

Semester-III										
Sr.	Course	Course	Course Name	Credits	Details of Sessional Marks				ESM	Total
No.	Type	Code			CT	TA	Lab.	Total		Marks
1	PCC	ECA-551	Computer Networks	5 (3-1-2)	15	20	15	50	50	100
2	PCC	ECA-553	Object Oriented Systems Modeling	5 (3-1-2)	15	20	15	50	50	100
3	PCC	ECA-555	Software Project Management	4 (3-0-2*)	15	20	15	50	50	100
3	PCC	ECA-557	Artificial Intelligence	4 (3-1-0)	30	20	-	50	50	100
5	PEC	ECA-	Programme Elective-I	4 (3-1-0)	30	20	-	50	50	100
6	ISC	ECA-559	Summer Training/ Internship and Seminar	3 (0-0-6)	-	100	-	100	-	100
Total Credits				25						

*During Practical hours students will do a Minor Project which may be extended as Major Project in Semester-IV

Semester-IV										
Sr.	Course	Course	Course Name	Credits	Details of Sessional Marks				ESM	Total
No.	Type	Code			CT	TA	Lab.	Total		Marks
Programme Elective-I										
			1 Theory of Automata & Formal Languages (ECA-561)							
			2 Simulation & Modeling (ECA-563)							
			3 Information Security & Cyber Laws (ECA-565)							
			4 E_Commerce (ECA-567)							
			5 Internet of Things (ECA-569)							

Semester-IV										
Sr.	Course	Course	Course Name	Credits	Details of Sessional Marks				ESM	Total
No.	Type	Code			CT	TA	Lab.	Total		Marks
1	PEC	ECA-	Programme Elective-II	4 (3-1-0)	30	20	-	50	50	100
2	PEC	ECA-	Programme Elective-III	4 (3-1-0)	30	20	-	50	50	100
3	PEC	ECA-	Programme Elective-IV	4 (3-1-0)	30	20	-	50	50	100
4	PRC	ECA-592	Project	13 (0-0-26)	-	50	-	50	50	100
Total Credits				25						

Programme Elective-II					Programme Elective-III					
			1 Compiler Design (ECA-552)							
			2 Machine Learning (ECA-554)							
			3 Advanced Database Management Systems (ECA-556)							
			4 ERP Systems (ECA-558)							
			5 Pythan Programming (ECA-560)							
Programme Elective-IV										
			1 Cryptography & Network Security (ECA-582)							
			2 Soft Computing (ECA-584)							
			3 Embedded System (ECA-586)							
			4 Virtual Reality (ECA-588)							
			5 Data Analytics (ECA-590)							

(ECA-551) COMPUTER NETWORKS 5 (3-1-2)

Course Content:

Unit-1:

Introduction Concepts: Goals and Applications of Networks, Network structure and architecture, The OSI reference model, services, Network Topology Design – Delay Analysis, Back Bone Design, Local Access Network Design. Physical Layer Transmission Media, Switching methods, ISDN, Terminal Handling.

Unit-2:

Medium Access sub layer: Medium Access sub layer - Channel Allocations, LAN protocols - ALOHA protocols - Overview of IEEE standards - FDDI. Data Link Layer - Elementary Data Link Protocols, Sliding Window protocols, Error Handling.

Unit-3:

Network Layer: Network Layer - Point - to Pont Networks, routing, Congestion control Internetworking -TCP / IP - IP packet, IP address, IPv6. '

Unit-4:

Transport Layer: Transport Layer - Design issues, connection management, session Layer-Design issues, remote procedure call. Presentation Layer-Design issues, Data Compression techniques, cryptography - TCP - Window Management.

Unit-5:

Application Layer: Application Layer: File Transfer, Access and Management, Electronic mail, Virtual Terminals, Other application, Example Networks - Internet and Public Networks.

Text and References Books:

1. Forouzen, "Data Communication and Networking", TMH
2. A.S. Tannenbaum, "Computer Networks", 3rd Edition, Prentice Hall India, 1997.
3. S. Keshav, "An Engineering Approach on Computer Net working", Addison Wesley, 1997
4. W. Stallings, "Data and Computer Communication", Mac-millan Press, 1989

Course Outcomes:

1. Explain the functions of the different layer of the OSI Protocol. (Understand)
2. Design of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) based on available network devices. (Apply, Analyze)
3. Develop network programing application for a given problem related to TCP/IP protocol stack. (Apply, Analyse)
4. Understand and analyze different routing algorithms. (Understand, Analyze)
5. Understand the use of IP addressing schemes as per IPV4 and IPV6. (Understand)

(ECA-553) OBJECT ORIENTED SYSTEM MODELING 5(3-1-2)

Course Content:

Unit-1:

Object Oriented Design and Modeling: Object oriented fundamentals, Objects and Classes, ObjectOriented Design Process, importance of modeling, principles of modeling, OOAD Methods, Software Development Life Cycle, Introduction to Unified Process, Introduction to UML: UML Terminology, conceptual model of the UML, Use of UML in Unified Process.

Unit-2:

Basic Structural Modeling: Classes, Relationships, common Mechanisms, and diagrams. Class & Object Diagrams: Terms, concepts, modeling techniques for Class & Object Diagrams, Links and Associations, Link Attributes and Link Classes, Generalization and Inheritance, Aggregation and Composition, Qualified Association, Handling multiplicity in Object creation, Abstract Classes, Specifying constraints in Class Diagrams, Advanced Structural Modeling: Advanced classes, advanced relationships, Interfaces, Types and Roles, Packages, Use Case Modeling: Use Cases and Use Case Diagrams, Use Case driven Methodology.

Unit-3:

Behavioral Modeling: Interactions and Interaction Diagrams, Use-Case Realization: Scenario, Events Trace Diagram, Collaboration Diagrams, State Chart Diagrams, Nested State Diagrams, Activity Diagrams, Advanced Behavioral Modeling Concepts, Architectural Modeling: Component, Deployment, Component diagrams and Deployment diagrams. Elementary Design Patterns, The MVC Architecture Pattern, Features of Elegant Software Design: Elegant variable, Elegant Classes, Elegant Methods, Elegant Packages, Introduction to Object Oriented Software Quality Metrics.

Unit-4:

Java Programming: Introduction to Java Programming, Operator, Data type, Variable, Arrays, Control Statements, Methods & Classes, Inheritance, Package and Interface, Exception Handling, Multithread programming, I/O, Java Applet, String handling, Networking, Event handling.

Unit-5:

Introduction to Advance Java Programming: Demonstration of concepts through example programs for AWT, Java Swing, Java Beans, Java Servlets, JSP, Modern Object Technologies and Web Services.

Lab Work:

1. Write a program in Java, to implements the Stack data Structure.
2. Write a program in Java to implement a simple Bank Account.
3. Write a program in Java showing the action from three threads using a suitable example
4. Write a program of threads in Java showing inter leaving of actions from two threads: t1 & t2 synchronizing on a shared object. Let t1 print message Ping and t2 prints message Pong. Take as command line arguments the following inputs to the program:
Sleep interval for thread t1
Sleep interval for thread t2
Messages per cycle
Number of Cycles
5. Write a program in Java which converts a text file into all capital letters.
6. Write a program to create a sequential file that could store details about five products. Details include product code, cost, no. Of items available and number of items available and are provided through keyboard.
7. Create a Person class with private instance variables for Person's name and birth date. Add appropriate accessor methods to access the variables. Then create a subclass CollegeGraduate with private instance variables for the student's GPA and year of graduation and appropriate accessors for these variables. Don't forget to include appropriate constructors for your classes. Then create a class with a main() method that manages your classes.
8. Develop an applet that receives three numeric values from the user and displays the largest of the three on the screen. Write a HTML page that embeds this applet.
9. Write an applet which draws a human face with ovals and arcs.
10. Write servlets that accepts user preferences (color, hobby etc.) from user, saves it as cookie on user machine and reads the cookie from the user machine.
11. Write an AWT application with checkbox such that all cable TV channels will be displayed from the selected category.

