DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

Scheme of Instruction

and

Syllabi of

B.E. VII & VIII- SEMESTERS

2018-2019

UNIVERSITY COLLEGE OF ENGINEERING

(AUTONOMOUS)

OSMANIA UNIVERSITY

HYDERABAD – 500 007, TELANGANA

SCHEME OF INSTRUCTION
BE (COMPUTER SCIENCE & ENGINEERING)
CSE: SEMESTER – VII

S.No	Course Code	Course Title	Scheme of Instruction			Contact Hrs/Wk	Scheme of Examination		Credits
			L	T	P		CIE	SEE	
Theory									
1.	PC 701 CS	Compiler Construction	3	1	0	4	30	70	3
2.	PC 702 CS	Distributed Systems	3	1	0	4	30	70	3
3.	PC 703CS	Information Security	3	1	0	4	30	70	3
4.	PC 704 CS	Embedded System Design	3	1	0	4	30	70	3
5.	PE-III	Professional Elective-III	3	1	0	4	30	70	3
6.	OE-II	Open Elective-II	3	0	0	3	30	70	3
Practicals									
8.	PC 751 CS	Compiler Construction Lab	0	0	2	2	25	50	1
9.	PC 752 CS	Distributed Systems Lab	0	0	2	2	25	50	1
	PC 753 CS	Embedded Systems Lab	0	0	2	2	25	50	1
10.	PW761CS	Project Work-II	0	0	2	2	50	--	4
11.	PW961CS	Summer Internship	0	0	0	0	50	--	2
Total			**18**	**05**	**08**	**31**	**355**	**570**	**27**

	Professional Elective-III
PE705CS	Mobile Computing
PE706CS	Image Processing
PE707CS	Software Quality and Testing
PE708CS	Web Services And Architecture
PE709CS	Computational Intelligence

	Open Elective-II
OE701BM	Human Factor Engineering
OE702BM	Basic Medical Engineering
OE701CE	Optimization Techniques
*OE701CS	Data Base Management Systems
*OE702CS	Information Security
OE701EC	Principles of electronic communication
**OE702EC	Fundamentals of IOT
OE701EE	Non-conventional Energy Sources
OE701ME	Startup Entrupreunership
OE702ME	Finite Element Methods

*CS Electives offered for BME/CE/EC/EE/ME branches only

**ECE Elective offered for BME/CE/EE/ME branches only

List of NPTEL Courses Approved for the academic year 2018-19 by BoS(CSE)

Professional Elective - IV

Subject	Start Date	End Date	Exam Date
Introduction to Machine Learning	27-08-2018	19-10-2018	28-10-2018
Deep Learning	30-07-2018	19-10-2018	28-10-2018
Social Network	30-07-2018	19-10-2018	28-10-2018
Scalable Data Science	06-08-2018	28-09-2018	07-10-2018

Professional Elective - V

Subject	Start Date	End Date	Exam Date
Model Checking	30-07-2018	19-10-2018	28-10-2018
Information Theory, Coding and Cryptography	30-07-2018	19-10-2018	28-10-2018
Cloud Computing	06-08-2018	28-09-2018	07-10-2018
Block Chain Architecture Design and Use Cases	30-07-2018	19-10-2018	28-10-2018
Hardware Modeling using Verilog	27-08-2018	19-10-2018	28-10-2018

Open Elective – III (BME/CE/EE/EC/ME)

Subject	Start Date	End Date	Exam Date
E-Business	30-07-2018	19-10-2018	28-10-2018
Software Engineering	30-07-2018	19-10-2018	28-10-2018
Introduction to R-Software	24-07-2018	15-09-2018	07-10-2018

Note: Students can register for the above courses online and obtain the certificate from NPTEL .

These electives are tentative only. New NPTEL / SWAYAM courses will be indicated at the beginning of semester from time to time.

PC 701 CS With effect from the academic year 2018-2019

COMPILER CONSTRUCTION

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	70 Marks
Sessionals	30 Marks
Credits	3

Course Objectives:

- To introduce the steps in language translation pipeline and runtime data structures used in translation
- To learn about Scanning (lexical analysis) process using regular expressions and use of LEX to generate scanner
- To introduce different Parsing strategies including top-down (e.g., recursive descent, Earley parsing, or LL) and bottom-up (e.g., backtracking or LR) techniques
- Describe semantic analyses using an attribute grammar
- To learn how to build symbol tables and generate intermediate code.
- To introduce techniques of program analysis and code optimization

Course Outcomes:

Student will be able to :

- Create lexical rules and grammars for a given language
- Generate scanners and parsers from declarative specifications.
- Describe an abstract syntax tree for a small language.
- Use program analysis techniques for code optimization
- Develop the compiler for a subset of a given language

UNIT – I

Introduction: Compilers, The translation process, Data structures and issues in compiler structure, Bootstrapping and Porting.

Scanning: The scanning process, Regular expressions, Finite Automata, Regular expressions to DFA's, use of LEX to generate scanner.

UNIT – II

Context Free Grammars & Parsing: The parsing process, Context free grammars, Parse tree & Abstract syntax trees, EBNF and syntax diagrams, and Properties of CFLs.

Top Down Parsing: Recursive descent parsing, LL (1) parsing, First and follow sets, Recursive descent parser, and Error recovery in top down parsers.

UNIT – III

Bottom-up Parsing: Overview, LR (0) items and LR (0) Parsing, SLR (1) Parsing, general LR(1) and LALR(1) parsing, YACC, and Error recovery in bottom-up parsers.

UNIT – IV

Semantic Analysis: Attributes and attribute grammars, Algorithms for attribute computation, Symbol table, Data types and Type checking.

Runtime Environments: Memory organization during program execution, Fully static runtime environments, Stack-based runtime environments, Dynamic memory, and Parameter parsing mechanisms.

UNIT – V

Code Generation: Intermediate code and data structures for code generation, Basic code generation techniques, Code generation of data structure references, Code generation of control statements and logical expressions, Code generation of procedure and function calls, Code generation in commercial compilers, Code optimization techniques, and Data flow equation.

Suggested Readings:

1. Kenneth C. Louden, "*Compiler Construction: Principles and Practice*", Thomson Learning Inc., 1997.
2. Ravi Sethi, Aho & Ullman JP, "*Compilers: Principles, Techniques and Tools*", Addison Wesley publishing co., 1986.
3. J.P. Tremblay and P.S. Sorenson, "*The Theory and Practice of Compiler Writing*", TMH-1985.

DISTRIBUTED SYSTEMS

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	70 Marks
Sessionals	30 Marks
Credits	3

Course Objectives:

- To acquire an understanding of the issues in distributed systems
- To study architectures and working of distributed file systems
- To expose the students to distributed transaction management, security issues and replication

Course Outcomes:

Student will be able to :

- Describe the problems and challenges associated with distributed systems.
- Implement small scale distributed systems .
- Understand design tradeoffs in large-scale distributed systems

UNIT-I

Introduction: Goals and Types of Distributed Systems

Architectures: Architectural Styles, System Architectures, Architectures versus Middleware, and Self-Management in Distributed Systems.

Processes: Threads, Virtualization, Clients, Servers, and Code Migration.

Communication: Fundamentals, Remote Procedure Call, Message-Oriented Communication, Stream-Oriented Communication, and Multicast Communication.

UNIT-II

Naming: Names, Identifiers and Addresses, Flat Naming, Structured Naming, and Attribute-Based Naming.

Synchronization: Clock Synchronization, Logical Clocks, Mutual Exclusion, Global Positioning of Nodes, and Election Algorithms.

Consistency and Replication: Introduction, Data-Centric Consistency Models, Client-Centric Consistency Models, Replica Management, and Consistency Protocols.

UNIT-III

Fault Tolerance: Introduction to Fault Tolerance, Process Resilience, Reliable Client-Server Communication, Reliable Group Communication, Distributed Commit, and Recovery.

Distributed Object-Based Systems: Architecture, Processes, Communication, Naming, Synchronization, Consistency and Replication, Fault Tolerance, and Security.

UNIT-IV

Distributed File Systems: Architecture, Processes, Communication, Naming, Synchronization, Consistency and Replication, Fault Tolerance, and Security.

Distributed Web-Based Systems: Architecture, Processes, Communication, Naming, Synchronization, Consistency and Replication, Fault Tolerance, and Security.

UNIT-V

Distributed Coordination-Based Systems: Introduction to Coordination Models, Architecture, Processes, Communication, Naming, Synchronization, Consistency and Replication, Fault Tolerance, and Security.

Map-Reduce: Example, Scaling, programming model, Apache Hadoop, Amazon Elastic Map Reduce, Mapreduce.net, Pig and Hive.

Suggested Readings:

1. Andrew S. Tanenbaum and Maarten Van Steen, "*Distributed Systems*", PHI 2nd Edition, 2009.
2. R.Hill, L.Hirsch, P.Lake, S.Moshiri, "*Guide to Cloud Computing*, Principles and Practice", Springer, 2013.
3. R.Buyya, J.Borberg, A.Goscinski,"*Cloud Computing-Principles and Paradigms*",Wiley 2013.

PC 703 CS With effect from the academic year 2018-2019

INFORMATION SECURITY

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	70 Marks
Sessionals	30 Marks
Credits	3

Course Objectives:

- To learn legal and technical issues in building secure information systems
- To provide an understanding of network security
- To expose the students to security standards and practices

Course Outcomes:

Student will be able to:

- Describe the steps in Security Systems development life cycle(SecSDLC)
- Understand the common threats and attack to information systems
- Understand the legal and ethical issues of information technology
- Identify security needs using risk management and choose the appropriate risk control strategy based on business needs
- Use the basic knowledge of security frameworks in preparing security blue print for the organization
- Usage of reactive solutions, network perimeter solution tools such as firewalls, host solutions such as antivirus software and Intrusion Detection techniques and knowledge of ethical hacking tools
- Use ethical hacking tools to study attack patterns and cryptography and secure communication protocols
- Understand the technical and non-technical aspects of security project implementation and accreditation

UNIT-I

Introduction: History, Critical Characteristics of Information, NSTISSC Security Model, Components of an Information System, Securing the Components, Balancing Security and Access, The SDLC, The Security SDLC.
Need for Security: Business Needs, Threats, Attacks, and Secure Software Development

UNIT-II

Legal, Ethical and Professional Issues: Law and ethics in Information Security, Relevant U.S. Laws, International Laws and Legal Bodies, Ethics and Information Security.

Risk Management: Overview, Risk Identification, Risk Assessment, Risk Control Strategies, Selecting a Risk Control Strategy, Quantitative versus Qualitative Risk Control Practices, Risk Management discussion Points, Recommended Risk Control Practices.

UNIT-III

Planning for Security: Security policy, Standards and Practices, Security Blue Print, Security Education, Continuity strategies.
Security Technology: Firewalls and VPNs: Physical Design, Firewalls, Protecting Remote connections.

UNIT-IV

Security Technology: Intrusion Detection, Access Control, and other Security Tools: Intrusion Detection and Prevention Systems-Scanning, and Analysis Tools- Access Control Devices.
Cryptography: Foundations of Cryptology, Cipher methods, Cryptographic Algorithms, Cryptographic Tools, Protocols for Secure Communications, Attacks on Cryptosystems

UNIT-V

Implementing Information Security: Information security project management, Technical topics of implementation, Non Technical Aspects of implementation, Security Certification and Accreditation.
Security and Personnel: Positioning and staffing security function, Employment Policies and Practices, and Internal control Strategies.
Information Security Maintenance: Security management models, Maintenance model, and Digital Forensics.

Suggested Readings:

1. Michael E Whitman and Herbert J Mattord, "*Principles of Information Security*", Cengage Learning, 2011.
2. Thomas R Peltier, Justin Peltier, John Blackley, "*Information Security Fundamentals*", Auerbach Publications, 2010.
3. Detmar W Straub, Seymour Goodman, Richard L Baskerville, "*Information Security, Policy, Processes, and Practices",* PHI, 2008.
4. Mark Merkow and Jim Breithaupt *" Information Security Principle and Practices"*, Pearson Education, 2007

PC 704 CS With effect from the academic year 2018-2019

EMBEDDED SYSTEM DESIGN

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	70 Marks
Sessionals	30 Marks
Credits	3

Course Objectives :

- To provide basics of embedded systems design and development flow.
- To study the processor architectures that supports embedded systems.
- To gain knowledge developing platforms for embedded systems.
- To provide basics of real time operating systems that supports embedded systems.
- To study the concepts on testing and development tools.

Course Outcomes :

Student will be able to :

- Understand the basics of embedded systems design and development flow.
- Apply knowledge to develop the embedded systems.
- Analyse the real time operating that supports embedded systems.

UNIT- I

Design of Embedded System: Sensors and Actuators, Embedded Processors, Memory Architectures, Input and Output.

UNIT –II

Embedded Systems development Environment: IDE, Cross compilation, Disassembler, Simulators, Emulators and Debugging, Target hardware debugging, Boundary Scan.

Embedded Computing Platform: Programming for Embedded systems using C, Device drivers, program modeling concepts, Process of Embedded system development: embedded software development on microcontroller platform, network-based embedded applications and embedded control applications.

UNIT-III

Embedded C Programming: Review of data types - Scalar types-Primitive types-Enumerated types-Subranges, Structure types-character strings -arrays- Functions. Interfacing C with Assembly. Embedded programming issues - Reentrancy, Portability, Optimizing, and testing embedded C programs.

UNIT- IV

Concept of Embedded Operating Systems, Differences between Traditional OS and RTOS. Real-time System Concepts, RTOS Kernel & Issues in Multitasking – Task Assignment, Task Priorities, Scheduling, Intertask Communication & Synchronization – Definition of Context Switching, Foreground ISRs and Background Tasks. Critical Section – Reentrant Functions, Interprocess Communication (IPC) – IPC through Semaphores, Mutex, Mailboxes, Message Queues or Pipes and Event Flags.

UNIT –V

VxWorks – POSIX Real Time Extensions, timeout features, Task Creation, Semaphores (Binary, Counting), Mutex, Mailbox, Message Queues, Memory Management – Virtual to Physical Address Mapping.

Suggested Readings:

1. Edward Ashford Lee and Sanjit Arun kumar Seshia, "Introduction to Embedded Systems- A cyber-Physiacal Systems Approach, Second Edition, MIT Press, 2017.
2. Jones, M Tim, *GNU/Linux Application Programming*, 2nd Edition, Course Technology PTR, 2008.
3. Raj Kamal, " Embedded systems Architecture, programming & Design", Tata McGraw Hill, 2010.
4. Real Time Systems, C.M.Krishna and G.Shin, McGraw-Hill Companies Inc., McGraw Hill International Edition, 1997.
5. Programming Embedded Systems with C and GNU Development Tools, Second Edition, 1977.

MOBILE COMPUTING
(PROFESSIONAL ELECTIVE-III)

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	70 Marks
Sessionals	30 Marks
Credits	3

Course Objectives:

- To introduce basics of wireless voice and data communication technologies
- To build working knowledge on various telephone and satellite networks
- To study the working principles of wireless LANs and standards
- To study principles of adhoc networks and routing
- To gain knowledge on integration of mobile networks into Internet
- To build skills in working with wireless application protocols to develop mobile applications.

