DEPARTMENT OF ELECTRONICS & COMMUNICATION 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

With effect from the Academic year 2018-2019

SCHEME OF INSTRUCTION

B.E. (ECE)

VII - SEMESTER

S. No.	Course Code	Course Title	Scheme of Instruction			Contact hr/week	Scheme of Examination		Credits
			L	T	P		CIE	SEE	
Theory									
1	HS 701 ME	Industrial & Financial Management	3	1	0	4	30	70	3
2	PC 701 EC	Embedded System Design	3	1	0	4	30	70	3
3	PC 702 EC	VLSI Design	3	1	0	4	30	70	3
4	PC 703 EC	Microwave Techniques	3	1	0	4	30	70	3
5	PC 704 EC	Wireless Communication	3	1	0	4	30	70	3
6	PE #	Professional Elective-III	3	0	0	3	30	70	3
7	OE #	Open Elective-II	3	0	0	3	30	70	3
8	MC #	Mandatory Course	-	-	-	3	50	-	3U
Practicals									
9	PC 751 EC	Microwave Laboratory	0	0	2	2	25	50	1
10	PC 752 EC	Electronic Design and Automation Laboratory	0	0	2	2	25	50	1
11	PW 761 EC	Project Work-I	-	-	2	2	50	0	4
Departmental Requirement									
12	PW961EC	Summer Internship*	-	-	-	-	50	-	2
Total			**21**	**5**	**6**	**35**	**410**	**590**	**29**

*Students have to undergo summer internship of 6 Weeks duration at the end of semester VI and credits will be awarded after evaluation.

PE # Professional Elective-III:

PE 701 EC Adaptive Filter Theory and Applications
PE 702 EC Satellite Communication
PE 703 EC Optical Communication

OE # Open Elective-II:

*OE 701 EC Principles of Electronic Communications
*OE 702 EC Fundamentals of IOT
OE 701 BM Human Factor Engineering & Ergonomics
OE 702 BM Basic Medical Equipment
OE 701 CE Optimization Techniques
OE 701 CS Database Systems
OE 702 CS Information Security
OE 701 EE Non Conventional Energy sources
OE 701 ME Startup Entrepreneurship
OE 702 ME Finite Element Methods

MC # Mandatory Course

MC 951 SP Yoga Practice
MC 952 SP NSS
MC 953 SP Sports

*** OE 701 EC and *OE 702 EC Electives are not offered to the students of ECE Department.**

L	:	Lectures	T	:	Tutorials
P	:	Practicals	CIE	:	Continuous Internal Evaluation
SEE	:	Semester End Examination	PC	:	Professional Core
PE	:	Professional Elective	OE	:	Open Elective
MC	:	Mandatory Course	PW	:	Project Work

HS 701 ME

Industrial and Financial Management

Credits:3

Instruction : (3L + 1T) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

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:

Students 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.

PC 701 EC

Embedded System Design

Credits:3

Instruction : (3L + 1T) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

Course Objectives:

- *To gain knowledge to design embedded systems.*
- *To understand the processor selection criteria for Embedded System Design.*
- *To gain the knowledge of ARM Cortex on Zynq for embedded systems.*
- *To gain the knowledge of tool chain for embedded systems.*
- *To understand the importance of RTOS in building real time systems*

Course Outcomes:

Student will be able to

- *Design an embedded system.*
- *Distinguish between RISC and CISC*
- *Use the ARM Cortex for design of embedded system*
- *Use Embedded Software Development Tools for Designing Embedded System applications*
- *Apply their understanding in building real time systems.*

Unit-I

Introduction To Embedded Systems: The Embedded Design Life Cycle - Product Specification, Hardware/Software Partitioning, Iteration And Implementation, Detailed Hardware (selection fo processor) and Software Design, Hardware/Software Integration, Product Testing And Release, Maintenance and Upgradation.

Unit-II

ARM Embedded Systems: The RISC design philosophy, The ARM design philosophy, ARM processor fundamentals, registers, current program status register, pipeline, exceptions, interrupts, and vector table, core extensions, architecture revisions, ARM processor families.

Unit-III

Embedded processing with ARM CORTEX on Zynq: Fundamentals of FPGA, types of FPGA, case study of Xilinx FPGA, Processing System, programmable logic, programmable logic interfaces, security, Zynq 7000 family members, Zynq versus standard FPGA, Zynq versus standard processor.

Unit-IV

Embedded Software Development Tools: Host And Target Machines, Cross Compilers, Cross Assemblers, Tool Chains, Linkers/Locators For Embedded Software, Address Resolution, Locator Maps. Getting Embedded Software Into Target System: PROM programmer, ROM emulator, In Circuit- Emulators, Monitors, Testing on Your Host Machine - Instruction Set Simulators, Logic Analyzers.

Unit-V

Introduction to Real Time Operating Systems: Tasks and task states, tasks and Data, Semaphores and shared data. Operating system services: Message queues, mailboxes and pipes, timer functions, events, memory management, Interrupt routines in an RTOS environment.

Suggested Readings:

1. Arnold S Berger, *Embedded Systems Design*, South Asian edition, CMP Books, 2005.
2. Andrew Sloss, Dominic Symes, Chris Wright, *ARM System Developer's Guide: Designing and Optimizing System Software* , Elsevier, 2004.
3. Louise H Crockett, Ross.A.Elliot et al " *The Zynq Book*" , Edition 1, Strathclyde academic media, July 2014.
4. David E Simon, "*An Embedded software primer*", Pearson, 2012

PC 702 EC

VLSI Design

Credits:3

Instruction : (3L + 1T) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

Course Objectives:

- *To provide a perspective on Digital Design in the Deep Sub-micron Technology.*
- *To focus on CMOS and Bi CMOS Short-channel Transistor Models.*
- *To Study CMOS Inverter elaborately.*
- *To explore static and dynamic implementations of combinational and sequential circuit designs and introduce Testability of VLSI circuits.*

Course Outcomes:

Students will be able to

- *Have an understanding of the Fabrication processes and the comparison between different state-of-the-art CMOS technologies.*
- *Acquire the knowledge in understanding CMOS Inverter characteristics. Illustrate circuit diagrams, stick diagrams and layouts.*
- *Design and analyze various Combinational Logic circuits in different models.*
- *Design and analyze various Arithmetic Blocks and Memory structures.*
- *Understand various fault models and test patterns.*

Unit- I

Design Abstraction in Digital circuits, Fabrication process flow of nMOS and pMOS transistors, Overview of CMOS and BiCMOS technologies, MOSFET Transistor under static conditions, channel Length Modulation, Velocity Saturation, Sub-threshold Condition, Threshold variations, MOS structure Capacitance, CMOS Latch up, Technology scaling.

Unit- II

CMOS Inverter, Voltage Transfer Characteristics, Static Power Consumption, Dynamic Power Consumption, Propagation Delay, Power-Energy and Energy-Delay Product, Layout Design of basic gates, Silicon on Insulation Technology, FinFET, Comparison of SOI and FinFET.

Unit- III

Designing Combinational Logic gates in CMOS: Complementary CMOS, Ratioed Logic, Pass Transistor Logic, Dynamic CMOS logic-basic principle, Signal integrity issues in Dynamic Design, domino logic, np-CMOS logic, Merits and Demerits of above logic styles. Designing sequential logic: Bistability Principle, Multiplexer based latch, Dynamic latch, Pipelining.

Unit- IV

Designing Arithmetic Building Blocks: Adder, Binary Adder, Full Adder, Mirror Adder, Transmission gate based Adder, Manchester Carry Chain Adder, Carry Bypass Adder, Carry Look ahead Adder, Carry Save Adder, Multiplier, Carry Save Multiplier, Barrel Shifter, Logarithmic Shifter. Design of Memory Structures: ROM cells, PROM, EPROM, EEPROM, Flash Memory, SDRAM and DRAM.