12. Create a simple Swing based applet that displays two buttons. Each time a button is clicked, a message is displayed that states which button was clicked.
13. Create JSP code that uses a persistent cookie (i.e. a cookie with an expiration date in the future) to keep track of how many times the client computer has visited the page. Use setMaxAge method to remain on the client's computer for one month. Display the number of page hits (i.e. cookie's value) every time the page loads.
14. Write JSP program that asks user his favourite color as request parameter and sets it as the background color of the page or sets the background color white if the parameter value is null.
15. Write a program in Java to show the mouse click event. The program should change the background colour of window randomly at each mouse click.

Text and Reference Books:

1. Balagurusamy E, "Programming in JAVA", TMH
2. Herbert Schildt, "The Complete Reference JAVA", TMH
3. Bruce Eckel, "Thinking in Java", Prentice Hall PTR.
4. Grady Booch, James Rumbaugh, Ivar Jacobson: The Unified Modeling Language User Guide, Pearson Education.
5. Mark Priestley: Practical Object-Oriented Design with UML, TATA Mc-GrawHill.
6. Meilir Page-Jones: Fundamentals of Object Oriented Design in UML, Pearson Education.
7. Pascal Roques: Modeling Software Systems Using UML2, WILEY-Dreamtech India Pvt. Ltd.
8. Applying UML and Patterns: An introduction to Object – Oriented Analysis and Design and Unified Process, Craig Larman, Pearson Education.
9. Atul Kahate: Object Oriented Analysis & Design, The McGraw-Hill Companies.

Course Outcomes:

1. Analyse information systems in real-world settings and use an object-oriented method for analysis and design. (Analyse)
2. Understand features of object-oriented design such as encapsulation, polymorphism, inheritance, and UML. (Understand)
3. Understand and prepare different types of UML diagrams like use case diagrams, interaction diagrams, nested state diagrams, state chart diagrams, activity diagram etc. (Understand, Apply)
4. Understand and appreciate the use of Design Patterns in the Software Development. (Understand, Apply)
5. Understand the core and advance Java Programming features and apply them in complex problem solving. (Understand, Apply)

(ECA-555) SOFTWARE PROJECT MANAGEMENT 4 (3-0-2*)

Course Content:

Unit-1:

Introduction and Software Project Planning: Fundamentals of Software Project Management (SPM), Need Identification, Vision and Scope document, Project Management Cycle, SPM Objectives, Management Spectrum, SPM Framework, Software Project Planning, Planning Objectives, Project Plan, Types of project plan, Structure of a Software Project Management Plan.

Unit-2:

Project Organization and Scheduling: Project Elements, Work Breakdown Structure (WBS), Types of WBS, Functions, Activities and Tasks, Project Life Cycle and Product Life Cycle, Ways to Organize Personnel, Project schedule, Scheduling Objectives, Building the project schedule, Scheduling terminology and techniques, Network Diagrams: PERT, CPM, Bar Charts: Milestone Charts, Gantt Charts.

Unit-3:

Project Monitoring and Control: Dimensions of Project Monitoring & Control, Earned Value Analysis, Earned Value Indicators: Budgeted Cost for Work Scheduled (BCWS), Cost Variance (CV), Schedule Variance (SV), Cost Performance Index (CPI), Schedule Performance Index (SPI), Interpretation of Earned Value Indicators.

Unit-4:

Software Quality Assurance: Concept of Software Quality, Software Quality Attributes, Software Quality Metrics and Indicators, Software Quality Assurance (SQA), SQA Activities, SQA Plans, Software Quality Frameworks, ISO 9000 Models, SEI Capability Maturity Model (CMM), Software verification and validation, Formal SQA Approaches: Proof of correctness, Statistical quality assurance, Clean room process.

Unit-5:

Software project estimation, Estimation methods, Estimation models, Decision process. Risk Management: Risks and risk types, Risk Breakdown Structure (RBS), Risk Management Process: Risk identification, Risk analysis, Risk planning, Risk monitoring, Cost Benefit Analysis, Software Project Management Tools: CASE Tools, Planning and Scheduling Tools like MS-Project.

Text and References Books:

1. Software Project Management, M. Cotterell, Tata McGraw-Hill Publication.
2. Information Technology Project Management, Kathy Schwalbe, Vikas Pub. House.
3. Software Project Management, S. A. Kelkar, PHI Publication

Course Outcomes:

1. Understand various concepts of Software Project Planning and Management. (Understand)
2. Understand various techniques of Human Resource Organization and Develop schedule of software projects using PERT/CPM. (Understand, Apply)
3. Understand cost benefit analysis, risk management and techniques of monitoring & control of software projects. (Understand)
4. Use concepts of software quality assurance in the development of software projects. (Apply)
5. Assess the project to develop the scope of work, provide accurate size, cost, time and effort estimates for software projects. (Apply, Analyze)

(ECA-557) ARTIFICIAL INTELLIGENCE 4(3-1-0)

Course Content:

Unit-1:

Introduction to Artificial Intelligence, Brief history, Various approaches to AI, Areas of application, Simulation of sophisticated & Intelligent Behavior in different area, Problem solving in games, natural language processing, automated reasoning, and visual perception, Knowledge and its role in AI, Heuristic algorithm versus solution guaranteed algorithms, Introduction to soft computing.

Unit-2:

Representing problems in state space, Informed versus uninformed search, Production System Model, Evaluation of the Production System, Depth First Search and Breadth First Search, Heuristics, Heuristic Search Techniques: Hill Climbing, Best First search, A* Algorithm, Branch and Bound, Cryptarithmic Problem, Means End Analysis, AO* Algorithm, Game Playing: MINMAX Search, Alpha-Beta Pruning, Heuristic Estimation.

Unit-3:

Knowledge Representation and Reasoning : Propositional Logic, First Order Predicate Logic, Graphs, Associative Network, Semantic Networks, Conceptual Dependencies, Frames, Scripts, Horn Clauses, Introductory Examples from PROLOG, Case Grammar Theory, Production Rules Knowledge Base, The Interface System, Forward & Backward Deduction, Inference System in Propositional and Predicate Logic, Reasoning under Uncertainty.

Unit-4:

Understanding Natural Languages, Various Approaches of NLP, Parsing techniques, Context free and transformational grammars, Transition nets, Augmented transition nets, Fillmore's grammars, Grammar free analyzers, Sentence generation, and translation, Introduction to Pattern Recognition, Structured Description, Symbolic Description, Machine Perception, Object Identification, Speech Recognition.

Unit-5:

Expert Systems: Architecture of Expert System, Representing and using domain knowledge, Expert System Shell, Explanation System, Knowledge Acquisition System, Case study of Existing Expert Systems like DENDRAL, MYCIN, Development of a small Expert System using programming Languages and tools like LISP, PROLOG, JESS.

Text and References Books:

1. N. J. Nilsson, "Artificial Intelligence: A New Synthesis", Elsevier Publications.
2. Charnick, "Introduction to A.I.", Addison Wesley.
3. Rich & Knight, "Artificial Intelligence", McGraw-Hill Publication.
4. Winston, "LISP", Addison Wesley
5. Marcellous, "Expert System Programming", PHI
6. Elamie, "Artificial Intelligence", Academic Press
7. Lioyed, "Foundation of Logic Processing", Springer Verlag
8. D. W. Patterson, "Introduction to Artificial Intelligence and Expert Systems", PHI.

Course Outcomes:

1. Understand different types of AI agents (Understand).
2. Understand and apply various AI search algorithms (uninformed, informed, heuristic, constraint satisfaction, genetic algorithms) (Understand, Apply).
3. Understand the fundamentals of knowledge representation, reasoning, and machine learning techniques and apply them to real world problems. (Understand, Apply)
4. Know how to build simple knowledge based systems using languages like LISP, Prolog, and AI tools like JESS. (Apply)
5. Carry out independent (or in a small group) research and communicate it effectively in a seminar. (Apply, Analyze)

Programme Elective-I 4 (3-1-0)
(Any one of the following five courses)

Theory of Automata & Formal Languages (ECA-561)

Course Content:

Unit-1:

Defining Languages and Grammars, Chomsky hierarchy, Kleene closures, Regular Expressions, Finite Automata (FA), Transition Graph, Generalised Transition Graph.