Course Outcomes:

Students will be able to

- Implement Adhoc Network Routing protocols.
- Mini based project based on tracking, localization and routing in wireless networks.
- Implement file transfer, access and authentication based applications for mobile computing.

UNIT I

Introduction – Wireless transmission – Frequencies for radio transmission – Signals – Antennas – Signal Propagation – Multiplexing – Modulations – Spread spectrum – MAC – SDMA – FDMA – TDMA – CDMA – Cellular Wireless Networks.

UNIT II

Telecommunication systems – GSM – GPRS – DECT – UMTS – IMT-2000 – Satellite Networks - Basics – Parameters and Configurations – Capacity Allocation – FAMA and DAMA – Broadcast Systems – DAB - DVB.

UNIT III

Wireless LAN – IEEE 802.11 - Architecture – services – MAC – Physical layer – IEEE 802.11a - 802.11b standards – HIPERLAN – Blue Tooth.

UNIT IV

Mobile IP, Dynamic Host Configuration Protocol, Routing in MANETs: DSDV, DSR, AODV and ZRP. MANETS vs VANETs.

UNIT V

Traditional TCP – classical TCP improvements – WAP, and WAP 2.0.

Mobile Transaction models, File Systems and Mobility Management

Suggested Readings:

1. Jochen H. Schiller, "*Mobile Communications*", Addison Wesley, Second Edition, 2003(Unit I Chap 1,2 &3- Unit II chap 4,5 &6-Unit III Chap 7.Unit IV Chap 8- Unit V Chap 9&10.)
2. William Stallings, "*Wireless Communications and Networks*", PHI/Pearson Education, 2002(Unit I Chapter – 7&10-Unit II Chap 9)
3. Kaveh Pahlavan, Prasanth Krishnamurthy, "*Principles of Wireless Networks*", Prentice Hall, 2003.
4. Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, "*Principles of Mobile Computing*", Springer, 2003.
5. Krzysztof Wesolowski, "*Mobile Communication Systems*", John Wiley and Sons Ltd, 2002.

IMAGE PROCESSING
(PROFESSIONAL ELECTIVE-III)

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	70 Marks
Sessionals	30 Marks
Credits	3

Course Objectives

- To introduce basics of visual perception, sampling, quantization and representation of digital images
- To introduce spatial domain and frequency domain filtering techniques necessary for image processing operations.
- To learn advanced image analysis techniques such as image compression, image segmentation, and object recognition
- To learn techniques of color image processing, multi resolution methods, wavelets and morphological processing

Course Outcomes

Student will be able to :

- Analyze images in the frequency domain using various transforms
- Design and implement algorithms that perform image processing operations such as histogram equalization, enhancement, restoration , filtering and denoising
- Explain color spaces , restoration and enhancement of color images
- Develop simple object recognition systems

UNIT I

Image Processing: Introduction, Examples, Fundamental steps, Components, Elements of visual perception, Light and Electromagnetic Spectrum, Image sensing and Acquisition, Image Sampling and Quantization, Basic relationships between pixels.

Intensity Transformations and Spatial Filtering: Background, Some basic intensity transformation functions, Histogram processing, Fundamentals of Spatial filtering, Smoothing spatial filters, Sharpening spatial filters, Combining Spatial Enhancement Methods.

UNIT II

Filtering in the Frequency Domain: Background, Preliminary concepts, Sampling and Fourier Transform of Sampled Functions, Discrete Fourier Transform (DFT) of one variable, Extension to functions of two variables, Some Properties of the 2-D Discrete Fourier Transform, Basics of Filtering in the Frequency Domain, Image Smoothing, Image Sharpening, Homomorphic Filtering.

Image Restoration: Noise Models, Restoration in the presence of noise only-Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering.
Linear Degradation, Position-invariant Degradation, Estimating the Degradation Function, Inverse Filtering, Minimum Mean Square Error Filtering, Constrained Least Squares Filtering, Geometric Mean Filter.

UNIT III

Color Image Processing: Color fundamentals, Color models, Pseudocolor Image Processing, Basics of Full-color Image Processing, Color Transformations, Smoothing and Sharpening, Color-based Image Segmentation, Noise in Color Images, Color Image Compression.

Wavelets and Multi resolution Processing: Background, Multiresolution Expansions, Wavelet Transforms in One Dimension, The Fast Wavelet Transform, Wavelet Transforms in Two Dimensions, Wavelet Packets.

UNIT IV

Image Compression: Fundamentals, Image Compression Models, Elements of Information Theory, Error- free Compression, Lossy Compression, Image Compression Standards, Some Basic Compression Methods.

Morphological Image Processing: Preliminaries, Erosion and Dilation, Opening and Closing, The Hit-or-Miss Transformation, Some Basic Morphological Algorithms, Some Basic Gray-Scale Morphological Algorithms.

UNIT V

Image Segmentation: Fundamentals, Point, Line and Edge Detection, Thresholding, Region-based Segmentation, Segmentation using Morphological Watersheds, The use of Motion in Segmentation.

Object Recognition: Patterns and Pattern Classes, Recognition based on Decision-theoretic Methods, Structural Methods.

Suggested Readings:

1. Rafael C. Gonzalez and Richard E. Woods, *Digital Image Processing*, PHI Learning Pvt. Limited, 3rd Edition, 2008.

2. William K. Pratt, *Digital Image Processing*, John Wiley & Sons, Inc., 3rd Edition, 2001.

PE 707 CS *With effect from the Academic year 2018-2019*

SOFTWARE QUALITY AND TESTING

(PROFESSIONAL ELECTIVE-III)

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	70 Marks
Sessionals	30 Marks
Credits	3

Course Objectives:

- To understand the challenges of Software Quality and the need for integration of quality activities in project life cycle
- To introduce supporting software quality devices
- To introduce software quality metrics and Quality Assurance models
- To understand the steps in software testing process and taxonomy of testing tools

.

Course Outcomes:

Student will be able to :

- Describe the role of quality assurance activities in the software process
- Compare several process improvement models such as CMM, CMMI, PCMM, and ISO9000
- Describe several process metrics for assessing and controlling a project
- Describe how available static and dynamic test tools can be integrated into the software development environment

UNIT - I

The Software Quality Challenge, Introduction Software Quality Factors, The Components of the Software Quality Assurance System – Overview, Development and Quality Plans.

UNIT - II

Integrating Quality Activities in the Project Life Cycle, Assuring the Quality of Software Maintenance Components, CASE Tools and their effect on Software Quality, Procedure and Work Instructions, Supporting Quality Devices, Configuration Management, Documentation Control, Project Progress Control.

UNIT - III

Software Quality Metrics, Costs of Software Quality, Quality Management Standards - ISO 9000 and Companion ISO Standards, CMM, CMMI, PCMM, Malcom Balridge, 3 Sigma, 6 Sigma, SQA Project Process Standards – IEEE Software Engineering Standards.

UNIT - IV

Building a Software Testing Strategy, Establishing a Software Testing Methodology, Determining Your Software Testing Techniques, Eleven – Step Software Testing Process Overview, Assess Project Management Development Estimate and Status, Develop Test Plan, Requirements Phase Testing, Design Phase Testing, Program Phase Testing, Execute Test and Record Results, Acceptance Test, Report Test Results, Test Software Changes, Evaluate Test Effectiveness.

UNIT - V

Testing Client / Server Systems, Testing the Adequacy of System Documentation, Testing Web-based Systems, Testing Off – the – Shelf Software, Testing in a Multiplatform Environment, Testing Security, Testing a Data Warehouse, Creating Test Documentation, Software Testing Tools, Taxonomy of Testing Tools, Methodology to Evaluate Automated Testing Tools, Load Runner, Win Runner and Rational Testing Tools, Java Testing Tools, JMetra, JUNIT and Cactus.

Suggested Readings:

1. Daniel Galin, *Software Quality Assurance – From Theory to Implementation*, Pearson Education.2004
2. Mordechai Ben – Menachem / Garry S.Marliss, *Software Quality – Producing Practical, Consistent Software*, BS Publications, 2014
3. William E. Perry, *Effective Methods for Software Testing*, 3 rd Edition, 2006, Wiley .
4. Srinivasan Desikan, Gopalaswamy Ramesh, *Software Testing, Principles and Practices*, 2006. Pearson Education.
5. Dr.K.V.K.K. Prasad, *Software Testing Tool*, Wiley Publishers

Web Resources :

1. http://www.sei.cmu.edu/cmmi/
2. www.ibm.com/software/awdtools/tester/functional/index.html
3. www.ibm.com/software/awdtools/test/manager/
4. *java-source.net/open-source/testing-tools*
5. www.junit.org
6. *java-source.net/open-source/web-testing-tools*

WEB SERVICES AND ARCHITECTURE
(PROFESSIONAL ELECTIVE-III)

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	70 Marks
Sessionals	30 Marks
Credits	3

Course Objectives

- To study the evolution of SOA and Web Services
- To understand the principles of service orientation , Service layers
- To learn about WS* Specifications , messaging with SOAP and Service composition
- To learn about service oriented analysis and service oriented design
- Gained knowledge on various open standards available for developing SOA compliant web services

Course Outcomes:

Student will be able to :

- Understand web service framework with respect to SOA
- Develop SOA compliant web services using open standards and various technologies
- Model and implement businesses processes using service oriented approach

UNIT- I :
SOA and Web Services Fundamentals: Introducing So, The Evolution of SOA, Web services and primitive SOA.

UNIT-II:
SOA and WS-*Extensions: Web Services and Contemporary SOA(I: Activity Management and Composition), Web Services and Contemporary SOA(II: Advanced Messaging, Metadata, and Security).

UNIT-III:
SOA and Service-Orientation: Principles of Service-Orientation, Service Layers.

UNIT-IV:
Building SOA (Planning And Analysis) : SOA Delivery Strategies, Services-Oriented Analysis (I: Introduction), Service-Oriented Analysis (II: Service Modeling).

UNIT-V:
Building SOA (Technology And Design): Service-Oriented Design (I: Introduction), Service-Oriented Design (II: SOA Composition Guidelines), Service-Oriented Design (III: Service-Design), Service-oriented Design (IV: Business Process Design), Fundamentals WS-*Extensions, SOA Platforms.

Suggested Readings

1. Thomas Eri*,"Service-Oriented Architecture(SOA): Concepts, Technology, and Design*", Prentice Hall PTR, 2005
2. James McGovern and Sameer Tyagi , "*Java Web Services Architecture*,", Morgan Kaufmann-May 2003.

COMPUTATIONAL INTELLIGENCE
(PROFESSIONAL ELECTIVE-III)

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	70 Marks
Sessionals	30 Marks
Credits	3

Course Objective:

- To introduce the concepts of Biological and Artificial neural networks
- To understand different neural architectures with supervised learning and their learning mechanisms
- To study different neural architectures with unsupervised learning such as PCA Networks , Kohenen's Self-Organizing Maps
- To introduce Markov decision processes , Q-Learning and TD-Learning
- To study different models of evolution and learning, neuro-fuzzy techniques, rough set theory and their applications

Course Outcomes:

Student will be able to :

- Design single and multi-layer feed-forward neural networks
- Implement various unsupervised learning networks
- Design new evolutionary operators , representations and fitness functions for specific practical problems
- Apply fuzzy logic and rough sets to handle uncertainty and vagueness in practical problems

UNIT -I

Introduction to Computational Intelligence / Soft computing: Soft versus Hard Computing, Various paradigms of computing

Foundations of Biological Neural Networks: Introduction to Neural Networks, Humans and Computers, Organization of the Brain, Biological Neuron, Biological and Artificial Neuron Models, Hodgkin-Huxley Neuron Model, Integrate-and-Fire Neuron Model, Spiking Neuron Model, Characteristics of ANN (Learning, Generalization, Memory, Abstraction, Applications), McCulloch-Pitts Model, Historical Developments

Essentials of Artificial Neural Networks: Introduction, Artificial Neuron Model, Operations of Artificial Neuron, Types of Neuron Activation Function, ANN Architectures, Classification Taxonomy of ANN – Connectivity (Feed forward, feedback, Single and Multi-layer), Neural Dynamics (Activation and Synaptic), Learning Strategy (Supervised, Unsupervised, Reinforcement), Learning Rules (Error Correction, Hebbian, Competitive, Stochastic), Types of Application (Pattern

Classification, Pattern Clustering, Pattern Association / Memory, Function Approximation, Prediction, Optimization)

UNIT –II

Neural Architectures with Supervised Learning: Single Layer Feed Forward Neural Networks (Perception), Multilayer Feed forward Neural Networks (Back propagation learning), Radial Basis Function Networks, Support Vector Machines, Simulated Annealing, Boltzmann Machine, Feedback (Recurrent) Networks and Dynamical Systems

Associative Memories: Matrix memories, Bidirectional Associative Memory, Hopfield Neural Network,

UNIT –III

Neural Architectures with Unsupervised Learning: Competitive learning, Principal Component Analysis Networks (PCA), Kohonen's Self-Organizing Maps, Linear Vector Quantization, Adaptive Resonance Theory (ART) Networks, Independent Component Analysis Networks (ICA)

UNIT -IV

Reinforcement Learning: Markov Decision Processes, Value Functions, Bellman Optimality Criterion, Policy and Value Iterations, Q-Learning, TD Learning

UNIT -V

Fuzzy Logic: Basic concepts, fuzzy set theory, basic operations, fuzzification, defuzzification, neurofuzzy approach, applications

Evolutionary and Genetic Algorithms: Basic concepts of evolutionary computing, genetic operators, fitness function and selection, genetic programming, other models of evolution and learning, ant colony systems, swarm intelligence, applications

Rough Set Theory: Basic concepts, indiscernability relation, lower and upper approximation, decision systems based on rough approximation, applications

Suggested Readings:

1. Jacek M. Zurada. Introduction to Artificial Neural Systems, Jaico Publishers, 1992.
2. S. Haykin. Neural Networks: A Comprehensive Foundation, Prentice Hall, 1999
3. P. S. Churchland and T. J. Sejnowski. The Computational Brain. MIT Press, 1992.
4. A. M. Ibrahim. Introduction to Applied Fuzzy Electronics. PHI, 2004
5. Z. Pawlak. Rough Sets, Kluwer Academic Publishers, 1991.

OE701 BM With effect from the academic year 2018-2019

HUMAN FACTOR ENGINEERING
(OPEN ELECTIVE-II)

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	70 Marks
Sessionals	30 Marks
Credits	3

Course Objectives:

- Provide a broad based introduction to ergonomic principles and their application in the design of work, equipment and the workplace.
- Consideration is given to musculo-skeletal disorders, manual handling, ergonomic aspects of the environment as well as to the social and legal aspects.

Course Outcomes:

Student will be able to:

- Apply ergonomic principles to the creation of safer, healthier and more efficient and effective activities in the workplace
- Conduct ergonomic risk assessments
- Develop appropriate control measures for ergonomic risk factors
- Describe work-related causes of musculo-skeletal disorders
- Design a workplace according to good ergonomic principles
- Assess ergonomic aspects of the working environment and work organization.