Unit- V

Implementation of strategies for Digital ICs, Testing of VLSI circuits: Test procedures; Design for Testability- Ad Hoc Testing, Scab Based testing, Boundary Scan Design, Built in Self Test, Built-in logic block observer, Test Pattern Generator, Automatic Test Pattern Generation (ATPG).

Suggested Readings:

1. JAN.M. Rabaey, A. Chandrakasan and B. Nikholic, *Digital Integrated Circuits – A Design Perspective,* 2nd Edition, PHI, 2007.
2. David A Hodges, H. Jackson and R. A. Saleh, *Analysis and Design of Digital Integrated Circuits in Deep Submicron Technology*, 3rd Edition, Tata McGraw Hill, 2007.
3. John. P. Uymera, *Introduction to VLSI Circuits and system*, student edition, John Wiley and Sons, 2003.

PC 703 EC

Microwave Techniques

Credits:3

Instruction : (3L + 1T) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

Course Objectives:

- *To learn field calculations between parallel planes and rectangular wave guide.*
- *To study and understand various microwave devices and circuits.*
- *To study the construction and to understand principal of amplification/Oscillation at microwave frequency.*

Course Outcomes:

Student will be

- *Able to understand electromagnetic wave propagation in parallel plane waveguides.*
- *Able to understand electromagnetic wave propagation in rectangular waveguides and resonators.*
- *Able to understand the formulation of Scattering Matrix and define them for various microwave components.*
- *Able to learn principle of operation and applications of specialized microwave vacuum tubes.*
- *Able to distinguish between transfer electron devices from ordinary low frequency semiconductor devices and learn basic modes of operation of Gunn Diode and its applications.*

Unit- I

Waves between parallel planes, TE, TM, TEM Waves characteristics, Velocity of propagation, Group and Phase velocity, Wave Impedance, Attenuation in parallel plate guides.

Unit- II

TE & TM Waves in rectangular wave guides, Wave impedance, Attenuation and Q of Waveguides, Waveguide resonators, Power handling capability, Transmission line analogy, Waveguide Design/Bandwidth.

Unit- III

Microwave circuit concepts, Normalized voltage and current, Scattering parameters, properties of S- Matrix, Unitary property. S-Matrix for directional coupler, Magic tee, Construction, principle and applications of Attenuator, Phase Shifter, Circulator, Isolator, S-Matrix of Circulator.

Unit- IV

High Frequency limitations of conventional tubes, Two cavity Klystron, Bunching by velocity modulation, Small signal theory of bunching, Effect of grid interception and de-bunching. Trans admittance, Reflex Klystron, Mathematical theory of bunching, Admittance spiral and condition of oscillation. Principle of operation, construction and characteristics of TWT Amplifier, Backward wave oscillator (qualitative treatment only).

Unit- V

Principle of operation, construction and characteristics of Multi-cavity magnetron,Microwave Solid-state devices: Introduction, Classification and Applications. TEDs —Introduction, Gunn Diode — Principle, RWH Theory, Characteristics, Basic Modes of Operation, Oscillation Modes, Introduction to Avalanche Transit-Time Devices.

Suggested Readings:

1. Samuel Y. Liao, *Microwave Devices and Circuits*, 3rd Edition, PHI, 1994.
2. Pozar D.M., *Microwave Engineering*, 3rd edition, John Wiley & Sons, 2005.
3. Skalnik, Krauss, Reich, *Microwave principles*, East West Press, 1976.

PC 704 EC

Wireless Communication

Credits:3

Instruction : (3L + 1T) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

Course Objectives:

- *An overview of key wireless technologies: Various generations of mobile communications voice, data, cordless, paging, fixed and mobile broadband wireless systems, and beyond.*
- *Wireless system design fundamentals: channel assignment, handoffs, interference, frequency reuse, capacity planning, large-scale fading, and more.*
- *Path loss, small-scale fading, multipath, reflection, diffraction, scattering, shadowing, spatial-temporal channel modeling, and microcell/indoor propagation.*
- *Techniques to reduce fading like equalization, diversity and channel coding.*
- *3G air interface standards, including W-CDMA, cdma2000, GPRS, UMTS, and EDGE.*

Course Outcomes:

Student will be able to

- *Develop design models for cellular systems.*
- *Understand the various fading effects in designing Indoor/ Outdoor propagation models for mobile communications.*
- *Understand the techniques and develop the models for equalization, diversity and channel coding.*
- *Understand and simulate the Multiple –access techniques.*
- *Understand the various Wireless Mobile systems like AMPS, GSM, EDGE, CDMA, WCDMA etc.*

Unit- I

Overview of various wireless technologies, The cellular concept: System design fundamentals, Frequency reuse, Channel Assignment strategies Handoff strategies, Interference and system capacity, Improving coverage and capacity in cellular systems, Basic cellular mobile communication system.

Unit- II

Mobile radio propagation: Large scale path loss-Introduction to radio wave, Free space propagation model, Three basic propagation mechanisms, Reflection, Ground reflection (two ray) model) model, Diffraction, Scattering, Practical link budge design using path loss models, Outdoor propagation models, Indoor propagation models, signal penetration into buildings.

Unit- III

Mobile radio propagation: Small scale fading and multipath — small scale multipath propagation, Impulse response model of a multipath channel, Small scale multipath measurements, Parameters of mobile multipath channels, Types of small scale fading, Rayleigh and Ricean distributions, Statistical models for multipath fading channels.

Unit- IV

Channel models for GSM, 3G and WiFi. Equalization, Diversity, Equalization in a communication receiver, Linear equalization, Non linear equalization, Algorithms for adaptive equalization, Diversity techniques, Rake receiver.OFDM , Introduction to MIMO.

Unit- V

Wireless systems and standards: Multiple access techniques for wireless communications—FDMA, TDMA, DSSS,FHSS, SDMA, Packet radio, CSMA, Reservation protocols, Evolution of wireless systems, Study of AMPS, 15-54, IS- 136, GSM, IS-95, CDMA-2000, WCDMA, Introduction to Multi User Detection, 4th Generation systems.

Suggested Readings:

1. Theodore S., Rappaport, *Wireless Communications*, Pearson Education, 2002.
2. V.K.Garg, *IS-95 CDMA & CDMA 2000*, Pearson Education, 2002.
3. William C.Y. Lee, *Mobile Communications Engineering*, McGraw Hill, Second Edition, 1998.

PC 751 EC

Microwave Laboratory

Credits: 1

Instruction : (2P) hrs per week *Duration of SEE : 3 hours*
CIE : 25 Marks *SEE : 50 Marks*

Course Objectives:

- *To define the range of frequencies for operation in microwave engineering.*
- *To discover the functioning of microwave components.*
- *To verify the various Characteristics of Active and Passive Microwave Devices Practically.*
- *To Measure Different parameters of an Antenna.*
- *To find Practically Optical Fiber Characteristics.*

Course Outcomes:

Student will be Able to

- *Study the characteristics of microwave sources.*
- *Estimate the guide wave length and free space wave length of a wave.*
- *Analyze the fiber optic analog and digital link characteristics.*
- *Plot the radiation characteristics of UHF and microwave antennas.*
- *Analyze the characteristics of microwave devices.*

List of Experiments

A. Microwave Source Characteristics

1. Reflex Klystron Characteristics
2. Gunn diode Characteristics

B. Waveguide, Component Characteristics

1. Measurement of standing wave pattern, VSWR measurement, Low & High VSWR measurements.
2. Measurement of Frequency, wavelength, group and phase velocity.
3. Measurement of an unknown load characteristics of windows.
4. Directional Coupler Characteristics, Coupling, Directivity. and Isolation Measurements.
5. E plane, H plane and Magic Tee characteristics.
6. Characteristics of Circulator, Isolator, Measurements of S-parameters through insertion loss and isolation.

C. Antenna Characteristics

1. Measurement of principle plane radiation patterns for horn, Yagi Uda, folded dipole.
2. Measurement of gain & input impedance.
3. Linear array characteristics.
4. Measurement of return loss with Vector Network Analyzer.