Unit-2:

Nondeterministic finite Automata (NFA), Deterministic finite Automata (DFA), Construction of DFA from NFA and optimization, Partitioning Algorithm, Equivalence of DFA and NFA and their optimization, FA with output: Moore machine, Mealy machine and their Equivalence, Applications and Limitation of FA.

Unit-3:

Arden Theorem, Pumping Lemma for regular expressions, Myhill-Nerode theorem, Context free grammar: Ambiguous Grammars and Simplification, Normal forms for CFGs, Pumping lemma for CFLs, Decidability of CFGs, Ambiguous to Unambiguous CFG.

Unit-4:

Push Down Automata (PDA): Description and definition, Working of PDA, Acceptance of a string by PDA, PDA and CFG Equivalence, Deterministic and non-deterministic PDA, Introduction to auxiliary PDA and Two Stack PDA.

Unit-5:

Turing machines (TM): Basic model, definition and representation, Language acceptance by TM, TM and Type – 0 Grammar, Integer function computation by TM, Halting problem of TM, Modifications in TM, Universal TM, Properties of recursive and recursively enumerable languages, decision problem, Un-decidability of Post Correspondence Problem, Church's Thesis, Recursive function theory, Godel Numbering.

Text and References Books:

1. Hopcroft, Ullman, "Introduction to Automata Theory, Language and Computation", Nerosa Publishing House
2. K.L.P. Mishra and N. Chandrasekaran, "Theory of Computer Science (Automata, Languages and Computation)", PHI.
3. Martin J. C., "Introduction to Languages and Theory of Computations", TMH
4. Papadimitrou, C. and Lewis, C.L., "Elements of theory of Computations", PHI
5. Cohen D. I. A., "Introduction to Computer theory", John Wiley & Sons
6. Kumar Rajendra, "Theory of Automata (Languages and Computation)", PPM

Course Outcomes:

1. Describe the capabilities and limitations of the abstract machines including finite automata, pushdown automata, and Turing machines and their associated languages. (Understand)
2. Construct finite automata, pushdown automata, Turing machines for the given grammar and vice versa. (Apply)
3. Show that a language is not regular / not context-free using pumping lemma. (Apply)
4. Outline the characteristics of P, NP and NP Complete problems in the context of Turing machines. (Understand)

SIMULATION AND MODELLING (ECA-563)

Course Content:

Unit-1

System definition and components, stochastic activities, continuous and discrete Systems, System modeling, types of models, static and dynamic physical models, Static and dynamic mathematical models, Full corporate model, types of system study.

Unit-2

System simulation, Why to simulate and when to simulate, Basic nature of simulation, technique of simulation, comparison of simulation and analytical methods, types of system simulation, real time simulation, hybrid simulation, simulation of pure-pursuit problem single-server queuing system and an inventory problem, Monte Carlo simulation, Distributed Lag models, Cobweb model.

Unit-3

Simulation of continuous systems, analog vs. digital simulation, simulation of water reservoir system, simulation of a servo system, simulation of an autopilot Discrete system Simulation, Fixed time-step vs. event-to-event model, generation of random numbers, Test for randomness, Generalization of non-uniformly distributed random numbers, Monte-Carlo computation vs. stochastic simulation.

Unit-4

System dynamics, exponential growth models, exponential decay models, modified exponential growth models, logistic curves, generalization of growth models, System Dynamics diagrams, Feedback in Socio-Economic systems, world model.

Unit-5

Simulation of PERT networks, Critical path computation, uncertainties in Activity duration, Resource allocation and consideration. Simulation software, Simulation languages, continuous and discrete simulation languages, Expression based languages, object-oriented simulation, generalpurpose vs. application-oriented simulation packages, CSMP-III, MODSIM-III.

Text and Reference Books:

1. Geoftrey Gordon, "System Simulation", PHI
2. Narsingh Deo, "System Simulation with digital computer", PHI
3. Averill M. Law, W. David Kelton, "Simulation Modeling and Analysis", TMH

Course Outcomes:

1. Understand the modeling process and various types of modeling techniques (Understand)
2. Understand various advantages of modeling & simulation over the actual experimentation analytical and experimentation techniques. (Understand)
3. Study various types of simulation techniques and understand their relative advantages and disadvantages. (Understand)
4. Understand and analyze the system dynamics with specific reference to various types of growth models. (Understand, Analyze)
5. Understand and use optimization techniques like PERT/CPM and various modeling & simulation tools. (Understand, Apply)

INFORMATION SECURITY & CYBER LAWS (ECA-565)

Course Content:

Unit-1:

Introduction to information systems, Types of information systems, Development of Information systems, Introduction to information security, Need for Information security, Threats of Information Systems, Information Assurance, Cyber Security and Security Risk Analysis.

Unit-2

Application security (Database, E-mail and Internet), Data Security Considerations - Backups, Archival Storage and Disposal of Data, Security Technology - Firewall and VPNs, Intrusion Detection, Access Control, Security Threats - Viruses, Worms, Trojan Horse, Bombs, Trapdoors, Spoofs, E-mail viruses, Macro viruses, Malicious Software, Network and Denial of Services Attack, Security Threats to E-

Commerce – Electronic Payment System, e-Cash, Credit/Debit Cards, Digital Signature, public Key Cryptography.

Unit-3

Developing Secure Information Systems, Application Development Security, Information Security Governance & Risk Management, Security Architecture & Design, Security Issues in Hardware, Data Storage & Downloadable devices, Physical Security of IT Assets, Access Control, CCTV and intrusion Detection Systems, Backup Security Measures.

Unit-4

Security Policies, why Policies should be developed, WWW Policies, Email Security Policies, Policy Review Process- Corporate policies- Sample Security Policies, Publishing and Notification requirement of the Policies.

Unit-5

Information Security Standards- ISO, IT Act, Copyright Act, Patent Law, IPR. Cyber Laws in India: IT Act 2000 Provisions, Intellectual Property Law: Copy Right Law, Software License, Semiconductor Law and Pattern Law.

Text and Reference Books:

1. Charles, P., and Shari Lawrence Pfleeger, "Analyzing Computer Security". Pearson Education India.
2. V.K. Pachghare, "Cryptography and information security", PHI Learning Pvt. Ltd., Delhi India.
3. Dr Surya Prakash Tripathi, Ritendra Goyal, and Praveen Kumar Shukla, "Introduction to Information Security and Cyber Law", Willey Dreamtech Press.
4. Schou, Shoemaker, "Information Assurance for the Enterprise", Tata McGraw Hill.
5. Chander Harish, "Cyber Laws and their Protection", PHI Learning Private Limited, Delhi, India.

Course Outcomes:

1. Understand information, information systems, information security, Cyber Security and Security Risk Analysis. (Understand)
2. Understand and apply application security, data security, security technology, security threats from malicious software. (Understand, Apply)
3. Understand the concepts of security threats to e-commerce applications such as electronic payment system, e-Cash, Credit/Debit Cards etc. (Understand)
4. Understand and apply Information Security Governance & Risk Management, Security of IT Assets and Intrusion Detection Systems. (Understand, Apply)
5. Understand various types of Security Policies, Cyber Ethics, IT Act, IPR and Cyber Laws in India. (Understand)

E-COMMERCE (ECA-567)

Course Content:

Unit -1

Introduction: Electronic Commerce - Technology and Prospects, Definition of E-Commerce, Economic potential of electronic commerce, Incentives for engaging in electronic commerce, forces behind E-Commerce, Advantages and Disadvantages, Architectural framework, Impact of E-commerce on business. Network Infrastructure for E-Commerce: Internet and Intranet based E-commerce issues, problems and prospects, Network Infrastructure, Network Access Equipment, Broadband telecommunication (ATM, ISDN, FRAME RELAY).