UNIT-I: Overview of Ergonomics (20%)

General Principles -Aims, objectives and benefits of ergonomics , Definition and scope of ergonomics and systems of work , The role of the ergonomist , Fitting the job to the person and the person to the job , Human characteristics, capabilities and limitations , Human error , Teamwork and ageing , Interfaces between job, person and environment , Human computer interaction

Biological Ergonomics- Body systems - musculo-skeletal and nervous , Anatomy, static and dynamic anthropometry . Biomechanics . Applying work physiology - body metabolism, work capacity and fatigue, Static and dynamic postures

Psychology-Perception of risk , Motivation and behaviour , Memory , Signal Detection Theory and vigilance , ‘Work 'Stress' - causes, preventative and protective measures , Work organisation - shift working and overtime

Developing an Ergonomics Strategy at Work- Culture of an organisation - commitment and decision-making , ‘Macro-ergonomics' and participatory ergonomic teams , Ergonomics at the design stage , Developing ergonomics, professional ergonomists and competence

UNIT-II: Ergonomics Methods and Techniques (20%)

Work Design -Task analysis and allocation of functions , User trials , Problem solving - scientific method

Ergonomics Risk Assessment- Definitions of hazard and risk , Priorities , Risk evaluation quantity and quality of risk , Assessment systems , Overall ergonomics approach , Control measures monitoring and feedback

Measurements and Information Gathering-Ergonomics standards , Observational techniques , Rating scales, questionnaires and check lists , Use of models and simulation

UNIT-III: Musculo-Skeletal Disorder (20%)

Manual Handling-The nature and causes of manual handling disorders , Risk assessment , Job design and training , Principles of handling and preventative and protective measures

Work Related Upper Limb Disorders (WRULD)- The nature and causes of WRULD/ 'Repetitive Strain Injuries'/Cumulative Disorders , Risk assessment , Principles of control, preventive and protective measures

UNIT-IV: Workplace, Job and Product Design (20%)

Workplace Layout and Equipment Design- Principles of workstation and system design , Space and workstation design principles , Risks to health: Musculoskeletal problems, Visual fatigue, Mental stress, Requirements for eye tests, Design considerations for Visual Display Unit (VDU) Stations: Ergonomic factors, Work stations, Design of work and practice, Carrying out assessments of risk at VDU workstations

Controls, Displays and Information-Visual, auditory and other displays , Quantitative and qualitative information , Compatibility and population stereotypes , Warnings, signs and labels , Sources and selection of data , Principles of software ergonomics

UNIT-V: Relevant Physical Factors of the Work Environment (10%) & **Standards and Social Aspects (10%)**

Lighting - Visual acuity and colour vision , Lighting levels, contrast and glare , Reflections and flicker fusion

Noise - Noise induced hearing loss , Distraction, annoyance and emergency signals

Thermal Environment- Body temperature regulation and acclimatisation ,Subjective assessments - thermal comfort and discomfort

Other Considerations- Smell, taste and tactile senses , Vibration - effects and subjective assessment

Clothing and Protective Equipment- Objective and subjective effects , Risk perception, and wearability , Design, style and fit

Standards - ISO standards , Sources of other standards

Selection and Training- Training Needs Analysis , Testing and interview techniques

Instruction and Supervision- Health information, legal requirements , Supervision and records , Measuring health and illness

Suggested Readings:

1. Introduction to Human factors and Ergonomics, 4th edition by Gariel Salvendy, John & Willey & Son's.
2. Introduction to Human Factors and Ergonomics, 4th Edition by Robert Bridger, CRC Press.
3. An Introduction to Human factors Engineering by 2nd Edition, Christopher D. Wickens, Sallie E. Gardon, Yili Liv, PHI series.
4. Stephen Konz and Steve Johnson 2007 Work Design: Occupational Ergonomics 7th Edition Holcomb Hathway.
5. Dul & Weerdmeester 2003 Ergonomics for Beginners Taylor & Francis.
6. R.S.Bridger 2003 Introduction to Ergonomics Taylor & Francis

OE 702 BM With effect from the academic year 2018-2019

BASIC MEDICAL ENGINEERING
(OPEN ELECTIVE-II)

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	70 Marks
Sessionals	30 Marks
Credits	3

Course Objectives:

- State the Physiological reasons for using a particular piece of Biomedical Equipment.
- Describe the operating principles of a wide range of biomedical equipment.
- To familiarize the latest technologies of modern medicine
- To make learners able to use new and updated diagnostic methodologies
- To make learners capable enough of adopting the methods of recovery and improving health with a service approach

Course Outcomes:

Student will be able to :

- Perform tests to assess the performance and safety of various Equipments.
- Learn the maintenance of biomedical equipment.

UNIT-I

Medical Monitoring and recording: Patient monitoring: System concepts, bedside monitoring systems, central monitors, heart rate and pulse rate measurement. Temperature measurement Blood pressure measurement: Direct and indirect methods. Respiration rate measurement: Impedance pneumograph, Apnoea detectors. Ambulatory monitoring: Arrhythmia monitor, data recording, replay and analysis, Telemetry.

UNIT-II

Physiotherapy and Electrotherapy Equipment: Diathermy machines: Short wave diathermy, Microwave diathermy and ultrasonic diathermy Electro diagnostic/Therapeutic apparatus: Nerve muscle stimulator, Functional electrical stimulator etc.

UNIT-III

Medical Imaging Equipment:

X-Ray machines: Properties and production of X-Rays, X-ray machine, Image Intensifier. X-ray computed tomography: basic principle and construction of the components. Ultrasonic Imaging: Physics of ultrasonic waves, medical ultrasound, basic pulse echo apparatus. Magnetic Resonance Imaging: Principle, Image reconstruction techniques, Basic NMR components, Biological effects, Merits.

UNIT-IV

Critical care Equipment:

Ventilators: Mechanics of respiration, artificial ventilators, Positive pressure ventilator, Types and classification of ventilators. Drug delivery system: Infusion pumps, basic components, implantable infusion system, closed loop control in infusion pump. Cardiac Defibrillators: Need for defibrillators, DC defibrillator, Implantable defibrillators, Defibrillator analyzer.

UNIT-V

Therapeutic Equipment:

Cardiac pacemakers: Need for cardiac pacemakers, External and implantable pacemakers, types.

Dialysis Machine: Function of kidney, artificial kidney, Dialyzers, Membranes, Hemodialysis machine. Lithotripters: The stone diseases problem, Modern Lithotripter systems, extra corporeal shockwave therapy.

Suggested Readings:

1. R.S.Khandpur, Hand Book of Biomedical Instrumentation, Tata McGraw Hill, Second Edition, 2014.
2. John G.Webster, Medical Instrumentation Application and design, Wiley India Edition, 2009.

OPTIMIZATION TECHNIQUES
(OPEN ELECTIVE-II)

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	70 Marks
Sessionals	30 Marks
Credits	3

UNIT-I

Introduction to Classical Optimization Techniques: Statement of optimization problem, Objective function, Classification of optimization problems. Classical Optimization Techniques: Single-variable a multi-variable optimization without constraints. Multi-variable optimization with equality constraints. Lagrange multiplier method, Multi-variable optimization with inequality constraints, Kuhn-Tucker conditions.

UNIT-II

Linear Programming: Standard form, Formulation of the LPP, Solution of simultaneous equations by pivotal condensation, Graphical methods, Simplex algorithm, Big M method, Two phase Simplex method, Duality principle, Dual simplex method.

UNIT-III

Non-linear Programming: One-dimensional search methods. Fibonacci method, Golden section method. Direct Search Method: Univariate search and pattern search methods, Powell's method.

UNIT-IV

Gradient Method: Steepest descent, conjugate gradient and Quasi-Newton methods, Fletcher-Reeves method of conjugate gradients.

UNIT-V

Dynamic Programming: Multistage design process, Types, Principle of optimality, Computational procedure in dynamic programming, Examples using calculus method and tabular method of solutions.

Suggested Readings:

1. S. S.Rao, "Optimization Theory and Application", New Age International, 3rd Edition, 1998.
2. Jasbir S.Arora, "Introduction to Optimum Design", McGraw Hill International Edition, 1989.
3. S.D.Sharma, "Operational Research", Kedamath Ramnath & Co., 2004.

DATA BASE MANAGEMENT SYSTEMS
(OPEN ELECTIVE-II)

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	70 Marks
Sessionals	30 Marks
Credits	3

Course Objectives:

- To introduce three schema architecture and DBMS functional components
- To learn formal and commercial query languages of RDBMS
- To understand the principles of ER modeling and theory of normalization
- To study different file organization and indexing techniques
- To familiarize theory of serializablity and implementation of concurrency control, and recovery

Course Outcomes :

Student will be able to:

- Understand the mathematical foundations on which RDBMS are built
- Model a set of requirements using the Extended Entity Relationship Model (EER), transform an EER model into a relational model ,and refine the relational model using theory of Normalization
- Develop Database application using SQL and Embedded SQL
- Use the knowledge of file organization and indexing to improve database application performance
- Understand the working of concurrency control and recovery mechanisms in RDBMS

UNIT – I

Introduction: Database System Applications, Purpose of Database Systems, View of Values, Nested Sub-queries, Complex Queries, Views, Modification of the Database, Joined Relations Data, Database Languages, Relational Databases, Database Design, Object–based and Semi-structured Databases, Data Storage and Querying, Transaction Management, Data Mining and Analysis, Database Architecture, Database Users and Administrators.

Database Design and the E-R Model: Overview of the Design Process, The Entity-Relationship Model, Constraints, Entity-Relationship Diagrams, Entity – Relationship Design Issues, Weak Entity Sets, Extended E-R Features, Database Design for Banking Enterprise, Reduction to Relational Schemas, Other Aspects of Database Design

UNIT – II

Relational Model: Structure of Relational Databases, Fundamental Relational-Algebra Operations, Additional Relational – Algebra Operations, Extended Relational - Algebra Operations, Null Values, Modification of the Databases.
Structured Query Language: Data Definition, Basic Structure of SQL Queries, Set Operations, Aggregate Functions, Null

UNIT – III

Advanced SQL: SQL Data Types and Schemas, Integrity Constraints, Authorization, Embedded SQL, Dynamic SQL, Functions and Procedural Constructs, Recursive Queries, Advanced SQL **Features. Relational Database Design:** Features of Good Relational Design, Atomic Domains and First Normal Form, Functional-Dependency Theory, Decomposition using Functional Dependencies.

UNIT – IV

Indexing and Hashing: Basic Concepts, Ordered Indices, B^+-tree Index Files, B-tree Index Files, Multiple-Key Access, Static Hashing, Dynamic Hashing, Comparison of Ordered Indexing and Hashing, Bitmap Indices, Index Definition in SQL.
Transactions: Transaction Concepts, Transaction State, Implementation of Atomicity and Durability, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Testing for Serializability

UNIT – V

Concurrency Control: Lock-based Protocols, Timestamp-based Protocols, Validation-based Protocols, Multiple Granularity, Multi-version Schemes, Deadlock Handling, Insert and Delete Operations, Weak Levels of Consistency, Concurrency of Index Structures.

Recovery System: Failure Classification, Storage Structure, Recovery and Atomicity, Log-Based Recovery, Recovery with Concurrent Transactions, Buffer Management, Failure with Loss of Nonvolatile Storage, Advanced Recovery Techniques, Remote Backup Systems

Suggested Readings:

1. Abraham Silberschatz, Henry F Korth, S Sudarshan, Database System Concepts, McGraw-Hill International Edition, 6th Edition, 2010
2. Ramakrishnan, Gehrke, Database Management Systems, McGraw-Hill International Edition, 3rd Edition, 2003
3. Elmasri, Navathe, Somayajulu, Fundamentals of Database Systems, Pearson Education, 4th Edition, 2004

INFORMATION SECURITY
(OPEN ELECTIVE-II)

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	70 Marks
Sessionals	30 Marks
Credits	3

Course Objectives:

- To learn legal and technical issues in building secure information systems
- To provide an understanding of network security
- To expose the students to security standards and practices

Course Outcomes:

Student will be able to:

- Describe the steps in Security Systems development life cycle(SecSDLC)
- Understand the common threats and attack to information systems
- Understand the legal and ethical issues of information technology
- Identify security needs using risk management and choose the appropriate risk control strategy based on business needs
- Use the basic knowledge of security frameworks in preparing security blue print for the organization
- Usage of reactive solutions, network perimeter solution tools such as firewalls, host solutions such as antivirus software and Intrusion Detection techniques and knowledge of ethical hacking tools
- Use ethical hacking tools to study attack patterns and cryptography and secure communication protocols
- Understand the technical and non-technical aspects of security project implementation and accreditation

UNIT-I

Introduction: History, Critical Characteristics of Information, NSTISSC Security Model, Components of an Information System, Securing the Components, Balancing Security and Access, The SDLC, The Security SDLC.
Need for Security: Business Needs, Threats, Attacks, and Secure Software Development

UNIT-II

Legal, Ethical and Professional Issues: Law and ethics in Information Security, Relevant U.S. Laws, International Laws and Legal Bodies, Ethics and Information Security.

Risk Management: Overview, Risk Identification, Risk Assessment, Risk Control Strategies, Selecting a Risk Control Strategy, Quantitative versus Qualitative Risk Control Practices, Risk Management discussion Points, Recommended Risk Control Practices.

UNIT-III

Planning for Security: Security policy, Standards and Practices, Security Blue Print, Security Education, Continuity strategies.
Security Technology: Firewalls and VPNs: Physical Design, Firewalls, Protecting Remote connections.

UNIT-IV

Security Technology: Intrusion Detection, Access Control, and other Security Tools: Intrusion Detection and Prevention Systems-Scanning, and Analysis Tools- Access Control Devices.
Cryptography: Foundations of Cryptology, Cipher methods, Cryptographic Algorithms, Cryptographic Tools, Protocols for Secure Communications, Attacks on Cryptosystems

UNIT-V

Implementing Information Security: Information security project management, Technical topics of implementation, Non Technical Aspects of implementation, Security Certification and Accreditation.
Security and Personnel: Positioning and staffing security function, Employment Policies and Practices, and Internal control Strategies.
Information Security Maintenance: Security management models, Maintenance model, and Digital Forensics.

Suggested Readings:

1. Michael E Whitman and Herbert J Mattord, "*Principles of Information Security*", Cengage Learning, 2011.
2. Thomas R Peltier, Justin Peltier, John Blackley, "*Information Security Fundamentals*", Auerbach Publications, 2010.
3. Detmar W Straub, Seymour Goodman, Richard L Baskerville, "*Information Security, Policy, Processes, and Practices",* PHI, 2008.
4. Mark Merkow and Jim Breithaupt *" Information Security Principle and Practices"*, Pearson Education, 2007

OE 701 EC *With effect from the Academic year 2018-2019*

PRINCIPLES OF ELECTRONIC COMMUNICATION

(OPEN ELECTIVE-II)

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	70 Marks
Sessionals	30 Marks
Credits	3

Course Objectives:

- Provide an introduction to fundamental concepts in the understanding of communications systems.
- Provide an introduction to network model and some of the network layers including physical layer, data link layer, network layer and transport layer.
- Provide an introduction to the evolution of wireless systems and current wireless technologies.