D. Optical Communication

1. Optical Transmitter & Receiver Characteristics (Source' & Detector).
2. Optical Fiber Characteristics: Attenuation, Numerical aperture, splicing losses (step & graded index).
3. Modulation & Demodulation Techniques.
4. Analog/Digital Transmission link characteristics.

E. Satellite Communication

1.Analysis of user position accuracy of GAGAN and GPS for single frequency GPS/GAGAN receiver.
2.Analysis of User position under various conditions using Single frequency receiver

Suggested Readings:

1. Samuel Y. Liao, *Microwave Devices and Circuits,* PHI, 3rd Edition, 1994.
2. Pozar D.M., *Microwave Engineering,* John Wiley & Sons 3 rd edition,2005.

PC 752 EC

Electronic Design and Automation Laboratory

Credits: 1

Instruction : (2P) hrs per week *Duration of SEE : 3 hours*
CIE : 25 Marks *SEE : 50 Marks*

Course Objectives:

- *To understand the programming constructs of Verilog HDL.*
- *To demonstrate the programming models of Verilog HDL: gate level, data flow, behavioural and structural modelling.*
- *To study the VLSI back end tools.*
- *To develop basic models of digital circuits using VLSI back end tools.*
- *To carry out mini projects using Verilog HDL.*

Course Outcomes:

Student will be

- *Able to achieve knowledge of Verilog HDL programming.*
- *Able to write programs in HDL at various levels of abstraction.*
- *Achieve knowledge of working with back end tools of VLSI.*
- *Able to develop models for basic designs using back end tools.*
- *Able to understand, formulate and develop models for various designs using HDL and back end tools.*

List of Experiments:

Part A

Write the Code using VERILOG, Simulate and synthesize the following:

1. Arithmetic Units: Adders and Subtractors.
2. Encoders, Decoders, Priority Encoder and Comparator.
3. 8 – Bit Parallel Adder using four bit tasks and functions.
4. Arithmetic and Logic Unit with minimum of eight instructions.
5. D, SR and JK Flip flops.
6. Registers/Counters.
7. Sequence Detector using Mealy and Moore type state machines.
8. Shift input data right arithmetic by the number of positions specified by another input shift by using conditional operator.
9. Convert BCD number into seven segment code.
10. Realize a four-bit ring counter with asynchronous reset and clear inputs.
11. Design a clock generator where its output clk produces 50 pulses in the period of 20 time units at a duty cycle of 60%. The clk must start from zero.
12. Swap contents of two registers with temporary register.
13. Read and write operations form Random Access Memory.
14. 4-bit pseudo-random Binary sequence generator using a linear feedback shift register.
15. Calculating the Factorial of Positive Integers.

Note:

1. All the codes should be implemented appropriately using Gate level, Dataflow and Behavioural Modelling.
2. All the programs should be simulated using test benches.
3. Minimum of two experiments to be implemented on FPGA/CPLD boards.

Part B

A. Transistor Level implementation of CMOS circuits
1. Basic Logic Gates: Inverter, two input NAND and NOR gates.
2. Half Adder and Full Adder.
3. 4:1 Multiplexer.
4. 2:4 Decoder.

B. Implementation of ASIC design flow
1. Four-bit ripple carry adder using one bit full adder.
2. Four-bit carry look-ahead adder.
3. Four-bit universal shift register.
4. Synchronous and asynchronous counters.
5. 8-bit register with parallel load and shift left modes of operation.

General Note: Mini Project cum Design exercise:

The student must design, develop code and test and design the following problems:

i) 8 bit CPU
ii) Generation of different waveforms using DAC
iii) RTL code for Booth's algorithm for signed binary number multiplication
iv) Development of HDL code for MAC unit and realization of FIR Filter
v) Design of 4 - bit thermometer to Binary Code Converter

Suggested Readings:

1 Samir Palnitkar, "*Verilog HDL: A Guide to Digital Design and Synthesis*", Pearson Education, 2005.
2 Jan M Rabaey, A. Chandrakasan and B. Nikolic., *Digital Integrated Circuits,* Prentice Hall of India, 2003.

PW 761 EC

Project Work-I

Credits: 4

Instruction : (2P) hrs per week *CIE: 50 Marks*

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:

- *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 EC

Summer Internship*

Credits: 2

Instruction: 08 Weeks *CIE: 50 Marks*

Course Objectives:

- *To give an experience to the students in solving real life practical problems with all its constraints.*
- *To give an opportunity to integrate different aspects of learning with reference to real life problems.*
- *To enhance the confidence of the students while communicating with industry engineers and give an opportunity for useful interaction with them and familiarize with work culture and ethics of the industry.*

Course Outcomes:

Student will be

- *Able to design/develop a small and simple product in hardware or software.*
- *Able to complete the task or realize a prespecified target, with limited scope, rather than taking up a complex task and leave it.*
- *Able to learn to find alternate viable solutions for a given problem and evaluate these alternatives with reference to prespecified criteria.*
- *Able to implement the selected solution and document the same.*

Summer Internship is introduced as part of the curricula for encouraging students to work on problems of interest to industries. A batch of two or three students will be attached to a person from an Electronics Industry / R & D Organization / National Laboratory/Any other program approved by the department for a period of 8 weeks. This will be during the summer vacation following the completion of the VI semester course. One faculty member will act as an internal guide for each batch to monitor the progress and interacts with the Industry guide.

After the completion of the project, students 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 student at the work place to be judged by industry guide and internal guide (25 Marks) followed by presentation before the committee constituted by the department (25 Marks). One faculty member will co-ordinate the overall activity of Summer Internship.

***Students have to undergo summer internship of 6 Weeks duration at the end of semester VI and credits will be awarded after evaluation in VII semester**

PROFESSIONAL ELECTIVE-III

PE 701 EC

Adaptive Filter Theory and Applications

Credits:3

Instruction : (3L) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

Course Objectives:

- *To provide the students how to process noisy signals whose statistics are either unknown or time varying.*
- *This subject provides the students how to apply adaptive filters in speech coding and echo cancellation.*
- *This subject provides information about Kalman filter theory.*

Course Outcomes:

Student will be

- *Able to learn how to design adaptive filters for different applications like speech coding and echo cancellation.*
- *Able to learn how to minimize/maximize error function using RLS , LMS, Gradient descent methods and convergence issues.*
- *Able to learn modelling of stochastic systems and processing of noisy signals using Kalman and Adaptive filters.*

UNIT- I

Foundations: Introduction to finite dimensional vectorspace theory, subspace, basis,dimension, linear operators, rank and nullity, inner product space, orthogonality, Gram-Schmidt orthogonalization, concepts of orthogonal projection,orthogonal decomposition ofvector spaces.Vector space of random variables, correlation as inner product Review of stochastic processes, models and model classification, the identification problem, classical methods of identification of impulse response and transfer function models.

UNIT- II

Gradient Methods: model learning techniques, linear least square estimator, minimum variance algorithm, Optimal FIR (Wiener) filter; Method of steepest descent;LMS gradient algorithms; Convergence of LMS algorithm; Variants of LMS algorithm – sign LMS, normalized LMS, block LMS

UNIT- III

Least Square Methods: stochastic approximation method and maximum likelihood method (YY Added) , Linear least squares estimation problem, Recursive Least Square Filters, Convergence of RLS filter.

UNIT- IV

Applications: Applications of adaptive filters to linear prediction, speech coding, adaptive noise canceling, Echo cancellation in telephone circuits.

UNIT- V

Kalman Filter theory: simultaneous state and parameter estimation, Recursive minimum mean square estimation for scalar random variables (YY added); Statement of the kalman filtering problem: Innovations process; Estimation of state using the innovations process; Filtering examples.