Unit-2

Mobile Commerce: Introduction, Wireless Application Protocol, WAP technology, Mobile Information device, Mobile Computing Applications.

Unit-3

Web Security: Security Issues on web, Importance of Firewall, components of Firewall, Transaction security, Emerging client server, Security Threats, Network Security, Factors to consider in Firewall design, Limitation of Firewalls.

Unit-4

Encryption: Encryption techniques, Symmetric Encryption- Keys and data encryption standard, Triple encryption, Asymmetric encryption- Secret key encryption, public and private pair key encryption, Digital Signatures, Virtual Private Network.

Unit -5

Electronic Payments: Overview, The SET protocol, Payment Gateway, certificate, digital Tokens, Smart card, credit card, magnetic strip card, E-Checks, Credit/Debit card based EPS, online Banking EDI Application in business, E- Commerce Law, Forms of Agreement, Govt. policies and Agenda.

Text and Reference Books:

1. Ravi Kalakota, Andrew Winston, "Frontiers of Electronic Commerce", Addison Wesley.
2. Bajaj and Nag, "E-Commerce the cutting edge of Business", TMH
3. P. Loshin, John Vacca, "Electronic commerce", Firewall Media, New Delhi

Course Outcomes:

1. Understand the E-commerce, its advantages & disadvantages and infrastructure requirements. (Understand)
2. Understand various concepts of mobile commerce (Understand)
3. Understand various issues related to web security and their limitations. (Understand)
4. Understand concepts of various encryption techniques, digital signatures and VPN (Understand)
5. Understand details of various electronic payments systems. (Understand)

INTERNET OF THINGS (ECA-569)

Course Content:

Unit-1: Introduction

What is the Internet of Things? : History of IoT, About IoT, Overview and Motivations, Examples of Applications, Internet of Things Definitions and Frameworks: IoT Definitions, IoT Architecture, General Observations, ITU-T Views, Working Definition, IoT Frameworks, Basic Nodal Capabilities

Unit-2: Fundamentals of IoT Mechanisms and Key Technologies Identification of IoT Objects and Services, Structural Aspects of the IoT, Environment Characteristics, Traffic Characteristics, Scalability, Interoperability, Security and Privacy, Open Architecture, Key IoT Technologies, Device Intelligence, Communication Capabilities, Mobility Support, Device Power, Sensor Technology, RFID Technology, Satellite Technology

Unit-3: Radio Frequency Identification Technology

RFID: Introduction, Principle of RFID, Components of an RFID system, Issues EPC Global Architecture Framework: EPCIS & ONS, Design issues, Technological challenges, Security challenges, IP for IoT, Web of Things. Wireless Sensor Networks: History and context, WSN Architecture, the node, Connecting nodes, Networking Nodes, Securing Communication WSN specific IoT applications,

challenges: Security, QoS, Configuration, Various integration approaches, Data link layer protocols, routing protocols and infrastructure establishment.

Unit-4: Resource Management in the Internet of Things

Clustering, Software Agents, Clustering Principles in an Internet of Things, Architecture, Design Guidelines, and Software Agents for Object Representation, Data Synchronization. Identity portrayal, Identity management, various identity management models: Local, Network, Federated and global web identity, user-centric identity management, device centric identity management and hybrid-identity management, Identity and trust.

Unit-5: Internet of Things Privacy, Security and Governance

Vulnerabilities of IoT, Security requirements, Threat analysis, Use cases and misuse cases, IoT security tomography and layered attacker model, Identity establishment, Access control, Message integrity, Non-repudiation and availability, Security model for IoT. Business models for Internet of Things: Business Models and Business Model Innovation, Value Creation in the Internet of Things, Business Model Scenarios for the Internet of Things.

Text and Reference Books:

1. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118-47347-4, Willy Publications
2. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", ISBN 978-3642-19156-5 e-ISBN 978-3-642-19157-2, Springer.
3. Parikshit N. Mahalle& Poonam N. Railkar, "Identity Management for Internet of Things", River Publishers, ISBN: 978-87-93102-90-3 (Hard Copy), 978-87-93102-91-0 (ebook).
4. Hakima Chaouchi, "The Internet of Things Connecting Objects to the Web" ISBN: 978-184821-140-7, Willy Publications.
5. Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things: Key Applications and Protocols, ISBN: 978-1-119-99435-0, 2nd Edition, Willy Publications.
6. Daniel Kellmereit, Daniel Obodovski, "The Silent Intelligence: The Internet of Things", Publisher: Lightning Source Inc; 1 edition (15 April 2014). ISBN-10: 0989973700, ISBN-13: 978-09-89973-70-0.

Course Outcomes:

1. Understand framework and architecture of Internet of Things. (Understand)
2. Understand key technologies in Internet of Things. (Understand)
3. Explain wireless sensor network architecture and its framework along with WSN applications. (Understand)
4. Explain resource management in the Internet of Things. (Understand)
5. Understand Security measures and design applications based on Internet of Things. (Understand, Apply)

Programme Elective-II 4 (3-1-0) (Any one of the following five courses)

COMPILER DESIGN (ECA-552)

Course Content:

Unit-1:

Introduction to Compiler, Phases and passes, Bootstrapping, Finite automata & regular expressions and their applications to lexical analysis, Implementation of lexical analyzers, lexical-analyzer generator, LEX-compiler, The syntactic specification of Programming languages: Context free

grammars, derivation and parse trees, capabilities of CFG, Application of grammars in syntax analysis, ambiguity and BNF notation, YACC.

Unit-2:

Basic Parsing Techniques: Parsers, top down parsing, Shift reduces parsing, operator precedence parsing, predictive parsers. Automatic Construction of efficient Parsers: LR parsers, the canonical Collection of LR(0) items, constructing SLR parsing tables, constructing Canonical LR parsing tables, Constructing LALR parsing tables, using ambiguous grammars, an automatic parser generator, implementation of LR parsing tables, constructing LALR sets of items.

Unit-3:

Syntax-directed Translation: Syntax-directed Translation schemes, Implementation of Syntax directed Translators, Intermediate code, postfix notation, Parse trees & syntax trees, three address code, quadruple & triples, translation of assignment statements, Boolean expressions, statements that alter the flow of control, postfix translation, translation with a top down parser. More about translation: Array references in arithmetic expressions, procedures call, declarations, Case statements.

Unit-4:

Symbol Tables: Data structure and representing scope information, Run-Time Administration: Implementation of simple stack allocation scheme, storage allocation in block structured language. Error Detection & Recovery: Lexical Phase errors, syntactic phase errors semantic errors.

Unit-5:

Introduction to code optimization: Loop optimization, the DAG representation of basic blocks, value numbers and algebraic laws, Global Data-Flow analysis.

Text and References Books:

1. Aho, Sethi & Ullman, "Compiler Design", Addison Wesley.
2. Kenneth C. Loudon, "Compiler Construction: Principles and Practice", Thomson Brooks Publication.
3. Allen I. Holub, "Compiler Design in C", PHI Publications.

Course Outcomes:

1. Describe the role of each phase of a compiler with its construction tools. (Understand)
2. Develop a Lexical Analyzer for recognizing tokens of a given language with an understanding of symbol table management and error handling. (Apply)
3. Construct top-down, bottom-up, operator precedence and SLR parsers with an understanding of Context Free Grammars and syntax analysis. (Apply)
4. Design and develop semantic analyzers for type-checking and intermediate code generators to translate the source program into an intermediate code. (Apply)
5. Construct code optimizers to optimize the target code generated. (Apply)

MACHINE LEARNING (ECA-554)

Course Content:

Unit-1: Introduction to Machine Learning

Why Machine learning, Examples of Machine Learning Problems, Structure of Learning, Learning versus Designing, Training versus Testing, Characteristics of Machine learning tasks, Predictive and descriptive tasks, Machine learning Models: Geometric Models, Logical Models, Probabilistic Models. Features: Feature types, Feature Construction and Transformation, Feature Selection.