Course Outcomes:

Student will be able to :

- Understand the working of analog and digital communication systems
- Understand the OSI network model and the working of data transmission
- Understand the evolution of communication technologies from traditional telephony systems to modern wireless communication systems.

UNIT- I

Introduction to communication systems: Electromagnetic Frequency Spectrum, Signal and its representation, Elements of Electronic Communications System, Types of Communication Channels, **Signal Transmission Concepts-**Baseband transmission and Broadband transmission, **Communication parameters**-Transmitted power, Channel bandwidth and Noise, Need for modulation **Signal Radiation and Propagation**-Principle of electromagnetic radiation, Types of Antennas, Antenna Parameters and Mechanisms of Propagation.

UNIT- II

Analog and Digital Communications: Amplitude modulation and demodulation, FM modulation and demodulation, Digital converters, Digital modulation schemes – ASK, FSK, PSK, QPSK, Digital demodulation.

UNIT- III

Data Communication and Networking: Network Models, OSI Model, Data Link Layer – Media Access control, Ethernet , Network Layer – Internet Protocol (IPv4/IPv6), Transport Layer – TCP, UDP.

UNIT- IV

Telecommunication Systems: Telephones, Telephone system, Paging systems, Internet Telephony.

Optical Communications: Optical Principles, Optical Communication Systems, Fiber –Optic Cables, Optical Transmitters & Receivers, Wavelength Division Multiplexing.

UNIT- V

Wireless Communications: Evolution of Wireless Systems: AMPS, GSM, CDMA, WCDMA, OFDM. Current Wireless Technologies: Wireless LAN, Bluetooth, PAN and ZigBee, Infrared wireless, RFID communication, UWB, Wireless mesh networks, Vehicular adhoc networks.

Suggested Readings:

1. Principles of Electronic Communication Systems, Louis E. Frenzel, 3e, McGraw Hill publications, 2008.
2. Data Communications and Networking, Behrouz A. Forouzan, 5e TMH, 2012.
3. Kennady, Davis, Electronic Communications systems, 4e, TMH, 1999.

OE 702 EC *With effect from the Academic year 2018-2019*

Fundamentals of IOT

(OPEN ELECTIVE-II)

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	70 Marks
Sessionals	30 Marks
Credits	3

Course Objectives:

- Discuss fundamentals of IoT and its applications and requisite infrastructure
- Describe Internet principles and communication technologies relevant to IoT
- Discuss hardware and software aspects of designing an IoT system
- Describe concepts of cloud computing and Data Analytics
- Discuss business models and manufacturing strategies of IoT products

Course Outcomes:

Student will be able to

- Understand the various applications of IoT and other enabling technologies.
- Comprehend various protocols and communication technologies used in IoT
- Design simple IoT systems with requisite hardware and C programming software
- Understand the relevance of cloud computing and data analytics to IoT
- Comprehend the business model of IoT from developing a prototype to launching a product.

UNIT- I

Introduction to Internet of Things

IOT vision, Strategic research and innnovation directions, Iot Applications, Related future technologies, Infrastructure, Networks and communications, Processes, Data Management, Security, Device level energy issues.

UNIT- II

Internet Principles and communication technology

Internet Communications: An Overview – IP,TCP,IP protocol Suite, UDP. IP addresses – DNS, Static and Dynamic IP addresses, MAC Addressess, TCP and UDP Ports, Application Layer Protocols –

HTTP,HTTPS, Cost Vs Ease of Production, Prototypes and Production, Open Source Vs Closed Source.

UNIT- III

Prototyping and programming for IoT

Prototyping Embedded Devices – Sensors, Actuators, Microcontrollers, SoC, Choosing a platform, Prototyping, Hardware platforms – Arduino, Raspberry Pi. Prototyping the physical design – Laser Cutting, 3D printing, CNC Milling.

Techniques for writing embedded C code: Integer data types in C, Manipulating bits - AND,OR,XOR,NOT, Reading and writing from I/ O ports. Simple Embedded C programs for LED Blinking, Control of motor using switch and temperature sensor for arduino board.

UNIT- IV

Cloud computing and Data analytics

Introduction to Cloud storage models -SAAS, PAAS, IAAS. Communication APIs, Amazon webservices for IoT, Skynet IoT Messaging Platform.

Introduction to Data Analytics for IoT - Apache hadoop- Map reduce job execution workflow.

UNIT- V

IoT Product Manufacturing - From prototype to reality

Business model for IoT product manufacturing, Business models canvas, Funding an IoT Startup,

Mass manufacturing - designing kits, designing PCB,3D printing, certification, Scaling up software, Ethical issues in IoT- Privacy, Control, Environment, solutions to ethical issues.

Suggested Readings:

1. Internet of Things - Converging Technologies for smart environments and Integrated ecosystems, River Publishers.
2. Designing the Internet of Things , Adrian McEwen, Hakim Cassimally. Wiley India Publishers
3. Fundamentals of embedded software: where C meets assembly by Daneil W lewies, Pearson.
4. Internet of things -A hands on Approach, Arshdeep Bahga, Universities press.

OE701EE *With effect from the Academic year 2018-2019*

Non-Conventional Energy Sources

(OPEN ELECTIVE-II)

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	70 Marks
Sessionals	30 Marks
Credits	3

UNIT I

Review of Conventional and Non-Conventional energy sources - Need for non-conventional energy sources Types of Non- conventional energy sources - Fuel Cells - Principle of operation with special reference to H2 °2 Cell - Classification and Block diagram of fuel cell systems - Ion exchange membrane cell - Molten carbonate cells - Solid oxide electrolyte cells - Regenerative system- Regenerative Fuel Cell - Advantages and disadvantages of Fuel Cells — Polarization - Conversion efficiency and Applications of Fuel Cells.

UNIT II

Solar energy - Solar radiation and its measurements - Solar Energy collectors -Solar Energy storage systems - Solar Pond - Application of Solar Pond - Applications of solar energy.

UNIT III

Wind energy- Principles of wind energy conversion systems - Nature of wind - Power in the Wind- Basic components of WECS -Classification of WECS -Site selection considerations -Advantages and disadvantages of WECS -Wind energy collectors -Wind electric generating and control systems - Applications of Wind energy -Environmental aspects.

UNIT IV

Energy from the Oceans - Ocean Thermal Electric Conversion (OTEC) methods - Principles of tidal power generation -Advantages and limitations of tidal power generation -Ocean waves - Wave energy conversion devices -Advantages and disadvantages of wave energy - Geo-thermal Energy - Types of Geo-thermal Energy Systems - Applications of Geo-thermal Energy.

UNIT V

Energy from Biomass - Biomass conversion technologies / processes - Photosynthesis - Photosynthetic efficiency - Biogas generation - Selection of site for Biogas plant - Classification of Biogas plants - Details of commonly used Biogas plants in India - Advantages and disadvantages of Biogas generation -Thermal gasification of biomass -Biomass gasifies.

Suggested Readings:

1. Rai G.D, *Non-Conventional Sources of Energy,* Khandala Publishers, New Delhi, 1999.
2. M.M.El-Wakil, *Power Plant Technology.* McGraw Hill, 1984.

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OE701ME *With effect from the Academic year 2018-2019*

STARTUP ENTREPRENEURSHIP

(Open Elective-II)

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	70 Marks
Sessionals	30 Marks
Credits	3

Course Objectives:

- To motivate students to take up entrepreneurship in future
- To learn nuances of starting an enterprise by creative thinking and shape ideas into reality.
- To understand action driven business plan and learn to prepare project budget.

Course Outcomes:

Students will be able to :

- Think creatively and and transform ideas into reality.
- Differentiate market transforming strategy.
- Create a complete business plan and workout the budget plan.

UNIT I: Creativity & Discovery

Definition of Creativity, self test creativity, discovery and delivery skills, The imagination threshold, Building creativity ladder, Collection of wild ideas, Bench marking the ideas, Innovative to borrow or adopt, choosing the best of many ideas, management of tradeoff between discovery and delivery, Sharpening observation skills, reinventing self, Inspire and aspire through success stories

UNIT II: From Idea to Startup

Introduction to think ahead backward, Validation of ideas using cost and strategy, visualizing the business through value profile, activity mapping, Risks as opportunities, building your own road map

UNIT III: Innovation career lessons

Growing & Sharing Knowledge, The Role of Failure In Achieving Success, Creating vision, Strategy, Action & Resistance: Differentiated Market Transforming Strategy; Dare to Take Action; Fighting Resistance; All About the startup Ecosystem; Building a Team; Keeping it Simple and Working Hard.

UNIT IV: Action driven business plan

Creating a completed non-business plan (a series of actions each of which moves your idea toward implementation), including a list of the activities to be undertaken, with degrees of importance (scale of 1 to 3, where 1 is 'most important'). A revision of the original product or service idea, in light of information gathered in the process, beginning to design the business or organization that will successfully implement your creative idea. Preparing an activity map.

UNIT V: Startup financing cycle

Preparing an initial cash flow statement, showing money flowing out (operations; capital) and flowing in. Estimate your capital needs realistically. Prepare a bootstrapping option (self financing). Prepare a risk map. Prepare a business plan comprising five sections: The Need; The Product; Unique Features; The Market; Future Developments. Include a Gantt chart (project plan – detailed activities and starting and ending dates); and a project budget.

Suggested Readings:

1. Vasant Desai, "Dynamics of Entrepreneurial Development and Management", Himalaya Publishing House, 1997.
2. Prasanna Chandra, "Project – Planning , Analysis, Selection, Implementation and Review", Tata McGraw-Hill Publishing Company Ltd., 1995.
3. B. Badhai, "Entrepreneurship for Engineers", Dhanpath Rai & Co., Delhi, 2001.
4. Stephen R. Covey and A. Roger Merrill, "First Things First", Simon and Schuster, 2002.
5. Robert D. Hisrich and Michael P.Peters, " Entrepreneurship", Tata McGRaw Hill Edition, 2002

OE702ME *With effect from the academic year 2018-2019*

FINITE ELEMENT METHODS

(Open Elective-II)

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	70 Marks
Sessionals	30 Marks
Credits	3

Course Objectives:

- To understand the theory and application of the finite element method for analyzing structural systems.
- To learn Approximation theory for structural problems as the basis for finite element methods
- To learn formulations for a variety of elements in one, two, and three dimensions. Implementations of element formulations will be examined using Matlab.
- To understand modeling and analysis of structures using planar, solid, and plate elements

Course Outcomes:

Student will be able to

- Understands the concept of Finite Element Method and realize its limitations.
- Able to formulate 1D, 2D and 3D element and distinguish between linear and higher order elements.
- Applying 1D , 2D and 3D elements to solve different static and dynamic problems.

UNIT I:

Introduction to Finite Element Method: solution method using FEM, descretisation, Boundary conditions, load application, types of elements comparison, Stress and Equilibrium, Boundary conditions. Strain-Displacement relations. Stress-strain relations.

One Dimensional problems: Finite element modeling, coordinates and shape functions.

Potential Energy approach: Assembly of Gloabal stiffness matrix and load vector. Finite element equations, Treatment of boundary conditions. Quadratic shape functions.

UNIT II:

Analysis of trusses and frames: Element stiffness matrix for a truss member. Analysis of plane truss with number of unknowns not exceeding two at each node. Analysis of frames with two translations and a rotational degree of freedom at each node.

Analysis of Beams: Element stiffness matrix for two nodded, two degrees of freedom per node beam element.

UNIT III:

Finite element modeling of two dimensional stress analysis with constant strain triangles and treatment of boundary conditions.

Finite element modeling of Axisymmetirc solids subjected to Axisymmetric loading with triangular elements.

UNIT IV:

Two dimensional four nodded isoprarametric elements and numerical integration.

Steady state heat transfer analysis: Ond dimensional analysis of a find and two dimensional analysis of thin palate. Analysis of uniform shaft subjected to torsion.

UNIT V:

Dynamic Analysis: Formulation of finite element mode, element matrices, evaluation of Eigen values and Eigen vectors for a stepped bar and a beam.

Time dependent field problems: Application to one dimensional heat flow in a rod. Finite element formation to three dimensional problems in stress analysis. Types of elements used.

Convergence requirements and geometric isotropy: Local, natural and global coordinates. Introduction to Finite Element Analysis Software.

Suggested Readings:

1. Tirupathi R. Chandraputla and Ashok, D. Belgundu" Introduction to Finite Elements in Engineering" Pearson Education, 2002, 3rd Edition.
2. Rao S.S., "The Finite Element Methods in Engineering", pergamon Press, 1989.
3. Segerlind, L.J. "Applied Finite Element Analysis", Wiley Publication, 1984.
4. Reddy J.N., "An Introduction to Finite Element Method", McGraw-Hill Company, 1984.

COMPILER CONSTRUCTION LAB

Instruction	2 Periods per week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessionals	25 Marks
Credits	1

Course Objectives:

- To learn usage of tools LEX, YAAC
- To develop a code generator
- To implement different code optimization schemes

Course Outcomes:

Student will be able to:

- To Generate scanner and parser from formal specification
- To design a compiler for a subset of any High level language

1. Construction of DFA from NFA
2. Scanner program using LEX
3. Construction of a Predictive parsing Table
4. SLR Parser table generation
5. Implement unification Algorithm
6. LR Parser table generation
7. Parser Generation using YACC
8. Write a program on code generation
9. Write a program on code optimization

DISTRIBUTED SYSTEMS LAB

Instruction	2 Periods per week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessionals	25 Marks
Credits	1

Course Objectives:

- To implement client and server programs using sockets
- To learn about working of NFS
- To use Map Reduce model for distributed processing
- To develop mobile applications

Course Outcomes:

Student will be able to :

- Write programs that communicate data between two hosts
- Configure NFS
- Use distributed data processing frameworks and mobile application tool kits

1. Implementation FTP Client
2. Implementation of Name Server
3. Implementation of Chat Server
4. Understanding of working of NFS (Includes exercises on Configuration of NFS)
5. Implementation of Bulletin Board.
6. Implement a word count application which counts the number of occurrences of each word a large collection of documents Using Map Reduce model.
7. Develop an application (small game-like scrabble, Tic-tac-Toe) using Android SDK.

EMBEDDED SYSTEMS LAB

Instruction	2 Periods per week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessionals	25 Marks
Credits	1

Course Objectives:

- To develop knowledge in programming techniques using embedded C language.
- To develop programming skill in understanding the interfacing techniques.
- To gain practical knowledge in scheduling and multitasking issues for Embedded System

1. Programs using Embedded C
2. Experiments to interface and to access all internal and external peripherals such as
    a. Stepper motor interface.
    b. LCD interface.
    c. LED interface.
    d. Keyboard interface.
    e. Serial and DAC system interface
3. Experiments on RTOS Applications using VxWorks
4. Practical implementation concepts of RTOS
    - Scheduling
    - Multiple Processes

PW 761 CS *With effect from the academic year 2018-2019*

PROJECT WORK –I

Instruction	2 Periods per week
Sessional	50 Marks
Credit	2

Course Objectives:

- To enhance practical and professional skills.
- To familiarize tools and techniques of systematic Literature survey and documentation
- To expose the students to industry practices and team work.
- To encourage students to work with innovative and entrepreneurial ideas

Course Outcomes:

Student will be able to :

- Demonstrate the ability to synthesize and apply the knowledge and skills acquired in the academic program to real-world problems
- Evaluate different solutions based on economic and technical feasibility
- Effectively plan a project and confidently perform all aspects of project management
- Demonstrate effective written and oral communication skills

The department can initiate the project allotment procedure at the end of VI semester and finalize it in the first two weeks of VII semester.