Suggested Reading:

1. Simon Haykins, "*Adaptive signal processing"*, PHI, 1986.
2. Bernard Widrow, *"Adaptive signal processing"*, PHI,1986.
3. Bozic. SM., *Digital and Kalman Filtering.*

PE 702 EC

Satellite Communication

Credits:3

Instruction : (3L) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

Course Objectives:

- *To familiarize with basic concepts related to satellite Communication.*
- *To understand Sub-Systems of Satellites and Launches.*
- *To design the Earth Station antennas.*
- *To know about the parameters affecting the Satellite System Performance.*
- *To understand the applications of satellites.*

Course Outcomes:

Student will be

- *Able to have knowledge about the Satellite communications Principles and Properties.*
- *Able to know about the Space craft subsystems and Launch vehicles.*
- *Able to design the Satellite Earth station antennas*
- *Able to analyze the effects of various parameters on Satellite System performance.*
- *Able to understand the applications of Satellite Communication.*

UNIT–I

Origin of Satellite communications, A Brief History of Satellite Communication, Basic principles and properties of satellite communication. Earth segment, Space segment, Interpretation of Kepler's Laws. Orbital Mechanics: The Equation of the Orbit, Describing the Orbit, Locating the Satellite in the Orbit, Orbital effects in communication system Performance: Doppler shift, Range variation, Eclipse and Sun-Transit Outage.

UNIT– II

Space craft sub systems, Equipment Reliability and Space Qualification: Space Qualification, Reliability, and Redundancy, Satellite launch and launch vehicles and Mechanics of Launching a Synchronous Satellite.

UNIT– III

Earth Stations: Earth Station Design for Low System Noise Temperature, Design of large antennas and small earth station antennas. Low noise amplifiers and High power Amplifiers for Satellite communication.

UNIT– IV

Satellite Link Design: Basic Transmission Theory, System Noise Temperature and G/T ratio: Noise Temperature, calculation of System Noise Temperature, Noise Figure and Noise Temperature, Propagation on Satellite-Earth paths: Attenuation, depolarization, atmospheric absorption, Tropospheric Multipath effects and Land and Sea Multipath, Multipath Effects in System Design, Faraday rotation in the Ionosphere, Ionospheric scintillations, Rain and ice effects.

UNIT– V

Satellite Navigation Applications: Global and Regional Satellite Navigation Systems- Operating Principles, Advantages, Limitations, Current Status and Applications, Remote Sensing Satellites

Suggested Readings:

1. Wilbur L. Pitchand and Henri G. Suyderhoud, Robert A. Nelson, *Satellite Communication Systems Engineering,* 2nd edn.3rd Impression, Pearson Education.2008.
2. Timothy Pratt and Charles Nestian. W, *Satellite Communication,* John Wiley and Sons, 1988.
3. Tri T. Ha, *Digital Satellite Communication,* Tata McGraw- Hill, Special Indian Edition 2009.

PE 703 EC

Optical Communication

Credits:3

Instruction: (3L) hrs per week *Duration of SEE: 3 hours*
CIE: 30 Marks *SEE: 70 Marks*

Course Objectives:

- *To become familiar with the fundamental concepts of Light, Basic laws of light, various types of Optical fibers, modes and configurations.*
- *To acquaint with theoretical analysis of the Signal propagation and distortion during propagation of light in fibers.*
- *To become familiar with Optical sources, Optical detectors and Optical amplifiers*
- *To understand the design principles of digital and analog optical fiber communication links*
- *To know the operating principles of WDM and components for its realization*

Course Outcomes:

Student will be

- *Able to apply Maxwell's equations to provide solutions to the problems of optical waveguides*
- *Able to design the optical link power budget and rise time budget for the given applications*
- *Able to deal with the optical communication system designs.*
- *Able to carry out the calculations of various noise powers at optical receivers*
- *Able to design the WDM systems with various system considerations*

UNIT- I

Overview of Optical Fiber Communications: The evolution of optical fiber systems, Elements of an Optical fiber transmission link, Optical fibers, Nature of light – basic optical laws and definitions – Modes and configurations, Mode of theory of circular waveguides, Single and multi-mode step index and graded index fibers, Fiber materials.

UNIT- II

Signal degradation in Optical fibers: Attenuation, Signal distortion in optical waveguides, Mode coupling, and Design optimization of single mode fibers.

Optical sources: Semiconductors as optical sources and their fabrication, LED's and Laser diodes, Linearity of sources, Modal, partition and reflection noise

UNIT- III

Photo detectors: Physical principles of PIN and APD, Photo detector noise, Detector response time, Avalanche multiplication noise, Temperature effect on Avalanche gain, Comparisons of Photo detectors.

Optical receiver operation: Fundamental receiver operation, Digital receiver performance calculation. Preamplifiers types, Analog receivers

UNIT- IV

Point-to-Point Optical links: System considerations, Link power budget, Rise time budget, Noise effects on system performance. Overview of analog links, Carrier noise ratio in analog systems

UNIT- V

Optical Amplifiers & WDM: Introduction to optical amplifiers, Basic applications and types of Optical amplifier, WDM concepts and Components, operational principles, passive components, Tunable sources and Tunable filters.

Suggested Readings:

1. Gerd Keiser, "*Optical Fiber Communications*", 3rd Edition, Tata McGraw- Hill publishing company Limited, New Delhi, 2000.
2. D.C.Agarwal, "*Fiber Optic Communication*", 2nd Edition, Wheeter publishing, New Delhi, 1993.
3. D. k. Mynbaev, L.L. Scheiner, "*Fiber-Optic Communications Technology*", Pearson education, New Delhi, 2006.

OPEN ELECTIVE-II

OE 701 EC

Principles of Electronic Communications

Credits:3

Instruction : (3L) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

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

Fundamentals of IOT

Credits:3

Instruction : (3L) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

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 (Author), 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.

OE 701 BM

Human Factor Engineering & Ergonomics

Credits:3

Instruction : (3L) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

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

Basic Medical Equipment

Credits:3

Instruction : (3L) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

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 variousEquipments.*
- *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 McGrawHill, Second Edition, 2014.
2. John G.Webster, *Medical Instrumentation Application and design*, Wiley India Edition, 2009.

OE 701 CE

Optimization Techniques

Credits:3

Instruction : (3L) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

Course Objectives:

- *To understand the basic concepts of operations research.*
- *To study about the linear programming and non linear programming.*
- *To gain knowledge on various gradient search methods.*

Course Outcomes:

Student will be

- *Able to solve problems of L.P. by graphical and Simplex methods.*
- *Able to formulate Operation Research formulation.*
- *Able to solve problems of Integer Programming.*

UNIT – I

Introduction: Definitions, Characteristics, Objective function, Classification of optimization problems, Engineering applications and limitations. Construction of L.P. Models, Slack and surplus variables, Standard form, Canonical form and matrix form of LP Problems.

UNIT – II

Linear Programming: Definitions and Formulation of the LPP, Graphical methods, numerical problems by graphical method, Simplex algorithm, Numerical problems using Simplex method.

UNIT – III

Artificial Variables, solution by the Big-M method, Two-Phase method, special cases in Simplex method viz. Degeneracy, alternate optima, unbound solutions and infeasible solutions and numerical problems. Duality principle, Dual problems and numerical problems.

UNIT – IV

Introduction, local and global optima, concave and convex functions, Kuhn-Tucker conditions, graphical solutions. Direct search method, Gradient method, Quadratic programming problems.

UNIT – V

Integer Linear Programming

Importance of Integer Linear Programming, Necessity, Definitions, Gomory's cutting plane method, Branch and bound method, zero-one programming, numerical problems.