Unit-2: Classification and Regression

Classification: Binary Classification- Assessing Classification performance, Class probability Estimation- Assessing class probability Estimates, Multiclass Classification. Regression: Assessing performance of Regression- Error measures, Overfitting: Catalysts for Overfitting, Case study of Polynomial Regression. Theory of Generalization: Effective number of hypothesis, Bounding the Growth function, VC Dimensions, Regularization theory.

Unit-3: Linear Models

Least Squares method, Multivariate Linear Regression, Regularized Regression, Using Least Square regression for Classification. Perceptron, Support Vector Machines, Soft Margin SVM, Obtaining probabilities from Linear classifiers, Kernel methods for non-Linearity.

Unit-4: Logic Based and Algebraic Models

Distance Based Models: Neighbours and Examples, Nearest Neighbours Classification, Distance based clustering-K means Algorithm, Hierarchical clustering, Rule Based Models: Rule learning for subgroup discovery, Association rule mining. Tree Based Models: Decision Trees, Ranking and Probability estimation Trees, Regression trees, Clustering Trees.

Unit-5: Probabilistic Models

Normal Distribution and Its Geometric Interpretations, Naïve Bayes Classifier, Discriminative learning with Maximum likelihood, Probabilistic Models with Hidden variables: Estimation/Maximization Methods, Gaussian Mixtures, and Compression based Models.

Trends in Machine Learning: Model and Symbols- Bagging and Boosting, Multitask learning, Online learning and Sequence Prediction, Data Streams and Active Learning, Deep Learning, Reinforcement Learning.

Text and Reference Books:

1. Peter Flach, Machine Learning: The Art and Science of Algorithms that Make Sense of Data, Cambridge University Press, Edition 2012.
2. Hastie, Tibshirani, Friedman: Introduction to Statistical Machine Learning with Applications in R, Springer, 2nd Edition-2012.
3. C. M. Bishop, Pattern Recognition and Machine Learning, Springer 1st Edition-2013.
4. Ethem Alpaydin, Introduction to Machine Learning, PHI 2nd Edition-2013.
5. Parag Kulkarni, Reinforcement and Systematic Machine Learning for Decision Making, Wiley, IEEE Press, Edition July 2012.

Course Outcomes:

1. Understand Machine learning and Machine Learning Models. (Understand)
2. Apply various classification and regression techniques and assess their performance. (Apply)
3. Apply various clustering algorithms for the problems to be solved with machine learning. (Apply)
4. Assessment of various machine learning models. (Analyze)
5. Understand probabilistic learning models and trends in machine learning. (Understand)

Advanced Database Management Systems (ECA-556)

Course Content:

Unit-1

Query Processing, Optimization & Database Tuning: Algorithms for Executing Query Operations. Heuristics For Query Optimizations, Estimations Of Query Processing Cost, Join Strategies For Parallel Processors, Database Workloads, Tuning Decisions, DBMS Benchmarks, Clustering & Indexing, Multiple Attribute Search Keys, Query Evaluation Plans, Pipelined Evaluations, System Catalogue In

RDBMS.

Unit-2

Extended Relational Model & Object Oriented Database System: New Data Types, User Defined Abstract Data Types, Structured Types, Object Identity, Containment, Class Hierarchy, Logic Based Data Model, Data Log, Nested Relational Model and Expert Database System.

Unit-3

Distributed Database System:

Structure of Distributed Database, Data Fragmentation, Data Model, Query Processing, Semi Join, Parallel & Pipeline Join, Distributed Query Processing in R* System, Concurrency Control in Distributed Database System, Recovery in Distributed Database System, Distributed Deadlock Detection and Resolution, Commit Protocols.

Unit-4

Enhanced Data Model For Advanced Applications:

Database Operating System, Introduction to Temporal Database Concepts, Spatial and Multimedia Databases, Data Mining, Active Database System, Deductive Databases, Database Machines, Web Databases, Advanced Transaction Models, Issues in Real Time Database Design.

Unit-5

Introduction to Expert Database and Fuzzy Database System: Expert Databases: Use of Rules of Deduction in Databases, Recursive Rules. Fuzzy Databases: Fuzzy Set & Fuzzy Logic, Use of Fuzzy Techniques to Define Inexact and Incomplete Databases.

Text and Reference Books:

1. Majumdar & Bhattacharya, "Database Management System", TMH.
2. Korth, Silbertz, Sudarshan, "Database Concepts", McGraw Hill.
3. Elmasri, Navathe, "Fundamentals of Database Systems", Addison Wesley.
4. Date C J, "An Introduction to Database System", Addison Wesley.
5. Ramakrishnan Gehrke, "Database Management System", McGraw Hill.
6. Bernstein, Hadzilacous, Goodman, "Concurrency Control & Recovery", Addison Wesley.
7. Ceri & Palgatti, "Distributed Databases", McGraw Hill.

Course Outcomes:

1. Understand the concepts and algorithms for Query Processing, Optimization & Database Tuning. (Understand)
2. Understand the Extended Relational Model & Object Oriented Database System. (Understand)
3. Explain the Structure of Distributed Database, Query Processing, Concurrency Control, Prevention and recovery from deadlock. (Understand)
4. Understand and analyze Enhanced Data Model for Advanced Applications including Issues in Real Time Database Design. (Understand, Analyze)
5. Understand the concept of Fuzzy logic and development of Fuzzy Database Systems. (Understand)

ERP Systems (ECA-558)

Course Content:

Unit-I

Enterprise wide information system, Custom built and packaged approaches, Needs and Evolution of ERP Systems, Common myths and evolving realities, ERP and Related Technologies, Business Process Reengineering and Information Technology, Supply Chain Management, Relevance to Data Warehousing, Data Mining and OLAP, ERP Drivers, Decision support system.

Unit-II

ERP Domain, ERP Benefits classification, Present global and Indian market scenario, milestones and pitfalls, Forecast, Market players and profiles, Evaluation criterion for ERP product, ERP Life Cycle: Adoption decision, Acquisition, Implementation, Use & Maintenance, Evolution and Retirement phases, ERP Modules.

Unit- III

Framework for evaluating ERP acquisition, Analytical Hierarchy Processes (AHP), Applications of AHP in evaluating ERP, Selection of Weights, Role of consultants, vendors and users in ERP implementation; Implementation vendors evaluation criterion, ERP Implementation approaches and methodology, ERP implementation strategies, ERP Customization, ERP-A manufacturing Perspective.

Unit- IV

Critical success and failure factors for implementation, Model for improving ERP effectiveness, ROI of ERP implementation, Hidden costs, ERP success inhibitors and accelerators, Management concern for ERP success, Strategic Grid: Useful guidelines for ERP Implementations.

Unit- V

Technologies in ERP Systems and Extended ERP, Case Studies Development and Analysis of ERP Implementations in focusing the various issues discussed in above units through Soft System approaches or qualitative Analysis tools, Learning and Emerging Issues, ERP and E-Commerce.

Text and Reference Books:

1. Lexis Leon, "Enterprise Resource Planning", TMH
2. Brady, Manu, Wegner, " Enterprise Resource Planning", TMH

Python Programming (ECA-560)

Course Content:

Unit 1: Introduction: The Programming Cycle for Python, Python IDE, Interacting with Python Programs, Elements of Python, Type Conversion. Basics: Expressions, Assignment Statement, Arithmetic Operators, Operator Precedence, Boolean Expression.

Unit 2: Conditionals and Loops: Conditional statement in Python: if-else statement, its working and execution, Nested-if statement and Elif statement in Python, Expression Evaluation & Float Representation, Loops: Purpose and working of loops, while loop including its working, For Loop, Nested Loops, Break and Continue.

Unit 3: Strings and Functions: Strings: Length of the string, Concatenation and Repeat operations, Indexing and Slicing of Strings. Python Data Structure: Tuples, Unpacking Sequences, Lists, Mutable Sequences, List Comprehension, Sets, Dictionaries, Functions: Parts of a Function, Execution of a Function, Keyword and Default Arguments, Scope Rules, Higher Order Functions: Treat functions as first class Objects, Lambda Expressions.

