working with Arrays** Storing data in Arrays, Processing arrays with loops & iterators, Using arrays with forms, Using arrays with forms, Working with array functions, Working with dates & times.	**5 Hrs**
5	**Chapter No. 5- Using functions & Classes** Creating user defined function, Creating classes ,Using Advanced OOP concepts	**4 Hrs**
	Unit II	
6	**Chapter No. 6. Working with Files & Directories** Reading files, Writing files , Processing directories , Performing Other files & directory operations	**8 Hrs**
7	**Chapter No. 7. Working with databases & SQL** Introducing databases & SQL, Using PHP MySQLi extension, Adding or modifying data, Handling errors , Using PHP's PDO extension, Building a Login form	**6 Hrs**
8	**Chapter No. 8. Working with XML** Introducing XML, Using PHP's Simple XML extension, Converting XML to SQL, Reading RSS feeds ,Using PHP's DOM extension, Recursively processing an XML document tree	**6 Hrs**
	Unit – III	
9	**Chapter No. 9.** Working with Cookies, Sessions & Headers Working with Cookies ,Cookie Basics , Cookie Attributes , Cookie Headers , Setting Cookies ,Reading Cookies , Removing Cookies, Working with Sessions , Session Basics , Creating Sessions and Session Variables , Removing Sessions and Session Variables, Using HTTP headers	**6 Hrs**
10	**Chapter No. 10.** Securing PHP Sanitizing Input and Output , Securing Data , Securing Configuration Files, Securing Database Access , Securing Sessions , Validating User Input, Working with Required Fields , Working with Numbers , Working with Strings , Working with Dates	**4 Hrs**

Text Books :

1. Vikram Vaswani, A Beginner's Guide PHP, Mc Graw Hill, 2009.

Evaluation Scheme

1. In Semester Assessment (ISA)

Assessment	Weightage in Marks
ISA- 1	20
ISA- 2	20
Assignments	10
Total	**50**

2. End Semester Assessment (ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter Nos.	Instructions
I	3 Questions to be set of 20 Marks Each	1,2,3,4,5	Any 2 questions are to be answered
II	3 Questions to be set of 20 Marks Each	6,7,8	Any 2 questions are to be answered
III	2 Questions to be set of 20 Marks Each	9,10	Any 1 question is to be answered

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15ECAP708	Web Services Lab

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Program: MASTER OF COMPUTER APPLICATIONS		
Course Code: **15ECAP708**	Course Title: **Web Services Lab.**	
L-T-P: **0-1-1**	Credits: 2	Contact Hrs: **4**
ISA Marks: **80**	ESA Marks: **20**	Total Marks: **100**
Teaching Hrs: **48**		Exam Duration: **3 Hours**

1) PHP

2) AJAX

1. XMLHttpRequest Object
2. Creating a request object
3. Sending a request to server
4. Receiving a response from the server

5. Ready State and Status of a request

3) JQUERY

6. Introduction and Installation
7. Syntax
8. jQuery Selectors
9. jQuery Events
10. jQuery Effects
    - i. jQuery Hide and Show Effect
    - ii. jQuery Fade Effect
    - iii. jQuery Slide Effect
    - iv. jQuery Animate

1. jQuery Callbacks
2. jQuery and HTML
    - i. jQuery Get
    - ii. jQuery Set
    - iii. jQuery Add
    - iv. jQuery Remove
    - v. jQuery css
    - vi. jQuery Width
    - vii. jQuery Height
3. jQuery and AJAX (Pre-Requisite: ServerEnd Technology)
    - i. AJAX Function
4. JQuery UI
    - i. Implementing Accordion
    - ii. Implementing Date picker
    - iii. Implementing Slider
    - iv. Implementing Progessbar
    - v. Implementing Tabs

4) HTML 5

1. Introduction
2. HTML5 New Elements
3. HTML5 Video
4. HTML5 Video/DOM
5. HTML5 Audio
6. HTML5 Drag and Drop
7. HTML5 Canvas
8. HTML5 SVG
9. HTML5 Canvas vs. SVG
10. HTML5 Geolocation

5) BOOTSTRAP

6) GOOGLE MAPS API

Evaluation Scheme

1. **In Semester Assessment (ISA) : Continuous Internal Assessment for 80 Marks.**
2. **End Semester Assessment (ESA) for 20 Marks.**

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16ECAC803	Python Programming

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Program: MASTER OF COMPUTER APPLICATIONS

Course Code: **16ECAC803**	Course Title: **Python Programming**	
L-T-P:**2-0-1**	Credits: **3**	Contact Hrs: **3**
ISA Marks-Theory: **50** +Practice: **100**	ESA Marks: **50**	Total Marks: **200**
Teaching Hrs: **42 + 24**		Exam Duration: **3 Hours**

No	Content	Hrs
	Unit I	
1	**Chapter No. 1.Getting started with Python, LANGUAGE AND ITS BUILT-INS**	**6 Hrs**
	Introduction to python – Installation - Python Interpreter – Interpreter and its environment. The Python Language - Object Oriented Python - Exceptions - Modules – Core Built-Ins - Regular Expression – Levels of Abstraction – Software Development Process. Programming Basics, Operators, Variables, Decision Statements, Functions, Classes and Objects, File Handling.	
2	**Chapter No. 2. LIBRARIES AND MODULES**	**6 Hrs**
	For loops, strings and tuples, using for loops, using sequence operators and functions with strings, indexing strings, string immutability, building a new string, slicing strings, tuples, Lists and dictionaries – using Lists, list methods, understanding when to use tuples and lists, nested sequences, shared references, dictionaries, hangman game. Functions, creating functions, parameters and return values, keyword arguments, default parameters, global variables, tic-tac-toe game. Threads.	
3	**Chapter No. 3. Database handling**	**4 Hrs**
	Database Connectivity Using Python: Working with DBM persistent Dictionaries, Working with Relational Databases: SQL statements, Defining Tables, Setting up a Database, Python database API's: Creating connections, Working with Cursors, Database Transactions, and Error Handling.	

Unit II

4 **Chapter No. 4. Working with XML** **6 Hrs**

Python with XML: Introduction to XML, Document Type Definitions, Schemas, HTML with XML, XML Libraries for Python: SAX, DOM.

5 **Chapter No. 5. NETWORK AND WEB PROGRAMMING** **6 Hrs**

Client side Network Protocol Modules – Socket and Server side Network Protocol Modules – CGI Scripting and Alternatives – MIME and Network Encodings.

6 **Chapter No. 6. EXTENDING AND EMBEDDING** **4 Hrs**

Extending and Embedding Classic Python – Extending and Embedding Jython – Distributing Extensions and Programs – Tkinter GUI Programming.

Unit – III

7 **Chapter No. 7. MVC with Python** **5 Hrs**

Introduction to Django: Introduction to Frameworks, MVC Design Pattern, Django Architecture, Basics of Dynamic Web Pages, Template System, Interacting with Databases.

8 **Chapter No. 8. Sound and Animation development** **5 Hrs**

Sound, animation and program development – reading keyboard, rotating a sprite, creating an animation, working with sound and music.

References:

1. Timothy A. Budd 'Exploring Python' – TATA McGRAW-HILL Edition – 2011
2. James Payne: Beginning Python, 1st Edition, Wiley India, 2010.
3. MIchael DAWSON, Python Programming, 3rd Edition, Course technology PTR, 2010

1. Assessment

Assessment	Theory	Lab.
ISA- 1	25	100
ISA- 2	25	
ESA	50	00
Total	**100**	**100**

2. End Semester Assessment (ESA) Pattern:

UNIT	8 Questions to be set of 20 Marks Each	Chapter Nos.	Instructions
I	3 Questions to be set of 20 Marks Each	1,2,3	Any 2 questions are to be answered
II	3 Questions to be set of 20 Marks Each	4,5,6	Any 2 questions are to be answered
III	2 Questions to be set of 20 Marks Each	7,8	Any 1 question is to be answered

Course project: In this course, group of 2 students will carry out project using Python.

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16ECAP803	Mini Project -1

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Program: MASTER OF COMPUTER APPLICATIONS

Course Code: **16ECAP803** Course Title: **Mini Project-1**

L-T-P: **0-0-3** Credits: **3** Contact Hrs: **3**

ISA Marks: **100** ESA Marks: **100** Total Marks: **200**

Teaching Hrs: **48** Exam Duration: **3 Hours**

Theme: "Development of Rich Internet Applications using Client and Server side Technology"

Rich Internet Applications engage users in ways never before imagined in technology. The advancement of technologies like XML, Windows Presentation Foundation (WPF), Adobe's Flash, and HTML5 has allowed for products to bring experiences to consumers that not only engage and inspire but also creates user interaction that simplifies technology use. Companies, whether in the consumer space or enterprise, can harness the power of what Rich Internet Applications offer by transforming traditionally static experiences into fluid, animated, and engaging applications.

Purpose:

- Developing rich reporting and analytics interfaces for enterprise-level information presentation.
- Developing cutting edge mobile applications that can be ported to multiple smart-phones without having to re-develop the application for each device.
- Developing animated experiences for consumers on the web.
- Cost-effectively modernizing existing application to appeal to new users.

Evaluation:

Students Assessment through CIE (80%) + SEE (20%)

Continuous Internal Evaluation	**Assessment**	**Marks**
	Problem Definition, Literature Review	10
	Synopsis and SRS Deliverables	10
	Design (Module wise algorithmic design)	20
	Coding	10
	Integration and testing	10

	Report	10
	Presentation skills and Viva-voce	10
	Total	**80**
Semester End Examination	Presentation	10
	Viva-voce	10
	Total	100

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16ECAP806	Mini Project-2

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Program: MASTER OF COMPUTER APPLICATIONS

Course Code: **16ECAP806** Course Title: **Mini Project-2**

L-T-P: **0-0-3** Credits: **3** Contact Hrs: **6**

ISA Marks: **100** ESA Marks: **100** Total Marks: **200**

Teaching Hrs: **72 approx.** Exam Duration: **3 Hours**

Theme: "Mini project Using Java"

Java is one of the fundamental programming languages that can be used in many applications as well as product developments. The simple reason for this is because Java can be put to use in various platforms due to its multi-platform nature. Java is one of the favorite choices for developers for many reasons like security, object oriented(reusability), cross platform computing, multithreaded capability, Rich API, Powerful development tools ,availability of various frameworks, Great collection of open source libraries, wonderful community support, Excellent documentation support. Support for various databases and many more.

Students can use the following tools in web and mobile applications as well as product developments:

- Struts, Spring, Hibernate and JPA
- JAXB and Apache Axis 2/Java
- JSP, Servlets, JDBC, EJB, JMS, JTA and JUnit
- Apache Tomcat, JBoss and GlassFish
- JavaScript, JSF, GWT and jQuery
- Eclipse, Netbeans and JBoss tools
- TestNG
- jBPM and Drools
- JCR

Objectives:

Help students to utilize and strengthen the knowledge of java which they have learnt in previous semester.

Methodology:

Students are asked to make a team of 3-4 members and can choose the different categories of projects like desktop applications, web applications, mobile application and distributed application and work once it is approved by the coordinator.

Assessment:

Students Assessment through CIE (80%) + SEE (20%)

Continuous Internal Evaluation	**Assessment**	**Marks**
	Problem Definition, Literature Review	10
	Synopsis and SRS Deliverables	10
	Design (Module wise algorithmic design)	20
	Coding	10
	Integration and testing	10
	Report	10
	Presentation skills and Viva-voce	10
	Total	**80**
Semester End Examination	Presentation	10
	Viva-voce	10
	Total	100

Course Objectives:

The Mini Project being part of the course work is not only a mechanism to demonstrate the abilities and specialization but also provides the opportunity to demonstrate originality, teamwork, inspiration, planning and organization in a software project. One can put into practice the techniques that have been taught throughout the previous courses. Mini-projects develop practical skills in students. The idea is to propose a problem that one might encounter in future career (be it in academia, industry, or government). Then propose a solution and implement it.

Theme: Java Based E-Commerce Applications with Multilingual Support

E-commerce Objectives:

Most business houses are shifting their operations to the online world. Right from buying apparels to computers to booking tickets and renting out apartments, everything can be done through the Internet now. It is a win-win formula for both the customers and the business houses. Digital India aims to boost E-business and the E-commerce industry with the vision that it would in turn boost the economy is a whole.

Multilingual Objectives:

Language is an essential driver of enterprise growth. The user interface is the key component of any application that needs to support various language speaking audiences. Making an app that appeals to and is available for more users broadens the market and brings more revenue in the app sales and there will be more exposure to the business.

***Evaluation*:**

- The project assessment is done by an evaluation team as per the schedule.

Guidelines for In Semester Assessment (ISA) Scheme

Phase wise distribution of marks	**Marks**
Identification and defining the problem	15
Software Requirement Specification	20
Software Design	15
Mid–way Implementation	10
Final Demo and Report Submission	20
Total	80

End Semester Assessment (ESA):

There will be a final presentation /demonstration//viva-voce at the end of the semester for 20 Marks

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16ECAE804	Web Content Management

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Program: MASTER OF COMPUTER APPLICATIONS

Course Code**: 16ECAE804**	Course Title: **Web Content Management**	
L-T-P:**3-0-1**	Credits: **4**	Contact Hrs: **5**
ISA Marks-Theory: **50** +Lab: **100**	ESA Marks: **50**	Total Marks: **200**
Teaching Hrs: **50 + 24**		Exam Duration: **3 Hours**

No	Content	Hrs
	Unit I	
1	**Chapter 1: What Content Management Is (and Isn't)**	**6 Hrs**
	What Is Content?, What Is a Content Management System?, Types of Content Management Systems, What a CMS Does, What a CMS Doesn't Do	
2	**Chapter 2 :Points of Comparison**	**7 Hrs**
	Target Site Type, Systems Versus Implementations, Platform Versus Product, Open Source Versus Commercial, Technology Stack, Management Versus Delivery, Coupled Versus Decoupled, Installed Versus Software-as-a-Service (SaaS), Code Versus Content, Code Versus Configuration, Uni- Versus Bidirectional Publishing, Practicality Versus Elegance, and the Problem of Technical Debt	
3	**Chapter 3 :Acquiring a CMS**	**7 Hrs**
	Open Source CMSs, Commercial CMSs, Software-as-a-Service, Build Your Own, Questions to Ask	
	Unit II	
4	**Chapter 4: The Content Management Team**	**7 Hrs**
	Editors, Site Planners, Developers, Administrators, Stakeholders	
5	**Chapter 5: CMS Feature Analysis**	**6 Hrs**
	The Difficulties of Feature Analysis, An Overview of CMS Features	
6	**Chapter 6 Content Modeling**	**7 Hrs**
	Data Modeling 101, Data Modeling and Content Management, Separating Content and Presentation, Defining a Content Model, Relationships, Content Composition, Content Model Manageability, A Summary of Content Modeling Features	
	Unit – III	
7	**Chapter 7 :Content Aggregation**	**5 Hrs**
	The Shape of Content, Content Geography, Aggregation Models: Implicit and Explicit, Aggregation Functionality, By Configuration or by Code, A Summary of Content Aggregation Features	
8	**Chapter 8 :Editorial Tools and Workflow**	**5 Hrs**
	The Content Lifecycle, The Editing Interface, Versioning, Version Control, and Version Labels, Dependency Management, Content Scheduling and Expiration, Workflow and Approvals, Collaboration, Content File Management, Permissions, A Summary of Editorial Tools	

Text Book:

1. "Web Content Management", Systems, Features, and Best Practices, Publisher: O'Reilly Media, March 2016.

WEB CONTENT MANAGEMENT SYSTEM – COURSE PROJECT

COURSE DESCRIPTION:

Today, many web publishers use content management systems (CMS) to allow them to instantly and dynamically update web pages and properties as new content becomes available so that every visit to a site is engaging, informative, and meaningful. The course project shall explore any one of the three most popular open source web-based content management systems—**WordPress, Joomla, and Drupal**—to create dynamic and flexible websites and landing pages. Students shall explore the fundamentals of planning dynamic websites, CMS database management, developing CSS-controlled site templates, and creating database-driven websites through the planning and creation of their own topic-based sites.

OBJECTIVES

- Introduce learners to any one of the three most popular open source content management systems (CMS) such as WordPress, Drupal, or Joomla.
- Create, deploy and Maintain websites using CMS, including creating and editing content, adding functionality, and creating custom templates and themes.

COURSE PROJECT TITLE: BUILDING WEBSITE USING CMS (JOOMLA / WORDPRESS OR DRUPAL)

To build website for any real world examples such as Corporate web sites or portals, Online magazines, newspapers, and publications, E-commerce and online reservations, Government applications, Small business web sites, Community-based portals, School, religious web sites or Personal or family homepages using popular Web Content Management System. The website shall facilitate to create, manage, store and deploy content on the Web, including text, graphics, video or audio as a part of Enterprise Content Management.