Suggested Readings:

1. Hillier, F. S. and Lieberman, G. J. (2009). *"Introduction to Operations Research."* Ninth Edition, McGraw-Hill, Holden-Day.
2. Taha, H.A. (2008). "*Operations Research, Pearson Education India*." New Delhi, India
3. Anand Sharma. (2014). "*Quantitative Techniques for Decision Making*."Himalaya Publishers.
4. Srinivasa Raju, K. and Nagesh Kumar, D. (2014). **"***Multicriterion Analysis in Engineering and Management."* Prentice Hall of India (PHI) Learning Pvt. Ltd, New Delhi.
5. Rao, S.S. (2009). "*Engineering Optimization: Theory and Practice*." John Wiley.
6. Sharma J.K. (2013). "*Operation Research: Theory and Applications*." Fifth Edition, Macmillan Publishers, New Delhi, India.

OE 701 CS

Database Systems

Credits:3

Instruction : (3L) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

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.

OE 702 CS

Information Security

Credits:3

Instruction : (3L) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

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 EE

Non Conventional Energy Sources

Credits:3

Instruction : (3L) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

Course Objectives:

- *To Understand the need of nonconventional energy sources.*
- *To Understand the basic working principles of various forms of nonconventional energy sources.*
- *To Understand the various limitations and applications of the renewable energy .*

Course Outcomes:

Student will be able to

- *Know the working principle and applications of fuel cell*
- *Describe the use of solar energy and the various components used in the energy Production with respect to an application like - heating, cooling, desalination, power generation, drying, cooking etc.*
- *Appreciate the need of wind energy and the various components used in energy Generation and know the classifications.*
- *Understand the concept of ocean energies – OTEC, wave and tidal energies*
- *Acquire the knowledge of different technologies used to in biomass technologies and their applications*

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.

OE 701 ME

Startup Entrepreneurship

Credits:3

Instruction : (3L) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

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:

Student 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.

OE 702 ME

Finite Element Methods

Credits:3

Instruction : (3L) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

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 Dimensionla 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.

MANDATORY COURSE

MC 951 SP

Yoga Practice

Credits:3U

Instruction : (3) hrs per week *CIE : 50 Marks*

Course Objectives:

- *Enhances body flexibility.*
- *Achieves mental balance.*
- *Elevates Mind and Body co-ordination.*
- *Precise time management.*
- *Improves positive thinking at the expense of negative thinking.*

Course Outcomes:

Student will

- *become more focused towards becoming excellent citizens with more and more discipline in their day-to-day life.*
- *An all-round development-physical, mental and spiritual health-takes place.*
- *Self-discipline and discipline with respect society enormouly increases.*
- *University environment becomes more peaceful and harmonious.*

UNIT-I

Introduction

Yoga definition-Health definition from WHO - Yoga versus Health - Basis of Yoga - yoga is beyond science- Zist of 18 chapters of Bhagavadgita - 4 types of yoga: Karma, Bhakti, Gnyana and Raja yoga – Internal and External yoga - Elements of Ashtanga yoga (Yama, Niyama, Asana, Pranayama, Prathyahara, Dharana, Dhyana and Samadhi) - Pancha koshas and their purification through Asana, Pranayama and Dhyana.

UNIT-II

Suryanamaskaras (Sun Salutations)

Definition of sun salutations - 7 chakras (Mooladhaar, Swadhishtaan, Manipura, Anahata, Vishuddhi, Agnya and Sahasrar) - Vaious manthras (Om Mitraya, Om Ravaye, Om Suryaya, Om Bhanave, Om Marichaye, Om Khagaye, Om Pushne, Om Hiranya Garbhaye, Om Adhityaya, Om Savitre, Om Arkhaya, and Om Bhaskaraya) and their meaning while performing sun salutations - Physiology - 7 systems of human anatomy - Significance of performing sun salutations.

UNIT-III

Asanas (Postures)

Pathanjali's definition of asana - Sthiram Sukham Asanam - 3rd limb of Ashtanga yoga - Loosening or warming up exercises - Sequence of perform in asanas (Standing, Sitting, Prone, Supine and Inverted) - Nomenclature of asanas (animals, trees, rishis etc) - Asanas versus Chakras - Asanas versus systems - Asanas versus physical health -Activation of Annamaya kosha.

UNIT-IV

Pranayama (Breathing Techniques)

Definition of Pranayama as per Shankaracharya - 4th limb of Ashtanga yoga - Various techniques of breathing - Pranayama techniques versus seasons - Bandhas and their significance in Pranayama - Mudras and their significance in Pranayama - Restrictions of applying bandhas with reference to health disorders - Pranayama versus concentration - Pranayama is the bridge between mind and body - Pranayam versus mental health - Activation of Pranamaya kosha through Pranayama.

UNIT-V

Dhyana (Meditation)

Definition of meditation - 7th limb of Ashtanga yoga - Types of mind (Conscious and Sub-Conscious) - various types of dhyana. Meditation versus spiritual health - Dharana and Dhyana - Extention of Dhyana to Samadhi - Dhyana and mental stress - Activation of Manomaya kosha through dhyana - Silencing the mind.

Suggested Reading:

1. *Light on Yoga* by BKS lyengar.
2. *Yoga education for children* Vol-1 by Swami Satyananda Saraswati.
3. *Light on Pranayama* by BKS lyengar.
4. *Asana Pranayama Mudra and Bandha* by Swami Satyananda Saraswati.
5. *Hatha Yoga Pradipika* by Swami Mukhtibodhananda.
6. *Yoga education for children* Vol-11 by Swami Niranjanananda Saraswati.
7. *Dynamics of yoga* by Swami Satyananda Saraswati.

MC 952 SP

National Service Scheme (NSS)

Credits:3U

Instruction : (3) hrs per week *CIE : 50 Marks*

Course Objectives:

- *To help in Character Moulding of students for the benefit of society.*
- *To create awareness among students on various career options in different fields.*
- *To remould the students behaviour with assertive skills and positive attitudes.*
- *To aid students in developing skills like communication, personality, writing and soft skills.*
- *To educate students towards importance of national integration, participating in electoral process etc by making them to participate in observing important days.*

List of Activities:

1. Orientation programme about the role of NSS in societal development
2. Swachh Bharath Programme
3. Guest lecture's from eminent personalities on personality development
4. Plantation of saplings/Haritha Haram Programme
5. Blood Donation / Blood Grouping Camp
6. Imparting computer education to school children
7. Creating Awareness among students on the importance of Digital transactions
8. Stress management techniques
9. Health Checkup Activities
10. Observation of Important days like voters day, World Water Day etc.
11. Road Safety Awareness Programs
12. Energy Conservation Activities
13. Conducting Programme's on effective communication skills
14. Awareness programme's on national integration
15. Orientation on Improving Entrepreneurial Skills
16. Developing Effective Leadership skills
17. Job opportunity awareness programs in various defence, public sector undertakings
18. Skill Development Programmes
19. Creating awareness among students on the Importance of Yoga and other physical activities
20. Creating awareness among students on various government sponsored social welfare schemes for the people.

Note: *At least Ten Activities should be conducted in the Semester* **.** Each event conducted under swachh barath, Plantation and important days like voters day, world water day may be treated as a separate activity.

