Applied Electronics and Instrumentation Engineering (AI)

AI010 701 VLSI

Teaching scheme **Credits: 4**

2 hours lecture and 2 hours tutorial per week

Objectives:

- *To impart knowledge of the VLSI Design and , scaling of devices*
- *To make an awareness on the various processes involved in the fabrication of different devices*

Module 1

Processes in IC fabrication: Overview of the VLSI fabrication process – Elemental semiconductors and compound semiconductors –Crystal growth: –Czochralski process – Wafer preparation – wafer cleaning – Epitaxial growth: – Chemical vapour deposition(CVD) – Molecular beam epitaxi(MBE) - Sputtering – Oxidation :– dry oxidation and wet oxidation -Lithography:- photolithography – fine line lithography – X-Ray lithography – electron beam lithography –photo mask fabrication –Etching:- wet etching and reactive plasma etching –Doping:- diffusion – mechanism - Fick's laws - impurity profiles – ion implantation and annealing – metallization: – physical vapour deposition –patterning –wire bonding and packaging

Module 2

VLSI Design: Circuit design – scaling of device structure – scaling factors - effects of miniaturization – VLSI Design cycle: –system specification – architectural design functional design – logic design – circuit design - physical design – fabrication –packaging testing and debugging new trends in design cycle – physical design cycle: - partitioning floor planning and placement – routing – compaction extraction and verification –
design styles:–full custom- standard cell - gate arrays - field programmable gate array – sea of gates-Stick diagram – Mask lay out –design rules - Design of simple logic circuits: inverter, NAND gate, NOR gate, CMOS logic system, BiCMOS Circuits – Sub system design process : design of a 4 bit shift register – Basics of Hard ware description languages : VHDL and Verilog

Module 3

VLSI process integration :Silicon Technology: Monolithic component fabrication – BJT fabrication – buried layer – impurity profile – parasitic effects – diodes – Schottky diode and transistor – FET –JFET– monolithic resistors sheet resistance and design – resistors in diffused region — Monolithic capacitor – junction capacitor– Isolation of components – junction isolation - dielectric isolation – IC crossovers - vias

Module 4

Silicon MOS Technology: MOSFET fabrication – NMOS – PMOS –Si gate technology - control of threshold voltage- Metal gate CMOS – Sillicon Gate CMOS – Twin well process – Latch up –BiCMOS technology - MOS resistance- MOS capacitor

Module 5

Compound semiconductor technology: GaAs Technology – Crystal structure – doping process – Channeling effect – MESFET –Fabrication - device modeling - Strained Si technology, Si-Ge,

References

1. VLSI Technology : S M Sze ,Tata McGraw Hill pub
2. VLSI Fabrication Principles: Sorab K Gandhi, John Wiley & sons
3. Basic VLSI Design : Douglas Pucknel, PHI
4. Integrated Circuits K R Botkar, Khanna pub
5. Algorithms for VLSI Physical design Automation : NaveedSherwani ,Springer
6. ULSI Technology :Chang, SM Sze,Tata McGraw Hill pub,
7. Principles of CMOS VLSI design :H E Weste , Pearson Edn
8. Modern VLSI Design : Wayne Wolf, Pearson Edn
9. VHDL primer, J Bhaskar

AI010 702

Computerised Process Control
(Common to EI010 702)

Teaching scheme **Credits: 4**
2 hours lecture and 2 hour tutorial per week

Objective:

- *To provide a detailed view of the implementation of SCADA in process industry.*
- *To give an insight about Instrumented Safety Systems and Programmable Logic controllers with applications using ladder programming.*
- *To teach about different digital controllers using z transforms.*
- *To impart knowledge about Distributed Control System and its architecture.*
- *To have an insight into Electrical Safety and Process Safety Management.*

Module 1

Introduction to computer control of process- need for computers in control system –block diagram of a computer control system- multi channel data acquisition system(DAS)
Supervisory Control and Data Acquisition System (SCADA) :Concepts- SCADA development from Telemetry, SCADA System Hardware, Remote Terminal Units (RTUs), Master Terminal Units, Communication philosophies, Communication Interface and Communication Protocols, Configuring Simple applications, Operator Interfacing and Applications of SCADA.