EXECUTION PLAN:

Sl.No	Demonstration	Implementation	Number of Slots
1.	**Introducing Content Management Systems** ○ An overview of some of the different tools and methods that today's web publishers are using to create highly-tailored dynamic web content. ○ Purchasing and configuring a domain name and web hosting.	1. Introduction to Joomla & Installation 2. Domain Name Registration & Configuration and Hosting 3. Create a Database 4. Content Preparation and Planning	02
2.	**Introduction to Joomla** ○ Explore the CAM model (Categories, Articles, and Menus) approach to creating content for Joomla environments. ○ Administration and management of users and media. ○ Installing Joomla ○ Exploring the Admin Interface ○ Content creation using the CAM	1. Write an article & put your articles in order with categories. 2. Customize Administrator's Panel 3. Change your website's look with Templates. 4. Expand your website's functionality with different extensions. 5. Content creation & Customization using the CAM model	02

	model o Content customization: images, video, audio, tags, formats, etc.			
3.	**Joomla Menus** o Creating and controlling menus for Joomla site. o To link to articles and create special menu items. o Adding and displaying menus o Linking menus to articles and other features	1. Categorize the articles which allow grouping your content better. 2. Create menu items for website.	02	
4.	**Extending Joomla –Plug-ins, Modules** o Use of Joomla, Plug-ins, Modules, Components and other extensions. o Installation of extensions, Finding and adding Joomla extensions o Adding and setting up 2 "big" extensions (choose blog, calendar, image gallery, Paypal-based shopping cart, or portfolio. Other extensions on approval)	Select Create Joomla Modules for the website such as Feed Display Module, Footer Module, Latest News Module, Search Module, Random Image Module, Who's Online Module etc.	02	
5.	**Custom Templates** o Explore the addition of creation and uses of customized Joomla templates o Modifying templates using CSS and HTML tricks.	Select and Customize template for website.	02	
6.	**User management and permissions** o Explore how to manage users in Joomla site, including managing who sees what based on login, as well as who can do what based on permissions assigned.	Control the use of Captcha, registration allowed and type of registration, default user group new users, reset password, and new user registration email notice to administration.	02	

Evaluation Scheme

1. Assessment

Assessment	Theory	Lab.
ISA- 1	25	100

ISA- 2	25	
ESA	50	00
Total	**100**	**100**

2. End Semester Assessment (ESA) Pattern:

UNIT	8 Questions to be set of 20 Marks Each	Chapter Nos.	Instructions
I	3 Questions to be set of 20 Marks Each	1,2,3	Any 2 questions are to be answered
II	3 Questions to be set of 20 Marks Each	4,5,6	Any 2 questions are to be answered
III	2 Questions to be set of 20 Marks Each	7,8	Any 1 question is to be answered

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16ECAE806	Cyber Security and Forensics

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Program: MASTER OF COMPUTER APPLICATIONS

Course Code: **16ECAE806** Course Title: **Cyber Security and Forensics**

L-T-P:**3-0-1** Credits: **4** Contact Hrs: **5**

ISA Marks-Theory: **50** +Lab: **100** ESA Marks: **50** Total Marks: **200**

Teaching Hrs: **50 +24** Exam Duration: **3 Hours**

No	Content	Hrs
	Unit I	
1	**Chapter 1: Introduction and Overview**	**10 Hrs**
	Introduction and Overview of Cyber Crime, Nature and Scope of Cyber Crime, Types ofCyber Crime, Social Engineering, Categories of Cyber Crime, Property Cyber Crime.	
2	**Chapter 2: Computer Forensic**	**10 Hrs**
	Unauthorized Access to Computers, Computer Intrusions, White collar Crimes, Viruses andMalicious Code, Internet Hacking and Cracking, Virus Attacks, Pornography, SoftwarePiracy, Intellectual Property, Mail Bombs, Exploitation ,Stalking and Obscenity in Internet,Digital laws and legislation, Law Enforcement Roles and Responses.	
Unit II		
3	**Chapter 3: Digital Forensic**	**10 Hrs**
	Introduction to Digital Forensics, Forensic Software and Hardware, Analysis	

and Advanced Tools, Forensic Technology and Practices, Forensic Ballistics and Photography, Face, Iris and Fingerprint Recognition, Audio Video Analysis, Windows System Forensics, Linux System Forensics, Network Forensics.

4 **Chapter 4: Cyber Crime Investigation** **10 Hrs**

Introduction to Cyber Crime Investigation, Investigation Tools, eDiscovery, Digital EvidenceCollection, Evidence Preservation, E-Mail Investigation, E-Mail Tracking, IP Tracking, EmailRecovery, Hands on Case Studies, Encryption and Decryption Methods, Search andSeizure of Computers, Recovering Deleted Evidences, Password Cracking.

Unit – III

5 **Chapter 5: Laws and Ethics** **10 Hrs**

Laws and Ethics, Digital Evidence Controls, Evidence Handling Procedures, Basics of IndianEvidence ACT IPC and CrPC , Electronic Communication Privacy ACT, Legal Policies.

Text Book:

1. Bernadette H Schell, Clemens Martin, "Cybercrime", ABC – CLIO Inc, California, 2004. https://www.amazon.com/dp/1851096833/ref=rdr_ext_tmb
2. "Understanding Forensics in IT ", NIIT Ltd, 2005. https://www.google.co.in/search?tbo=p&tbm=bks&q=subject:%22Computer+crimes%22&source=gbs_ge_summary_r&cad=0
3. Nelson Phillips and Enfinger Steuart, "Computer Forensics and Investigations", Cengage Learning, New Delhi, 2009. https://www.amazon.com/dp/1435498836/ref=rdr_ext_tmb

References:

1. Kevin Mandia, Chris Prosise, Matt Pepe, "Incident Response and Computer Forensics ", Tata McGraw -Hill, New Delhi, 2006.
2. Robert M Slade," Software Forensics", Tata McGraw - Hill, New Delhi, 2005.

Evaluation Scheme

1. Assessment

Assessment	Theory	Lab.
ISA- 1	25	100
ISA- 2	25	
ESA	50	00
Total	**100**	**100**

2. End Semester Assessment (ESA) Pattern:

UNIT	8 Questions to be set of 20 Marks Each	Chapter Nos.	Instructions
I	3 Questions to be set of 20 Marks Each	1,2	Any 2 questions are to be answered

II	3 Questions to be set of 20 Marks Each	3,4	Any 2 questions are to be answered
III	2 Questions to be set of 20 Marks Each	5	Any 1 question is to be answered

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16ECAE807	IT Infrastructure & Management

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Program: MASTER OF COMPUTER APPLICATIONS

Course Code: **16ECAE807** Course Title: **IT Infrastructure Management**

L-T-P:**3-0-1** Credits: **4** Contact Hrs: **5**

ISA Marks-Theory: **50** +Lab: **100** ESA Marks: **50** Total Marks: **200**

Teaching Hrs: **50** Exam Duration: **3 Hours**

No	Content	Hrs
	Unit I	
1	**Chapter 1. Introduction** Basic Conceptual Overview of Router, Routing Protocols and Routed Protocols & Conceptual Overview of the concept of Zoning, Internet , Extranet, Intranet (Militarized Zone), De-Militarized Zones.	**5 Hrs**
2	**Chapter 2. IT Infrastructure Components and their associated Zones** Firewall , IPS (Intrusion Prevention System) , VPN (Virtual Private Network), NATing, Servers-Domain Name System Server, Proxy Server,Web Application Server, DHCP Server, FTP Server, Mail Server	**5 Hrs**
3	**Chapter 3. Firewall** : Basic Operation of Firewall, Types of Firewall-Stateless-Static Packet Filtering Firewall, Stateful-Dynamic Filtering Firewall, Firewall Rule Set-Conceptual Overview, Standard Firewall Rules, How to Create a Firewall Rule ;Windows Firewall -Configuration of a Windows Based Firewall on PC, Host Based Firewall, Security Products ;Modern Firewall Architecture- Deep Packet Inspection; Essence of a Firewall in the Corporate IT Infrastructure- How it protects the Servers in the Corporate Infrastructure; Protection to Corporate IT Infrastructure in absence of a Firewall.	**5 Hrs**
4	**Chapter 4. IPS (Intrusion Prevention System)** What is an IPS Device, Uses of IPS Device, Modes of Operation of IPS Device, IPS Device Update Mechanism, Advantages of IPS Device, Disadvantages of IPS	**5 Hrs**

	Device	
	Unit II	
5	**Chapter 5. VPN (Virtual Private Network)** Leased Line Network and the Advnet of VPN, What is VPN (Virtual Private Network? How VPN can be Helpful? How does VPN Work? Types of VPN - Remote Access, VPN Tunneling, Equipments to set up VPN Connectivity, VPN Case let – Challenge, VPN Technology - SSL VPN and IPSec VPN, Encryption and Security Protocols in VPN, Advantages of VPN, VPN Related Threats- End Point Security Posture , Split Tunneling- Concept, Advantages, Configuration, ICS Split Tunneling Problem, Web Application Attacks, Unauthorized Access to Host, Insecure Storage of Authentication Credentials by VPN Clients, Misconfiguration, RSA - VPN Implementation, Setting Client Based VPN Connection **NATing-** Conceptual Overview, NATing Operation - How it works? Applications of NATing	**10Hrs**
6	**Chapter 6. Domain Name System Server-** Conceptual Overview, DNS Hierarchical Structure, Distributed Database- Top Level Domains Classification - Geographical and organizational, Fully Qualified Domain Name; DNS Server Classification - Zone Information/ Function, DNS Operation Modes - Recursive and Iterative, DNS Caching-a. Conceptual Overview, How DNS Resolves Queries; DNS Records - A, AAAA, MX, NS, PTR, CNAME-Registering DNS Records in Corporate/ ISP DNS Servers; DNS Zone Files, DEMO:nslookup utility -Command Line tool for forward DNS query, Reverse DNS Queryand Extracting Domain Related Information; DNS Threats and Mitigation- Split Zone Architecture, Zone Information Leakage - Unauthorized Zone Zone Transfer, Reverse DNS Lookup, Zone Transfers Applications to keep DNS updated, Security Zone Transfers using DNS/ TSIG, Security Zone Transfers using DNSSEC (DNS Security) Protocol- How DNSSEC Works? Difference between DNS TSIG and DNSSEC; Cache Poisoning Attack, Conceptual Overview - How it happens, Implications- Mail Redirection, Web Redirection, URL Redirection; Deletion Attack, DoS Attack- Demo:DoS Attack on a DNS Server, Dynamic Updates using DHCP Client/ Server, Integrated with ADS, Wrong Configuration - Non-Authoritative, Recursive Mode, Integrity Compromise of ROOT Hints File, DNS Amplification Attacks, Other Security Parameters- Restrict DNS servers to listen on specific addresses, Configure Global Query Block List.	**10Hrs**
	Unit – III	
7	**Chapter 7. Proxy Server**- Conceptual Overview, Operation - How Proxy Server Works , Applications of Proxy Server; **Antivirus -** Types of Malwares - Virus, Worms, Trojans, Spyware, Ghostware, RansomWare etc., What is an Antivirus-	**5 Hrs**

	How does an Antivirus Work? **Web Application Server-** Conceptual Overview, Web Application Attacks		
8	**Chapter 8. DHCP Serve**r -Conceptual Overview, Overview of DHCP Operation, Uses of DHCP Server; **FTP Server**- Conceptual Overview, FTP Operations - Active and Passive FTP, Uses of FTP Server; **Mail Server**- Conceptual Overview, Overview of Email Filter Devices.		**5 Hrs**

References:

1. Kemp, Juliet, Spinger, "Linux System Administration"
2. Anita Sengar "IT Infrastructure Management" 2012 Edition, publisher: S K Kataria and Sons
3. Sjaak Laan "Infrastructure Architecture - Infrastructure Building Blocks and Concepts Second Edition, Kindle Edition, Lulu Press Inc; Second Edition

IT Infrastructure Management Practices

COURSE DESCRIPTION:

IT infrastructure consists of a set of physical devices and software applications that are required to operate the entire enterprise. IT infrastructure is also consists both human and technical capabilities. These services include the following- Computing platforms used to provide computing services, that connect employees, customers, and suppliers into a coherent digital environment, including servers ,Data management services that store and manage corporate data and provide capabilities for analyzing the data and Application software services that provide enterprise-wide capabilities such as enterprise resource planning, customer relationship management, supply chain management, and knowledge management systems that are shared by all business units. It allows an organization to deliver IT solutions and services to its employees, partners and/or customers and is usually internal to an organization and deployed within owned facilities.

OBJECTIVES

- Acquire comprehensive knowledge, technical expertise and hands-on experience in IT Infrastructure Management
- To learn all aspects of IMS such as Networking, Operating Systems, Virtualizations and Data Center technologies.

LAB REQUIREMENTS:

- A modern web-browser with HTML5 and JavaScript enabled.
- Remote Desktop Client connection software.
- Internet connectivity Microsoft Account (LiveID).

LIST OF EXERCISES

Expt./ Job	Lab	Implementation	Number

No.	assignments/experiment		of Slots
1.	Web Server	Apache Web Server, IIS Server: Install and Configure the Apache Web Server on Linux and IIS server on windows.	01
2.	Samba Server	Implementation of Windows files and print services for Linux allowing the sharing of files and printers between Windows and Linux.	01
3.	LDAP Server	LDAP Server: Lightweight Directory Access Protocol-Server Installation to access a directory service.	01
4.	Mail Server	Mail Server configuration- POP3 Server, IMAP Server	01
5.	Proxy Server	Develop a small web proxy server, which is able to cache web pages. It is a very simple proxy server which only understands simple GET-requests, but is able to handle all kinds of objects - not just HTML pages, but also images.	01
6.	Firewalls and NAT (Network Address Translation)	Use of iptables to build a permissive firewall by selectively filtering packets based on protocol type. To demonstrate how addresses may be translated from private addresses to public and vice versa as they pass in and out of the firewall.	01
7.	Cloud Infrastructure: Azure Hands-on Lab (HOL) Build your Infrastructure in the Cloud using Windows Azure Infrastructure Services -	1. Login to the Windows Azure Management Portal, Define a new Windows Azure Affinity Group and Create a new Windows Azure Storage Account. 2. Register a DNS Server in Windows Azure. 3. Define a Virtual Network in Windows Azure. 4. Configure Windows Server Active Directory in a Windows Azure VM. 5. Configure New Machine for File Services in a Windows Azure VM.	01

References:

1. https://amizone.net/AdminAmizone/WebForms/Academics/NewSyllabus/194201472058683.pdf
2. http://itproguru.com/azurehol/#sthash.HMydlzVA.dpuf
3. https://simms-teach.com/docs/cis192/cis192lab08.pdf
4. https://simms-teach.com/resources.php
5. http://www.cs.rpi.edu/~kotfid/security1/PDF2/NS1_lab_6_1_4_en.pdf
6. http://www.cse.unsw.edu.au/~cs3331/12s1/Labs/
7. https://www.6diss.org/workshops/ca/dns-practical.pdf
8. http://www.dwaynewhitten.com/info306/pages/lab.html
9. http://www.bo.ingv.it/~scacciag/home_files/teach/netadminguide.pdf
10. https://techpolymath.com/2015/02/16/how-to-setup-a-dns-server-for-a-home-lab-on-ubuntu-14-04/
11. http://www.dwaynewhitten.com/info306/lab2.pdf

Evaluation Scheme

1. Assessment

Assessment	Theory	Lab.
ISA- 1	25	100
ISA- 2	25	
ESA	50	00
Total	**100**	**100**

2. End Semester Assessment (ESA) Pattern:

UNIT	8 Questions to be set of 20 Marks Each	Chapter Nos.	Instructions
I	3 Questions to be set of 20 Marks Each	1, 2, 3, 4	Any 2 questions are to be answered
II	3 Questions to be set of 20 Marks Each	5, 6	Any 2 questions are to be answered
III	2 Questions to be set of 20 Marks Each	7, 8	Any 1 question is to be answered

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16ECAE802	NO SQL

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Program: MASTER OF COMPUTER APPLICATIONS

Course Code: **16ECAE802** Course Title: **NoSQL**

L-T-P: **3-0-1** Credits: **4** Contact Hrs: **5**

ISA Marks-Theory: **50** +Practice: **100** ESA Marks: **50** Total Marks: **200**

Teaching Hrs: **50** Exam Duration: **3 Hours**

No	**Content**	**Hrs**
	Unit I	
1	**Chapter 1 – Introduction to NoSQL** What it is & Why you need it, Hello NoSQL : Getting Initial hands-on Experience, Interfacing and Interacting with NoSQL	**8 Hrs**
2	**Chapter 2 – NoSQL Basics** Understanding the Storage Architecture, Performing CRUD operations, Querying NoSQL Stores, Modifying Data Stores & Managing Evolution, Indexing and ordering datasets.	**12Hrs**
	Unit II	

3	**Chapter 3 – Advanced NoSQL** Using NoSQL in the CLOUD, Scalable Parallel Processing with MapReduce, Analyzing BigData with Hive.	**8 Hrs**
4	**Chapter 4 – Working with NoSQL** Surveying Database Internals, Using MySQL as a NoSQL solution, WebFrameworks and NoSQL, Migrating from RDBMS to NoSQL.	**12 Hrs**
	Unit – III	
5	**Chapter 5 – Developing Web Application with NoSQL** Php and MongoDB – Comparing documents in MongoDB & PHP, MongoDB classes, Connecting & Disconnecting, Inserting Data, listing your data, Modifying data with PHP, Deleting data, DBRef, GridFS & PHP Driver, Creating a Blog Application with PHP driver - Designing the Application, Listing the Posts, Looking at a Single Post, Searching the Psots, Adding, Deleting & modifying Posts, Creating the Index Pages, Recapping the blog application.	**6 Hrs**
6	**Chapter 6 – NoSQL Database Administration** Using Administrative tools, Backing up the MongoDB Server, Digging Deeper into Backups, Restoring Individual Databases or Collections, Automating Backups, Backing up Large Databases, Importing Data into MongoDB, Exporting data into MongoDB, Securing.	**4 Hrs**

Text Book:

1. "Professional NoSQL" by Shashank Tiwari, 2011, WROX Press (Chapter 1,2,3,4,5,6,7.8.9,10.11.12.13.15)
2. The Definitive guide to MongoDB, The NoSQL Database for Cloud and Desktop Computing, Apress 2010. (Chapter 6,7,8,9).

NOSQL PRACTICES

COURSE DESCRIPTION:

The widespread emergence of big data storage needs has driven the development and adoption of a new class of non - relational databases commonly referred to as NoSQL databases. The NoSQL (or Not-Only SQL) databases are basically developed to meet the requirements of the modern cloud-based decentralized apps and are a good solution as compared to the relational databases in many ways. These unstructured databases are widely known for their non-relational and schema less data model, improved performance and scalability factors which are always an issue with relational database systems. This course will explore the origins of NoSQL databases and the characteristics that distinguish them from traditional relational database management systems. Core concepts of NoSQL databases will be presented followed by an exploration of how different database technologies implement these core concepts.