MC 953 SP

Sports

Credits:3U

Instruction : (3) hrs per week *CIE : 50 Marks*

Course Objectives:

1. *To develop an understanding of the importance of sport in the pursuit of a healthy and active lifestyle at the College and beyond.*
2. *To develop an appreciation of the concepts of fair play, honest competition and good sportsmanship.*
3. *To develop leadership skills and foster qualities of co-operation, tolerance, consideration, trust and responsibility when faced with group and team problem-solving tasks.*
4. *To develop the capacity to maintain interest in a sport or sports and to persevere in order to achieve success.*
5. *To prepare each student to be able to participate fully in the competitive, recreational and leisure opportunities offered outside the school environment.*

Course Outcomes:

Student will be

1. *Students' sports activities are an essential aspect of university education, one of the most efficient means to develop one's character and personal qualities, promote the fair game principles, and form an active life position.*
2. *Over the past year, sports have become much more popular among our students. Let us remember the most memorable events related to sports and physical training.*
3. *Special attention was paid to team sports. Our male and female games and sports have achieved remarkable progress at a number of competitions.*
4. *Our teams in the main sports took part in regional and national competitions. Special thanks to our team in track and field athletics, which has been revitalized this year at ICT and which has won Javelin competition.*
5. *Staff of our faculties and students of Sports, Physical Development, & Healthy Lifestyle of Faculty congratulates everyone on the upcoming New Year and wishes you robust health and new victories in whatever you conceive.*

I. Requirements:

i) Track Paint (students should bring)
ii) Shoes
iii) Volley Ball, Foot Ball and Badminton (Shuttle)
iv) Ground, Court, indoor stadium and swimming pool

II. Evaluation Process:

Total Marks 50

i) 20 marks for internal exam (continuous evaluation)
   a) 8 marks for viva
   b) 12 marks for sports & fitness

ii) 30 marks for end exam
   a) 10 marks for viva
   b) 20 marks for sports & fitness

SCHEME OF INSTRUCTION
B.E. (ECE)
VIII - SEMESTER

S. No.	Course Code	Course Title	Scheme of Instruction			Contact hr/week	Scheme of Examination		Credits
			L	T	P		CIE	SEE	
Theory									
1	PE #	Professional Elective-IV	3	0	0	3	30	70	3
2	PE #	Professional Elective - V	3	0	0	3	30	70	3
3	OE#	Open Elective –III	3	0	0	3	30	70	3
4	PW861EC	Project Work –II / **Internship(Full Time)	--	--	4	4	50	100	8
5	MC 901EG	Gender Sensitization	3	0	0	3	30	70	3U
	Total		**12**	**0**	**4**	**16**	**170**	**380**	**17**

PE # Professional Elective – IV

PE 801EC Pattern Recognition
PE 802EC Analog IC Design
PE 803EC RADAR Systems

PE # Professional Elective-V

PE 804 EC GRNSS and Augmentation Systems
PE 805 EC Low Power VLSI Design
PE 806 EC Internet of Things

OE # Open Elective-III

* OE 801EC Global and Regional Satellite Navigation Systems
  OE 801BM Instrumentation Engineering
  OE 802BM Human-Machine Interface
  OE 801CE Road Safety Engineering
  OE 801CE Green Building Technologies
  OE 801CS Data Science Using R
  OE 801EE Illumination and Electric Traction
  OE 801ME Composite Materials
* OE 802ME Industrial Administration and Financial Management
  OE 803ME 3D Printing Technology
* OE 801MT Statistical Applications in Engineering

*** OE 801 EC,*OE 802 ME and * OE 801 MT Electives are not offered to the students of ECE Department.**

**** It is mandatory for students registering for Internship (Full Time) to undertake SWAYAM/NPTEL Courses having a minimum duration of 8 weeks starting from Semester V to meet the credit requirements of Professional and Open Electives of Semester VIII.**

L	:	Lectures	T	:	Tutorials
P	:	Practicals	CIE	:	Continuous Internal Evaluation
SEE	:	Semester End Examination	HS	:	Humanities and Social Sciences
PE	:	Professional Elective	OE	:	Open Elective
MC	:	Mandatory Course	PW	:	Project Work

List of NPTEL Courses Approved for the academic year 2018-2019

Professional Elective – IV & V

S No.	Course Title	Start Date	End Date	Exam Date
1	Principles of Signal Estimation for MIMO/ OFDM Wireless Communication	30-07-18	19-10-18	28-10-2018
2	Analysis and Design Principles of Microwave Antennas	06-08-18	28-09-18	07-10-2018
3	Computational Electromagnetics & Applications	30-07-18	19-10-18	28-10-2018
4	Applied Optimization for Wireless, Machine Learning, Big Data	30-07-18	19-10-18	28-10-2018
5	Architectural Design of Digital Integrated Circuits	06-08-18	28-09-18	07-10-2018
6	Fabrication Techniques for MEMs-based sensors : clinical perspective	30-07-18	19-10-18	28-10-2018
7	Op-Amp Practical Applications: Design, Simulation and Implementation	30-07-18	19-10-18	28-10-2018
8	Information Theory, Coding and Cryptography	30-07-18	19-10-18	28-10-2018
9	Advanced Topics in Probability and Random Processes	06-08-18	28-09-18	07-10-2018
10	Microwave Integrated Circuits	27-08-18	19-10-18	28-10-2018
11	Fiber-Optic Communication Systems and Techniques	30-07-18	19-10-18	28-10-2018

Open Elective – III

S No.	Course Title	Start Date	End Date	Exam Date
1	Control System Design	30-07-18	19-10-18	28-10-2018
2	Electrical Distribution System Analysis	06-08-18	28-09-18	07-10-2018
3	Facts Devices	06-08-18	28-09-18	07-10-2018
4	E-Business	30-07-2018	19-10-2018	28-10-2018
5	Software Engineering	30-07-2018	19-10-2018	28-10-2018
6	Introduction to R-Software	24-07-2018	15-09-2018	07-10-2018
7	Irrigation and Drainage	30-07-2018	19-10-2018	28-10-2018

8	Bioengineering: An Interface with Biology and Medicine	06-08-2018	28-09-2018	07-10-2018
9	Integrated Waste Management for a Smart City	30-07-2018	19-10-2018	28-10-2018
10	The Joy of Computing using Python	30-07-2018	19-10-2018	28-10-2018
11	Introduction to Machine Learning	27-08-2018	19-10-2018	28-10-2018
12	Deep Learning	30-07-2018	19-10-2018	28-10-2018
13	Cloud Computing	06-08-2018	28-09-2018	07-10-2018
14	Social Networks	30-07-2018	19-10-2018	28-10-2018
15	Ethics in Engineering Practice	27-08-2018	19-10-2018	28-10-2018
16	Marketing research and analysis	06-08-2018	28-09-2018	07-10-2018
17	Innovation, Business Models and Entrepreneurship	06-08-2018	28-09-2018	07-10-2018
18	Fundamentals of manufacturing processes	30-07-2018	19-10-2018	28-10-2018
19	Introduction to research	06-08-2018	28-09-2018	07-10-2018
20	Health Research Fundamentals	06-08-2018	28-09-2018	07-10-2018
21	Neuroscience of Human Movement	30-07-2018	19-10-2018	28-10-2018
22	Non-Conventional Energy Resources	30-07-2018	19-10-2018	28-10-2018
23	Ecology and Environment	27-08-2018	19-10-2018	28-10-2018

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

PROFESSIONAL ELECTIVE-IV

PE 801 EC

Pattern Recognition

Credits:3

Instruction : (3L) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

Course Objectives:

- *To provide the students both traditional and modern pattern classification methods required for pattern recognition.*
- *To provide parameter estimation techniques if the distribution of the data is not known.*
- *To provide different learning algorithms and application of a deep neural network.*

Course Outcomes:

Student will be

- *Able to learn data classification techniques based on Bayesian decision theory.*
- *Able to learn parameters estimation and density estimation methods required for data classification*
- *Able to learn neural networks and deep convolutional networks and its application for numerals and image data classification*

UNIT – I

Introduction to Pattern Recognition: Pattern Recognition system, Bayesian decision theory,two category classifier, minimum error rate classification, discriminant functions and decision surfaces, two category cases. Discriminant functions for normal density function.

UNIT – II

Maximum likelihood and Bayesian parameter estimation Techniques: General principles, parameter estimation from a multivariate distribution. Component analysis and discriminants: Principle component analysis and Fisher linear Discriminant.

UNIT – III

Non-parametric Techniques: Introduction, density estimation, Parzen window. Nearest neighbor rule, convergence and error rate for nearest neighbor rule, Metrics and nearest neighbor classification: Properties of metrics and tangent distance.

UNIT – IV

Linear discriminant functions and Decision surfaces: Two category and multi-category cases, Generalized Linear discrinant functions Data description and clustering: similarity measures, criterion functions for clustering, k means and fuzzy k means clustering techniques and Support vector machine.