Module 2

Programmable Logic Controllers: Introduction to Instrumented Safety Systems and Safety Integrity Levels, Sequential and Combinational Control, Microprocessor Based Programmable Logic Controllers - Architecture, I/O Modules, Isolators, PLC Programming Languages, PLC ladder programming : Programming On-Off inputs to produce on – off outputs, Concept of Redundancy and Triple Modular Redundant PLCs, PLC Installation and Testing.

Module 3

Digital controllers: Design of Control algorithms using Z transforms – Dead beat algorithm – Dahlin's method –Ringing – Kalman's approach – Digital PID algorithms – Position and velocity form . Modified Z transforms to system with dead time –Smith predictor algorithm. Internal model control using Z transform.

Module 4

DCS Basic Packages: Introduction to Centralized & De-centralized Control, Direct Digital Control and Distributed Process Control, DCS Architecture, Local Control Units, DCS Configuration with associated accessories, I/O Hardware, Multiplexers, A/D and D/A Converters, Set Point Stations, DCS Flow sheet Symbols. Redundancy Concepts, Data Highways,Field Buses, CRT Displays, Man Machine Interface, Operator Stations, Engineer' Stations, System Integration with PLC, SCADA and Computers, OPC Connectivity.

Module 5

Electrical safety: NEMA standards, grounding and shielding – standards , power grounding, concept of shielding, electro static instrument shielding . Process safety management: elements of process safety management- process safety information – process hazard analysis .

Reference Books

1. Stuart A.Boyer "Supervisory **Control and Data Acquisition**
2. Jeff Weigunt. "Creating HMI/ SCADA Industrial Applications using Microsoft Access", ISA.
3. RJ.Willam, "Hand book of SCADA System for the Oil and Gas Industry", Mold Clwyd.
4. Considine, Applications of Computers in Process Control
5. Krishnakanth, Computerised Based Industrial Controls
6. B.G Liptak - Handbook of Process Control - 1996
7. Jon Stenerson "Fundamentals of Programmable Logic Controllers, Sensors and Communications", Prentice Hall of India.
8. John webb: Programmable logic controllers, PHI
9. Deshpande, P.B. and Ash R.H., Elements of Computer Process Control, Instruments Society of America, 1981
10. C.L.Smith, Digital Computer Process Control, Intext Educational Publications 1972
11. M.P.Lukas, Distributed Control System, Van Nostrand Rainhold Compony 1986.
12. Frank D Petruzella, Programmable Logic Controllers (Mc Graw Hill)
13. Dobrivoje Popovic and Vijay P. Bhatkar - Distributed Computer Control for Industrial Automation - Marcel Dekker, INC, 1990.
14. LIPTAK, Instrument engineers hand book: Process software and digital networks , third edition.
15. LIPTAK, Instrument engineers hand book: Process measurement and analysis, fourth edition.

AI 010703

Biomedical Instrumentation

(Common to EI010 703 and IC010 703)

Teaching scheme **Credits:** 3
2 hours lecture and 1 hour tutorial per week

Objectives:

- *To help students learn the basics of instrumentation related to biomedical systems.*
- *To help students get overall knowledge of the medical equipments for diagnosis and therapy.*
- *To help students understand the relative electrical safety measures and standards.*
- *To help students know general concepts of imaging system.*

Module 1

Introduction to BMI: general perspective including objectives– an overview of safety requirements, biometrics, biomedical instruments, parameters, man-machine interface and components.
Bioelectric potentials: human cell- action potential, generation and propagation of bio electric action potential, resting potential- relative refractory period, absolute refractory period.
Electrodes: electrode theory- types of electrodes- biopotential electrodes- polarizable and nonpolarizable electrodes- equivalent circuit of electrode-skin interface.
Transducers: transducers for biological applications: pressure, flow, pulse, respiration; chemical sensor- implantable transducer.

Module 2

Cardio vascular system: electrical activity of heart- ECG- typical ECG and characteristics- ECG as a diagnostic tool- monitoring scheme- lead system- introduction to ECG machine.
Phonocardiography- principle and clinical applications.
Biopotential Recording- noise, motion artifacts and other considerations.