OBJECTIVES

- Demonstrate competency in designing NoSQL database management systems.
- Demonstrate competency in describing how NoSQL databases differ from relational databases from a theoretical perspective.
- Demonstrate competency in selecting a particular NoSQL database for specific use cases.

LAB REQUIREMENTS:

- Computer with latest configuration having Windows and Unix OS Versions.
- Java software installed.

LIST OF EXERCISES

Expt./ Job No.	Lab assignments/experiment	Implementation	Number of Hours
1.	Set up MongoDB environment.	i. Installation of MongoDB on Windows and Unix platform. ii. Operations on Start, Stop and Restart MongoDB. iii. Using MongoDB Help. iv. Getting MongoDB Statistics.	02
2.	Create/Drop, NoSQL Datatypes	i. Differentiate between database, document and collection. ii. Create Database, Drop Database. iii. Create Collection, Drop Collection. iv. MongoDB Datatypes.	02
3.	Working with MongoDB Documents	Insert Document, Update Document, Delete Document,	02
4.	Data Retrieval	i. Projection ii. Limit Records iii. Sort Records iv. Indexing v. Aggregation	02
5.	Creating Backup	i. Replication ii. Sharding iii. Create Backup iv. Deployment	02
6.	MongoDB in Java	Set up MongoDB JDBC driver, Connect to database, Create a Collection, Retrieve a Collection, Insert a Document, Retrieve a Documents, Update Document.	04

References:

1. https://www.tutorialspoint.com/mongodb/mongodb_tutorial.pdf
2. https://blog.codecentric.de/files/2012/12/MongoDB-CheatSheet-v1_0.pdf
3. http://www.guru99.com/mongodb-tutorials.html

Evaluation Scheme

1. Assessment

Assessment	Theory	Lab.
ISA- 1	25	100
ISA- 2	25	
ESA	50	00
Total	**100**	**100**

2. End Semester Assessment (ESA) Pattern:

UNIT	8 Questions to be set of 20 Marks Each	Chapter Nos.	Instructions
I	3 Questions to be set of 20 Marks Each	1,2	Any 2 questions are to be answered
II	3 Questions to be set of 20 Marks Each	3,4	Any 2 questions are to be answered
III	2 Questions to be set of 20 Marks Each	5,6	Any 1 question is to be answered

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16ECAE803	Database Administration

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Program: MASTER OF COMPUTER APPLICATIONS

Course Code: **16ECAE803**	Course Title: **Database Administration**	
L-T-P:**3-0-1**	Credits: **4**	Contact Hrs: **5**
ISA Marks-Theory: **50** +Lab: **100**	ESA Marks: **50**	Total Marks: **200**
Teaching Hrs: **50**		Exam Duration: **3 Hours**

No	Content	Hrs
	Unit I	
1	**Chapter No. 1 : Introduction** Why Learn Database Administration?, A Unique Vantage Point, The Management Discipline of Database Administration, Evaluating a DBA Job Offer, Database, Data and System Administration, DBA Tasks, DBMS Release Migration, Types of DBAs.	7 Hrs
2	**Chapter No. 2: Creating the Database Environment** Defining the Organization's DBMS Strategy, Installing the DBMS, Upgrading DBMS Versions and Releases, Database Standards and Procedures.	7 Hrs
3	**Chapter No. 3: Database Change Management** Change management Requirements, Types of changes, Impact of Change on Database Structures,	6 Hrs
	Unit II	
4	**Chapter No. 4 Performance Management** Defining Performance, Monitoring versus Management, Service-Level Management, Types of performance tuning, Performance Tuning tools, DBMA performance Basics.	7 Hrs
5	**Chapter No. 5 System and Database Performance** The Larger Environment, DBMS Installation and Configuration Issues, System Monitoring, Techniques for optimizing Databases, Database reorganization.	7 Hrs
6	**Chapter No. 6 Application Performance** Designing Applications for Relational Access, Relational Optimization, Additional Optimization Considerations, Reviewing Access Paths, SQL Coding and Tuning for Efficiency.	6 Hrs
	Unit – III	
7	**Chapter No. 7 Database Security** Data Breaches, Database Security Basics, Granting and Revoking Authority, Authorization Roles and Groups, Other Database Security Mechanisms, Encryption.	5 Hrs
8	**Chapter No. 8 Database Backup and Recovery** The Importance of Backup and Recovery, Preparing for Problems, Backup, Recovery, Alternatives to Backup and Recovery	5 Hrs

Text Book:

1. Craig S. Mullins "Database Administration: The complete guide to DBA Practices and Procedures"2nd Edition, Addison Wesley.

Evaluation Scheme

1. Assessment

Assessment	Theory	Lab.
ISA- 1	25	100
ISA- 2	25	
ESA	50	00
Total	**100**	**100**

2. End Semester Assessment (ESA) Pattern:

UNIT	8 Questions to be set of 20 Marks Each	Chapter Nos.	Instructions
I	3 Questions to be set of 20 Marks Each	1,2,3	Any 2 questions are to be answered
II	3 Questions to be set of 20 Marks Each	4,5,6	Any 2 questions are to be answered
III	2 Questions to be set of 20 Marks Each	7,8	Any 1 question is to be answered

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16ECAE808	Cloud Computing

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Program: MASTER OF COMPUTER APPLICATIONS

Course Code: **16ECAE808** Course Title: **Cloud Computing**

L-T-P:**3-0-1** Credits: **4** Contact Hrs: **5**

ISA Marks-Theory: **50** +Lab: **100** ESA Marks: **50** Total Marks: **200**

Teaching Hrs: **50 + 24** Exam Duration: **3 Hours**

No	Content	Hrs
	Unit I	
1	**Chapter 1:Cloud Computing Basics** Cloud Computing Overview, Applications, Intranets and the Cloud, First Movers in the Cloud.	**7 Hrs**
2	**Chapter 2:Cloud Computing with the Titans** Google, EMC, Microsoft, Amazon. Salesforce.com, IBM, Partnerships.	**6 Hrs**
3	**Chapter 3:Hardware and Infrastructure** Clients, Security, Network, Services.	**7 Hrs**
	Unit II	
4	**Chapter 4:Cloud Storage and Standards** Overview, Cloud Storage Providers. **Standards:** Application, Client, Infrastructure.	**7 Hrs**

5	**Chapter 5: Software as a Service** Overview, Driving Forces, Company Offerings, Industries.	**6 Hrs**
6	**Chapter 6: Software plus Services** Overview, Mobile Device Integration, Providers, Microsoft Online.	**7 Hrs**
	Unit – III	
7	**Chapter 7: Developing Applications** Google, Microsoft, Cast Iron Cloud, Development, Troubleshooting, Application Management.	**5 Hrs**
8	**Chapter 8: Best Practices and the Future of Cloud Computing** Analyze Your Service, Best Practices, How Cloud Computing Might Evolve.	**5 Hrs**

Text Book:

1. Anthony T.Velete, Toby J.Velete, Cloud Computing A Practical Approach, Mc Graw Hill, 2009.

Cloud Computing Practices

Objective

This is the lab course for Cloud Computing. Each student as to accomplish given lab EXERCISE .The goals are expose students to the process of Cloud environment with intent of practical understanding of cloud services.

Concepts

Windows Azure, Google app, Amazon VPC, Amazon EC2.

Required Textbooks

Anthony T.Velete, Toby J.Velete, Cloud Computing A Practical Approch, Mc Graw Hill, 2009

Expt No.	***Brief description about the experiment***	***Number Of Slots***
	DEMONSTRATION	
1	Introduction Cloud using Windows Azure Infrastructure Services	1
2	Introduction to Registering a DNS Server in Windows Azure	1
3	Introduction to Google app engine for Java.	1
4	Introduction to how to create an Amazon VPC.	1

5	Introduction to Setting up Routing in VPC and Deploying Amazon EC2 instance in Amazon VPC	1
	EXERCISE	
6	Implementation of cloud using windows Azure.	*1*
7	Collaborating on Calendars Schedules and Task Management, Event Management, Contact Management, Project Management, Word Processing, Spreadsheets, Databases, Presentations.	*1*
8	Implementation of web app on google app engine.	*1*
9	Implementation of Amazon VPC.	*1*
10	Implementation of Storing and Sharing Files, Sharing Digital Photographs.	*1*
11	Collaborating via Web Based Communication Tools, Social Networks and Groupware, Blogs and Wikis.	*1*
	STRUCTURED ENQUIRY	
12	Developing a task management web application on Google app engine.	*2*

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Evaluation Scheme

1. Assessment

Assessment	**Theory**	**Lab.**
ISA- 1	25	100
ISA- 2	25	
ESA	50	00
Total	**100**	**100**

2. End Semester Assessment (ESA) Pattern:

UNIT	8 Questions to be set of 20 Marks Each	Chapter Nos.	Instructions
I	3 Questions to be set of 20 Marks Each	1,2,3	Any 2 questions are to be answered
II	3 Questions to be set of 20 Marks Each	4,5,6	Any 2 questions are to be answered
III	2 Questions to be set of 20 Marks Each	7,8	Any 1 question is to be answered

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16ECAC903	Mobile Application Development

Program: MASTER OF COMPUTER APPLICATIONS

Course Code: 16ECAC903	Course Title: **Mobile Application Development**	
L-T-P:**3-0-1**	Credits: **4**	Contact Hrs: **5**
ISA Marks-Theory: **50** +Lab: **100**	ESA Marks: **50**	Total Marks: **200**
Teaching Hrs: **42 + 24**		Exam Duration: **3 Hours**

No	Content	Hrs
	Unit I	
1	**Chapter No. 1- Mobility and Android** Introduction, Mobility Panorama, Mobile Platforms, App Development Approaches, Android Overview.	2 Hrs
2	**Chapter No. 2- Getting Started with Android** Introduction, Setting up Development Environment, Saying Hello to Android, Traversing an Android App, Project Structure, Logical Components of an Android App, Android Tool Repository, Installing and Running App Devices.	2 Hrs
3	**Chapter No. 3- Learning with an Application** Introduction, 3CheersCable App, Mobile App Development, Challenges, Tenets of a Winning App.	3 Hrs
4	**Chapter No. 4- App User Interface** Introduction, Activity, UI Resources, UI Elements and Events, Interaction among Activities, Fragments, Action Bar and Applications.	5 Hrs
5	**Chapter No. 5- App Functionality - Beyond UI** Introduction, Threads, AsyncTask, Service, Notifications, Intents and Intent Resolution, Broadcast Receivers, Telephony and SMS- Their Application.	4 Hrs
	Unit II	
6	**Chapter No. 6. App Data - Persistence and Access** Introduction, Flat Files, Shared Preferences, Relational Data, Data Sharing Across Apps, Enterprise Data.	4 Hrs
7	**Chapter No. 7. Graphics and Animation** Introduction, Android Graphics, Android Animation.	4 Hrs
8	**Chapter No. 8. Multimedia** Introduction, Audio, Video and Images, Playback, Capture and Storage.	4 Hrs
9	**Chapter No. 9. Location Services and Maps** Introduction, Google Play Services, Location Services, Maps	4 Hrs
	Unit – III	
10	**Chapter No. 10. Sensors** Introduction, Sensors in Android, Android Sensor Framework, Motion Sensors, Position Sensors, Environment Sensors.	4 Hrs
11	**Chapter No. 11. Testing Android Apps** Introduction, Testing Android App Components, App Testing Landscape Overview Publishing Apps: Introduction, Groundwork, Configuring, Packaging,	4 Hrs

Distributing.

12 **Chapter No. 12. Publishing Apps** **2 Hrs**

Introduction, Groundwork, Configuring, Packaging, Distributing.

Text Book:

1. AnubhavPradhan, Anil V Deshpande, Composing Mobile Apps using Android, 2010, Wiley, 2010

References:

1. Barry Burd, Android Application Development All in one for Dummies.
2. Ian F Darwin, Android Cookbook.
3. Frank Ableson, RobiSen, Chris King, C. Enrique Ortiz, Android in Action, Manning Publications.

Mobile Application Development Course Project

Objective:

This is the course Project for the Mobile App Development. The students will be divided into project teams, and each team will develop a marketable mobile app. ideally, each project team will have 2 or 3 students with a maximum of 4. The goals are to expose students to the process of developing a new mobile app from start to finish and to provide an experience very similar to what a developer would have at any company where they work to produce an app that not only works but is also something that meets the needs of their clients.

Concepts:

Mobile app development, project management, and quality assurance.

Required Textbooks

AnubhavPradhan, Anil V Deshpande, Composing Mobile Apps using Android, 2010 wiley, 2010.

Chapters	Topic	Course Project	Slots
Ch-01: Mobility and Android. Ch-02: Getting Started with Android. Ch-03: Learning	Mobility Panorama, App Development Approaches, Setting Development Environment, Installing and Running App Devices, Mobile App Development Challenges.	Development of logical Architecture for given Mobile Application.	2

with an Application.			
Ch-04: App User Interface. Ch-05: App Functionality.	Activity, UI Resources, UI Elements and Events, Threads, AsyncTask, Notification, Broadcast Receivers	Building User Interface for given Application.	2
Ch-06: App Data – Persistence and Access.	Flat Files, Shared Preferences, Relational Data, Data Sharing Across Apps.	Exchanging a Data with in Enterprise Application.	2
Ch-07: Graphics and Animation.	Android Graphics, Android Animation.	Adding Animation and Graphics into Application.	2
Ch-11: Testing Android Apps.	Testing Android App Components, App testing Landscape Overview.	Testing an App.	2
Ch-12: Publishing Apps.	Groundwork, Configuring, Packaging, Distribution.	Deploying an App.	2

Evaluation Scheme

1. Assessment

Assessment	**Theory**	**Lab.**
ISA- 1	25	100
ISA- 2	25	
ESA	50	00
Total	**100**	**100**

2. End Semester Assessment (ESA) Pattern:

UNIT	8 Questions to be set of 20 Marks Each	Chapter Nos.	Instructions
I	3 Questions to be set of 20 Marks Each	1,2,3,4,5	Any 2 questions are to be answerec
II	3 Questions to be set of 20 Marks Each	6,7,8,9	Any 2 questions are to be answerec
III	2 Questions to be set of 20 Marks Each	10,11,12	Any 1 question is to be answered

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16ECAP901	Mini Project-3

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Program: MASTER OF COMPUTER APPLICATIONS

Course Code: 16ECAP901	Course Title: **Mini Project-3**	
L-T-P: **0-0-2**	Credits: **2**	Contact Hrs: **4**
ISA Marks: **100**	ESA Marks: **100**	Total Marks: **200**
Teaching Hrs: **36**		Exam Duration: **3 Hours**

Theme:"Development of Applications using .NET/ JavaTechnology"

.NET Technology

The Microsoft .NET framework has major advantages over previous programming languages and environments. Applications written in .NET may be in any of several different programming languages (languageinteroperability). .NET consists of a re-useable library of classes (smallcomponents that help developers create applications). It also consists of a development environment to help developers rapidly and graphically build applications. All operating system functions can be encapsulated within .NET.The framework manages the execution of applications and Web services, and provides many functionalities including security enforcement and memory management. Because of these advantages, corporations and industry are beginning to embrace .NET. They will need graduates whoknow how to use it.Hence, a project done using this technology would give an insight of the powerful features of .NET and help the students to find a job in this field. Below is a list of some of the types of applications that can be created using the .NET platform.

- Customer relationship management
- Accounting applications
- Product/inventory applications
- Warehousing applications using hand-held devices
- Web sites
- Value chain/supply management
- Integration with partners through the Internet
- XML Web services
- PDA (hand-held) applications

Objectives of using .NET Technology-

Student doing a project in .NET technology should be able to:

1. Develop an application that is pure OOP, platform independent, language independent and interoperable.
2. Use the features of .NET to make the application scalable, maintainable, easily deployable, reliable and secure.
3. Work with databases using ADO.NET.
4. Develop background processes windows services.

5. Create animations using .NET's WPF.
6. Create and use Web Services through SOA.

Java Technology

Java is one of the fundamental programming languages that can be used in many applications as well as product developments. The simple reason for this is because Java can be put to use in various platforms due to its multi-platform nature. Java is one of the favorite choices for developers for many reasons like security, object oriented(reusability), cross platform computing, multithreaded capability, Rich API, Powerful development tools ,availability of various frameworks, Great collection of open source libraries, wonderful community support, Excellent documentation support. Support for various databases and many more.

Students can use the following tools in web and mobile applications as well as product developments:

 Struts, Spring, Hibernate and JPA
 JAXB and Apache Axis 2/Java
 JSP, Servlets, JDBC, EJB, JMS, JTA and JUnit
 Apache Tomcat, JBoss and GlassFish
 JavaScript, JSF, GWT and jQuery
 Eclipse, Netbeans and JBoss tools
TestNG
jBPM and Drools
 JCR

Objectives:

Help students to utilize and strengthen the knowledge of Java which they have learnt in previous semester.

Methodology:

Students are asked to make a team of 3-4 members and can choose the different categories of projects like desktop applications, web applications, mobile application and distributed application and work once it is approved by the coordinator.