UNIT – V

Neural networks and deep learning: Model of an artificial neuron, different learning rules, perceptron and its training algorithm, multilayer neural network, back propagation algorithm, Deep convolutional neural networks, architecture, training algorithm and its application to digit data set classification.

Suggested Readings:

1. Richard O.Duda, Peter E Heart, David G.Stork, *Pattern Classification*, John Wiley & Sons 2002.
2. Rafael C.Gonzalez and Richard E. Woods, *Digital Image processing*, Pearson, NY 2018.
3. B.Yegnanarayana, *Artificial Neural Networks*, Prentice Hall , New Delhi 2007.

PE 802 EC

Analog IC Design

Credits:3

Instruction : (3L) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

Course Objectives:

- *Develop models of basic CMOS amplifiers.*
- *Learn the concepts of advanced current mirrors and band-gap reference circuits.*
- *Design and develop two-stage Opamp.*
- *Analyze applications of Opamp: comparator and oscillator.*
- *Familiarize with switched capacitor based circuits.*

Course Outcomes:

Student will be able to

- *Understand CMOS Analog circuits and design amplifiers using current mirrors.*
- *Analyze the effect of Supply and temperature on circuit operation.*
- *Design a two stage CMOS operational Amplifier.*
- *Understand the operation of comparators and oscillators.*
- *Implement filters with switch capacitor circuits.*

UNIT- I

Brief Review of Small Signal and Large Signal Model of BJTs and MOSFETs. Current Mirrors and Single Stage Amplifiers – Simple CMOS current mirror, common source amplifier, source follower, common gate amplifier, cascode amplifiers. Source degenerated current mirrors.

UNIT-II

High out impedance – current mirrors, cascode gain stage Wilson current mirror, MOS differential pair and gain stage. Wide swing current mirrors. Bipolar current mirrors – bipolar gain stages. Differential pairs with current mirror loads MOS and bipolar widlar current sources, supply insensitive biasing, temperature insensitive biasing, band gap reference, band gap reference circuits.

UNIT- III

Operational amplifiers, Basic two stage MOS Operational amplifier–Characteristic parameters, Design of two stage opamp. two stage MOS Op-Amp with Cascodes. MOS Telescopic-cascode Op-Amp. MOS Folded cascode op-amp. MOS Active Cascode Op-Amp. Fully differential folded cascode op-amp. CMFB Circuits. Current feedback op-amps. Stability and frequency compensation of op-amps. Phase margin and noise in op-amps.

UNIT – IV

Comparators: Op-Amp Based Comparators, Charge Injection Errors – Latched Comparators CMOS and BiCMOS Comparators – Bipolar Comparators.

Oscillators and mixers: Basics of oscillators - Feedback oscillators, negative resistance oscillators, (two port oscillators), ring oscillators - Differential ring oscillators, LC oscillators, relaxation oscillators, voltage controlled oscillators, Tuning delay and frequency.

UNIT -V

Switched capacitor circuits: Basic building blocks; basic operation and analysis, inverting and non inverting integrators, signal flow diagrams, first order filter. Implementation of Higher order filters using switched capacitor circuits.

Suggested Readings:

1. David Johns, Ken Martin, *Analog Integrated Circuit Design*, John Wiley & sons. 2004.
2. Behzad Razavi, *Design of Analog CMOS Integrated Circuits*, Tata Mc Grah Hill. 2002.
3. Paul.R. Gray & Robert G. Major, *Analysis and Design of Analog Integrated Circuits*, John Wiley & sons. 2004.
4. Jacob Baker.R.et.al., *CMOS Circuit Design*, IEEE Press, Prentice Hall, India, 2000.

PE 803 EC

RADAR Systems

Credits:3

Instruction : (3L) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

Course Objectives:

- *To familiarize with basic concepts of radar systems.*
- *To understand different Radar Systems.*
- *To know about Radar antennas.*
- *To know the propagation effects on a radar signal.*
- *To understand tracking radar principles.*

Course Outcomes:

Student will be

- *Able to understand the components of a radar system.*
- *Able to demonstrate the function of FMCW radar.*
- *Able to analyze the concept of MTI radar systems.*
- *Able to incorporate the effects of environment condition in a radar system.*
- *Able to apply appropriate mathematical and computer models relevant to radar systems to calculate system performance.*

Unit- I

Radar Systems: Description of basic radar system and its elements, Block diagram and operation of a radar, Applications of Radar. Radar frequencies Radar equation, Radar cross-section of target, Prediction of range performance, Minimum detectable signal, Receiver noise figure, Effective noise temperature, Signal to noise ratio, System losses, False alarm time and probability of false alarm, Integration of radar pulses, Pulse-repetition frequency and range ambiguities. Swerling Models.

Unit- II

CW and FMCW Radars: Doppler effects, CW Radar, FMCW Radar, Multiple frequency CW radar, Low noise front-ends, A-scope, B-scope, PPI Displays, Duplexers. **MTI and Pulse Doppler Radar**: MTI radar, Delay line canceller, Multiple and staggered prf, Blind speeds, Limitations to MTI performance, MTI using range gated Doppler filters, Pulse doppler radar, Non coherent radar. CFAR techniques in Radar Detection

Unit- III

Search Radar: Range equation, Search scans, Effect of surface reflection, Line of Sight (LOS), propagation effects, Environmental noise. Radar Antennas: Antenna parameters- Parabolic reflector antennas, Cassegrain antenna, Cosecant - squared Antenna pattern.

Unit- IV

Tracking Radar: Sequential lobing, Conical scan, Monopulse - Amplitude comparison and Phase comparison methods, Tracking in range and in Doppler, Acquisition, Comparison of trackers.

Unit- V

Modern Trends in Radar Technology: Track while scan radars, Phased array Radars, Radar System design Example for a typical search radar and tracking radar.

Suggested Readings:

1. Skolnik, Merrill I, *Introduction to Radar Systems*, MGH, third edn., 2001.
2. Barton. David K, *Modern Radar System Analysis*, Artech House, 1988.
3. Peebles PZ, '*Radar Principles'*, John – Willey, 2004.

PROFESSIONAL ELECTIVE-V

PE 804 EC

GRNSS and Augmentation Systems

Credits:3

Instruction : (3L) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

Course Objectives:

- *To explain the basic principle of GPS and its operation.*
- *To make the students to understand signal structure, errors, coordinate systems*
- *To make the students understand the GPS navigation and observation files.*
- *Highlight the importance of integrating GPS with other systems.*
- *To demonstrate the principle of DGPS and to facilitate the various augmentation systems.*

Course Outcomes:

Student will be able to

- *Understand the principle and operation of GPS.*
- *Frame various coordinate systems for estimating position.*
- *Estimate the various errors and their effect on position estimation.*
- *Use GPS in various fields such as navigation, GIS etc.*
- *Apply DGPS principle and can also analyze various augmentation systems.*

UNIT- I

GPS fundamentals: Trilaiteration, Transit, GPS Principle of Operation, Architecture: Space, Control and User Segments, Operating frequencies, Orbits, Keplerian elements.

UNIT- II

GPS and UTC Time, Signal structure, SPS and PPS services, C/A and P-Codes, Geometry of ellipsoid, geodetic reference system, Geoid and Ellipsoid and Regional datum : Earth Centered Earth Fixed (ECEF) and Earth Centered Inertial (ECI) Coordinate systems and World Geodetic System (WGS 84) datum, Types of receivers, Spoofing and Anti-spoofing.

UNIT- III

GPS Error Models: Ionospheric error, Tropospheric error, Ephemeris error, Clock errors, Satellite and receiver instrumental biases, Multipath; GPS Navigation and Observation data formats, Various DOPs.

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. Relative advantages of SBAS, SBAS features and Principle of operation of Wide area augmentation system (WAAS), GPS Aided GEO Augmented Navigation (GAGAN) and Ground Based Augmentation System (GBAS): Local Area Augmentation System (LAAS).