Unit 4: Classes and Files: Generate prime numbers with the help of Sieve of Eratosthenes algorithm, File I/O: File input and output operations in Python Programming Exceptions and Assertions Modules: Introduction, Importing Modules, Abstract Data Types: Abstract data types and ADT interface in Python Programming, Classes: Definition and operations in the classes, Special Methods (such as `_init_`, `_str_`, comparison methods and Arithmetic methods etc.), Class Example, Inheritance, Inheritance and OOP.

Unit 5: Iterators & Recursion: Recursive Fibonacci, Tower of Hanoi, Search: Simple Search, Binary Search, Estimating Search Time in Simple Search and Binary Search, Sorting & Merging: Selection Sort, Merge List, Merge Sort, Higher Order Sort.

Text and Reference Books:

1. Allen B. Downey, 'Think Python: How to Think Like a Computer Scientist', 2nd edition, Updated for Python 3, Shroff/O, Reilly Publishers, 2016, (<http://greenteapress.com/wp/thinkpython/>)
2. Guido van Rossum and Fred L. Drake Jr, An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.
3. John V Guttag, –Introduction to Computation and Programming Using Python, Revised and expanded Edition, MIT Press, 2013.
4. Robert Sedgewick, Kevin Wayne, Robert Dondero, Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
5. Timothy A. Budd, Exploring Python||, Mc-Graw Hill Education (India) Private Ltd., 2015.
6. Kenneth A. Lambert, Fundamentals of Python: First Programs||, CENGAGE Learning, 2012.
7. Charles Dierbach, Introduction to Computer Science using Python: A Computational. Problem Solving Focus, Wiley India Edition, 2013.
8. Paul Gries, Jennifer Campbell and Jason Montojo, Practical Programming: An Introduction to Computer Science using Python 3||, Second edition, Pragmatic Programmers, LLC, 2013. Mapped With: <https://ict.iitk.ac.in/product/pythonprogramming-a-practical>

Course Outcomes:

1. Understanding Fundamentals of Python Programming
2. Understand and implement Control Structures.
3. Learn and implement Strings and Functions in Python.
4. Understand and implement advance functions like iteration and recursion.
5. Implement Object Oriented Programming concepts in Python

Programme Elective-III 4 (3-1-0)
(Any one of the following five courses)

CLOUD COMPUTING (ECA-572)

Course Content:

Unit-1

Distributed computing models and technologies, Enabling Technologies and System Models for Cloud Computing, techniques, and architectures, Introduction to Cloud Computing including benefits, challenges, and risks.

Unit-2

Cloud Computing Models including Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS), Software-as-a-Service (SaaS), virtualization, security and privacy issues, performance and systems issues, capacity planning, disaster recovery, Public cloud, private cloud and hybrid clouds.

Unit-3

Cloud OS, Cloud architectures including federated clouds, challenges in implementing clouds, data centers, hypervisor CPU and memory management, Scalability, Performance, and QoS.

Unit-4

Cloud hosted applications, Data centers for Cloud Computing, Principles of Virtualization platforms and other advanced and research topics in cloud computing.

Unit-5

Security and Privacy issues in the Cloud, VM Ware ESX Memory Management, Capacity Planning and Disaster Recovery in Cloud Computing.

Text and Reference Books:

1. Distributed and Cloud Computing, 1st edition, Morgan Kaufmann, 2011.
2. Technical papers from major journals and major conferences on computing, networking, cloud computing.

Course Outcomes

1. Understand various basic concepts related to cloud computing technologies. (Understand)
2. Understand the architecture and concept of different cloud models: IaaS, PaaS, SaaS. (Understand)
3. Apply the underlying principle of cloud virtualization, cloud storage, data management and data visualization. (Apply)
4. Use different cloud programming platforms and tools. (Apply)
5. Design and deploy cloud application using cloud platforms (Analyze)

SOFTWARE QUALITY ENGINEERING (ECA-574)

Course Content:

Unit-1:

Introduction: Defining Software Quality, Software Quality Attributes and Specification, Cost of Quality, Defects, Faults, Failures, Defect Rate and Reliability, Defect Prevention, Reduction, and Containment, Overview of Different Types of Software Review, Introduction to Measurement and Inspection Process, Documents and Metrics.

Unit-2:

Software Quality Metrics: Product Quality Metrics: Defect Density, Customer Problems Metric, Customer Satisfaction Metrics, Function Points, In-Process Quality Metrics: Defect Arrival Pattern, Phase-Based Defect Removal Pattern, Defect Removal Effectiveness, Metrics for Software Maintenance: Backlog Management Index, Fix Response Time, Fix Quality, Software Quality Indicators.

Unit-3:

Software Quality Management and Models: Modeling Process, Software Reliability Models: The Rayleigh Model, Exponential Distribution and Software Reliability Growth Models, Software Reliability Allocation Models, Criteria for Model Evaluation, Software Quality Assessment Models: Hierarchical Model of Software Quality Assessment.

Unit-4:

Software Quality Assurance: Quality Planning and Control, Quality Improvement Process, Evolution of Software Quality Assurance (SQA), Major SQA Activities, Major SQA Issues, Zero Defect Software, SQA Techniques, Statistical Quality Assurance, Total Quality Management, Quality Standards and Processes.

Unit-5:

Software Verification, Validation & Testing: Verification and Validation, Evolutionary Nature of Verification and Validation, Impracticality of Testing all Data and Paths, Proof of Correctness,

Software Testing, Functional, Structural and Error-Oriented Analysis & Testing, Static and Dynamic Testing Tools, Characteristics of Modern Testing Tools.

Text and References Books:

1. Jeff Tian, Software Quality Engineering (SQE), Wiley-Inter Science, 2005; ISBN 0-471-71345-7.
2. Metrics and Models in Software Quality Engineering, Stephen H. Kan, Addison-Wesley (2002)

Course Outcomes:

1. Understand the concept of quality, quality attribute, quality metrics and software technical reviews. (Understand)
2. Understand and discuss the needs for software quality assessment models and apply professional practices in the development of quality software. (Understand, Apply)
3. Understand and apply Software Quality Management Models in the development of software. (Understand, Apply)
4. Understand the concept of software quality assurance and use software quality standards in the development of software. (Understand)
5. Apply the concepts of software verification & validation, error tracking to enforce quality into the software. (Apply)

DIGITAL IMAGE PROCESSING (ECA-576)

Course Content:

Unit-1:

Introduction and Fundamentals Motivation and Perspective, Applications, Components of Image Processing System, Element of Visual Perception, A Simple Image Model, Sampling and Quantization. Image Enhancement in Spatial Domain Introduction; Basic Gray Level Functions–Piecewise-Linear Transformation Functions: Contrast Stretching; Histogram Specification; Histogram Equalization; Local Enhancement; Enhancement using Arithmetic/Logic Operations–Image Subtraction, Image Averaging; Basics of Spatial Filtering; Smoothing - Mean filter, Ordered Statistic Filter; Sharpening – The Laplacian.

Unit-2:

Image Enhancement in Frequency Domain Fourier Transform and the Frequency Domain, Basis of Filtering in Frequency Domain, Filters – Low-pass, High-pass; Correspondence Between Filtering in Spatial and Frequency Domain; Smoothing Frequency Domain Filters–Gaussian Lowpass Filters; Sharpening Frequency Domain Filters – Gaussian Highpass Filters; Homomorphic Filtering. Image Restoration A Model of Restoration Process, Noise Models, Restoration in the presence of Noise only Spatial Filtering – Mean Filters: Arithmetic Mean filter, Geometric Mean Filter, Order Statistic Filters – Median Filter, Max and Min filters; Periodic Noise Reduction by Frequency Domain Filtering–Bandpass Filters; Minimum Mean-square Error Restoration.