Evaluation:

Students Assessment through CIE (80%) + SEE (20%)

Continuous Internal Evaluation	**Assessment**	**Marks**
	Problem Definition, Literature Review	10
	Synopsis and SRS Deliverables	10
	Design (Module wise algorithmic design)	20
	Coding	10
	Integration and testing	10
	Report	10
	Presentation skills and Viva-voce	10
	Total	**80**
Semester End	Presentation	10

Examination	Viva-voce	10
	Total	100

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16ECAE905	Wireless & Mobile Computing

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Program: MASTER OF COMPUTER APPLICATIONS

Course Code: 16ECAE905 | Course Title: **Wireless & Mobile Computing**

L-T-P:**3-0-1** | Credits: **4** | Contact Hrs: **5**

ISA Marks: **50 + 100** | ESA Marks: **50** | Total Marks: **200**

Teaching Hrs: **42 + 24** | Exam Duration: **3 Hours**

No	**Content**	**Hrs**
	Unit I	
1	**Chapter1:Introduction**	**4 Hrs**
	Mobility Of Bits & Bytes, Wireless-The Beginning, Mobile Computing, Dialog Control, Networks, Middle Gear & Gateways, Applications & Services, Developing Mobile Computing Applications, Security In Mobile Computing, Standard And Standard Bodies And Players In The Wireless Space.	
2	**Chapter 2 : Wireless LAN**	**4 Hrs**
	Introduction, Wireless LAN advantages, IEEE 802.11 standards, Wireless LAN architectures, Mobility in Wireless LAN, Deploying Wireless LAN, Mobile adhoc Networks and Sensor Networks. Wireless LAN security, WiFi versus 3G.	
3	**Chapter 3: Mobile Computing Architecture**	**4 Hrs**
	History of computers, History of Internet, Internet-the ubiquities networks, Architecture for mobile computing, The three-tier architectures, Design consideration for mobile computing, Mobile computing through internet, Making existing applications mobile enable.	
4	**Chapter 4: Mobile Computing through Telephony**	**4 Hrs**
	Evaluation of telephony, Multiple access procedure, Mobile computing through telephone, Developing an IVR application, Voice XML, Telephony application Programming Interphase(TAPI).	
	Unit II	
5	**Chapter 5:Emerging Technologies**	**4 Hrs**

Introduction, Blue-tooth, Radio Frequency Identification (RFID), Wireless Broad Band (WiMAX), Mobile IP, Internet protocol Ver 6 (IP v6), Java card.

6 Chapter 6 : Global System for Mobile Communication (GSM) **4 Hrs**

Introduction, GSM architectures, GSM entities, Call routing in GSM, PLMN interface, GSM address and identifiers, Network aspect in GSM, GSM frequency allocation, Authentication and security,

7 Chapter 7: Short Message Services (SMS) **4 Hrs**

Mobile Computing over SMS, Short Message Services (SMS), Value Added Services through SMS, Accessing the SMS Bearer.

8 Chapter 8: General Packet Radio Service (GPRS) **4 Hrs**

Introduction, GPRS and packet data network, GPRS network architecture, GPRS network operation, Data services in GPRS, Application for GPRS, Limitation of GPRS, Billing and Charging in GPRS.

Unit – III

9 Chapter 09 : Wireless Application Protocol (WAP) **5 Hrs**

Introduction, WAP, MMS, GPRS, Application

10 Chapter 10 : CDMA & 3G **5 Hrs**

Introduction, Spread Spectrum technology, IS-95, CDMA vs GSM, Wireless Data, 3rd generation network, Application on 3G.

Text Book:

1. Asoke K Talukder & Roopa R Yavagal . Mobile Computing , Tata McGraw Hill Education Private Limited, New Delhi.

References:

1. Raj Kamal , Mobile Computing, Oxford University Press

Evaluation Scheme

1. In Semester Assessment (ISA)

Assessment	Marks
ISA- 1	20
ISA- 2	20
Assignments	10
Total	**50**

2. End Semester Assessment (ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter Nos.	Instructions
I	3 Questions to be set of 20 Marks Each	1,2,3,4	Any 2 questions are to be answered

II	3 Questions to be set of 20 Marks Each	5,6,7,8	Any 2 questions are to be answered
III	2 Questions to be set of 20 Marks Each	9,10	Any 1 question is to be answered

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16ECAE906	Machine Learning

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Program: MASTER OF COMPUTER APPLICATIONS

Course Code: **16ECAE906** Course Title: **Machine Learning**

L-T-P:**3-0-1** Credits: **4** Contact Hrs: **5**

ISA Marks-Theory: **50** +Lab: **100** ESA Marks: **50** Total Marks: **200**

Teaching Hrs: **42 + 24** Exam Duration: **3 Hours**

No	Content	Hrs
	Unit I	
1	**Chapter 1. Introduction**	**4 Hrs**
	Introduction: Statistical Decision Theory - Regression, Classification, Bias Variance:	
2	**Chapter 2. Linear Regression and Linear Classification**	**6 Hrs**
	Linear Classification, Logistic Regression, Linear Discriminant Analysis; Perceptron; Linear Regression, Multivariate Regression, Subset Selection, Shrinkage Methods, Principal Component Regression, Partial Least squares.	
3	**Chapter 3. Support Vector Machines and Artificial Neural Networks**	**6 Hrs**
	Support Vector Machines, Neural Networks - Introduction, Early Models, Perceptron Learning, Backpropagation, Initialization, Training & Validation.	
	Unit II	
4	**Chapter 4. Bayesian Learning and Decision Trees**	**6 Hrs**
	Parameter Estimation - MLE, MAP, Bayesian Estimation Decision Trees, Regression Trees, Stopping Criterion & Pruning Loss functions, Categorical Attributes, Multiway Splits, Missing Values Decision Trees - Instability.	
5	**Chapter 5. Evaluation Measures and Hypothesis Testing**	**4 Hrs**
	Evaluation Measures, Bootstrapping & Cross Validation, Class Evaluation	

Measures, ROC curve, MDL

6 **Chapter 6. Ensemble Methods and Clustering** **6 Hrs**

Ensemble Methods - Bagging, Committee Machines and Stacking, Boosting, Gradient Boosting, Random Forests, Multi-class Classification, Naive Bayes, Bayesian Networks; Partitional Clustering, Hierarchical Clustering, Birch Algorithm, CURE Algorithm, Density-based Clustering.

Unit – III

7 **Chapter 7. Graphical Models and Expectation Maximization** **5 Hrs**

Undirected Graphical Models, HMM, Variable Elimination, Belief Propagation; Gaussian Mixture Models, Expectation Maximization.

8 **Chapter8. Learning Theory and Reinforcement Learning** **5 Hrs**

Learning Theory, Introduction to Reinforcement Learning, RL framework, TD learning, Solution Methods, Applications.

Text Book:

1. T. Hastie, R. Tibshirani, J. Friedman. The Elements of Statistical Learning, 2e,
2. Christopher Bishop.Pattern Recognition and Machine Learning. 2e.

References:

1. Introduction to machine learning with python by Andreas C.Miiller and Sarah Guide

Machine Learning Practices Using Python

1) Implement linear regression with one variable to predict profits for a food truck. Suppose you are the CEO of a restaurant franchise and are considering different cities for opening a new outlet. The chain already has trucks in various cities and you have data for profits and populations from the cities.
2) Build a logistic regression model to predict whether a student gets admitted to a university. Suppose that you are the administrator of a university department and you want to determine each applicant's chance of admission based on their results on two exams.
3) Implement one-vs-all logistic regression and neural networks to automate handwritten digit recognition (0 to 9)
4) Implement the backpropagation algorithm for neural networks and apply it to task of hand –written digit recognition.
5) Build a Spam Classifier using Support Vector Machines.
6) Implement the K-means clustering algorithm and apply it to compress an image.

7) Build Principle Component analysis to find a low dimensional representation of face images.
8) Implement the anomaly detection algorithm and apply it to detect failing servers on a network.
9) Build a recommender system for movies by using collaborative filtering.

Evaluation Scheme

1. Assessment

Assessment	Theory	Lab.
ISA- 1	25	100
ISA- 2	25	
ESA	50	00
Total	**100**	**100**

2. End Semester Assessment (ESA) Pattern:

UNIT	8 Questions to be set of 20 Marks Each	Chapter Nos.	Instructions
I	3 Questions to be set of 20 Marks Each	1,2,3,4	Any 2 questions are to be answered
II	3 Questions to be set of 20 Marks Each	5,6,7	Any 2 questions are to be answered
III	2 Questions to be set of 20 Marks Each	8,9	Any 1 question is to be answered

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17ECAC701	Web Programming

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Program: MASTER OF COMPUTER APPLICATIONS

Course Code:**17ECAC701**	Course Title: **Web Programming**	
L-T-P:**3-0-0**	Credits: **3**	Contact Hrs: **3**
ISA Marks:**: 50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs: **42**		Exam Duration: **3 Hours**

No	Content	Hrs
	Unit I	
1	**Chapter 1: Fundamentals of Web, XHTML**	**2Hrs**
	Internet, WWW, Web Browsers, and Web Servers; URLs; MIME; HTTP; The Web Programmers Toolbox. XHTML: Basic syntax; Standard structure; Basic text markup; Images; Hypertext Links; Lists.	
2	**Chapter 2: XHTML – 2, CSS**	**4 Hrs**
	XHTML (continued): Tables; Forms; Frames. CSS: Introduction; Levels of style sheets; Selector forms; Property value forms; Font properties; List properties; Color; Alignment of text; The box model; Background images; The <span> and <div> tags.	
3	**Chapter 3: JavaScript**	**4 Hrs**
	Overview of JavaScript; Syntactic characteristics; Primitives, operations, and expressions; Screen output and keyboard input; Control statements; Object creation and modification; Arrays; Functions; Constructor; Pattern matching using regular expressions; Errors in scripts; Examples.	
4	**Chapter 4: JavaScript and HTML Documents, Dynamic Documents with JavaScript**	**6Hrs**
	The JavaScript execution environment; The Document Object Model; Element access in JavaScript; Events and event handling; Handling events from the Body elements, Button elements, Text box and Password elements; The DOM 2 event model; The navigator object. Introduction to dynamic documents; Element positioning; Moving elements; Element visibility; Changing colors and fonts; Dynamic content; Stacking elements; Locating the mouse cursor; Reacting to a mouse click; Slow movement of elements; and dropping elements.	
	Unit II	
5	**Chapter 5: XML**	**8Hrs**
	Introduction; Syntax; Document structure; Document Type definitions; Namespaces; XML schemas; Displaying raw XML documents; Displaying XML documents with CSS; XSLT style sheets; XML processors; Web services.	
6	**Chapter 6: Perl, CGI Programming**	**8Hrs**
	Origins and uses of Perl; Scalars and their operations; Assignment statements and simple input and output; Control statements; Fundamentals of arrays; Hashes; References; Functions; Pattern matching; file input and output; Examples. The Common Gateway Interface; CGI linkage; Query string format; CGI.pm module; A survey example; Cookies.	
	Unit – III	
7	**Chapter 7: PHP**	**5 Hrs**

Origins and uses of PHP; Overview of PHP; General syntactic characteristics; Primitives, operations and expressions; Output; Control statements; Arrays; Functions; Pattern matching; Form handling; Files; Cookies; Session tracking.

8 **Chapter 8: Database Access** **5 Hrs**

Relational databases; Architectures for database access; MySQL; Database access with Perl and MySQL; Database access with PHP and MySQL.

Text Book:

1. Sebesta, R.W., Programming the World Wide Web, 3rd, Pearson education, 2006.(Chapters 1, 2, 3, 4, 5, 6, 8, 9, 10, 12, 14.1, 14.3 to 14.6)

References:

1. Deitel, P.J. and Goldberg, Internet & World Wide Web How to H program, 3rd, Pearson education, 2004.
2. Chris Bates, Web Programming Building Internet Applications, 3rd, Wiley India, 2006.
3. Xue Bai et al The Web Warrior Guide to Web Programming, Thomson, 2003.

Evaluation Scheme

1. Assessment

Assessment	Theory
ISA- 1	25
ISA- 2	25
ESA	50
Total	**100**

2. End Semester Assessment (ESA) Pattern:

UNIT	8 Questions to be set of 20 Marks each	Chapter Nos.	Instructions
I	3 Questions to be set of 20 Marks Each	1, 2, 3, 4	Any 2 questions are to be answered
II	3 Questions to be set of 20 Marks Each	5,6	Any 2 questions are to be answered
III	2 Questions to be set of 20 Marks Each	7,8	Any 1 question is to be answered

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17ECAE801	Information Storage & Management

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Course Code: 17ECAE801 | **Course Title: Information Storage and Management**

L-T-P: **3-0-1**	Credits: **4**	Contact Hrs: **5**
ISA Marks: Theory:**50** +Practice:**100**	ESA Marks: **50**	Total Marks: **200**
Teaching Hrs: **42 + 24**		Exam Duration: **3 Hours**

No	Content	Hrs
	Unit I	
1	**Chapter 1: Introduction to Information Storage:** Information Storage, Evolution of storage architecture, Data Center Infrastructure, Virtualization and Cloud Computing. Data center environment: Application, DBMS, Host, Connectivity, Storage, Disk Drive Components, Disk Drive Performance, Host Access To Data, Direct Attached Storage, Storage Design Based on Application, disk native Command Queuing	**6 Hrs**
2	**Chapter 2 : Data protection: RAID** RAID Implementation Methods, RAID Array Components, RAID Techniques, Raid Levels, RAID Impact on Disk performance, RAID Comparison, HOT Spares	**5 Hrs**
3	**Chapter 3. Intelligent Storage Systems:** Components of an Intelligent storage system, LUN Masking, Types of Intelligent storage Systems	**5 Hrs**
	Unit II	
4	**Chapter 4: Fibre Channel Storage Area Networks:** Fiber channel: Overview, Components of SAN, FC Connectivity, Switched Fabric ports, Fibre Channel Architecture, Zoning, FC SAN Topologies, Virtualization in SAN. IP SAN: iSCSI, FCIP.	**6 Hrs**
5	**Chapter 5: Network Attached Storage (NAS):** Components of NAS, NAS Implementations, NAS File sharing Protocols, Factors Affecting NAS Performance, File Level Virtualization.	**5 Hrs**
6	**Chapter 6: Content Addressed Storage(CAS) and Unified Storage** Object Based Storage Devices, Content Addressed Storage, Unified Storage	**5 Hrs**
	Unit – III	
7	**Chapter 7: Local Replication and Remote Replication** : Local Replication Technologies, Remote Replication Technologies.	**5 Hrs**

8	**Chapter 8: Securing & Managing the Storage Infrastructure** Information security Framework, Risk Traid, Storage Security Domains, Monitoring the Storage Infrastructure, Storage Infrastructure Management activities, Storage Infrastructure Management Challenges.	**5 Hrs**

Text Book:

1. G.Somasundaram, Aloka Shrivastava, “EMC Education Services, Information Storage and Management”, Wiley, 2009.

References:

1. Foundations ULF Troppens, Rainer Erkens and Wolfgang Muller, “Storage Networks Explained”, John Wiley & Sons, 2003.
2. Robert Spalding, “Storage Networks: The complete Reference”, Tata Mc Graw Hill, 2003.
3. Richard barker and Paul Massiglia, “Storage Area Networks Essentials: A complete Guide to understanding and Implementing SANS”, John Wiley India, 2002.
4. Marc Farely, “ Building Storage Networking Fundamentals”, Cisco press, 2005

Evaluation Scheme

In Semester Assessment (ISA)

Assessment	Marks
ISA- 1	20
ISA- 2	20
Assignments	10
Total	**50**

End Semester Assessment (ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter Nos.	Instructions
I	3 Questions to be set of 20 Marks Each	1,2,3	Any 2 questions are to be answered
II	3 Questions to be set of 20 Marks Each	4,5,6	Any 2 questions are to be answered
III	2 Questions to be set of 20 Marks Each	7,8	Any 1 question is to be answered

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17ECAE802	Linux Administration
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Course Code: **17ECAE802**	Course Title: **Linux Administration**	
L-T-P:**3-0-1**	Credits: **4**	Contact Hrs: **5**
ISA Marks-Theory: **50** +Lab: **100**	ESA Marks: **50**	Total Marks: **200**
Teaching Hrs: **42+24**		Exam Duration: **3 Hours**

No	Content	Hrs
	Unit I	
1	**Chapter 1. Basic System Configuration** Opening Graphical Applications, System Locale and Keyboard Configuration: Setting the System Locale, Changing the Keyboard Layout**,** Managing Users and Groups; Introduction to Users and Groups, Managing Users in a Graphical Environment..	**6 Hrs**
2	**Chapter 2. Package Management, Services and Daemons** Yum: Checking For and Updating Packages, Packages and Package Groups, Configuring Yum and Yum Repositories. Configuring Services, Running Services OpenSSH: The SSH Protocol, An Open SSH Configuration, Open SSH Clients	**6 Hrs**
3	**Chapter 3. Web & Mail Servers :** **Web Servers: The Apache HTTP Server** Updating the Configuration, Running the httpd Service, Editing the Configuration Files, Working with Modules , Setting Up Virtual Hosts, Setting Up an SSL Server. **Mail Servers**- Email Protocols, Email Program Classifications, Mail Transport Agents, Mail Delivery Agents, Mail User Agents	**8 Hrs**
	Unit II	
4	**Chapter 4. File & Directory Servers :** **FTP Servers :** The File Transfer Protocol, FTP Servers, Files Installed with **vsftpd,** Starting and Stopping **vsftpd,vsftpd** Configuration Options.Runing FTP Server **Samba Server :** Introduction to Samba, Samba Daemons and Related Services, Connecting to a Samba Share, Configuring a Samba Server ,Starting and Stopping Samba, Samba Server Types and the smbconf File, Samba Security Modes, Samba Account Information Databases, Samba Network Browsing , Samba with CUPS Printing Support, Samba Distribution Programs **Directory Servers -**OpenLDAP, Introduction to LDAP, Installing the OpenLDAP Suite , Configuring an OpenLDAP Server , SELinux Policy for Applications Using LDAP, Running an OpenLDAP Server, Configuring a System to Authenticate Using OpenLDAP	**10 Hrs**

5	**Chapter 5 Viewing and Managing Log Files -** Locating Log Files, Basic Configuration of Rsyslog, Working with Queues in Rsyslog , Using Rsyslog Modules , Interaction of Rsyslog and Journal, Structured Logging with Rsyslog , Debugging Rsyslog, Using the Journal, Managing Log Files in a Graphical Environment.	**5 Hrs**
	Unit – III	
6	**Chapter. 6. Working with the GRUB 2 Boot Loader** Configuring the GRUB 2 Boot Loader, Customizing GRUB Menu, GRUB 2 Password Protection, Reinstalling GRUB , GRUB 2 over Serial Console, Terminal Menu Editing During Boot, UEFI Secure Boot	**5 Hrs**
8	**Chapter 7. Automating System Tasks** -Cron and Anacron- Installing Cron and Anacron, Running the Crond Services, Configuring Anacron Jobs, Configuring Cron Jobs, Controlling Access to Cron,Black and White Listing of Cron Jobs At and Batch-Installing At and Batch,Running the At Service, Configuring an At Job, Configuring a Batch Job, Viewing Pending Jobs, Additional Command Line Options, Controlling Access to At and Batch.	**5 Hrs**

Textbook:

4. Fedora 21 System Administrator's Guide Deployment, Configuration, and Administration of Fedora 21 Edition 1.0, Author Jaromír Hradílek jhradilek@redhat.com, Douglas Silas silas@redhat.com , Martin Prpič mprpic@redhat.com etc.