The department will appoint a project coordinator who will coordinate the following:

Collection of project topics/ descriptions from faculty members (Problems can also be invited from the industries)

Grouping of students (max 3 in a group)

Allotment of project guides

The aim of project work is to develop solutions to realistic problems applying the knowledge and skills obtained in different courses , new technologies and current industry practices. This requires students to understand current problems in their domain and methodologies to solve these problems. To get awareness on current problems and solution techniques, the first 4 weeks of VII semester will be spent on special lectures by faculty members, research scholars, post graduate students of the department and invited lectures by engineers from industries and R&D institutions. After completion of these seminars each group has to formalize the project proposal based on their own ideas or as suggested by the project guide.

Seminar schedule will be prepared by the coordinator for all the students from the 5th week to the last week of the semester which should be strictly adhered to.

Each group will be required to:

1. Submit a one page synopsis before the seminar for display on notice board.
2. Give a 30 minutes presentation followed by 10 minutes discussion.
3. Submit a technical write-up on the talk.

At least two teachers will be associated with the Project Seminar to evaluate students for the award of sessional marks which will be on the basis of performance in all the 3 items stated above.

The seminar presentation should include the following components of the project:

*Problem definition and specification

*Literature survey

*Broad knowledge of available techniques to solve a particular problem.

*Planning of the work, preparation of bar (activity) charts

*Presentation- oral and written.

PW 961 CS *With effect from the academic year 2018-2019*

SUMMER INTERNSHIP

University Examination	50 Marks
Credits	2

Course Objectives:

- To train and provide hands-on experience in analysis, design, and programming of information systems by means of case studies and projects.
- To expose the students to industry practices and team work.
- To provide training in soft skills and also train them in presenting seminars and technical report writing.

Course Outcomes:

Student will be able to :

- Get Practical experience of software design and development, and coding practices within Industrial/R&D Environments.
- Gain working practices within Industrial/R&D Environments.
- Prepare reports and other relevant documentation.

Summer Internship is introduced as part of the curricula of encouraging students to work on problems of interest to industries. A batch of three students will be attached to a person from the Computer Industry/Software Companies/R&D Organization for a period of 8 weeks. This will be during the summer vacation following the completion of the III year Course. One faculty coordinator will also be attached to the group of 3 students to monitor the progress and to interact with the industry co-ordinate (person from industry).

After the completion of the project, student will submit a brief technical report on the project executed and present the work through a seminar talk to be organized by the Department. Award of sessionals are to be based on the performance of the students, to be judged by a committee constituted by the department. One faculty member will co-ordinate the overall activity of Industry Attachment Program.

SCHEME OF INSTRUCTION

BE (COMPUTER SCIENCE & ENGINEERING)

SEMESTER – VIII

S.No	Course Code	Course Title	Scheme of Instruction			Contact Hrs/Wk	Scheme of Examination		Credits
			L	T	P		CIE	SEE	
Theory									
1.	PE-IV	Professional Elective-IV	3	1	0	4	30	70	3
1.	PE-V	Professional Elective-V	3	1	0	4	30	70	3
2.	OE-III	Open Elective-III	3	1	0	4	30	70	3
Practicals									
3.	PW861CS	Project Work –II	0	0	4	4	50	100	8
4.	MC901EG	Mandatory Course	0	0	3	3	50	-	3Units
Total			**09**	**03**	**07**	**19**	**190**	**310**	**17**

	Open Elective-III
OE 801 MT	**Statistical Applications in Engineering
OE801BM	**Human Machine Interaction
OE802BM	Instrumentation Engineering
OE801CE	Road Safety Engineering
OE802CE	Green Building Technologies
OE801CS	*Data Science Using R
OE801EC	Global and Regional Satellite Navigation Systems
OE801EE	Illumination and Electric Traction
OE801ME	Composite Materials
OE802 ME	Industrial and Financial Management
OE803ME	3D Printing Technology

	Professional Elective-IV
PE801CS	Data Mining
PE802CS	Information Retrieval Systems
PE803CS	Machine learning
PE804CS	Natural Language Processing
PE805CS	Data Science using R

	Professional Elective-V
PE 806 CS	Multi Core & Gpu Programing
PE 807 CS	Cloud Computing
PE 808 CS	Human Computer Interaction

	Mandatory Course
MC901EG	Gender Sensitization

*CS Electives offered for BME/CE/EC/EE/ME branches only

** Electives offered for CE/EC/EE branches only

PE 801 CS *With effect from the Academic year 2018-2019*

DATA MINING
(PROFESSIONAL ELECTIVE-IV)

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	70 Marks
Sessionals	30 Marks
Credits	3

Course Objectives:

- To introduce the basic concepts of data Mining and its applications
- To understand different data mining like classification, clustering and Frequent Pattern mining
- To introduce current trends in data mining

Course Outcomes:

Student will be able to:

- Organize and Prepare the data needed for data mining using prepreprocessing techniques
- Implement the appropriate data mining methods like classification, clustering or Frequent Pattern mining on a given data set
- Define and apply metrics to measure the performance of various data mining algorithms

UNIT-I

Introduction: Why Data Mining? What is Data Mining? What kinds of data can be mined? What kinds of patterns can be mined? Which technologies are used ? Which kinds of applications are Targeted? Major issues in Data Mining. Getting to know your data: Data objects and attributed types. Basic statistical descriptions of data. Data visualization, Measuring data similarity and dissimilarity.

UNIT-II

Mining frequent patterns, Associations and correlations: Basic concepts and methods, Frequent Item set Mining Methods, Which patterns are interesting? Pattern evaluation methods.

UNIT-III

Classification : Basic concepts, Decision tree induction, Bayes classification methods,

Classification: Advance methods, Bayesian Belief Network, Classification by back propagation, Support vector machine,

UNIT-IV

Cluster Analysis: Concepts and Methods: Cluster Analysis, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid-Based Methods, Evaluation of clustering.

UNIT-V

Data Mining Trends and Research Frontiers: Mining Complex Data Types, Other Methodologies of Data Mining, Data Mining Applications, Data Mining and Society, Data Mining trends.

Suggested Readings:

1. Jiawei Han, Micheline Kamber, Jin Pei, Data Mining: Concepts & Techniques, 3rd Edition., Morgon Koffman ,2011
2. Vikram Pudi P.Radha Krishna, *Data Mining*, Oxford University Press, 1st Edition, 2009.
3. Pang-Ning Tan, Michael Steinbach, Vipin kumar, *Introduction to Data Mining*, Pearson Education, 2008.

INFORMATION RETRIEVAL SYSTEMS

(PROFESSIONAL ELECTIVE-IV)

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	70 Marks
Sessionals	30 Marks
Credits	3

Course Objectives:

- To understand indexing and querying in information retrieval systems
- To learn the different models for information retrieval
- To expose the students to text classification and clustering
- To learn about web searching

Course Outcomes:

Students will be able to :

- Understand the algorithms and techniques for information retrieval (document indexing and retrieval, query processing)
- Quantitatively evaluate information retrieval systems
- Classify and cluster documents
- Understand the practical aspects of information retrieval such as those in web search engines.

UNIT-I

Boolean Retrieval: An example information, Building an inverted index, Processing Boolean queries, The extended Boolean model versus ranked retrieval.

The term vocabulary and postings lists: Document delineation and character sequence decoding, determining the vocabulary of terms, Faster postings list intersection via skip pointers, Positional postings, and Phrase queries.

Dictionaries and tolerant retrieval: Search structures for dictionaries, Wildcard queries, Spelling correction.

Index construction: Hardware basics, Blocked sort-based indexing, Single-pass in-memory indexing, Distributed indexing, Dynamic indexing, Other types of indexes.

UNIT-II

Index compression: Statistical properties of terms in information retrieval, Dictionary compression, Postings file compression.

Scoring, term weighting and the vector space model: Parametric and zone indexes, Term frequency and weighting, The vector space model for scoring, and Variant tf-idf functions.

Computing scores in a complete search system: Efficient scoring and ranking, Components of an information retrieval system, Vector space scoring and query operator interaction.

Evaluation in information retrieval: Information retrieval system evaluation, Standard test collections, Evaluation of unranked retrieval sets, Evaluation of ranked retrieval results, Assessing relevance.

UNIT-III

Relevance feedback and query expansion: Relevance feedback and pseudo relevance feedback, Global methods for query reformulation.

XML retrieval: Basic XML concepts, Challenges in XML retrieval, A vector space model for XML retrieval, Evaluation of XML retrieval, Text-centric vs. data-centric XML retrieval.

Probabilistic information retrieval: Basic probability theory, The Probability Ranking Principle, The Binary Independence Model.

Language models for information retrieval: Language models, The query likelihood model.

UNIT-IV

Text classification and Naive Bayes: The text classification problem, Naive Bayes text classification, The Bernoulli model, Properties of Naive Bayes, and Feature selection.

Vector space classification: Document representations and measures of relatedness in vector spaces, Rocchio classification, k- nearest neighbor, Linear versus nonlinear classifiers.

Flat clustering: Clustering in information retrieval, Problem statement, Evaluation of clustering, k-means.

Hierarchical clustering: Hierarchical agglomerative clustering, Single-link and complete-link clustering, Group-average agglomerative clustering, Centroid clustering, Divisive clustering.

UNIT-V

Matrix decompositions and Latent semantic indexing: Linear algebra review, Term-document matrices and singular value decompositions, Low-rank approximations, Latent semantic indexing.

Web search basics: Background and history, Web characteristics, Advertising as the economic model, The search user experience, Index size and estimation, Near-duplicates and shingling.

Web crawling and Indexes: Overview, Crawling, Distributing indexes, Connectivity servers. Link analysis: The Web as a graph, Page Rank, Hubs and Authorities.

Suggested Readings:

1. Christopher D. Manning, Prabhakar Raghavan, Hinrich Schütze, *An Introduction to Information Retrieval*, Cambridge University Press, Cambridge, England, 2008
2. David A. Grossman, Ophir Frieder, *Information Retrieval – Algorithms and Heuristics*, Springer, 2nd Edition (Distributed by Universities Press), 2004.
3. Gerald J Kowalski, Mark T Maybury. *Information Storage and Retrieval Systems*, Springer, 2000
4. Soumen Chakrabarti, *Mining the Web: Discovering Knowledge from Hypertext Data*, Morgan-Kaufmann Publishers, 2002.

PE 803 CS *With effect from the academic year 2018-2019*

MACHINE LEARNING
(PROFESSIONAL ELECTIVE-IV)

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	70 Marks
Sessionals	30 Marks
Credits	3

Course objectives:

- To introduce the basic concepts of machine learning and range of problems that can be handled by machine learning
- To introduce the concepts of instance based learning and decision tree induction
- To introduce the concepts of linear separability , Perceptron and SVM
- To learn the concepts of probabilistic inference, graphical models and evolutionary learning
- To learn the concepts of ensemble learning, dimensionality reduction and clustering

Course Outcomes:

Student will be able to :

- Explain the strengths and weaknesses of many popular machine learing approaches
- Recognize and implement various ways of selecting suitable model parameters for different machine learning techniques
- Design and implement various machine learning algorithms in a range of real-world applications

UNIT-I

Introduction: Learning, Types of Machine Learning.
Concept learning: Introduction, Version Spaces and the Candidate Elimination Algorithm. **Learning with Trees:** Constructing Decision Trees, CART, Classification Example

UNIT-II

Linear Discriminants: The Perceptron, Linear Separability, Linear Regression
Multilayer Perceptron (MLP): Going Forwards, Backwards, MLP in practices, Deriving back **Propagation SUPPORT Vector Machines**: Optimal Separation, Kernels

UNIT-III

Some Basic Statistics: Averages, Variance and Covariance, The Gaussian, The Bias-Variance Tradeoff Bayesian learning: Introduction, Bayes theorem. Bayes Optimal Classifier, Naive Bayes Classifier.

Graphical Models: Bayesian networks, Approximate Inference, Making Bayesian Networks, Hidden Markov Models, The Forward Algorithm.

UNIT-IV

Evolutionary Learning: Genetic Algorithms, Genetic Operators, Genetic Programming **Ensemble learning:** Boosting, Bagging

Dimensionality Reduction: Linear Discriminant Analysis, Principal Component Analysis

UNIT-V

Clustering: Introduction, Similarity and Distance Measures, Outliers, Hierarchical Methods, Partitional Algorithms, Clustering Large Databases, Clustering with Categorical Attributes, Comparison

Suggested Readings:

1. Tom M. Mitchell, *Machine Learning*, Mc Graw Hill, 1997
2. Stephen Marsland, *Machine Learning - An Algorithmic Perspective*, CRC Press, 2009
3. Margaret H Dunham, *Data Mining*, Pearson Edition., 2003.
4. Galit Shmueli, Nitin R Patel, Peter C Bruce, *Data Mining for Business Intelligence*, Wiley India Edition, 2007
5. Rajjan Shinghal, *Pattern Recognition*, Oxford University Press, 2006.

NATURAL LANGUAGE PROCESSING
(PROFESSIONAL ELECTIVE-IV)

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	70 Marks
Sessionals	30 Marks
Credits	3

Course Objectives:

- To learn about corpus-based work collections
- To understand the models and methods of Statistical NLP
- To introduce IR and ML based techniques for NLP tasks

Course Outcomes:

Student will be able to :

- Impalement probabilistic models and estimate parameters for such models
- Gain understanding of linguistic phenomenon and will explore linguistic features relevant to each NLP task
- Apply the methods to new NLP problems and also to problems outside NLP

UNIT-I

Introduction of Elementary Probability Theory, Essential Information Theory

UNIT-II

Linguistic Essentials Corpus-Based Work Collocations.

UNIT-III

Statistical Inference: Bins: Forming Equivalence Classes, Reliability vs. Discrimination, n-gram models, Building n-gram models, An Information Theoretic Approach.
Word Sense Disambiguation: Methodological Preliminaries, Supervised and unsupervised learning, Pseudo words, Upper and lower bounds on performance, Supervised Disambiguation, Bayesian classification.

UNIT-IV

Evaluation Measures, Markov Models: Hidden Markov Models, Use, General form of an HMM Part-of-Speech Tagging

UNIT-V

Probabilistic Context Free Grammars: Introduction of Clustering **Information Retrieval:** Background, The Vector Space Model.

Suggested Readings:

1. Christopher D. Manning, Hinrich Schutze, *Foundations of Statistical Natural Language Processing*, MIT Press, 1999.
2. James Allan, *Natural Language Understanding*, Pearson Education, 1994.
3. Tanveer Siddiqui, US Tiwary, *Natural Language Processing and Information Retrieval*, Oxford University Press, 2008.