Unit-3:

Color Image Processing Color Fundamentals, Color Models, converting Colors to different models, Color Transformation, Smoothing and Sharpening, Color Segmentation, Morphological Image Processing Introduction, Logic Operations involving Binary Images, Dilation and Erosion, Opening and Closing, Morphological Algorithms–Boundary Extraction, Region Filling, Extraction of Connected Components, Convex Hull, Thinning, Thickening

Unit-4:

Registration Introduction, Geometric Transformation – Plane to P lane transformation, Mapping, Stereo Imaging – Algorithms to Establish Correspondence, Algorithms to Recover Depth

Segmentation Introduction, Region Extraction, Pixel-Based Approach, Multi-level Thresholding, Local Thresholding, Region-based Approach, Edge and Line Detection: Edge Detection, Edge Operators, Pattern Fitting Approach, Edge Linking and Edge Following, Edge Elements Extraction by Thresholding, Edge Detector Performance, Line Detection, Corner Detection.

Unit-5:

Feature Extraction Representation, Topological Attributes, Geometric Attributes Description Boundary-based Description, Region-based Description, Relationship, Object Recognition Deterministic Methods, Clustering, Statistical Classification, Syntactic Recognition, Tree Search, Graph Matching.

Text and Reference Books:

1. Digital Image Processing 2nd Edition, Rafael C. Gonzalvez and Richard E. Woods. Published by: Pearson Education.
2. Digital Image Processing and Computer Vision, R.J. Schalkoff Published by: John Wiley and Sons, NY.
3. Fundamentals of Digital Image Processing, A.K. Jain. Published by Prentice Hall, Upper Saddle River, NJ.

Course Outcomes:

1. Apply sampling and quantization techniques for conversion of an analog image into digital form. (Apply)
2. Enhance the image using various types of filtering, segmentation and edge detection techniques. (Apply)
3. Analyze and interpret the effects of high pass and low pass filter in an image. (Analyse)
4. Restore the image in the presence of noise by using modern restoration software. (Apply)
5. Use the techniques of morphological image processing, image registration and image recognition. (Apply)
6. Apply various tools and techniques in multidisciplinary engineering and medical fields like embedded programming, CAD, web applications, MRI, CT-Scan, Angiography etc. (Apply)

DATA WAREHOUSING & MINING (ECA-578)

Course Content:

Unit-1:

Overview, Motivation (for Data Mining), Data Mining-Definition & Functionalities, Data Processing, Form of Data Preprocessing, Data Cleaning: Missing Values, Noisy Data, Binning, Clustering, Regression, Computer and Human inspection, Inconsistent Data, Data Integration and Transformation. Data Reduction:-Data Cube Aggregation, Dimensionality reduction, Data Compression, Numerosity Reduction, Clustering, Discretization and Concept hierarchy generation.

Unit-2:

Concept Description:- Definition, Data Generalization, Analytical Characterization, Analysis of attribute relevance, Mining Class comparisons, Statistical measures in large Databases. Measuring Central Tendency, Measuring Dispersion of Data, Graph Displays of Basic Statistical class Description, Mining Association Rules in Large Databases, Association rule mining, mining SingleDimensional Boolean Association rules from Transactional Databases: Apriori Algorithm, Mining Multilevel Association rules from Transaction Databases and Mining Multi-Dimensional Association rules from Relational Databases

Unit-3:

Classification and Predictions:

What is Classification & Prediction, Issues regarding Classification and prediction, Decision tree, Bayesian Classification, Classification by Back propagation, Multilayer feed-forward Neural Network, Back propagation Algorithm, Classification methods K-nearest neighbor classifiers, Genetic Algorithm.

Cluster Analysis:

Data types in cluster analysis, Categories of clustering methods, partitioning methods. Hierarchical Clustering- CURE and Chameleon. Density Based Methods-DBSCAN, OPTICS. Grid Based Methods-STING, CLIQUE. Model Based Method –Statistical Approach, Neural Network approach, Outlier Analysis

Unit-4:

Data Warehousing: Overview, Definition, Delivery Process, Difference between Database System and Data Warehouse, Multi-Dimensional Data Model, Data Cubes, Stars, Snow Flakes, Fact Constellations, Concept hierarchy, Process Architecture, 3-Tier Architecture, Data Mart.

Unit-5:

Aggregation, Historical information, Query Facility, OLAP function and Tools, OLAP Servers, ROLAP, MOLAP, HOLAP, Data Mining interface, Security, Backup and Recovery, Tuning Data Warehouse, Testing Data Warehouse.

Text and Reference Books:

1. M. H. Dunham, "Data Mining: Introductory and Advanced Topics", Pearson Education
2. Jiawei Han, Micheline Kamber, "Data Mining Concepts & Techniques", Elsevier
3. Sam Anahory, Dennis Murray, "Data Warehousing in the Real World: A Practical Guide for Building Decision Support Systems, 1/e " Pearson Education
4. Mallach, "Data Warehousing System", McGraw –Hill

Course Outcomes:

1. Understand importance of abstraction of Knowledge from unstructured sources at sufficient level. (Understand)
2. Use of high level operational skills and real world case studies for knowledge discovery and data warehousing based principles. (Apply)
3. Understand the areas of probability, statistics and machine learning algorithms which underpin the knowledge discovery enterprise. (Understand)
4. Design data mining and data warehousing systems and solutions to meet user requirements and specifications. (Apply, Analyze)
5. Compare and contrast OLAP and data mining as techniques for extracting knowledge from a data warehouse. (Evaluate)

MOBILE APPLICATION DEVELOPMENT (ECA-580)

Course Content:

Unit-1

Introduction to mobile computing, Characteristics of mobile applications, History of mobile application frameworks, Android Development Environment, Factors in Developing Mobile Applications, Mobile Software Engineering, Frameworks and Tools, Generic UI Development, VUIs and Mobile Apps, Text-to-Speech Techniques, Designing the Right UI, Multichannel and Multi modal UIs.

Unit-2

Overview of mobile application development languages: Java and Android Studio.

Unit-3:

Application models of mobile application frameworks, User-interface design for mobile applications, Managing application data, Integrating with cloud services, Integrating networking, OS and hardware into mobile-applications

Unit-4:

Addressing enterprise requirements in mobile applications – performance, scalability, modifiability, availability and security, Security and Hacking, Active Transactions, Hacking Android

Unit-5:

Testing methodologies for mobile applications, Publishing, deployment, maintenance and management, Platforms and Additional Issues, Development Process, Architecture, Design, Technology Selection, Mobile App Development Hurdles.

Text and Reference Books:

1. Rajiv Ramnath, Roger Crawfis, and Paolo Sivilotti, Android SDK 3 for Dummies, Wiley.
2. Bill Phillips, Chris Stewart, Brian Hardy, and Kristin Marsicano, Android Programming: The Big Nerd Ranch Guide, Big Nerd Ranch LLC, 2nd edition, 2015.
3. Christian Keur and Aaron Hillegass, iOS Programming: The Big Nerd Ranch Guide, 5th edition, 2015.
4. Valentino Lee, Heather Schneider, and Robbie Schell, Mobile Applications: Architecture, Design and Development, Prentice Hall, 2004.
5. Tomasz Nurkiewicz and Ben Christensen, Reactive Programming with RxJava, O'Reilly Media, 2016.
6. Raoul-Gabriel Urma, Mario Fusco, and Alan Mycroft, Java 8 in Action: Lambdas, Streams, and Functional-Style Programming, Manning Publications, 2015.
7. Benjamin J. Evans and Martijn Verburg, The Well-Grounded Java Developer: Vital Techniques of Java 7 and Polyglot Programming, Manning Publications, 2013.
8. Brian Fling, Mobile Design and Development, O'Reilly Media, Inc., 2009.