References:

1. Kemp, Juliet, Spinger, “Linux System Administration”
2. Anita Sengar “IT Infrastructure Management” 2012 Edition, publisher: S K Kataria and Sons
3. Sjaak Laan “Infrastructure Architecture - Infrastructure Building Blocks and Concepts Second Edition, Kindle Edition, Lulu Press Inc; Second Edition

Linux Administration Practices

COURSE DESCRIPTION:

IT infrastructure consists of a set of physical devices and software applications that are required to operate the entire enterprise. IT infrastructure is also consists both human and technical capabilities. These services include the following- Computing platforms used to provide computing services, that connect employees, customers, and suppliers into a coherent digital environment, including servers ,Data management services that store and manage corporate data and provide capabilities for analyzing the data and Application software services that provide enterprise-wide capabilities such as enterprise resource planning, customer relationship management, supply chain management, and knowledge management systems that are shared by all business units. It allows an organization to deliver IT solutions and services to its employees, partners and/or customers and is usually internal to an organization and deployed within owned facilities.

OBJECTIVES

- Acquire comprehensive knowledge, technical expertise and hands-on experience in IT Infrastructure Management
- To learn all aspects of IMS such as Networking, Operating Systems, Virtualizations and Data Center technologies.

LAB REQUIREMENTS:

- A modern web-browser with HTML5 and JavaScript enabled.
- Remote Desktop Client connection software.
- Internet connectivity Microsoft Account (LiveID).

LIST OF EXERCISES

Expt./ Job No.	Lab assignments/experiment	Implementation	Number of Slots
8.	Web Server	Apache Web Server, IIS Server: Install and Configure the Apache Web Server on Linux and IIS server on windows.	01
9.	Samba Server	Implementation of Windows files and print services for Linux allowing the sharing of files and printers between Windows and Linux.	01
10.	LDAP Server	LDAP Server: Lightweight Directory Access Protocol- Server Installation to access a directory service.	01
11.	Mail Server	Mail Server configuration- POP3 Server, IMAP Server	01
12.	Proxy Server	Develop a small web proxy server, which is able to cache web pages. It is	01

		a very simple proxy server which only understands simple GET-requests, but is able to handle all kinds of objects - not just HTML pages, but also images.	
13.	Firewalls and NAT (Network Address Translation)	Use of iptables to build a permissive firewall by selectively filtering packets based on protocol type. To demonstrate how addresses may be translated from private addresses to public and vice versa as they pass in and out of the firewall.	01
14.	Cloud Infrastructure: Azure Hands-on Lab (HOL) Build your Infrastructure in the Cloud using Windows Azure Infrastructure Services -	6. Login to the Windows Azure Management Portal, Define a new Windows Azure Affinity Group and Create a new Windows Azure Storage Account. 7. Register a DNS Server in Windows Azure. 8. Define a Virtual Network in Windows Azure. 9. Configure Windows Server Active Directory in a Windows Azure VM. 10. Configure New Machine for File Services in a Windows Azure VM.	01

References:

12. https://amizone.net/AdminAmizone/WebForms/Academics/NewSyllabus/194201472058683.pdf
13. http://itproguru.com/azurehol/#sthash.HMydlzVA.dpuf
14. https://simms-teach.com/docs/cis192/cis192lab08.pdf
15. https://simms-teach.com/resources.php
16. http://www.cs.rpi.edu/~kotfid/security1/PDF2/NS1_lab_6_1_4_en.pdf
17. http://www.cse.unsw.edu.au/~cs3331/12s1/Labs/
18. https://www.6diss.org/workshops/ca/dns-practical.pdf
19. http://www.dwaynewhitten.com/info306/pages/lab.html
20. http://www.bo.ingv.it/~scacciag/home_files/teach/netadminguide.pdf
21. https://techpolymath.com/2015/02/16/how-to-setup-a-dns-server-for-a-home-lab-on-ubuntu-14-04/
22. http://www.dwaynewhitten.com/info306/lab2.pdf

Evaluation Scheme

Assessment

Assessment	Theory	Lab.

ISA- 1	25	100
ISA- 2	25	
ESA	50	00
Total	**100**	**100**

End Semester Assessment (ESA) Pattern:

UNIT	8 Questions to be set of 20 Marks Each	Chapter Nos.	Instructions
I	3 Questions to be set of 20 Marks Each	1, 2, 3, 4	Any 2 questions are to be answered
II	3 Questions to be set of 20 Marks Each	5, 6	Any 2 questions are to be answered
III	2 Questions to be set of 20 Marks Each	7, 8	Any 1 question is to be answered

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17ECAP901	ASP .Net Lab.

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Course Code: 17ECAP901 Course Title: ASP .NET Lab **Lab.**

L-T-P:**0-0-1** Credits: **1** Contact Hrs: **2**

ISA Marks:**: 100** ESA Marks: **--** Total Marks: **100**

Teaching Hrs: **24** Exam Duration: **3 Hours**

Expt./ Job No.	*Lab assignments/experiment*	*No. of Lab. Slots per batch (estimate)*
Demonstration		
1	Program to demonstrate ASP.Net Web Forms	01
2	Program to demonstrate validation in ASP.Net	01
3	Program to demonstrate working with Data Base applications.	01
4	Program to demonstrate session tracking in ASP.Net	01
	Exercises	

<table>
<tr><td>5</td><td>
a) Write a program to display a feedback form. The different options for the list box must be ASP-XML, Dot NET, JavaPro and Unix, C, C++. When the Submit Form button is clicked after entering the data, a message must be displayed.
b) Write a program containing the following controls:
a. A List Box
b. A Button
c. An Image
d. A Label
The listbox is used to list items available in a store. When the user clicks on an item in the listbox, its image is displayed in the image control. When the user clicks the button,the cost of the selected item is displayed in the control.
</td><td>01</td></tr>
<tr><td>6</td><td>
a) Write a program to get a user input such as the boiling point of water and test it to the appropriate value using Compare Validator.
b) Declare one TextBox control, one Button control, one Label control, and one RegularExpressionValidator control in an .aspx file. The submit() function checks if the page is valid. If it is valid, it returns "The page is valid!" in the Label control. If it is not valid, it returns "The page is not valid!" in the Label control. If validation fails, the text "The zip code must be 5 numeric digits!" will be displayed in the RegularExpressionValidator control.
</td><td>01</td></tr>
<tr><td>7</td><td>
I. Create table CANDIDATE with the following
<table>
<tr><td>Column name</td><td>Datatype</td></tr>
<tr><td>Ccode</td><td>Int</td></tr>
<tr><td>Name</td><td>Char(20)</td></tr>
<tr><td>DOJ</td><td>Date</td></tr>
</table>
i) Insert following records into the table:
<table>
<tr><td>Code</td><td>1001</td><td>1002</td><td>1003</td></tr>
<tr><td>Name</td><td>S.Raman</td><td>M.Sushil</td><td>Mohanyes</td></tr>
<tr><td>DOJ</td><td>12-Jun-97</td><td>12-Nov-97</td><td>30-Jul-97</td></tr>
</table>
ii) Order the records on the basis of seniority of employees. iii) Drop the table.
</td><td>01</td></tr>
<tr><td>8</td><td>Write a Program in ASP that has a form taking the user’s name as</td><td>01</td></tr>
</table>

	input. Store this name in a permanent cookie & whenever the page is opened again, then value of the name field should be attached with the cookie's content.	
9	Create a Session dictionary using object tag. In session-on start add keys for Time, UserAgent, RemoteIP& add appropriate values. Create a simple page to display the values.	01
10	Write a Program to delete all cookies of your web site that has created on the client's computer	01
	Structured enquiry	
11	Write an application that contains a list of following technologies: • ASP.NET, ADO.NET, C#. • It also contains a textbox in which the user has to enter a name and a textarea in which the user has to enter his comments. When the Submit is clicked, the output should display the name entered in the textbox and the user-selection from the listbox. All the above should be displayed with the tracing for the page being enabled.	02

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17ECAE903	RESTful Web Services

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Course Code: 17ECAE903 | Course Title: **RESTful Web Services**

L-T-P: **3-0-1** | Credits: **4** | Contact Hrs: **5**

ISA Marks: **50** | ESA Marks: **50** | Total Marks: **100**

Teaching Hrs: **42+24** | Exam Duration:**3Hrs**

No	**Content**	**Hrs**
	Unit I	

1	**Chapter 1 : The Programmable Web and Its Inhabitants** Kinds of Things on the Programmable Web, HTTP: Documents in Envelopes, Method Information, Scoping Information, The Competing Architectures, RESTful, Resource-Oriented Architectures, RPC-Style Architectures, REST-RPC Hybrid Architectures, The Human Web Is on the Programmable Web, Technologies on the Programmable Web, HTTP, URI, XML-RPC, SOAP, WS-*, WSDL, WADL, Leftover Terminology.	**4 Hrs**
2	**Chapter 2 : Writing Web Service Clients** **Web Services Are Web Sites**, Wrappers, WADL, and ActiveResource, del.icio.us: The Sample Application, What the Sample Clients Do, Making the Request: HTTP Libraries, Optional Features, Ruby: rest-open-uri and net/http, Python: httplib2, Java: HttpClient, C#: System.Web.HTTPWebRequest, PHP: libcurl, JavaScript: XMLHttpRequest, The Command Line: curl, Other Languages.Processing the Response: XML Parsers: Ruby: REXML, I Guess, Python: ElementTree, Java: javax.xml, Xerces, or XMLPull, C#: System.Xml.XmlReader , PHP, JavaScript: responseXML, Other Languages, JSON Parsers: Handling Serialized Data , Clients Made Easy with WADL	**4 Hrs**
3	**Chapter 3 : What Makes RESTful Services Different?** Introducing the Simple Storage Service, Object-Oriented Design of S3 , A Few Words About Buckets, A Few Words About Objects, What If S3 Was a Standalone Library? Resources, HTTP Response Codes, An S3 Client, The Bucket List : The Bucket, The S3 Object, Request Signing and Access Control: Signing a URI, Setting Access Policy: Using the S3 Client Library, Clients Made Transparent with ActiveResource : Creating a Simple Service, An ActiveResource Client, A Python Client for the Simple Service, Parting Words.	**4 Hrs**
4	**Chapter 4 : The Resource-Oriented Architecture** Resource-Oriented What Now? What's a Resource? URIs: URIs Should Be Descriptive, The Relationship Between URIs and Resources : Addressability, Statelessness : Application State Versus Resource State, Representations: Deciding Between Representations, Links and Connectedness, The Uniform Interface: GET, PUT, and DELETE : HEAD and OPTIONS, POST: Creating subordinate resources, Appending to the resource state, Overloaded POST: The not-so-uniform interface, Safety and Idempotence, Safety: Idempotence ,Why safety and idempotence matter Why the Uniform Interface Matters, That's It!	**4 Hrs**
5	**Chapter 5 : Designing Read-Only Resource-Oriented Services** Resource Design, Turning Requirements Into Read-Only Resources, Figure Out the Data Set, General Lessons, Split the Data Set into Resources, General Lessons, Name the Resources, Encode Hierarchy into Path Variables, No Hierarchy? Use Commas or Semicolons, Map URIs, Scale, Algorithmic Resource? Use Query Variables, URI Recap, Design Your Representations: The Representation Talks About the State of the Resource, The Representation Links to Other States, Representing the List of Planets, Representing Maps and Points on Maps, Representing the Map Tiles, Representing Planets and Other Places, Representing Lists of Search Results, Link the Resources to Each Other, The HTTP Response : What's Supposed to Happen? Conditional HTTP GET, What Might Go Wrong? Conclusion.	**4 Hrs**

Unit II

6	**Chapter 6 : Designing Read/Write Resource-Oriented Services** **User Accounts as Resources :** Why Should User Accounts Be Resources? Authentication, Authorization, Privacy, and Trust, Turning Requirements into Read/Write Resources, Figure Out the Data Set, Split the Data Set into Resources , Name the Resources with URIs, Expose a Subset of the Uniform Interface, Design the Representation(s) Accepted from the Client, Design the Representation(s) to Be Served to the Client, Link This Resource to Existing Resources, What's Supposed to Happen? What Might Go Wrong? **Custom Places :** Figure Out the Data Set, Split the Data Set into Resources, Name the Resources with URIs, Expose a Subset of the Uniform Interface ,Design the Representation(s) Accepted from the Client, Design the Representation(s) Served to the Client, Link This Resource to Existing Resources, What's Supposed to Happen? What Might Go Wrong? **A Look Back at the Map Service**	**4 Hrs**
7	**Chapter 7 : A Service Implementation :** A Social Bookmarking Web Service, Figuring Out the Data Set, **Resource Design:** REST in Rails, The User Controller, The Bookmarks Controller, The User Tags Controller, The Calendar Controller, The URI Controller, The Recent Bookmarks Controller, The Bundles Controller, The Leftovers, Remodeling the REST Way, Implementation: The routes.rb File. Design the Representation(s) Accepted from the Client, Design the Representation(s) Served to the Client, Connect Resources to Each Other, What's Supposed to Happen? What Might Go Wrong? **Controller Code :** What Rails Doesn't Do:Conditional GET: param[:id] for things that aren't IDs, The Application Controller, The Users Controller The Bookmarks Controller, The Tags Controller, The Lesser Controllers, The Calendar Controller : The RecentController, The UrisController, Model Code: The User Model The Bookmark Model, What Does the Client Need to Know? Natural-Language Service Description, Description Through Standardization ,Hypermedia Descriptions	**4 Hrs**
8	**Chapter 8 : REST and ROA Best Practices** Resource-Oriented Basics, The Generic ROA Procedure, Addressability : Representations Should Be Addressable : State and Statelessness: Connectedness, The Uniform Interface : Safety and Idempotence, New Resources: PUT Versus POSTOverloading POST, This Stuff Matters : Why Addressability Matters, Why Statelessness Matters, Why the Uniform Interface Matters, Why Connectedness Matters A terrifying example. Resource Design : Relationships Between Resources, Asynchronous Operations, Batch Operations, Transactions: When In Doubt, Make It a Resource, URI Design, Outgoing Representations, Incoming Representations, Service Versioning, Permanent URIs Versus Readable URIs, **Standard Features of HTTP :** Authentication and Authorization: Basic authentication, Digest authentication, WSSE username token : Compression, Conditional GET, Caching : Please cache Thank you for not caching, Default caching rules, Look-Before-You-Leap, Requests Partial GET : Faking PUT and DELETE, The Trouble with Cookies, Why Should a User Trust the HTTP	**4 Hrs**

	Client?, Applications with a Web Interface, Applications with No Web Interface What Problem Does this Solve?	
9	**Chapter 9 : The Building Blocks of Services** **Representation Formats :** XHTML, XHTML with Microformats, Atom, OpenSearch SVG, Form-Encoded Key-Value Pairs, JSON, RDF and RDFa, **Framework-Specific Serialization Formats :** Ad Hoc XHTML, Other XML Standards and Ad Hoc Vocabularies, Encoding Issues, XML and HTTP: Battle of the encodings, The character encoding of a JSON document **Prepackaged Control Flows:** General Rules, Database-Backed Control Flow, GET, PUT, POST for creating a new resource, POST for appending to a resource, DELETE **The Atom Publishing Protocol:** Collections, Members, Service document, Category documents, Binary documents as APP members, **GData:** Querying collections, Data extensions, POST Once Exactly, **Hypermedia Technologies :** URI Templates, XHTML 4, XHTML 4 links, XHTML 4 forms, Shortcomings of XHTML 4, XHTML 5, WADL : Describing a del.icio.us resource, Describing an APP collection, Is WADL evil?	**4 Hrs**
10	**Chapter 10 : The Resource-Oriented Architecture Versus Big Web Services** What Problems Are Big Web Services Trying to Solve? SOAP :The Resource-Oriented Alternative, WSDL: The Resource-Oriented Alternative, UDDI: The Resource-Oriented Alternative, Security: The Resource-Oriented Alternative, Reliable Messaging : The Resource-Oriented Alternative, Transactions: The Resource-Oriented Alternative, BPEL, ESB, and SOA, Conclusion.	**4 Hrs**
	Unit – III	
11	**Chapter 11 : Ajax Applications as REST Clients** From AJAX to Ajax, The Ajax Architecture, A del.icio.us Example, The Advantages of Ajax, The Disadvantages of Ajax, REST Goes Better, Making the Request, Handling the Response, JSON, Don't Bogart the Benefits of REST, Cross-Browser Issues and Ajax Libraries : Prototype, Dojo, Subverting the Browser Security Model, Request Proxying, JavaScript on Demand: Dynamically writing the script tag, Library support.	**5 Hrs**
12	**Chapter 12 : Frameworks for RESTful Services** Ruby on Rails : Routing, Resources, Controllers, and Views, Outgoing Representations, Incoming Representations, Web Applications as Web Services, The Rails/ROA Design Procedure. Restlet: Basic Concepts: Writing Restlet Clients, Writing Restlet Services: Resource and URI design, Request handling and representations, Compiling, running, and testing, Conclusion. Django: Create the Data Model, Define Resources and Give Them URIs, Implement Resources as Django Views, The bookmark list view, The bookmark detail view: Further directions, Conclusion	**5 Hrs**

Text Book:

1. RESTful Web Services by Sam Ruby, Leonard Richardson, Publisher: O'Reilly Media, Inc. Release Date: May 2007 ISBN: 9780596529260

References:

1. **Hands-On RESTful Python Web Services: Develop RESTful web services or APIs ...** By Gaston C. Hillar