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.

PE 805 EC

Low Power VLSI Design

Credits:3

Instruction : (3L) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

Course Objectives:

- *Develop models of CMOS transistor and Power analysis of CMOS Inverter.*
- *Learn the Power estimation techniques of CMOS circuits.*
- *Familiarize with of dynamic and leakage power optimization techniques.*
- *Know Low Power Very Speed Dynamic Digital circuits.*

Course Outcomes:

Student will be able to

- *Understand the importance of Nanometer transistor*
- *Calculate Power in Digital circuits*
- *Explain various dynamic and leakage power optimization techniques*
- *Understand the Energy Recovery Circuits.*

UNIT-I

MOS Transistor – Nanometer Transistor and its model – body effect, Channel Length Modulation and short channel effects – velocity saturation, sub-threshold conduction, threshold voltage control, drain induced barrier lowering, gate induced drain leakage, Complete MOS Transistor Model and large and small signal models of BJTs and MOSFETs.
CMOS Inverter: Static and Dynamic behavior and Power, Energy and Energy-Delay analysis of CMOS Inverter

UNIT-II

Power Estimation Techniques: Circuit Level – Modeling of Signals, Signal Probability Calculations, Statistical techniques; High Level Power Analysis – RTL Power Estimation, Fast Synthesis, Analytical Approaches, Architectural Power Estimation.

UNIT-III

Power Optimization Techniques – I: Dynamic Power Reduction – Dynamic Power Component, Circuit Parallelization, Voltage Scaling Based Circuit Techniques, Circuit Technology – Independent Power Reduction, Circuit Technology Dependent Power Reduction;

UNIT-IV

Power Optimization Techniques – II: Leakage Power Reduction – Leakage Components, Design Time Reduction Techniques, Run-time Stand-by Reduction Techniques, Run-time Active Reduction Techniques Reduction in Cache Memories.

UNIT-V

Power Optimization Techniques – III: Low Power Very Fast Dynamic Logic Circuits, Low Power Arithmetic Operators, Energy Recovery Circuit Design, Adiabatic – Charging Principle and its implementation issues.

Suggested Readings:

1. Jan M Rabaey, A Chandrakasan, Borvioje N *"Digital Integrated Circuits Design Perspective*" PHI-2nd edition,2005.
2. Kaushik Roy and Sharat Prasad, *Low-Power CMOS VLSI Circuit Design*, Wiley Inter-science Publications, 2000.
3. Christian Piguet, *Low Power CMOS Circuits Technology, Logic Design and CAD Tools*, 1st Indian Reprint, CRC Press, 2010.

PE 806 EC

Internet of Things

Credits:3

Instruction : (3L) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

Course Objectives:

- *To introduce the concepts of automation in daily life.*
- *To familiarize the concepts of all IoT based communication systems.*
- *To understand the importance of cloud technologies in the field of IoT.*
- *To get familiar with standard embedded boards like Raspberry Pi.*
- *To study a real time system with a view of an application program interface(API).*

Course Outcomes:

Student will be

- *Able to design IoT based solutions for given problem statements.*
- *Able to develop programs for Raspberry Pi.*
- *Able to demonstrate the functionality of cloud communication.*
- *Able to analyze the technologies used in IoT.*
- *Able to incorporate multiple sensors to develop an IoT based system.*

Unit- I

Introduction to Internet of Things

Definition and Characteristics of IoT, Physical Design of IoT: Things in IoT,IoT protocols, Logical Design of IoT: IoT functional Blocks, Communication Models, APIs, IoT enabling TEchnologies: Wireless Sensor Networks, Cloud Computing, Big Data Analytics
IoT Applications: Smart Home, Smart Cities, Smart Environment, Smart Energy, Smart Retail and Logistics, Smart Agriculture and Industry, Smart Industry and smart Health (Ref1)

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. 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

Unit- III

API Development and Embedded programming

Getting started with API, Writing a new API, Real time Reactions, Other Protocols, Techniques for writing embedded code:Memory management, Performance and Battery Life, Libraries, Debugging.

Developing Internet of Things: IoT design Methodology, Case study on IoT System for weather monitoring .

Unit -IV

IoT Systems - Logical Design using Python

Introduction to Python, Data Types and Structures, Control Flow, Functions, Modules, Packages, File Hnadling, Date/Time Operations., Classes, Python packages for IoT

IoT Physical Devices and Endpoints: Raspberry Pi, Interfaces of Pi, Programming pi with Python - Controlling LED and LDR using Pi with python programming.

Unit- V

Cloud computing and Data analytics and IoT Product Manufacturing

Introduction to Cloud storage models and Communication APIs, Amazon webservices for IoT, Skynet IoT Messaging Platform. Introduction to Data Analytics for IoT(Ref 1). Case studies illustrating IoT Design – Smart Lighting, Weather Monitoring, Smart Irrigation.(Ref 1) Business model for IoT product manufacturing, IoT Startups, Mass manufacturing, Ethical issues in IoT.

Suggested Readings:

1. *Internet of Things (A Hands-on-Approach)* , Vijay Madisetti , ArshdeepBahga, VPT Publisher, 1st Edition, 2014
2. *Designing the Internet of Things* , Adrian McEwen (Author), Hakim Cassimally. Wiley India Publishers
3. *Fundamentals of Python*, Kenneth A Lambert and B.L. Juneja, Cenage Learning

OPEN ELECTIVE-III

OE 801 EC

Global and Regional Satellite Navigation Systems

Credits:3

Instruction : (3L) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

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.*
- *Able to understand the GPS Signal structure and services.*
- *Able to understand about various errors.*
- *Able to use of GPS in various fields such as navigation, GIS etc.*
- *Able to 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.

OE 801 BM

Instrumentation Engineering

Credits:3

Instruction : (3L) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

Course Objectives:

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

Course Outcomes:

Student will be able to

- *Design various signal conditioning circuits*
- *Apply the principles in applications*

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

OE 802 BM

Human-Machine Interface

Credits:3

Instruction : (3L) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

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

- *To design user centric interfaces.*
- *To design innovative and user friendly interfaces.*
- *To apply HMI in their day-to-day activities.*
- *To criticise existing interface designs, and improve them.*
- *To 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.

OE 802 CE

Road Safety Engineering

Credits:3

Instruction : (3L) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

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.

OE 802 CE

Green Building Technologies

Credits:3

Instruction : (3L) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

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.*
- *Be acquainted with the end-use energy requirements.*
- *Be familiar 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.

OE 801 CS

Data Science Using R

Credits:3

Instruction : (3L) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

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 SyntheticTransaction 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 EE

Illumination and Electric Traction

Credits:3

Instruction : (3L) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

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.*

Course Outcomes:

Student will be

- *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

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.

OE 801 ME

Composite Materials

Credits:3

Instruction : (3L) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

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 architectures.

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.

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.

OE 802 ME

Industrial and Financial Management

Credits:3

Instruction : (3L) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

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.

OE 803 ME

3D Printing Technology

Credits:3

Instruction : (3L) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

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

OE 801 MT

Statistical Applications in Engineering

Credits:3

Instruction : (3L) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

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:

Student 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.

PW 861 EC

Project Work-II

Credits: 8

Instruction : (4P) hrs per week
CIE : 50 Marks *SEE : 100 Marks*

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:

- *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 - 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 1nd week of VIII^{t} 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.

MC 901 EG

Gender Sensitization

Credits:3U

Instruction : (3L) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

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

- *Students will have developed a better understanding of important issues related to gender in contemporary India.*
- *Students will be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature and film.*
- *Students will attain a finer grasp of how gender discrimination works in our society and how to counter it.*
- *Students and professionals will be better equipped to work and live together as equals.*
- *Students will 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 caste-Different Masculinities; **Just Relationships: Being Together as Equals:** Mary Kom and Onler-Love 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-teasing-Coping 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.