Course Outcomes

1. Understand technology and business trends impacting mobile applications. (Understand)
2. Understand and implement mobile application development languages. (Understand, Apply)
3. Understand the characterization and architecture of mobile applications. (Understand)
4. Understand and design enterprise scale requirements of mobile applications. (Understand, Apply, Analyze)
5. Design and develop mobile applications using application development framework. (Apply, Analyze)

Programme Elective-IV 4 (3-1-0) (Any one of the following five courses)

CRYPTOGRAPHY & NETWORK SECURITY (ECA-582)

Course Content:

Unit-1:

Introduction to security attacks, services and mechanism, introduction to cryptography. Conventional Encryption: Conventional encryption model, classical encryption techniques substitution ciphers and transposition ciphers, cryptanalysis, stereography, stream and block ciphers. Modern Block Ciphers: Block ciphers principals, Shannon's theory of confusion and diffusion, fiestal structure, data encryption standard(DES), strength of DES, differential and linear crypt

analysis of DES, block cipher modes of operations, triple DES, IDEA encryption and decryption, strength of IDEA, confidentiality using conventional encryption, traffic confidentiality, key distribution, random number generation.

Unit-2:

Introduction to graph, ring and field, prime and relative prime numbers, modular arithmetic, Fermat's and Euler's theorem, primality testing, Euclid's Algorithm, Chinese Remainder theorem, discrete logarithms. Principals of public key crypto systems, RSA algorithm, security of RSA, key management, Diffie-Hellman key exchange algorithm, introductory idea of Elliptic curve cryptography, Elganel encryption.

Unit-3:

Message Authentication and Hash Function: Authentication requirements, authentication functions, message authentication code, hash functions, birthday attacks, security of hash functions and MACS, MD5 message digest algorithm, Secure hash algorithm(SHA). Digital Signatures: Digital Signatures, authentication protocols, digital signature standards (DSS), proof of digital signature algorithm.

Unit-4:

Authentication Applications: Kerberos and X.509, directory authentication service, electronic mail security-pretty good privacy (PGP), S/MIME.

Unit-5:

IP Security: Architecture, Authentication header, Encapsulating security payloads, combining security associations, key management. Web Security: Secure socket layer and transport layer security, secure electronic transaction (SET). System Security: Intruders, Viruses and related threads, firewall design principals, trusted systems.

Text and References Books:

1. William Stallings, "Cryptography and Network Security: Principals and Practice", Prentice Hall, New Jersey.
2. Johannes A. Buchmann, "Introduction to Cryptography", Springer-Verlag.
3. Bruce Schneier, "Applied Cryptography".

Course Outcomes:

1. Understand and deploy cryptographic techniques to secure data in networks. (Understand, Apply)
2. Analyze the vulnerabilities in any computing system and design a security solution. (Apply, Analyse)
3. Understand and use standard algorithms for confidentiality, integrity and authenticity. (Understand, Apply)
4. Apply various key distribution and management schemes in network system. (Apply)
5. Apply security protocols in various IT applications. (Apply)

SOFT COMPUTING (ECA-584)

Course Content:

Unit 1: Introduction to Intelligent Systems and Soft Computing Characteristic behavior of Intelligent systems, Knowledge based systems, Knowledge Representation and Processing, Soft Computing characteristics, Constitutes of Soft Computing-Fuzzy Logic and Computing, Neural Computing, Evolutionary Computing, Rough Sets, Probabilistic Reasoning and Machine Learning.

Unit 2: Neuro Computing - Supervised Learning Biological background, Pattern recognition tasks, Features of artificial neural networks, Activation functions, Perceptron model, Perceptron for

classification and its limitations, Architectures of multilayer feed-forward neural networks, Back-propagation learning algorithm, Limitations of MLP.

Unit 3: Neuro Computing - Unsupervised Learning Hebb's learning rule for competitive learning, Kohonen's self-organizing map and network topology, applications of SOM, Hopfield network and its topology, Boltzman Machines, Adaptive Resonance Theory.

Unit 4: Fuzzy Logic and Fuzzy Systems: Evolution of fuzzy logic, fuzzy sets, fuzzy logic operations, fuzzy relations, Fuzzy arithmetic and fuzzy measures. Fuzzy rules and reasoning, Fuzzy inference systems, Fuzzy modeling and decision making, Neuro-fuzzy modeling.

Unit 5: Evolutionary Computing Biological background and Overview of evolutionary computing, Genetic algorithm and search space, Operators in genetic algorithm- encoding, selection, crossover, and mutation, Classification of GA, Evolutionary Programming and Strategies, Applications of fuzzy in pattern recognition-character recognition. Applications of evolutionary computing in Image processing and computer vision, applications of Soft computing in mobile ad-hoc networks, Information Retrieval, Semantic web, and Software Engineering.

Text and Reference Books:

1. Fakhreddine O. Karray, Clarence De Silva, 'Soft Computing and Intelligent systems design' Pearson Education, ISBN 978-81-317-2324-1.
2. B. K. Tripathy, J. Anuradha, 'Soft Computing: advances and applications', Cengage learning, ISBN-13: 978-81-315-2619-4.
3. S. N. Sivanandam, S. N. Deepa, Principles of Soft Computing, Wiley publications, 2nd Edition.
4. J. S. R. Jang, C. T. Sun, E. Mizutani, 'Neuro-Fuzzy and Soft Computing- A computational approach to Learning and Machine Intelligence' PHI.
5. David E. Goldberg, Genetic Algorithms - Pearson Education, 2006.
6. Satish Kumar, "Neural Networks - A Classroom Approach", Tata McGraw-Hill.

Course Outcomes:

1. Understand differential behavior of Human and Intelligent Systems. (Understand)
2. Understand and use supervised and un-supervised learning techniques in ANN. (Understand)
3. Understand and apply different soft computing techniques like Genetic Algorithms, Fuzzy Logic, Neural Network and their combination. (Understand, Apply)
4. Correlate human-like processing in problem solving with current technologies in various domains like Bio Informatics, Multimedia Systems, Big Data Analytics, etc.
5. Apply evolutionary computing techniques in real life problems. (Apply)

EMBEDDED SYSTEMS (ECA-586)

Course Content:

Unit-1:

Introduction to Embedded Systems Definition and Classification – Overview of Processors and hardware units in an embedded system – Software embedded into the system – Exemplary Embedded Systems – Embedded Systems on a Chip (SoC) and the use of VLSI designed circuits.

Unit-2:

Devices and Buses for Devices Network I/O Devices -Device I/O Types and Examples – Synchronous - Iso-synchronous and Asynchronous Communications from Serial Devices -Examples of Internal Serial-Communication Devices -UART and HDLC -Parallel Port Devices -Sophisticated interfacing

features in Devices/Ports-Timer and Counting Devices -„12C“, „USB“, „CAN and advanced I/O Serial high speed buses-ISA, PCI, PCI-X, cPCI and advanced buses.

Unit-3:

Programming Concepts and Embedded Programming in C, Programming in assembly language (ALP) vs. High Level Language, C Program Elements, Macros and functions -Use of Pointers -NULL Pointers-Use of Function Calls–Multiple function calls in a Cyclic Order in the Main Function Pointers – Function Queues and Interrupt Service Routines Queues Pointers – Concepts of ‘C’ Program compilers–Cross compiler–Optimization of memory codes.

Unit-4:

Real Time Operating Systems Timing and clocks in embedded system, Task modelling and management: RTOS Task scheduling models -Handling of task scheduling and latency and deadlines as performance metrics – Co-operative Round Robin Scheduling – Cyclic Scheduling with Time Slicing (Rate Monotonics Co-operative Scheduling) – Preemptive Scheduling Model strategy by a Scheduler – Critical Section Service by a Pre-emptive Scheduler – Fixed (Static) Real time scheduling of tasks

Unit-5:

Embedded control and control hierarchy, communication strategies for embedded system: encoding and flow chart. Fault tolerance and formal verification.

Text and References Books:

1. William Stalling, “Computer Organization & Architecture”, Pearson education Asia
2. Mano Morris, “Computer System Architecture”, PHI

Course Outcomes:

1. Understand the difference between general computing system and embedded system. (Understand)
2. Understand the working of devices, buses and types of communications like serial, parallel etc. (Understand)
3. Understand cross compiler and implement embedded programming using assembly and C languages. (Understand, Apply)
4. Understand real time operating system concepts and develop real time embedded systems. (Understand, Apply)
5. Understand and apply the concept of embedded control and communication. (Understand, Apply)

Virtual Reality (ECA-588)

Data Analytics (ECA-590)