Evaluation Scheme

In Semester Assessment (ISA)

Assessment	Marks
ISA- 1	20
ISA- 2	20
Assignment	10
Total	**50**

End Semester Assessment (ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter Nos.	Instructions
I	3 Questions to be set of 20 Marks Each	1, 2, 3, 4, 5	Any 2 questions are to be answered
II	3 Questions to be set of 20 Marks Each	6, 7, 8, 9,10	Any 2 questions are to be answered
III	2 Questions to be set of 20 Marks Each	11, 12	Any 1 question is to be answered

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RESTFull Web Services

SI NO	Topics
1.	Working on XML-RPC and SOAP Protocol
2.	Working on Web Service Client using httplib2 python library
3.	Understanding of CURL command and its options
4.	Implementation of XML and JSON Parsing using Python
5.	Working on client application to store and retrive the data using S3 Bucket
6.	Implementation of RESTfull services for data request and response
7.	Working on Authentication and Authorization for RESTfull services
8.	Implementation of RESTfull services for data and serialization formats, Database connectivity
9.	Integration of AJAX and REST Clients

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17ECAE902	Full Stack Development - MEAN

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Course Code:17ECAE902 Course Title: Full Stack Development - MEAN

L-T-P: **3-0-1**	Credits: **4**	Contact Hrs: **5**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs: **42+24**		Exam Duration:**3Hrs**

No	**Content**	**Hrs**
	Unit I	
1	**Chapter 1 : Introduction to MEAN**	**5 Hrs**
	Three-tier web application development, The evolution of JavaScript, Introducing MEAN, Installing MongoDB, Installing Node.js, Introducing NPM.	
2	**Chapter 2 : Getting Started with Node.js**	**5 Hrs**
	Introduction to Node.js, JavaScript closures, Node modules, Developing Node.js web applications.	
3	**Chapter 3 : Building an Express Web Application**	**6 Hrs**
	Introduction to Express, Installing Express, Creating your first Express application, The application, request, and response objects, External middleware, Implementing the MVC pattern, Configuring an Express application, Rendering views, Serving static files, Configuring sessions.	
	Unit II	
4	**Chapter 4 : Introduction to MongoDB**	**5 Hrs**
	Introduction to NoSQL, Introducing MongoDB , Key features of MongoDB, MongoDB shell, MongoDB databases , MongoDB collections, MongoDB CRUD operations	
5	**Chapter 5 : Introduction to Mongoose**	**6 Hrs**
	Introducing Mongoose, Understanding Mongoose schemas, Extending your Mongoose schema, Defining custom model methods, Model validation, Using Mongoose middleware, Using Mongoose DBRef.	
6	**Chapter 6 : Managing User Authentication Using Passport**	**6 Hrs**
	Introducing Passport, Understanding Passport strategies, Understanding Passport OAuth strategies; **Introduction to AngularJS:-** Introducing AngularJS, Key concepts of AngularJS, Installing AngularJS, Structuring an AngularJS application, Bootstrapping your AngularJS application, AngularJS MVC entities	
	Unit – III	
7	**Chapter 7: Creating a MEAN CRUD Module**	**4 Hrs**
	Introducing CRUD modules, Setting up the Express components, Introducing the ngResource module, Implementing the AngularJS MVC module, Finalizing your module implementation.	
8	**Chapter 8: Testing MEAN Applications**	**5 Hrs**
	Introducing JavaScript testing, Testing your Express application, Testing your AngularJS application; Adding Real-time Functionality Using Socket.io:- Introducing	

WebSockets, Introducing Socket.io, Installing Socket.io, Building a Socket.io chat.

Text Book:

1. Amos Q, Haviv, Mean Web Development, Packt Publishing 2014.

References:

1. COLIN J. IHRIG, Full Stack Javascript Development with MEAN, Sitepoint.

Evaluation Scheme

In Semester Assessment (ISA)

Assessment	Marks
ISA- 1	20
ISA- 2	20
Assignment	10
Total	**50**

End Semester Assessment (ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter Nos.	Instructions
I	3 Questions to be set of 20 Marks Each	1, 2, 3	Any 2 questions are to be answered
II	3 Questions to be set of 20 Marks Each	4.5.6	Any 2 questions are to be answered
III	2 Questions to be set of 20 Marks Each	7,8	Any 1 question is to be answered

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Practice Experiments for Full Stack

Sl No	EXPERIMENT NAME
1	Build a real-time polls application with Node.js, Express, AngularJS, and MongoDB
2	Setting Up a MEAN Stack Single Page Application
3	A Sample App with Node.js, Express and MongoDB
4	REST Service with Web Interface using the MEAN Stack
5	Creating an RSS Feed Reader With the MEAN Stack
6	Create a TV Show Tracker using AngularJS, Node.js and MongoDB
7	Deploying a MEAN App to Amazon EC2

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17ECAE901	Block Chain Technologies

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Course Code:17ECAE901	Course Title: **Block Chain Technologies**	
L-T-P: **3-0-1**	Credits: **4**	Contact Hrs: **5**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: 1**00**
Teaching Hrs: **42+24**		Exam Duration:**3Hrs**

No	Content	Hrs
	Unit I	
1	**Introduction** What blockchain is, What blockchain isn't, Blockchain definitions, How are blockchains different from databases? History of blockchain, Blockchain 2.0, The motivations behind blockchain, Characteristics of blockchain, Background of DLT, The different types of blockchain, Overview of blocks, Influence of Moore's law on blockchain technology.	5 hrs
2	**A Bit of Cryptography**. Cryptography in blockchain, Classical cryptography, Cryptographic primitives, Symmetric key cryptography, Asymmetric key cryptography, Elliptic-curve cryptography, Digital signatures, Cryptographic hashing.	6 hrs
3	**Cryptography in Blockchain** Hashing in blockchain, Linking blocks in a blockchain, Linking blocks using an SHA256 hashing algorithm, Block structure, Blockchain functionality, Creating a blockchain, Byzantine failure problem in blockchain, Digital signatures in blockchain, Creating an identity, Signatures in transaction, Asset ownership in blockchain, Transferring an asset, Transmitting the transaction, Claiming the asset, Blockchain wallets.	6 hrs
	Unit - 2	
4	**Networking in Blockchain**. Peer-to-peer (P2P) networking, Network discovery, Block synchronization, Building a simple blockchain in a P2P network, Validating a new block, Selecting the longest chain, Conflict resolution, Block exchange between peers, Initial block synchronization, Broadcasting scenarios, Application interfaces.	6 hrs
5	**Cryptocurrency.** Bitcoin basics, Getting started with Bitcoin Core, Keys and addresses, Transactions, Mining and consensus, Blockchain, Blockchain networks, Bitcoin hard forks and altcoins, A simple cryptocurrency application: Transactions, Wallet, Transaction	6 hrs

management.

6	Diving into Blockchain - Proof of Existence**.** MultiChain blockchain platform, Setting up a blockchain environment, Getting started with MultiChain, Proof of Existence architecture, Building the Proof of Existence application, Executing and deploying the application.	5 hrs
	Unit - 3	
7	Diving into Blockchain - Proof of Ownership**.** Digital assets and identity, Proof of ownership, Smart contracts, Choosing the smart contract platform, NEO blockchain: Building blocks of a NEO blockchain, NEO technology, NEO nodes, NEO network, NEO transactions, Ethereum blockchain: Ethereum nodes, Getting started, Creating a decentralized application.	4 hrs
8	Blockchain Security**.** Transaction security model, Decentralized security model, Attacks on the blockchain, Threats of quantum computing.	4 hrs

Text Book:

1. Foundations of Blockchain, O'REILLY publications, 2019

References:

Evaluation Scheme

In Semester Assessment (ISA)

Assessment	Marks
ISA- 1	20
ISA- 2	20
Assignment	10
Total	**50**

End Semester Assessment (ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter Nos.	Instructions
I	3 Questions to be set of 20 Marks Each	1, 2, 3,	Any 2 questions are to be answered
II	3 Questions to be set of 20 Marks Each	4, 5, 6	Any 2 questions are to be answered
III	2 Questions to be set of 20 Marks Each	7, 8	Any 1 question is to be answered

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Practices

1. Implementation of basic cryptographic algorithms such as AES, ECC, RSA, ECDSA, SHA256.

2. Implementation of cryptographic primitives such as hash functions and digital signatures.
3. Implementation of P2P blockchain application.
4. Implementation of Interface for the cryptocurrency application such as wallet application and explorer application.
5. Implement decentralized application development using MultiChain blockchain framework by considering real time use case.
6. Develop decentralized application using smart contract concept in NEO and Ethereum blockchain platforms by considering real time use case.
7. Simulation of double spend attack on the Bitcoin unconfirmed transaction.

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17ECAP904	Robotic Process Automation.

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Program: MASTER OF COMPUTER APPLICATIONS		
Course Code: **17ECAP904**	Course Title: **Robotics Process Automation**	
L-T-P: **0-0-2**	Credits: **2**	Contact Hrs: **Full Time**
ISA Marks: **100**	ESA Marks: **--**	Total Marks: **100**
Teaching Hrs: **Full Time**		Exam Duration: **3 Hours**
The students shall undergo certification on Robotics Process Automation (RPA) during the IV or V semester vacation by choosing Automation Anywhere or UiPath course or both. The evaluation for the course shall be done after successful completion of certification on any one or both during VI semester followed by internal assessment and submission of report.		

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18ECAP701	Software Engineering Lab.

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Course Code: 18ECAP701 Course Title: **Software Engineering Lab.**

L-T-P: **0-0-2**	Credits: 2	Contact Hrs: **4**
ISA Marks: **100**	ESA Marks: **--**	Total Marks: **100**
Teaching Hrs: **24 (T) + 24 (P)**		Exam Duration: **3 Hours**

Objectives :

- To develop a problem statement.
- Identify Use Cases and develop the Use Case model.
- Identify the business activities and develop an UML Activity diagram. 5. Identity the conceptual classes and develop a domain model with UML Class diagram.
- Using the identified scenarios find the interaction between objects and represent them using UML Interaction diagrams.
- Draw the State Chart diagram.
- Identify the User Interface, Domain objects, and Technical services. Draw the partial layered, logical architecture diagram with UML package diagram notation.
- Draw Component and Deployment diagrams.

Expt No.	DEMONSTRATION	*Slots*
1	Overview of the UML and its Basic building blocks, Rules, Common Mechanisms	1
2	Case study - SRS, DFD, ER Model .	1
3	Introduction to Static Modeling and Dynamic Modeling's	1
4	Introduction to Architectural Modeling	1
	EXERCISE	
5	Design OO design Models for the following cases. **Cases:** 1. Passport automation system. 2. Banking and ATM system 3. Exam Registration 4. Stock maintenance system. 5. Online course reservation system 6. E-ticketing 7. Software personnel management system 8. Credit card processing 9. e-book management system 10. Recruitment system 11. Hostel Management 12. Conference Management System 13. BPO Management System. 14. Pay roll system 15. Library management System	1

	16. Payment Gateway	
6	Design following diagrams for chosen case study. i. Class Diagrams ii. Object Diagrams	1
7	Design following diagrams for chosen case study. i. Interaction Diagrams ii. Sequence Diagrams iii. Collaboration Diagrams	1
8	Design following diagrams for chosen case study. i. Behavioral Modeling ii. Use case Diagrams iii. Activity Diagrams	1
9	Design following diagrams for chosen case study. i. Advanced Behavioral Modeling ii. State Chart Diagrams	1
	STRUCTURED ENQUIRY	
10	Design following diagrams for chosen case study. i. Architectural Modeling ii. Component Diagrams iii. Deployment Diagrams	1

Evaluation Scheme

In Semester Assessment (ISA): Continuous Internal Assessment for 100 Marks.

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18ECAE808	DevOps

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Course Code: 18ECAE808 | Course Title: **DevOps**

L-T-P: **2-0-1** | Credits: **3** | Contact Hrs: **4**

ISA Marks: **50** | ESA Marks: **50** | Total Marks: **100**

Teaching Hrs: **42+24** | Exam Duration:**3Hrs**

No	**Content**	**Hrs**
	Unit I	

1	**Chapter 1 : Introduction to DevOps and Continuous Delivery** Introducing DevOps, How fast is fast?, The Agile wheel of wheels, Beware the cargo cult Agile fallacy, DevOps and ITIL.	**4 Hrs**
2	**Chapter 2 : A View from Orbit :** **The DevOps process and Continuous Delivery – an overview :** The developers, The revision control system, The build server, The artifact repository, Package managers, Test environments, Staging/production,Release management, Scrum, Kanban, and the delivery pipeline, Wrapping up – a complete example, Identifying bottlenecks	**4 Hrs**
3	**Chapter 3 : How DevOps Affects Architecture** Introducing software architecture, The monolithic scenario, Architecture rules of thumb, The separation of concerns, The principle of cohesion, Coupling, Back to the monolithic scenario, A practical example, Three-tier systems, The presentation tier, The logic tier, The data tier, Handling database migrations, Rolling upgrades, Hello world in Liquibase, The changelog file, The pom.xml file, Manual installation, Microservices, Interlude – Conway's Law, How to keep service interfaces forward compatible, Microservices and the data tier, DevOps, architecture, and resilience	**6 Hrs**
4	**Chapter 4 : Everything is Code** The need for source code control,The history of source code management, Roles and code, Which source code management system? A word about source code management system migrations, Choosing a branching strategy, Branching problem areas, Artifact version naming, Choosing a client, Setting up a basic Git server, Shared authentication, Hosted Git servers, Large binary files, Trying out different Git server implementations, Docker intermission, Gerrit : a) Installing the git-review package, b)The value of history revisionism, The pull request model, GitLab	**6 Hrs**
	Unit II	
5	**Chapter 5 : Building the Code** Why do we build code? The many faces of build systems, The Jenkins build server, Managing build dependencies, The final artifact, Cheating with FPM, Continuous Integration, Continuous Delivery, Jenkins plugins, The host server, Build slaves, Software on the host, Triggers, Job chaining and build pipelines, A look at the Jenkins filesystem layout, Build servers and infrastructure as code, Building by dependency order, Build phases, Alternative build servers, Collating quality measures, About build status visualization, Taking build errors seriously, Robustness	**6 Hrs**
6	**Chapter 6 : Testing the Code** Manual testing, Pros and cons with test automation, Unit testing, JUnit in general and JUnit in particular, A JUnit example, Mocking, Test Coverage, Automated integration testing, Docker in automated testing, Arquillian, Performance testing, Automated acceptance testing, Automated GUI testing, Integrating Selenium tests in Jenkins, JavaScript testing, Testing backend integration points, Test-driven development, REPL-driven development, A complete test automation scenario : Manually testing our web application, Running the automated test, 3Finding a bug, Test walkthrough, Handling tricky dependencies with Docker	**6 Hrs**

7	**Chapter 7 : Deploying the Code** Why are there so many deployment systems? Configuring the base OS, Describing clusters, Delivering packages to a system, Virtualization stacks: Executing code on the client, A note about the exercises, The Puppet master and Puppet agents, Ansible, PalletOps, Deploying with Chef, Deploying with SaltStack, Salt versus Ansible versus Puppet versus PalletOps execution models, Vagrant, Deploying with Docker, Comparison tables, Cloud solutions, AWS, Azure.	**4 Hrs**
8	**Chapter 8 : Monitoring the Code** Nagios, Munin, Ganglia, Graphite, Log handling, Client-side logging libraries, The ELK stack.	**4 Hrs**
	Unit – III	
9	**Chapter 9 : Issue Tracking** What are issue trackers used for? Some examples of workflows and issues, What do we need from an issue tracker? Problems with issue tracker proliferation, All the trackers : Bugzilla, Trac, Redmine, The GitLab issue tracker, Jira	**5 Hrs**
10	**Chapter 10 : The Internet of Things and DevOps** Introducing the IoT and DevOps, The future of the IoT according to the market, Machine-to-machine communication, IoT deployment affects, software architecture, IoT deployment security, Okay, but what about DevOps and the IoT again?, A hands-on lab with an IoT device for DevOps	**5 Hrs**

Text Book:

1. Practical DevOps by Joakim Verona Publisher: Packt Publishing, Release Date: February 2016, ISBN: 9781785882876

References:

1. **Effective DevOps,** Building a Culture of Collaboration, Affinity, and Tooling at Scale , By Jennifer Davis, Ryn Daniels, **Publisher:** O'Reilly Media, **Release Date:** June 2016 , **Pages:** 410.

2. **The DevOps Handbook:** How to Create World-Class Speed, Reliability, and Security in Technology Organizations, Gene Kim, Patrick Debois, John Willis, Jez HumbleIT Revolution Press, 2016 - Business & Economics - 480 pages.

Evaluation Scheme

In Semester Assessment (ISA)

Assessment	Marks
ISA- 1	20
ISA- 2	20
Assignment	10
Total	**50**

End Semester Assessment (ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter Nos.	Instructions
I	3 Questions to be set of 20 Marks Each	1, 2, 3, 4,	Any 2 questions are to be answered
II	3 Questions to be set of 20 Marks Each	5, 6, 7, 8,	Any 2 questions are to be answered
III	2 Questions to be set of 20 Marks Each	9, 10	Any 1 question is to be answered

DevOps Practice Exercise:

The objectives of these practice exercise is to learn DevOps best practices and to define entire infrastructure as code and learn about infrastructure as code, continuous integration, continuous delivery, Terraform, AWS, Packer, Docker, and much more.