PE 805 CS *With effect from the academic year 2018-2019*

DATA SCIENCE USING R
(PROFESSIONAL ELECTIVE-IV)

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	70 Marks
Sessionals	30 Marks
Credits	3

Course Objectives:

- To learn basics of R Programming environment : R language , R- studio and R packages
- To learn various statistical concepts like linear and logistic regression , cluster analysis , time series forecasting
- To learn Decision tree induction, association rule mining and text mining

Course Outcomes:

Student will be able to :

- Use various data structures and packages in R for data visualization and summarization
- Use linear , non-linear regression models, and classification techniques for data analysis
- Use clustering methods including K-means and CURE algorithm

UNIT-I

Introduction To R: Introduction, Downloading and Installing R, IDE and Text Editors, Handling Packages in R.

Getting Started With R: Introduction, Working with Directory, Data Types In R, Few Commands for Data Exploration.

Loading and Handling Data In R: Introduction, Challenges of Analytical Data Processing, Expression, Variables, Functions, Missing Values Treatment In R, Using 'As' Operator To Change The Structure Of The Data, Victors, Matrices, Factors, List, Few Common Analytical Tasks, Aggregation And Group Processing Of A Variable, Simple Analysis Using R, Methods For Reading Data, Comparison Of R GUI's For Data Input, Using R With Databases And Business Intelligence Systems.

UNIT- II

Exploring Data In R: Introduction, Data Frames, R Functions for Understanding Data in Data Frames, Load Data Frames, Exploring Data, Data Summary, Finding the Missing Values, Invalid Values And Outliers, Descriptive Statistics, Spotting Problems In Data with Visualization.

UNIT- III

Linear Regression Using R: Introduction, Model Fitting, Linear Regression, Assumptions of Linear Regression, Validating Linear Assumption.

Logistic Regression: Introduction, What Is Regression?, Introduction To Generalized Linear Model, Logistic Regression, Binary Logistic Regression, Diagnosing Logistic Regression, Multinomial Logistic Regression Model.

UNIT-IV

Decision Tree: Introduction, What Is A Decision Tree?, Decision Tree Representation In R, Appropriate Problems For Decision Tree Learning, Basic Decision Tree Learning Algorithm, Measuring Features, Hypothesis Space Search In Decision Tree Learning, Inductive Bias In Decision Tree Learning, Why Prefer Short Hypotheses, Issues In Decision Tree Learning.

Time Series In R: Introduction, What Is Time Series Data, Reading Time Series Data, Decomposing Time Series Data, Forecasts Using Exponential Smoothing, ARIMA Models.

UNIT-V

Clustering: Introduction, What Is Clustering, Basic Concepts in Clustering, Hierarchical Clustering, K-Means Algorithm, CURE Algorithm, Clustering in Non-Euclidean Space, Clustering for Streams and Parallelism.

Association Rules: Introduction, Frequent Itemset, Data Structure Overview, Mining Algorithm Interfaces, Auxiliary Functions, Sampling from Transaction, Generating Synthetic Transaction Data, Additional Measures of Interestingness, Distance Based Clustering Transaction and Association.

Text Mining: Introduction, Definition of Text Mining, A Few Challenges in Text Mining, Text Mining Verses Data Mining, Text Mining In R, General Architectures of Text Mining Systems, Pre-Processing of Documents In R, Core Text Mining Operations, Using Background Knowledge for Text Mining, Text Mining Query Languages.

Mining Frequent Patterns, Associations and Correlations: Basic Concepts and Methods.
Frequent Itemset, Closed Itemset And Association Rules.
Frequent Itemset: Mining Methods, Pattern Evaluation Methods, Sentiment Analysis

Suggested Readings:

1. Data Analytics using R by Seema Acharya. McGraw Hill education.
2. Practical Data Science with R, Nina Zumel and John Mount, Manning Shelter Island.
3. The R book, Crawley, Michael J. John Wiley & Sons, Ltd

MULTI-CORE & GPU PROGRAMMING

(PROFESSIONAL ELECTIVE-V)

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	70 Marks
Sessionals	30 Marks
Credits	3

Course Objectives

- To learn the paradigms of parallel computing, PRAM and BSP model.
- To study the heterogeneous processor architectures
- To understand the multicore programming using OpenCL
- To provide basics of OpenCL computing models

Course Outcomes

Student will be able to:

- Apply the knowledge of parallel computing models to solve real time applications.
- Gain the knowledge of heterogeneous processor architectures
- Apply the multi core programming knowledge to solve the sequential tasks.

UNIT-I

Introduction to Parallel Computing: Scope of Parallel Computing, Sieve of Eratosthenes, Control and Data Approach, PRAM model of parallel computation, Design paradigms of Parallel Computing, examples, Bulk Synchronous Parallel (BSP) model, algorithms on PRAM and BSP model.

UNIT-II

Introduction to Heterogeneous Multi-Core Processors, Many cores Programming, Cell Processor Multinode Computing.

Introduction to Graphics Processors, Graphics Processing Units, GPGPUs and GPU Hardware. Programming using CUDA/ OpenCL, Direct Compute CPU alternatives, Directives and libraries, Understanding Parallelism with GPUs.

UNIT-III

Heterogeneous Multi-Core Programming with OpenCL: OpenCL Programming Model, OpenCL Device Architectures, Memory hierarchy, DRAM / global, local / shared, private / local, textures, Constant Memory, Pointers, Parameter Passing, Arrays and dynamic Memory, Multi-dimensional Arrays, Memory Allocation, Memory copying across devices, Programs with matrices, Performance evaluation with different memories

UNIT-IV

Introduction to OpenCL: Understanding OpenCL's Concurrency and Execution Model, Dissecting a CPU/GPU, OpenCL Implementation. Programs for concurrent Data Structures such as Worklists, Linked-lists. Synchronization across CPU and GPU

Functions: Device functions, Host functions, Kernels functions, Using libraries (such as Thrust), and developing libraries.

UNIT-V

Case Studies: Image Processing, Graph algorithms, Simulations, Deep Learning, Dynamic parallelism, Unified Virtual Memory, Multi-GPU processing, Peer access, Heterogeneous processing

Suggested Readings:

1. David Kaeli, Perhaad Mistry, Dana Schaa and Dong Ping Zhang **,** *Heterogeneous Computing with OpenCL 2.0***,** 1st Edition, Mourgan Kaufmann, 2015.
2. Vipin Kumar, George Karypis, Anshul Gupta, Ananth Grama, "Introduction to Parallel Computing", Addison Wesly, 2003
3. Gregory V. Wilson, *Practical Parallel Programming*, PHI, 1998.

CLOUD COMPUTING
(PROFESSIONAL ELECTIVE-V)

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	70 Marks
Sessionals	30 Marks
Credits	3

Course Objectives:

- To introduce basic concepts cloud computing and enabling technologies
- To learn about Auto-Scaling, capacity planning and load balancing in cloud
- To introduce security, privacy and compliance issues in clouds
- To introduce cloud management standards and programming models

.

Course Outcomes:

Student will be able to :

- Understand the architecture and concept of different cloud models: IaaS, PaaS, SaaS
- Create virtual machine images and deploy them on cloud
- .Identify security and compliance issues in clouds.

UNIT- I

Introduction, Benefits and challenges, Cloud computing services, Resource Virtualization, Resource pooling sharing and provisioning

UNIT -II

Scaling in the Cloud, Capacity Planning , Load Balancing, File System and Storage,

UNIT-III

Multi-tenant Software, Data in Cloud , Database Technology, Content Delivery Network, Security Reference Model , Security Issues, Privacy and Compliance Issues

UNIT-IV

Portability and Interoperability Issues, Cloud Management and a Programming Model Case Study, Popular Cloud Services

UNIT- V

Enterprise architecture and SOA, Enterprise Software , Enterprise Custom Applications, Workflow and Business Processes, Enterprise Analytics and Search, Enterprise Cloud Computing Ecosystem.

Suggested Readings:

1. Cloud Computing - Sandeep Bhowmik, Cambridge University Press, 2017.

2. Enterprise Cloud Computing - Technology, Architecture, Applications by Gautam Shroff, Cambridge University Press, 2016.

3. Kai Hwang, Geoffrey C.Fox, Jack J.Dongarra, "*Distributed and Cloud Computing From Parallel Processing to the Internet of Things*", Elsevier, 2012.

HUMAN COMPUTER INTERACTION
(PROFESSIONAL ELECTIVE-V)

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	70 Marks
Sessionals	30 Marks
Credits	3

Course Objectives:

- To introduce interaction frameworks and styles
- To learn about interaction design process , design standards and principles
- To introduce the concept of usability and usability testing
- To familiarize interface components and technical issues of concern

Course Outcomes:

Student will be able to :

- Describe different types of interactive environments and interaction styles
- Understand the user interface design process and the need for user-centered design
- Describe techniques for developing prototypes of user interfaces and evaluation of user interfaces
- Create an appropriate usability test plan
- Understand the human and technical issues involved in the usage of text, icons and colors in user interfaces

UNIT- I

Interaction Paradigms: Computing Environments, Analyzing Interaction Paradigms, Interaction Paradigms
Interaction Frameworks and Styles: Frameworks for Understanding Interaction, Coping with Complexity, Interaction Styles.

UNIT- II

Interaction Design Process: Iterative Design, User-Centered Design, Interaction Design Models, Overview of Interaction Design Models
Discovery: Discovery Phase Framework, Collection, Interpretation , Documentation
Design: Conceptual Design, Physical Design, Evaluation, Interface Design Standards, Designing the Facets of the Interface.

UNIT- III

Design Principles: Principles of Interaction Design, Comprehensibility, Learnability, Effectiveness/Usefulness, Efficiency/Usability, Grouping, Stimulus Intensity , Proportion , Screen Complexity, Resolution/Closure, Usability Goals

Interaction Design Models: Model Human Processor, Keyboard Level Model, GOMS, Modeling Structure, Modeling Dynamics, Physical Models

Usability Testing: Usability, Usability Test, Design the Test, Prepare for the Test, Perform the Test, Process the Data

UNIT- IV

Interface Components: The WIMP Interface, Other Components

Icons: Human Issues Concerning Icons, Using Icons in Interaction Design, Technical Issues Concerning Icons

Color: The Human Perceptual System, Using Color in Interaction Design, Color Concerns for Interaction Design, Technical Issues Concerning Color

UNIT- V

Text: Human Issues Concerning Text, Using Text in Interaction Design, Technical Issues Concerning Text

Speech and Hearing: The Human Perceptual System, Using Sound in Interaction Design, Technical Issues Concerning Sound

Touch and Movement: The Human Perceptual System, Using Haptics in Interaction Design, Technical Issues Concerning Haptics.

Suggested Readings:

1. Steven Heim, *The Resonant Interface: HCI Foundations for Interaction Design*, Addison-Wesley, 2007
2. J. Preece, Y. Rogers, and H. Sharp, *Interaction Design: Beyond Human-Computer Interaction*, Wiley & Sons, 2nd Edition, 2007
3. Ben Shneiderman , Catherine Plaisant, *Designing the User Interface: Strategies for Effective Human-Computer Interaction*, Addison-Wesley, 5th Edition, 2009.

STATISTICAL APPLICATIONS IN ENGINEERING
(Open Elective-III For EEE, MECH, CIVIL)

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	70 Marks
Sessionals	30 Marks
Credits	3

Course Objectives :

- To Introduce the basics of Probability
- To provide the knowledge of various distributions like Normal Weibull, Log normal etc
- To provide the knowledge of tests of significance like F-test, t-test and Chi-square test

Course Outcomes:

Students will be able to :

- Explain what is meant by a statistic and its sampling distribution
- Apply various probability distributions to solve practical problems
- Estimate unknown parameters of populations and apply the tests of hypothesis
- Judge the independence of attributes of given data.

UNIT I : Basic Probability: Introduction- Random experiments and events, Mutually exclusive events, Probability of an event, Addition law of Probability, Conditional Probability, Independent events and Independent experiments, Baye's theorem .
Random Variables-One dimensional Random Variable, Discrete Random Variable, Continuous Random Variable.

UNIT II : Basic Statistics : Measures of Central tendency (Mean, Median, Mode), Moments, Skewness, Kurtosis.
Probability distributions, Binomial, Poisson-Evaluation of statistical parameters for these two distributions.

UNIT III : Continuous Distributions: Exponential, Gamma, Normal distribution, Wei-bull distribution, χ^2- distribution, t-distribution, F-distribution,Lognormal distribution , Evaluation of statistical parameters for these distributions.

UNIT IV : Applied Statistics: Sampling, Standard Error, Test of significance for large samples, Null hypothesis, Alternate hypothesis, Critical region, Critical values, Level of significance, Confidence interval, Test of significance, Large sample test for single proportion, Difference of proportions, Single mean, Difference of means, Difference of standard deviations.

UNIT V : Test of Significance for Small samples : Tests of Significane for small samples Test for single mean, Difference of means, Test for ratio of variances (F- test, t-test), Chi-square test for goodness of fit and independence of attributes.

Suggested Readings:

1. R.K.Jain & S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publications, 5th Edition, 2016.
2. S. Ross," A First Course in Probability" , Pearson Education India, 2002.
3. S.C. Gupta and V.K.Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand& Sons, 2014.
4. Peter V. O' Neil., Advanced Engineering Mathematics 7th Edition, Cengage Learning.
5. Kanti B. Dutta., Mathematical Methods of Science and Engineering Cengage Learning.
6. N.P . Bali and M. Goyal, " A text book of Engineering Mathematics", Laxmi Publications, 2010.
7. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons ,9th Edition, 2012.
8. P.N. Arora,Sumeet Arora, S. Arora, Comprehensive Statistical Methods, S.Chand & Company Ltd, 2008.

HUMAN-MACHINE INTERFACE
(OPEN ELECTIVE-III)

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	70 Marks
Sessionals	30 Marks
Credits	3

Course Objectives:

- To stress the importance of a good interface design.
- To understand the importance of human psychology in designing good interfaces.
- To motivate students to apply HMI in their day – to – day activities.
- To bring out the creativity in each student – build innovative applications that are user friendly.
- To encourage students to indulge into research in Machine Interface Design.

Course Outcomes:

Student will be able to:

- Design user centric interfaces.
- Design innovative and user friendly interfaces.
- Apply HMI in their day-to-day activities.
- Criticise existing interface designs, and improve them.
- Design application for social and technical task.

UNIT-I:

Introduction - Introduction to Human Machine Interface, Hardware, software and operating environment to use HMI in various fields.

The psychopathology of everyday things – complexity of modern devices; human-centered design; fundamental principles of interaction; Psychology of everyday actions- how people do things; the seven stages of action and three levels of processing; human error

UNIT-II:

Understanding goal directed design - Goal directed design; Implementation models and mental models; Beginners, experts and intermediates – designing for different experience levels; Understanding users; Modeling users – personas and goals.

UNIT-III:

GUI - benefits of a good UI; popularity of graphics; concept of direct manipulation; advantages and disadvantages; characteristics of GUI; characteristics of Web UI; General design principles.

UNIT-IV:

Design guidelines - perception, Gesalt principles, visual structure, reading is unnatural, color, vision, memory, six behavioral patterns, recognition and recall, learning, factors affecting learning, time.

UNIT-V:
Interaction styles - menus; windows; device based controls, screen based controls.
Communication - text messages; feedback and guidance; graphics, icons and images; colours.

Suggested Readings:

1. Alan Dix, J. E. Finlay, G. D. Abowd, R. Beale "Human Computer Interaction", Prentice Hall.
2. Wilbert O. Galitz, "The Essential Guide to User Interface Design", Wiley publication.
3. Alan Cooper, Robert Reimann, David Cronin, "About Face3: Essentials of Interaction design", Wiley publication.
4. Jeff Johnson, "Designing with the mind in mind", Morgan Kaufmann Publication.
5. Donald A. Normann, "Design of everyday things", Basic Books; Reprint edition 2002.

INSTRUMENTATION ENGINEERING
(OPEN ELECTIVE-III)

Instruction	3 Periods per week
Duration of University Examination	3 Hours
Semester Examination	70 Marks
Sessionals	30 Marks
Credits	3

Course Objectives:

- To understand the need of instrument
- Understand the principle of operation of different sensors
- To design signal conditioning circuits for different industrial sensors
- To design the instruments.

UNIT I

Instrument, block diagram of an instrument, Principles of transduction and measurement, Sensor Classification, Functional specifications of sensors; static and dynamic characteristics of measurement systems. Primary sensors, bimetals, Bellows, Bourdon tube, capsule, diaphragm, applications.

UNIT – II

Resistive sensors. Potentiometers, Strain gages, RTDs, Thermistors, LDR. Signal conditioning. Wheatstone bridge, balance and deflection measurements. Instrumentation amplifier. Interference types and reduction. Shield grounding. Isolation amplifiers, Applications.

UNIT-III

Reaction variation and electromagnetic sensors. Capacitive sensors, inductive sensors, LVDT, electromagnetic sensors. Signal conditioning, AC bridges, AC amplifiers, electrostatic shields, carrier amplifiers, phase-sensitive detectors, Applications.

UNIT-IV

Self-generating sensors: Thermoelectric sensors, thermocouples, piezoelectric sensors, photovoltaic sensors. Signal conditioning. chopper and low-drift amplifiers, Noise in op-amps. Digital sensors. Telemetry and data acquisition, Applications.

UNIT-V

Other sensors: Accelerometer transducers, Gyroscopes, Ph sensors, measurement of Conductivity, viscosity, conductivity, flow meters, Humidity, signal conditioning and Applications.

Suggested Readings:

1. Ramon Pallas-Areny and John G.Webster, *Sensors and signal conditioning*, John Wiley and Sons, 1991.
2. Principles of measurements by J P Bentely
3. Electronic measurements and instrumentation by A K Sawhany

ROAD SAFETY ENGINEERING

Instruction	3 Periods per week
Duration of University Examination	3 Hours
Semester Examination	70 Marks
Sessionals	30 Marks
Credits	3

Course Objectives

- Introduction to various factors considered for road safety and management
- Explain the road safety appurtenances and design elements
- Discuss the various traffic management techniques

Course Outcomes

Student will be able to :

- Prepare accident investigation reports and database
- Apply design principles for roadway geometrics improvement with various types of traffic safety appurtenances/tools
- Manage traffic including incident management

UNIT - I

Road accidents: Causes, scientific investigations and data collection, Analysis of individual accidents to arrive at real causes, statistical methods of analysis of accident data, Basic concepts of Road accident statistics,Safety performance function: The empirical Bayes method Identification of Hazards road location. Application of computer analysis of accident data.

UNIT-II

Safety in Road Design: Operating the road network for safety, highway operation and counter measures, road safety audit, principles-procedures and practice, code of good practice and checklists, vehicle design factors & Driver characteristics influencing road safety.

UNIT - III

Road Signs and Traffic Signals: Classification, Location of Signs, measures of sign effectiveness, Types of visual perception, sign regulations, sign visibility, sign variables, Text versus symbols. Road Marking: Role of Road markings, Classification, visibility. Traffic Signals: Need, Signal face. Illumination and location of Signals, Factors affecting signal design, pedestrians' safety, fixed and vehicle actuated signals. Design of signa1s, Area Traffic control. Delineators, Traffic Impact Attenuators, Road side rest areas, Safety Barriers, Traffic Aid Posts.

UNIT-IV

Traffic Management Techniques: Integrated safety improvement and Traffic Calming Schemes, Speed and load limit, Traffic lights, Safety cameras, Tests on driver and vehicles, pedestrian safety issues, Parking, Parking enforcement and its influence on Accidents. Travel Demand Management; Methods of Traffic management measures: Restriction of Turning Movements, Oneway streets, Tidal Flow Operation Methods, Exclusive Bus Lanes and Closing Side-streets; Latest tools and techniques used for Road safety and traffic management. Road safety issues and various measures for road safety; Legislation, Enforcement, Education and Propaganda, Air quality, Noise and Energy Impacts; Cost of Road Accidents.

UNIT-V

Incident Management: Introduction, Characteristics of Traffic Incidents, Types of Incidents, Impacts, Incident management process, Incident traffic management; Applications of ITS: Motorist information, Equipment used; Planning effective Incident management program, Best practice in Incident management programs. National importance of survival of Transportation systems during and after all natural disasters especially cyclones, earthquakes, floods etc and manmade disasters like sabotage, terrorism etc.

Suggested Readings:

1. Guidelines on Design and Installation of Road Traffic Signals,IRC:93.
2. Specification for Road Traffic Signals, IS: 7537-1974.
3. Principles and Practice of Highway Engineering by L.R. Kadiyali andN.B.Lal.
4. Hand book of T.E. Myer Kutz, Editor McGraw Hill, 2004.

GREEN BUILDING TECHONOLOGIES

Instruction	3 Periods per week
Duration of University Examination	3 Hours
Semester Examination	70 Marks
Sessionals	30 Marks
Credits	3

Course Objectives:

- Exposure to the green building technologies and their significance.
- Understand the judicial use of energy and its management.
- Educate about the Sun-earth relationship and its effect on climate.
- Enhance awareness of end-use energy requirements in the society.
- Develop suitable technologies for energy management.

Course Outcomes:

Student will be able to :

- Understand the fundamentals of energy use and energy processes in building.
- Identify the energy requirement and its management.
- Know the Sun-earth relationship vis-a-vis its effect on climate.
- Acquaint with the end-use energy requirements.
- Familiarize with the audit procedures of energy.

UNIT I

Overview of the significance of energy use and energy processes in building: Indoor activities and environmental control - Internal and external factors on energy use and the attributes of the factors - Characteristics of energy use and its management - Macro aspect of energy use in dwellings and its implications.

UNIT II

Indoor environmental requirement and management: Thermal comfort - Ventilation and air quality – Air-conditioning requirement - Visual perception - Illumination requirement - Auditory requirement.

UNIT III

Climate, solar radiation and their influences: Sun-earth relationship and the energy balance on the earth's surface - Climate, wind, solar radiation, and temperature - Sun shading and solar radiation on surfaces - Energy impact on the shape and orientation of buildings.

UNIT IV

End-use, energy utilization and requirements: Lighting and day lighting - End-use energy requirements - Status of energy use in buildings Estimation of energy use in a building - Heat gain and thermal performance of building envelope - Steady and non steady heat transfer through

the glazed window and the wall - Standards for thermal performance of building envelope - Evaluation of the overall thermal transfer

UNIT V

Energy management options: Energy audit and energy targeting - Technological options for energy management.

Suggested Readings:

1. Michael Bauer, Peter Mösle and Michael Schwarz, "Green Building – Guidebook for Sustainable Architecture", Springer, Heidelberg, Germany, 2010.
2. Norbert Lechner, *"Heating, Cooling, Lighting - Sustainable Design Methods for Architects",* Wiley, New York, 2015.
3. Mike Montoya, *"Green Building Fundamentals*", Pearson, USA, 2010.
4. Charles J. Kibert, *"Sustainable Construction - Green Building Design and Delivery*", John Wiley & Sons, New York, 2008.
5. Regina Leffers, *"Sustainable Construction and Design*", Pearson / Prentice Hall, USA, 2009.
6. James Kachadorian, *"The Passive Solar House: Using Solar Design to Heat and Cool Your Home",* Chelsea Green Publishing Co., USA, 1997.

DATA SCIENCE USING R

Instruction	4 Periods per week
Duration of University Examination	3 Hours
Semester Examination	70 Marks
Sessionals	30 Marks
Credits	3

Course Objectives:

- To learn basics of R Programming environment : R language , R- studio and R packages
- To learn various statistical concepts like linear and logistic regression , cluster analysis , time series forecasting
- To learn Decision tree induction, association rule mining and text mining

Course Outcomes:

Student will be able to :

- Use various data structures and packages in R for data visualization and summarization
- Use linear , non-linear regression models, and classification techniques for data analysis
- Use clustering methods including K-means and CURE algorithm

UNIT-I

Introduction To R: Introduction, Downloading and Installing R, IDE and Text Editors, Handling Packages in R.

Getting Started With R: Introduction, Working with Directory, Data Types In R, Few Commands for Data Exploration.

Loading and Handling Data In R: Introduction, Challenges of Analytical Data Processing, Expression, Variables, Functions, Missing Values Treatment In R, Using 'As' Operator To Change The Structure Of The Data, Victors, Matrices, Factors, List, Few Common Analytical Tasks, Aggregation And Group Processing Of A Variable, Simple Analysis Using R, Methods For Reading Data, Comparison Of R GUI's For Data Input, Using R With Databases And Business Intelligence Systems.

UNIT-II

Exploring Data In R: Introduction, Data Frames, R Functions for Understanding Data in Data Frames, Load Data Frames, Exploring Data, Data Summary, Finding the Missing Values, Invalid Values And Outliers, Descriptive Statistics, Spotting Problems In Data with Visualization.

UNIT- III

Linear Regression Using R: Introduction, Model Fitting, Linear Regression, Assumptions of Linear Regression, Validating Linear Assumption.

Logistic Regression: Introduction, What Is Regression?, Introduction To Generalized Linear Model, Logistic Regression, Binary Logistic Regression, Diagnosing Logistic Regression, Multinomial Logistic Regression Model.

UNIT IV

Decision Tree: Introduction, What Is A Decision Tree?, Decision Tree Representation In R, Appropriate Problems For Decision Tree Learning, Basic Decision Tree Learning Algorithm, Measuring Features, Hypothesis Space Search In Decision Tree Learning, Inductive Bias In Decision Tree Learning, Why Prefer Short Hypotheses, Issues In Decision Tree Learning.

Time Series In R: Introduction, What Is Time Series Data, Reading Time Series Data, Decomposing Time Series Data, Forecasts Using Exponential Smoothing, ARIMA Models.

UNIT-V

Clustering: Introduction, What Is Clustering, Basic Concepts in Clustering, Hierarchical Clustering, K-Means Algorithm, CURE Algorithm, Clustering in Non-Euclidean Space, Clustering for Streams and Parallelism.

Association Rules: Introduction, Frequent Itemset, Data Structure Overview, Mining Algorithm Interfaces, Auxiliary Functions, Sampling from Transaction, Generating Synthetic Transaction Data, Additional Measures of Interestingness, Distance Based Clustering Transaction and Association.

Text Mining: Introduction, Definition of Text Mining, A Few Challenges in Text Mining, Text Mining Verses Data Mining, Text Mining In R, General Architectures of Text Mining Systems, Pre-Processing of Documents In R, Core Text Mining Operations, Using Background Knowledge for Text Mining, Text Mining Query Languages.

Mining Frequent Patterns, Associations and Correlations: Basic Concepts and Methods.
Frequent Itemset, Closed Itemset And Association Rules.
Frequent Itemset: Mining Methods, Pattern Evaluation Methods, Sentiment Analysis

Suggested Readings:

1. Data Analytics using R by Seema Acharya. McGraw Hill education.
2. Practical Data Science with R, Nina Zumel and John Mount, Manning Shelter Island.
3. The R book, Crawley, Michael J. John Wiley & Sons, Ltd

OE 801 EC *With effect from the academic year 2018-2019*

Global and Regional Satellite Navigation Systems

Instruction	3 Periods per week
Duration of University Examination	3 Hours
Semester Examination	70 Marks
Sessionals	30 Marks
Credits	3

Course Objectives:

- To explain the basic principle of GPS and its operation.
- To make the students to understand signal structure.
- To make the students understand the GPS errors.
- Highlight the importance of integrating GPS with other systems.
- To make the students understand about various GRNSS.

Course Outcomes:

Student will be able to:

- Understand the principle and operation of GPS.
- Understand the GPS Signal structure and services.
- Understand about various errors.
- Use of GPS in various fields such as navigation, GIS etc.
- Understand principle of Operation of various GRNSS.

UNIT I

Introduction to Satellites, their properties, Orbits and Launch vehicles, Kepler's Laws, GPS fundamentals: Principle of Trilaiteration, Transit, GPS Operating Principle, Architecture: Space, Control and User Segments and its Frequencies.

UNIT II

GPS Signal structure: C/A and P-Codes, SPS and PPS services, GPS Coordinate Systems: Significance, Types of GPS receivers, Selective Availability, Spoofing and Anti-spoofing.

UNIT III

GPS Errors: Ionospheric error, Tropospheric error, Ephemeris error, Clock errors, Satellite and receiver instrumental biases, Multipath; Dilution of Precision (DOP).

UNIT IV

GPS Modernization: Future GPS satellites, New signals and their benefits, New Control Segment, Principle of operation of DGPS, architecture and limitations, GPS Applications: Surveying Mapping Marine, air and land Navigation, Military and Space Application.GPS Integration with Geographic Information System (GIS), Inertial Navigation System (INS), Pseudolite and Cellular.

UNIT V

Other GRNSS: GLONASS, GALILEO, QZNSS, CNSS and IRNSS System: Principle of Operation, Features and their Current Status.

Suggested Readings:

1. Ahmed El-Rabbany, "*Introduction to GPS",* Artech House Publishers, 2/e, Boston 2006.
2. Elliot D Kaplan and Christopher J Hegarty," *Understanding GPS principles and applications*", Artech House Publishers, 2/e Boston & London 2005.
3. B.Hofmann-Wellenhof, H.Lichtenegger, and J.Collins, "*GPS Theory and Practice,"* Springer Verlog, 5/e, 2008.

OE801EE *With effect from the academic year 2018-2019*

ILLUMINATION AND ELECTRIC TRACTION
(OPEN ELECTIVE-III)

Instruction	4 Periods per week
Duration of University Examination	3 Hours
Semester Examination	70 Marks
Sessionals	30 Marks
Credits	3

Course Objectives:

- To introduce the students and understand Utilization of electrical energy for various applications like industrial heating, welding etc.,
- To understand the concept of illumination, and know the applications of various lamps to factory lighting, street lighting etc.
- To understand the concept of electrification of traction system.

UNIT I

Industrial Heating: Advantages and methods of electric heating. Description, operation and performance of resistance ovens — Design of elements. Core type, Coreless type furnaces, High frequency eddy current heating, Dielectric heating. Arc furnace. Electric welding, Resistance welding, welding transformer and its rating, various types of Electric arc welding and electric resistance welding.