1) **DevOps basics:** Learn the origins of DevOps and the basic principles and techniques.
2) **AWS crash course:** Hands-on session where you learn to use the most important AWS services, including IAM, EC2, ASG, EBS, ELB, S3, and RDS.
3) **Infrastructure as code**: Overview of different techniques to manage infrastructure, including ad-hoc scripts (e.g., Bash, Python), configuration management tools (e.g., Chef, Puppet), machine images (e.g., VMs, Docker), and provisioning tools (e.g., Terraform, CloudFormation).
4) **Terraform introduction**: Go through a series of coding exercises that cover the basic Terraform syntax, state management, loops, conditionals, lifecycle management, and common gotchas.
5) **Advanced Terraform**: Go through a series of coding exercises that cover Terraform modules, file layout, keeping code DRY, team workflows, and automated testing.
6) **Immutable infrastructure:** Overview of immutable infrastructure practices, versioning artifacts, promoting artifacts through environments, and deployment.
7) **Packer introduction:** Build your own AMIs and other virtual machine images using Packer.
8) **Docker introduction**: Create your own Docker images and deploy them using Docker orchestration tools.
9) **Continuous delivery**: Learn how to integrate Terraform, Packer, and Docker into a continuous delivery pipeline.
10) **DevOps best practices**: Learn about continuous integration, microservices, feature toggles, canary deployments, monitoring, alerting, and log aggregation.
11) **Production readiness review:** A Gruntwork engineer goes through a checklist of questions with your team to see what work you need to do to be ready for prod.
12) **Architecture deployment:** Deploy your customized Reference Architecture in AWS.
13) **Architecture walkthrough:** Overview of how the architecture works and how to use it.
14) **Migrating to the new architecture:** Learn the process of migrating your apps and data to the new architecture.

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19ECAP706	Computer Networks Lab..

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Course Code:19ECAP706 Course Title: **Computer Networks Lab.**

L-T-P:0-0-1.5	Credits: 1.5	Contact Hrs:3
ISA Marks:: **100**	ESA Marks: **--**	Total Marks: **100**
Teaching Hrs: **36**		Exam Duration: **3 Hours**

#	Lab Assignment	No. of Lab slots per Batch(Estimate)
01	Introduction to hardware components and Ethernet LAN setup.	2
02	Investigation of IP addressing and subnet design.	1
03	Application of Windows OS Built-in Networks Diagnostic Tools.	2
04	Network Packet Monitoring and Analysis.	1
05	Analysis of the Data Link Layer Protocols (Ethernet, ARP)	1
06	Analysis of the Web Protocols (DNS, HTTP)	1
07	Analysis of the Email Protocols (SMTP, POP3)	1
08	Computer Network Routing Using Statical Routes and RIP Protocol	1
09	Computer Network Routing by Using Open shortest Path First (OSPF) Dynamic Routing Protocol.	1
10	Getting acquainted with switching environment	1

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(01FM18MCAXX)	
18ECAP801	Mini Project -1

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Course Code: **18ECAP801**	Course Title: **Mini Project - 1**	
L-T-P: **0-0-2**	Credits: **2**	Contact Hrs: **4**
ISA Marks: **100**	ESA Marks: **100**	Total Marks: **200**
Teaching Hrs: **48**		Exam Duration: **3 Hours**

Theme: “Development of Rich Internet Applications using PHP”

Rich Internet Applications (RIAs) are web applications that offer the responsiveness, “rich” features and functionality approaching that of desktop applications. This course provides an end-to-end look at building Rich Internet Applications that employ HTML5, Ajax, jQuery, etc. This course provides platform for integrating various server-side and client-side technologies to create a robust applications.

Purpose:

- Developing rich reporting and analytics interfaces for enterprise-level information presentation.
- To build state-of-the-art web applications utilizing the powerful features provided by the combination of the PHP language, Ajax, and Web Services.

- To provide an authoritative overview to a set of key technologies for building web applications (HTML, HTML5, JavaScript, Dynamic HTML, CSS, ASP, AJAX, and XML).
- Able to apply the above key technologies for developing light-weighted and rich-content Web applications
- To offer users a better visual experience and more interactivity than traditional browser applications that use only HTML and HTTP.
- To create advanced user interfaces.

Evaluation:

Students Assessment through ISA (100%) + ESA (100%)

In Semester Assessment	**Assessment**	**Marks**
	Problem Definition, Literature Review	10
	Synopsis and SRS Deliverables	10
	Design (Module wise algorithmic design)	20
	Coding	10
	Integration and testing	10
	Report	20
	Presentation skills and Viva-voce	20
	Total	**100**
End Semester Assessment	Presentation	50
	Viva-voce	50
	Total	100

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18ECAE806	Cyber Security and Forensics

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Course Code: **18ECAE806** Course Title: **Cyber Security and Forensics**

L-T-P: **2-0-1** Credits: **3** Contact Hrs: **4**

ISA Marks: **50** ESA Marks: **50** Total Marks: **100**

Teaching Hrs: **42+24** Exam Duration:**3Hrs**

No	**Content**	**Hrs**

Unit I

1	**Chapter 1: Introduction to Cybercrime, Cyber offenses & Cybercrime** Cybercrime definition and origins of the world, Cybercrime and information security, Classifications of cybercrime, A global Perspective on cybercrimes. Cyber attack plans, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets, Proliferation of Mobile and Wireless Devices, Credit Card Frauds in Mobile and Wireless Computing Era.	**8 Hrs**
2	**Chapter No. 2. Methods used in Cybercrime** Phishing, password Cracking, Keyloggers and Spyware, Virus and Worms, Trojan and backdoors, Steganography, DOS and DDOS attack, SQL injection, Buffer Overflow, Attack on wireless networks, Identity theft.	**8 Hrs**

Unit II

3	**Cybercrimes and Cyber security: The Legal Perspectives** Why do we need Cyber law: The Indian Context, The Indian IT Act, Digital Signature and the Indian IT Act, Amendments to the Indian IT Act, Cybercrime and Punishment.	**8 Hrs**
4	**Chapter 4: Understanding computer Forensics, Forensics of Hand-held devices** Historical background of forensics; Digital forensics science; need for computer forensics; cyber forensics and digital evidence; Analysis E-mail; Digital forensics life cycle; chain of custody concepts; network forensics; Forensics and social networking; challenges in computer forensics; Hand-held devices and digital forensics; Toolkits for Hand-held device forensics; Techno-legal challenges form hand-held devices	**8 Hrs**

Unit – III

5	**Chapter 5: Social, political, Ethical and Psychological Dimensions** Intellectual property in the cyberspace; Ethical dimension of cybercrimes; Psychology, mindset and skills of hackers and other cybercriminals; Sociology of cybercriminals.	**5 Hrs**
6	**Chapter 6: Cybercrime: Illustrations, Examples and Case studies** Introduction, Real-Life Examples, Case Studies: Illustrations of Financial Frauds in Cyber Domain, Digital Signature-Related Crime Scenarios, Digital forensics case illustrations Online Scams.	**5 Hrs**

Text Book

1. Nina Godbole & Sunit Belapure, “Cyber Security”, Wiley India, 2011 and Reprint 2018.

References

1. Dhiren R Patel, “Information security theory & practice”, PHI learning PVT. Ltd, 2010.
2. Bill Nelson, “Guide to Computer Forensics and Investigations”, 4th Edition, CENGAGE Publication. 2009

Evaluation Scheme

In Semester Assessment (ISA)

Assessment	**Theory**
ISA- 1	15
ISA- 2	15
Lab practices	20
Total	**50**

End Semester Assessment (ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter Nos.	Instructions
I	3 Questions to be set of 20 Marks Each	1, 2	Any 2 questions are to be answered
II	3 Questions to be set of 20 Marks Each	3,4	Any 2 questions are to be answered
III	2 Questions to be set of 20 Marks Each	5,6	Any 1 question is to be answered

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Proposed Cyber Security and Forensics Practices

S No	Practices	Tools
1	Implementation of SQL Injection and avoidance	Python Php Tools (Crime, Security or Forensics)
2	Implementation of Digital signature	
3	Implementation of .Steganography	
4	Writing Literature survey report on various issues in Cybersecurity and Forensics	
5	Presentation on domain chosen in Cybercrime, Cyber security or Cyber Forensics.	
6	Demonstration of tool/s used in Cybercrime, Cyber Security or Cyber Forensics	

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19ECAC802	Information Security

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Course Code: 19ECAC802	Course Title: Information Security

L-T-P: 3-0-1	Credits: 4	Contact Hrs: 5
CIE Marks: 50	SEE Marks: 50	Total Marks: 100
Teaching Hrs: 40+24		Exam Duration: 3 hrs

Content	Hrs
Unit - 1	
Chapter No. 1 : Cryptography Basics Introduction, Classic Crypto: Modern Crypto, Taxonomy of Cryptography & Cryptanalysis.	**04 hrs**
Chapter No. 2: Symmetric Key Crypto Introduction, Stream Ciphers, Block Ciphers, Block cipher modes	**06 hrs**
Chapter No. 3: Public Key Crypto and Hash Functions Introduction, Knapsack, RSA, Diffie-Hellman, Elliptic Curve Cryptography, Public Key Notation, Uses for Public Key Crypto, Public Key Infrastructure Hash Functions: Introduction, The Birthday Problem, Non-Cryptographic Hashes, Tiger Hash, HMAC	**06 hrs**
Unit - 2	
Chapter No. 4 Authentication and Authorization Authentication: Introduction, Authentication Methods, Passwords, Biometrics, Two-Factor Authentication, Single Sign-On and Web Cookies, Authorization: Introduction, Access Control Matrix, Multilevel Security Models	**05 hrs**
Chapter No. 5 Authorization and Authentication Protocols Authorization: Multilateral Security, Firewalls, Intrusion Detection, Simple Authentication Protocols: Introduction, Simple Security Protocols, Authentication Protocols	**06 hrs**
Chapter No. 6 Security Protocols Real World Security Protocols: Introduction, Secure Socket Layer, IPSec, Kerberos, GSM	**05 hrs**
Unit - 3	
Chapter No. 7 Software Flaws and Malware Introduction, Software Flaws, Malware, Miscellaneous Software Based Attacks, software tamper resistance, Digital Rights Management.	**04 hrs**

Chapter No. 8 **Cyber Crimes and Laws** Introduction, Computer Forensics, Online Investigative tool, tracing and recovering electronic evidence, Internet fraud, Identity Theft, Industrial Espionage, Cyber Terrorism. Indian IT laws: Introduction and briefs of Law clauses.	**04 hrs**

Text Book:

2. Mark Stamp, "Information Security: Principles and Practices", 2nd Edition, John Wiley and Sons, 2011.

Reference Books:

1. Michael E. Whitman and Herbert J. Mattord, "Principles of Information Security**",** 2nd Edition, Thompson, 2005.
2. William Stallings, "Network Security Essentials Applications and Standards", Person Education, 2000.
3. Behrouz A. Forouzan, "Cryptography and Network Security**",** Tata McGraw-Hill, 2007.

Activities

#	TOPICS	ACTIVITY	WEIGHTAG
1	**Cryptography Basics**	• Write a program to perform encryption and decryption using the following algorithms: a) Ceaser Cipher b) Substitution Cipher c) Hill Cipher	05
2	**Symmetric key encryption**	• Write a Java program to implement the DES algorithm logic	05
3		• Write a C/JAVA program to implement the Rijndael algorithm logic.	10
4	**Symmetric block cipher**	• Using Java Cryptography, encrypt the text "Hello world" using BlowFish. Create your own key using Java keytool.	10
5		• Write a C/JAVA program to implement the BlowFish algorithm logic	10
6	**Asymmetric cryptographic algorithm**	• Write a Java program to implement RSA Algoithm	10
7		• Implement the Diffie-Hellman Key Exchange mechanism using HTML and JavaScript. Consider the end user as one of the parties (Alice) and the JavaScript application as other party (bob).	10

8	**Secure Hash Algorithm**	• Calculate the message digest of a text using the SHA-1 algorithm in JAVA.	10
9	**Intrusion detection System**	• Explore the Intrusion Detection System "Snort"	10
10		• Study of Anti-Intrusion Technique – Honey pot	10
11	**IP security**	• Study of IP based Authentication	10
		TOTAL	**100**

Evaluation Scheme

1. In Semester Assessment (ISA)

Assessment	Marks
ISA- 1	10
ISA- 2	10
Activities	30
ISA	**50**
ESA	**50**
Total	**100**

2. End Semester Assessment (ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter Nos.	Instructions
I	3 Questions to be set of 20 Marks Each	1, 2, 3	Any 2 questions are to be answered
II	3 Questions to be set of 20 Marks Each	4,5,6	Any 2 questions are to be answered
III	2 Questions to be set of 20 Marks Each	7,8	Any 1 question is to be answered

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20ECAC706	OOPS using Java

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Course Code: **20ECAC706** Course Title: **Object Oriented Programming using Java**

L-T-P: **3-0-1** Credits: **4** Contact Hrs.:**5**

ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs.: **40+24**		Exam Duration:**3Hrs**

No	Content	Hrs.
	Unit I	
1	**Chapter No. 1. Introduction and Fundamental Programming Structures in Java**	**4 Hrs.**
	History of java, features of java, A simple java programming, Comments, Data Types, Variables, Constants, Operators, Control Flow, Big Numbers, Arrays	
2	**Chapter No. 2. Objects and Classes**	**6 Hrs.**
	Introduction to Object-Oriented Programming, Classes, Objects, Identifying Classes, Relationships between Classes, Using Predefined Classes, Objects and Object Variables, Mutator and Accessor Methods, First Steps with Constructors, Implicit and Explicit Parameters, Benefits of Encapsulation, Class-Based Access Privileges, Private Methods, Static Fields and Methods, Method Parameters, Object Construction, Overloading, Packages.	
3	**Chapter No. 3. Inheritance and Java Strings**	**6 Hrs.**
	Classes, Super classes, and Subclasses, Inheritance Hierarchies, Polymorphism, Dynamic Binding, Preventing Inheritance: Final Classes and Methods, Casting, Abstract Classes. Java String, Strings Are Immutable, String Buffer class, String Builder class, to String () method, String Tokenizer in Java.	
	Unit II	
4	**Chapter 4: Interfaces and Inner Classes**	**6 Hrs.**
	Interfaces, Properties of Interfaces, Interfaces and Abstract Classes, Object Cloning, Interfaces and Callbacks, Inner Classes, Use of an Inner Class to Access Object State, Special Syntax Rules for Inner Classes, Local Inner Classes, Accessing final Variables from Outer Methods, Anonymous Inner Classes, Static Inner Classes.	
5	**Chapter 5 : Exceptions and Multithreading**	**6 Hrs.**
	Dealing with Errors, The Classification of Exceptions, Declaring Checked Exceptions, How to Throw an Exception, Creating Exception Classes, Catching Exceptions, Catching Multiple Exceptions, Rethrowing and Chaining Exceptions, The finally Clause; Multithreading:- What Are Threads?, Interrupting Threads, Thread States, Thread Properties.	
6	**Chapter 6: Collections**	**4 Hrs.**
	Collection Interfaces, Collection and Iterator Interfaces in the Java Library, Linked Lists, Array Lists, Hash Sets, Tree Sets, Object Comparison, Queues and Dequeues, Priority Queues, Maps.	
	Unit – III	

7	**Chapter 7: Servlets**	**4 Hrs.**
	Background; The life cycle of servlet, A simple servlet, The Servlet API, The javax.servlet Package ,The Servlet Interface, The Servlet Config Interface, Servlet Context Interface, Servlet Request Interface, Servlet Response Interface, The Cookies class.	
8	**Chapter 8: JSP and Database Access**	**4 Hrs.**
	Overview of JSP, Invoking java code from JSP, JSP expressions, scriplet, page directive.	

Text Books

1. Core Java Volume-I Fundamentals 10thEdition,2016, by CAY S.Horstmann, Gray Cornell.
2. Jim Keogh, J2EE The Complete Reference, Tata McGraw Hill 2007.

References

1. Head First Java 2nd Edition by Kathy Sierra and Bert Bates, OREILLY.

Links https://www.studytonight.com/java/component-of-java.php

https://www.javatpoint.com/java-programs.