UNIT II

Schematic Utilization and Connection Diagrams for Motor Control:

Two supply sources for 3 phase Induction motors. Direct reversing, remote control operation, and jogging operating of Induction motor. Contactor control circuit. Push button control stations. Over load relays, limit switches, float switches. Interlocking methods for reversing control.

UNIT III

Illumination: Introduction, nature and production of light, Sensitivity of the eye, Units of light. The inverse square law and cosine law, Solid angle, Lighting calculations — Determination of M.S.C.P, Rousseau's construction, Discharge lamps, Sodium vapour lamps, Mercury vapour lamps — Fluorescent lamp, Starting and power factor corrections, Stroboscopic effects — Neon signs, Application to factory lighting, Street lighting and Flood lighting.

UNIT IV

Electric Traction: System of Electric Traction — Transmission of drive — Systems of track electrification — Traction mechanics — Speed time curves — Tractive effort — Power of Traction motor — Specific energy consumption — Mechanics of train movement— Coefficient of adhesion.

Traction Motors: Desirable characteristics, d.c series motors, a.c series motors 3-phase induction motors, d.c motor series & parallel control, Energy saving.

UNIT V

Train Lighting: Systems of train lighting — Special requirements of train lighting — Methods of obtaining unidirectional polarity — Methods of obtaining constant output — Single battery system — Double battery parallel block system — Principal equipment of double battery system — Coach wiring — Dynamo.

Batteries: Lead acid batteries, SMF batteries, Construction and maintenance, Charging and rating of batteries.

Suggested Readings:

1. Partab H, Art and Science of Utilization of Electric Power, Dhanpat Rai & Sons, 1997.
2. K.B. Raina & S.K. Bhattacharya, Electrical Design, Estimating and Costing, Wiley Eastern Ltd., 1991.
3. Partab H, Modern Electric Traction, Dhanpat Rai & Sons, 2000.
4. B.L.Theraja, A Text Book of Electrical Technology, S.Chand & Company Ltd, Vol —I.

OE801ME *With effect from the academic year 2018-2019*

COMPOSITE MATERIALS

(Open Elective-III)

Instruction	3 Periods per week
Duration of University Examination	3 Hours
Semester Examination	70 Marks
Sessionals	30 Marks
Credits	3

Course Objectives:

- To know the properties of fiber and matrix materials used in composites, as well as some common manufacturing techniques.
- To know the various moulding process and architecture of composite laminates
- To know how to estimate the laminate properties from lamina properties.
- To understand the strength of an orthotropic lamina and measurement of basic composite properties.

Course Outcomes:

Student will be able to :

- Understand the distinction of composites , its advantages, classification and applications
- Predict the properties of composite lamina and laminate
- Understand the testing of composites and design the structure using the appropriate design criteria.

UNIT I: Introduction to composite materials: general characteristics, Fibres, Matrix materials, interfaces, polymer matrix composites, metal matrix composites, ceramic matrix composites, carbon fibre composites

UNIT II: Molding Processes: hand layup, vacuum molding, compression molding, pultrusion molding, centrifugal molding, filament winding, prepegs and molding compounds and architecture of composite materials: laminates, sandwich composites and other achitectures.

UNIT III: Micromechanics of Composites: Mechanical properties: Production of Elastic constant, micromechanical approach, Halpin-Tsal equations, Transverse stresses. Thermal properties: Hygrothermal stresses, mechanics of load transfer from matrix to fibre.

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UNIT IV: Macromechanics of Composites: Elastic constants of a lamina, relations between engineering constants and reduced stiffness and compliances, variation of lamina properties with orientation, analysis of laminated composites, stresses and strains with orientation.

UNIT V: Strength of an orthotropic lamina: Maximum stress theory, maximum strain criteria, maximum work (Tsai-Hill) criterion, quadratic interaction criteria. Designing with composite materials. Measurement of constituent material properties: Fibre tests, Matrix tests. Measurement of basic composite properties: Tensile test, compressive test, a plane shear test, interlaminar shear test, flexure test.

Suggested Readings:

1. Jones, R.M., "Mechanics of Composite Materials", McGraw Hill Co., 1967.

2. Ronald F. Gibson, "Principles of Composite Materials Mechanics", McGraw-Hill, Inc., 1994.

3. Krishan, K. Chewla, "Composite Material", Springer - verlag, 1987.

4. Carl. T. Herakovich, "Mechanics of Fibrous Composites", John Wiley Sons Inc., 1998.

OE802ME *With effect from the academic year 2018-2019*

INDUSTRIAL AND FINANCIAL MANAGEMENT

(Open Elective-III)

Instruction	3 Periods per week
Duration of University Examination	3 Hours
Semester Examination	70 Marks
Sessionals	30 Marks
Credits	3

Course Objectives:

- To understand various types of organizational structures, manufacturing processes and importance of plant layout and the role of scheduling function in optimizing the utilization of resources
- To understand the importance of quality, inventory control and concepts like MRP I and MRP II
- To understand the nature of financial management and concepts like breakeven analysis, depreciation and replacement analysis

Course Outcomes:

Student will be able to :

- Understand the different phases of product life cycle, types of manufacturing systems, plant layout optimization problems and role of scheduling function in better utilization of resources
- Understand the Fundamental concepts of quality control, process control, material control and apprceiate the importance of MRP-I and MRP –II.
- Know the different terminology used in financial management and understand the different techniques of capital budgeting and various types of costs involved in running an industrial organisation.

UNIT-I

Types of organizations, organizational structures. Designing Products, Services and Processes: New product design and development. Product life cycle: phasing multiple products. Manufacturing process Technology: Product, job shop, batch, assembly line and continuous process technology; flexible manufacturing systems. Design of Services, service process technology operations capacity; capacity planning decisions, measuring capacity; estimating future capacity needs.

UNIT-II

Locating production and services facilities, effects of location and costs and revenues, factor rating, simple median model (linear programming) Layout planning; process layout; product layout — Assembly lines; line balancing manufacturing cellular layout. Scheduling systems and aggregate planning for production and services; loading assignment algorithm; priority sequencing and other criteria.

UNIT-III

Quality planning and Control: basic concepts, definitions and history of quality control. Quality function and concept of quality cycle. Quality policy and objectives. Economics of quality and measurement of the cost of quality. Quality considerations in design.

Process control: machine and process capability analysis. Use of control charts and process engineering techniques for implementing the quality plan. Acceptance sampling: single, double and multiple sampling, operating characteristic Curve - calculation of producers risk and consumers risk.

UNIT-IV

Inventory control: deterministic and stochastic inventory models; variable demand; lead time, specific service level, perishable products and service.

Inventory control in application; concepts for the practioners; saving money in inventory systems; ABC classifications. Inventory control procedures; Quantity - reorders versus periodic inventory systems; material requirement planning (MRP); MRP as a scheduling and ordering system; MRP system components; MRP computational procedure; Detailed capacity planning; MRP - limitation and advantages; Manufacturing Resources Planning (MRP-II).

UNIT-V

Elements of cost, overheads, breakeven analysis, depreciation, replacement analysis. Nature of financial management-time value of money, techniques of capital budgeting and method, cost of capital, financial leverage.

Suggested Readings:

1. Buifa and Sarin, "Production and operations management" - Wiley Publications.

2. I.M. Pandey, "Elements of Financial Management" Vikas Publications, New Delhi, 1994.

3. James C. Van Home & John, M. Wachowicz, Jr., "Fundamentals of Financial Management", Pearson Education Asia, 11th ed. 2001.

OE803ME *With effect from the academic year 2018-2019*

3D PRINTING TECHNOLOGY

(Open Elective-III)

Instruction	3 Periods per week
Duration of University Examination	3 Hours
Semester Examination	70 Marks
Sessionals	30 Marks
Credits	3

Course Objectives:

- To understand the fundamental concepts of 3D Printing, its advantages and limitations.
- To classify various types of 3D Printing Processes and know their working principle, advantages, limitations etc.
- To have a holistic view of various applications of these technologies in relevant fields such as Mechanical, Bio-medical, Aerospace, electronics etc.

Course Outcomes:

Student will be able to :

- Understand the significance of 3D Printing and compare it with conventional manufacturing process.
- Classify various types of 3D PRINTING processes, rapid tooling and understand the working principle and applications of them with case studies.
- Know the various types of errors that creep up while saving the .STL file format and also will be able to appreciate the features of various types of software's used in 3D Printing.
- Appreciate the diversified applications of 3D PRINTING in various fields like biomedical, aerospace, automobile, defence, architecture etc.

UNIT-I

Introduction: Prototyping fund3D Printingentals, Historical development, Fund3D Printingentals of 3D PRINTING, Advantages and Limitations of 3D PRINTING , Commonly used Terms, Classification of 3D PRINTING process, 3D PRINTING Process Chain: Fund3D Printingental Automated Processes, Process Chain.

UNIT-II

Liquid-based 3D Printing Systems: Stereo lithography Apparatus (SLA): Models and specifications, Process, working principle, photopolymers, photo polymerization, Layering technology, laser and laser scanning, Applications, Advantages and Disadvantages, Case studies. Solid ground curing (SGC): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies

Solid-based 3D Printing Systems: L3D Printinginated Object Manufacturing (LOM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Fused Deposition Modeling (FDM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies.

UNIT-III

Powder Based 3D Printing Systems: Selective laser sintering (SLS): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Three dimensional Printing (3DP): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Laser Engineered Net Shaping (LENS), Electron Be3D Printing Melting.

UNIT-IV

3D Printing Data Formats: STL Format, STL File Problems, Consequence of Building Valid and Invalid Tessellated Models, STL file Repairs: Generic Solution, Other Translators, Newly Proposed Formats. Rapid Prototyping Software's: Features of various RP software's like Magics, Mimics, Solid View, View Expert, 3 D View, Velocity 2, Rhino, STL View 3 Data Expert and 3 D doctor.

UNIT-V

Applications of 3D Printing : Application in Design, Application in Engineering, Analysis and Planning, Aerospace Industry, Automotive Industry, Jewellery Industry, Coin Industry, GIS application, Arts and Architecture. RP Medical and Bioengineering Applications: Planning and simulation of complex surgery, Customized Implants & Prosthesis, Design and Production of Medical Devices, Forensic Science and Anthropology, Visualization of Biomolecules. Printed electronics, Biopolymers, Packaging

Suggested Readings:

1. Chua C.K., Leong K.F. and LIM C.S, Rapid prototyping; Principles and Applications, World Scientific Publications , Third Edition, 2010.
2. D.T. Ph3D Printing and S.S. Dimov, Rapid Manufacturing, Springer, 2001.
3. TerryWohlers, Wholers Report 2000, Wohlers Associates, 2000.
4. PaulF.Jacobs, Rapid Prototyping & Manufacturing ASME Press, 1996

PROJECT WORK – II

Instruction	3 Periods per week
Duration of University Examination	Viva Voce
University Examination	100 Marks
Sessionals	50 Marks
Credits	8

Course Objectives :

- To enhance practical and professional skills.
- To familiarize tools and techniques of systematic Literature survey and documentation
- To expose the students to industry practices and team work.
- To encourage students to work with innovative and entrepreneurial ideas

Course Outcomes :

Student will able to :

- Demonstrate the ability to synthesize and apply the knowledge and skills acquired in the academic program to real-world problems
- Evaluate different solutions based on economic and technical feasibility
- Effectively plan a project and confidently perform all aspects of project management
- Demonstrate effective written and oral communication skills

The aim of Project work –II is to implement and evaluate the proposal made as part of Project Work - I. Students can also be encouraged to do full time internship as part of project work-II based on the common guidelines for all the departments . The students placed in internships need to write the new proposal in consultation with industry coordinator and project guide within two weeks from the commencement of instruction.

The department will appoint a project coordinator who will coordinate the following:

Re-grouping of students - deletion of inters hip candidates from groups made as part of project work-I

Re-Allotment of internship students to project guides

Project monitoring at regular intervals

All re-grouping/re-allotment has to be completed by the 1st week of VIIIth semester so that students get sufficient time for completion of the project.

All projects(internship and departmental) will be monitored at least twice in a semester through student presentation for the award of sessional marks. Sessional marks are awarded by a monitoring committee comprising of faculty members as well as by the supervisor. The first review of projects for

25 marks can be conducted after completion of five weeks. The second review for another 25 marks can be conducted after 12 weeks of instruction.

Common norms will be established for the final documentation of the project report by the respective departments. The students are required to submit draft copies of their project report within one week after completion of instruction.

Note: Three periods of contact load will be assigned to each project guide.

GENDER SENSITIZATION

(Mandatory Course)

Instruction	3 Periods per week
Sessionals	50 Marks
Credits	3

Course Objectives:

- To develop students' sensibility with regard to issues of gender in contemporary India.
- To provide a critical perspective on the socialization of men and women.
- To introduce students to information about some key biological aspects of genders.
- To help students reflect critically on gender violence.
- To expose students to more egalitarian interactions between men and women

Course Outcomes:

Students will :

- Be able to develop a better understanding of important issues related to gender in contemporary India.
- Be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender through discussion of materials derived from research, facts, everyday life, literature and film.
- Get a finer grasp of how gender discrimination works in our society and how to counter it.
- Develop a sense of appreciation of women in all walks of life.

UNIT-I

UNDERSTANDING GENDER: Why Should We Study It? Socialization: Making Women, Making Men: Introduction-Preparing for Womanhood-Growing up male-First lessons in casteDifferent Masculinities; Just Relationships: Being Together as Equals: Mary Kom and OnlerLove and acid just do not mix-Love Letters-Mothers and Fathers-Further reading: Rosa Parks-The brave heart.

UNIT-II

GENDER AND BIOLOGY: Missing Women: Sex selection and Its Consequences – Declining sex ratio. Demographic Consequences; Gender Spectrum: Beyond the Binary – Two or many – Struggles with discrimination; Our Bodies, Our Health.

UNIT-III

GENDER AND LABOUR: Housework: the Invisible Labour: "My mother doesn't work"- Share the Load"; Women's Work; Its Politics and Economics: Fact and fiction-Unrecognized and unaccounted work- Wages and conditions of work.

UNIT-IV

ISSUES OF VIOLENCE: Sexual Harassment: Say No! : Sexual harassment – not eve-teasingCoping with everyday harassment-"Chupulu"; Domestic Violence: Speaking Out: Is home a safe place? When women unite-Rebuilding lives-New forums for justice; Thinking about Sexual Violence: Blaming the victim – "I fought for my life". The caste face of violence.

UNIT – V

GENDER STUDIES: Knowledge - Through the Lens of Gender - Point of view - Gender and the structure of knowledge – Unacknowledged women artists of Telangana: Whose History? Questions for Historians and Others: Reclaiming a past-Writing other histories-Missing pages from modern Telangana history.

Suggested Readings:

1. A.Suneetha, Uma Bhrugubanda, Duggirala Vasanta, Rama Melkote, Vasudha Nagaraj Asma Rasheed, Gogu Shyamala, Deepa Sreenivas and Susie Tharu, "Towards a World of Equals: A Bilingual Text book on Gender" Telugu Akademi, Hyderabad, 1st Edition, 2015.

2. www.halfthesky.cgg.gov.in.