Activities

#	TOPICS	ACTIVITY	WEIGHTAGE
1	Introduction and Fundamental Programming Structures in Java	• Java installation, path setting ,steps for compilation and Running the java program, • Simple java programming and usage of the followings: Comments, Data Types, Variables, Constants, Operators, Control Flows, Big Numbers, and Arrays.	10
2	Objects and Classes	• Java Programs on: Relationships between Classes and Objects, • Class Constructors, Access Privileges, • Static Fields and Methods, • Overloading and Packages.	10
3	Inheritance and Java Strings	Java Programs on : • Inheritance and different String class. • Use of Final, Static, Abstract keys in program	15
4	Interfaces and Inner Classes	Java Programs on : • Abstract Classes, Object Cloning • Interfaces and different Inner Classes.	10

5	Exceptions and Multithreading	Java Programs on : • Exception ,Chaining Exceptions handlings • Multithreading's,multitaskings	15
6	Collections	Java Programs on : • Java Programs on Collection packages. • Linked Lists, Array Lists, • Hash Sets, Tree Sets, Object Comparison, • Queues and Dequeues, Priority Queues, Maps.	15
7	Servlets	Java Programs on • A simple servlet programs, • The Servlet API, • Servlet Interface and Cookie classes.	15
8	JSP and Database Access	Java Programs on • JSP and Database Access.	10
		Total	**100**

Evaluation Scheme

1. In Semester Assessment (ISA)

Assessment	Marks
ISA- 1	10
ISA- 2	10
Activities	30
ISA	50
ESA	50
Total	100

2. End Semester Assessment (ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter Nos.	Instructions
I	3 Questions to be set of 20 Marks Each	1, 2, 3	Any 2 questions are to be answered
II	3 Questions to be set of 20 Marks Each	4, 5, 6	Any 2 questions are to be answered
III	2 Questions to be set of 20 Marks Each	7, 8	Any 1 question is to be answered

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School of Management Studies and Research

Course Code: **16MBAP704** Course Title: **Managerial Communication and Aptitude**
L-T-P**: 0-0-2** Credits: **2** Contact Hrs: **04hrs/week**
ISA Marks: **100** ESA Marks: **--** Total Marks: **100**
Teaching Hrs: **56 hrs**

Part 1: Managerial Communication

Topic 1: Discussions and Debates

- Understanding discussion
- Parameters measured in Group Discussions
- Video Analysis of Group Discussions

10 hrs

Topic 2: Writing Skills

- Business letters
- Covering letter
- Resume writing
- Email etiquette

10 hrs

Topic 3: Interview Skills

- What companies expect
- Showing Commitment and Learning Ability
- Handling difficult questions
- Understanding interviewer psychology
- Situation Reaction and Presence of Mind
- Dressing right
- Interview etiquette

10hrs

Part 2: Managerial Aptitude

Arithmetical Reasoning:

- Number Systems and Speed Math
- Factors and Multiples
- Combinations
- Probability

- Percentages
- Interest
- Alligations and Averages
- Man-Hour Calculations

14 hrs

Analytical Thinking

- Data Analysis
- Data Interpretation
- Data Sufficiency
- Puzzles

06 hrs

Verbal Logic

- Verbal Analogy
- Verbal Classification
- Letter and Number Series
- Decoding the Codes

04 hrs

Non – Verbal Logic

- Non – Verbal Analogy
- Non – Verbal Classification
- Pattern Completion
- Pattern Comparison

02 hrs

References:

- Vilanilam J V, More Effective Communication: A Manual for Professionals, Sage Publications.
- Shirley Taylor, 2005, Communication for Business: A Practical Approach, 4th Edition, Pearson Longman.
- John M Penrose, Robert W. Rasberry, and Robert J. Myers, Advanced Business Communication, 3rd edition, Thomson South-Western.
- Raymond V. Lesikar, Basic Business Communication: Irwin/McGraw-Hill, 1999
- Sam Phillips, 3000 Synonyms and Antonyms 1st Edition, Goodwill Publishing House
- John Jackman and Wendy Wren, Nelson English Evaluation Pack – Book 5, Thomas Nelson

School of Management Studies and Research

Course Code:**16MBAE801**		Course Title: **Sales Management**
L-T-P**: 2-1-0**	Credits: **03**	Contact Hrs: **04hrs/week**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs: **28 hrs**		Exam Duration: **3 hrs**

Module 1:

Introduction to Sales Management:

Introduction, Evolution of sales management, nature importance of sales management, role and skills of modern sales people, sales management positions/sales as a career, responsibilities (social, ethical, legal) of sales person

06 hrs

Module 2:

Planning sales team:

Nature of organization, types, characteristics of the organization, sales budget, designing of sales territories, sales objectives, quotas and targets, role of ICT in sales organization

07 hrs

Module 3:

Sales-force Management: recruitment and placement, training and development, personal selling, motivation, leadership, analysis and evaluation

10 hrs

Module 4:

Contemporary topics: Global Sales-force management, Role of technology in Sales-force and Distribution channel management, ethical, social and technological issues in sales-force management.

5 hrs

References:

- Spiro, Stanton, Rich, *Management of Sales force*, 11th Edition Tata McGRAW Hill
- Krishna K Havaldar, M Cavale, *Sales and Distribution Management: Text and Cases*, McGRAW Hill
- Tapan K Panda, Sunil Sahadev, *Sales and Distribution Management,* 2nd Edition, Oxford Higher Education.

School of Management Studies and Research

Course Code: **16MBAE806**		Course Title: **Digital Marketing**
L-T-P**: 2-1-0**	Credits: **03**	Contact Hrs: **04hrs/week**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs: **28 hrs**		Exam Duration: **3 hrs**

Module 1:

Introduction to digital marketing: Need and relevance for digital marketing, evolution of digital marketing, challenges/issues concerning digital marketing and future of digital marketing.

06 hrs

Module 2:

Ethical components in digital marketing

Social media campaigns: analyzing successful green campaigns,

Social media and customer engagement: the social feedback cycle, open access to information and the connected customers.

The social web and engagement: the engagement process

Introduction to social media as a business tool: use of face book, YouTube, twitter and LinkedIn as modern tools for business operations and communications.

12 hrs

Module 3:

The new role of the customer: social interactions on social media.

Customer Relationships: Social CRM.

Overview of social business: building a social business ecosystem, social profiles, social applications, using brand outposts and communities

05 hrs

Module 4:

Contemporary topics **05 hrs**

References:

- Dave Evans,*Social Media Marketing: The Next Generation of Business Engagement* Wiley Publication Inc
- Sameer Deshpande and Nancy R Lee,*Social Marketing in India* , Sage Publications
- Diane Martin and John Schouten,*Sustainable Marketing,* Prentice Hall Publications
- Robert Dahlstorm, *Green Marketing: Theory, Practice, and Strategies* (English) 1st Edition South Western Publications

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School of Management Studies and Research

Course Code: **16MBAE834**		Course Title: **Inventory Management**
L-T-P**: 3-0-0**	Credits: **3**	Contact Hrs: **03 hrs/week**
ISA Marks: 5**0**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs: **40hrs**		Exam Duration: **3 hrs**

Module 1

Dependent and independent demand, Demand Forecasting, Need for inventory, types of inventory, effect of inventory on profitability. **08hrs**

Module 2

Basic inventory Model, Inventory model with continuous replenishment, inventory model with discounts, Inventory model with uncertain demand, Inventory model with variable demand and fixed lead time, Inventory model with fixed demand and variable lead time, inventory model with variable demand and lead time **12 hrs**

Module 3

Selective inventory control, dependent inventory management(MRP), Collaborative Planning, Forecasting and Replenishment, JIT systems **06 hrs**

Module 4

Inventory as substitute for capacity, Multilocation inventory models –one origin several destinations, several origin several destinations system **10 hrs**

Module 5

Role of inventory in food security, impact of real time data communication on inventory management **04 hrs**

References

- Buffa and Sarin ,*Operations Management*
- Max Muller ,*Essentials of Inventory Management*
- NarasimhanSitaramn and Mcleavey Dennis, *Production Planning and Inventory Control*

School of Management Studies and Research

Course Code: **16MBAE835** Course Title: **Logistics and Warehouse Management**
L-T-P**: 3-0-0** Credits: **3** Contact Hrs: **03 hrs/week**
ISA Marks: 5**0** ESA Marks: **50** Total Marks: **100**
Teaching Hrs: **40hrs** Exam Duration: **3 hrs**

Module 1
Introduction
Inventory Flow, Information Flow, Planning and Coordination flows , Operational flows, Difference between Logistics and Supply Chain Management Linkage of Logistics to other functions, Objectives of Logistics Management, 5Ps and & 7 Rs of Logistics. Modes of transportation and documentation
10 hrs

Module 2
Location Selection and Network Design
Transportation – Location Trade-offs, , Location Models, Locating Service Organisations
Transportation Modeling, Routing, Transshipment, Multi location and multi item ware house modeling.
12 hrs

Module 3
Warehouse Management
Warehouse Operations, Material Handling and Packaging, Parts and Service Support, Bar coding, RFID, Electronic Data Interchange (EDI),Automated material handling,Warehouse Management Systems (WMS) **08 hrs**

Module 4
Strategic Logistic Practices
International Logistics, Third party and Fourth party logistics,ERP and Ecommerce & Logistics
06 hrs

Module 5
Reverse Logistics and its impact on Environment
Definition, evolution and trends. Economic and environmental impact
04 hrs

References

- G. Raghuram and Rangaraj,*Logistics and Supply Chain Management: Cases and Concepts* Laxmi Publications (2015)
- Christopher, M; Richard Irwin *Logistics and Supply Chain Management*
- Chopra and Mendal, *Supply Chain Management*

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Course Code: **17MBAC704**		Course Title: **Business Research and Statistics**
L-T-P**: 3-1-0**	Credits: **4**	Contact Hrs: **05 hrs/week**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs: **40 hrs**		Exam Duration: **3 hrs**

Module 1:

Introduction to business research:

Meaning and objectives of research, Types of research, Stages in research process, Characteristics of Good Research

Philosophy of Research Methodology: Ontology, Logic of Procedure, epistemology, Research Gap

07 hrs

Module 2:

Concepts in Research:

Variables, Qualitative and Quantitative Research

Research design: Meaning, Importance, Steps in research design,

Types- Descriptive, Exploratory and causal

Sampling :meaning of sample and sampling, methods of sampling-

i)Non– Probability Sampling Convenient, Judgment, Quota, Snow ball,

ii) Probability – Simple Random, Stratified, Cluster, Multi Stage.

06 hrs

Module3:

Types of Data& Data Collection:

Primary and secondary

Methods of Data collection– Personal Interviews, Telephonic or Internet Interview, Observation, Focus group interviews, Expert opinions, self administered questionnaire

Schemes of analysis Secondary data analysis, Qualitative data analysis

Introduction to business statistics: Importance of statistics in managerial decision-making, the nature of study, limitations and misuse of statistical data, subdivisions within statistics.

Data: types, Frequency Distribution, Representation, Measures of Central Tendency, Measures of dispersion

14 hrs

Module 4:

Types of measurement and Scales:

Nominal, Ordinal, Interval, Scale,

Types of Measurement Scales, Attitude rating, Likert, Thurstone, Semantic Differential

04 hrs

Module 5:

Hypothesis andProbability distribution:

Meaning, Nature, Significance, Types of Hypothesis,

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Normal distribution, Correlation and Regression Analysis, Test for means and Proportions, Test for equality of population means, confidence interval, introduction to Chi-square test.
Report writing, ethical issues, and plagiarism

09 hrs

References:

- Cooper and Schlinder, *Business Research Methods,* TMH
- William Zikmund, *Business Research Methods*, Cengage Publication
- G. C. Ramamurthy, *Research Methodology*, Dreamtech Press
- Uma Sekaran and Roger Bougie, *Research Methods for Business*, Wiley Publications
- Uwe Flick, *An Introduction to Qualitative Research*, Sage Publications
- Gerard Guthrie, *Basic Research Methods*, Sage Publications

- G. C. Beri, 2005, *Business Statistics*, 2nd edition, Tata McGraw-Hill.
- R I Lewin and David S Rubin, *Statistics for Management*, 7th edition, Pearson.
- Robert E. Stine, Dean Foster, *Statistics for Business: Decision Making and Analysis*, 1st edition, Pearson
- Bruce Bowerman, Emly S. Murphree, Richard O'Connell*Business Statistics in Practice*, 5th edition, Tata McGraw-Hill.
- J K Sharma, *Business Statistics*, 2rd edition, Pearson

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Course Code: **17MBAP803**	Course Title: **MS Excel for Managers**
L-T-P**: 0-0-2** Credits: **2**	Contact Hrs: **04Sessions/week**
ITA Marks: **100** ETA Marks: **--**	Total Marks: **100**
Teaching Hrs: **56hrs**	

MS Excel

- MS Excel Basics
- Editing Worksheet
- Formatting Cells
- Formatting Worksheets
- Working with Formula
- Advanced Operations
- MS Excel Resources

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Course Code: **17MBAW802** Course Title: **Project work Phase - I**
L-T-P**: 0-0-2** Credits: **2** Contact Hrs: **04Sessions/week**
ITA Marks: **100** ETA Marks: **--** Total Marks: **100**
Teaching Hrs: **56hrs**

Student has to execute the below mentioned tasks about the industry related to his/her SIIT firm

Task s:

- Review of literature (Strategic Management models and tools)
- Value chain study
- Internal value chain and identification of drivers
- Report writing

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Course Code: **17MBAW803** Course Title: **Entrepreneurship Project -Phase III**
L-T-P**: 0-0-3** Credits: **3** Contact Hrs: **06Sessions/week**
ITA Marks: **100** ETA Marks: **--** Total Marks: **100**
Teaching Hrs: **56hrs**

Tasks

- Finalization of business model
- Prepare for commercial launch
- Report on Business plan and reflections on experience

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Course Code: **17MBAW804**	Course Title: **Project work Phase - II**
L-T-P**: 0-0-2** Credits: **2**	Contact Hrs: **04Sessions/week**
ITA Marks: **50** ETA Marks: **50**	Total Marks: **100**
Teaching Hrs: **56hrs**	Viva-voce: **3 hrs**

Project work Phase – I is prerequisite

Student has to execute the below mentioned tasks

Tasks

- Industry value chain and identification of drivers
- Compare and contrast Company value chain with industry value chain
- Industry Trends and futuristic outlook
- Report writing

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Course Code: **18MBAE805** Course Title: **Integrated Marketing Communications**

L-T-P**: 2-1-0** Credits: **03**Contact Hrs: **04 Sessions/week**

ITA Marks: **50** ETA Marks: **50**Total Marks: **100**

Teaching Hrs: **28 hrs** Exam Duration: **3 hrs**

Module 1:

Integrated marketing communication: Integrated marketing communication: The evolution of IMC, reasons for growing importance of IMC, the promotional mix- advertising, direct marketing, internet marketing, sales promotion, publicity, public relations, personal selling, promotion management, IMC planning process

06hrs

Module 2:

Organizing for advertising and promotion: The role of advertising agencies, agency compensation, evaluating agencies, developing the integrated marketing communication program, Importance of creative advertising

Media planning & strategy: An overview on media planning, developing media plan, market analysis and target market identification, establishing media objective, developing and implementation media strategies, evaluation and follow up.

Internet and IMC: Measuring the effectiveness of Internet advertising, advantages of Internet marketing, direct marketing on Internet budgeting for marketing communication.

12hrs

Module 3:

Consumer Decision Making Process: Steps of effective communication, communication objectives, consumer decision making process, how advertising works- AIDA and hierarchy effects model, convincing senior executives on the marketing communication budget**.**

05hrs

Module 4:

Contemporary topics: Shift to Mobile and Beyond, Social Media Impact on Communication and Brand Journalism

05hrs

References:

- Belch, M.A., and Belch, G.E., *Advertising and Promotion*, Tata Mc-Graw Hill Publication
- Keller Kevin, Strategic Brand Management, Pearson Publication, Third Edition
- Shah, K. and D'souza, A., *Advertising & Promotion*, Tata Mc-Graw Hill Publication

School of Management Studies and Research

Course Code: **18MBAE807** Course Title: **Industrial Marketing**
L-T-P**: 2-1-0** Credits: **03** Contact Hrs: **04 Sessions/week**
ITA Marks: **50** ETA Marks: **50** Total Marks: **100**
Teaching Hrs: **28 hrs**Exam Duration: **3 hrs**

Module1:

Basic concept of Industrial Marketing: Industrial Marketing, consumer and industrial products, consumer and industrial marketing, differences of consumer and industrial marketing.

Industrial markets: Industrial customers, specificities of industrial markets, the environment of Industrial Marketing. The specificities and the risks in international markets. The trends in globalization of industrial markets

5 hrs

Module 2:

Organization's purchasing behaviour, system of purchasing decisions: System of taking decisions in the Industrial Marketing. The poles in the system of taking purchasing decisions in Industrial Marketing.Factors that affect the purchasing decision in Industrial Marketing.

Process of taking purchasing decisions for industrial products.Types of purchasing activities in Industrial Marketing.Marketing Strategies for the purchasing activities and the stages of the process of taking purchasing decisions. Information sources that are used from members of the Taking purchasing decisions' system

10 hrs

Module 3:

Pricing and Promotion in Industrial Marketing: The importance of pricing in Industrial Marketing. In-house and external factors determine the price. Procedures, processes and pricing policies.The mixture promotion in industrial marketing. Sales promotion, advertising, direct marketing, public relations and personal selling.

Distribution of industrial products: The importance of industrial products. Administration and revitalization of existing industrial products. The Marketing distribution functions, main forms of intermediate, forms of industrial channels. Design, selection and management of distribution channels.

08 hrs

Module 4:

Contemporary topics

Systematic approach to the management and control of supplier/customer relationships, interactive strategic marketing planning: A new approach. Smart Business to business strategy.

05 hrs

References:

1. Tomaras P. (2009). Industrial Marketing. Published by the author. Athens, (ISBN: 978-960-90674-3-0). (in Greek)
2. Ralph S Alexander, Richard M Hill, Industrial Marketing-Edition-3

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Course Code: **18MBAE808**
Course Title: **Product and Brand Management**
L-T-P**: 2-1-0**
Credits: **03**Contact Hrs: **04hrs/week**
ITA Marks: **50**
ETA Marks: **50** Total Marks: **100**
Teaching Hrs: **28hrs**
Exam Duration: **3 hrs**

Module 1:
Introduction to Product Management, Role and Functions of Product Managers,Product Mix and SBU Strategies, Portfolio analysis (BCG / GE Multifactor Matrix), Marketing Planning

7 hrs

Module 2:
Product Decisions over the PLC, New Product Development Process, Pricing and Promotion strategies, channel management

7 hrs

Module 3:
Introduction to Brand Management- Branded House Vs House of Brands, Corporate Brand,Brand prism by Kapferer Model, Brand Anatomy,Branding Decisions- Line Extensions, Category Extension, Brand Equity – Concept and measure

10hrs

Module 4:
Contemporary Practices **04hrs**

References:

- Donald R Lehamann, Product management 4th Edition, Mcgrow Higher Ed
- Marc Annacchino, New Product Development, 2003 Ed, Elsevier Butterworh-Heinemann
- Saaksvuori Antti, Product Lifecycle management, Springer- Verlag
- Kevin Lane Keller, M G Parameswaran, Isaac Jacob, Strategic Brand Management, 2008, Person publication
- David Aaker, Brand Management, TMH publication
- YLR Murthy, Brand management Indian prospective, Vikas Publications

School of Management Studies and Research

Course Code:**19MBAW802** Course Title: **Internship and Project work**
L-T-P**: 0-0-7** Credits: **7**Contact Hrs: **14Sessions/week**
ITA Marks: **50** ETA Marks: **50** Total Marks: **100**
Teaching Hrs: **98 hrs** Viva-voce: **3 hrs**

PART I

- Broad overview pertaining industry and detailed organization profile in the framework of foundation courses (Human Resource Management, Marketing Management, Operations Management and Financial Management)
- Student has to work on the research area
- Data collection
- Analysis and Interpretation
- Findings, recommendations and conclusion
- Report writing
- Experience worth noting

PART II

Detailed industry profile based on secondary source

Tasks

- Data collection
- Analysis
- Interpretation using tools leading to Challenges, Megatrends and Impact in the global context
- Scope and Opportunities in local prospective