Module 3

Nervous system: EEG- typical EEG and characteristics- significance- lead system, clinical applications, evoked potentials, introduction to EEG machine.
Respiratory system: respiratory measurements - lung volume and capacities- spirometer

Module 4

Electrical safety– physiological effects of electricity, micro and macro shock hazards, electrical safety codes and standards- patient safety considerations in power distribution and equipment design.

Therapeutic Equipment: pacemaker, defibrillator, dialysis machine, ventilators.
Operation theatre equipment: surgical diathermy equipment- diathermic equipment using microwaves, short waves and ultra sound.

Module 5

Medical Imaging: computed tomography- basic principle- data accumulation scanning motions– X ray tubes- collimators- detectors- image reconstruction algorithms- display.
Nuclear Magnetic Resonance: nuclear structure and angular momentum- magnetic dipole moment- resonance- RF magnetic field- Larmor frequency- free induction decay- an overview of NMR instrumentation and imaging system.

Text Books

1. Leslie Cromwell, Fred J. Weibell and Erich A Pferffer - Biomedical Instrumentation and Measurements - Prentice Hall of India, 1990
2. R.S Khandpur - Handbook of Biomedical Instrumentation - Tata Mc Graw – Hill

References

1. John G. Webster - Medical Instrumentation - Application and Design - Houghton mifflin company, Boston
2. John C. Cobbold - Tranducers for Biomedical measurements - John wiley & Sons
3. Jacob Kline- Hand book of Biomedical Engineering - Academic Press INC

AI 010 704

Analytical Instrumentation

(Common to EI010 704 and IC010 704)

Teaching scheme **Credits:** 3

2 hours lecture and 1 hour tutorial per week

Objectives

- *To impart a basic knowledge about analytical instruments, its concepts, and its technique.*
- *To give a vast knowledge about different types of spectroscopic analysis.*
- *To study about different types of chromatographic analysis.*

Module 1

Introduction to Analytical Instrumentation: Fundamentals of analytical instruments: Elements of an analytical instrument – PC based analytical instruments –Classification of instrumental techniques . Electro magnetic radiation- Electromagnetic spectrum- Laws relating to absorption of radiation. Absorption spectroscopy: Absorption instruments – Radiation sources- Optical filters- Monochromators- Detectors.

Ultra violet and visible absorption spectroscopy- Colorimeters/ photometers: Single beam and double beam filter photometer – Spectro photometers: Single beam and double beam spectro photo meters- Infra red spectroscopy: Basic components- Radiation sources- Monochromators- Detectors.

Module 2

Flame Photometry: Principle and constructional details of flame photometer- Emission system – Optical system – Detectors . Atomic absorption spectrophotometers: Theoretical concepts, Instrumentation: Radiation sources - Burners and flames - Plasma excitation sources - Optical and electronic system .

Fluorescence spectroscopy: Principle of fluorescence – Measurement of fluorescence – Single beam and double beam filter fluorimeter- Ratio fluorimeter. Spectro fluorimeters.

Raman spectrometer- Basic theory-Photo acoustic spectroscopy- Photo thermal spectroscopy .

Module 3

Mass spectrometer: Principle of operation- Magnetic deflection mass spectrometers- Components of a mass spectrometer – Inductively coupled plasma mass spectrometer.

Nuclear Magnetic Resonance spectroscopy: Basic principle – Constructional details of NMR spectrometer – Nuclear radiation detectors .

Electron Spin Resonance spectrometer: Basic ESR spectrometer – Electron spectroscopy: Instrumentation for electron spectroscopy.. X- Ray spectrometers: X – ray spectrum – Instrumentation for x –ray spectrometry. X-ray diffractometers- X-ray absorption meters- X- ray fluorescence spectrometry.

Module 4

Industrial Gas analyzers- pH meters- Conductivity meters - Dissolved oxygen meters- Sodium analyser – Gas analysers- Paramagnetic oxygen analyser – CO analysers – Flue gas analysers- Blood PH measurement – Thin film technology for gas sensors- Basic concepts. Measurement techniques and application of gas sensors. Thermal Sensors:- Radiation Sensors, Mechanical Sensors and Bio-Chemical Sensors.

Module 5

Chromatography: Chromatographic process – Classification- Terms in chromatography- Gas chromatography: Block diagram- Principle - Constructional details – Column details- GC detectors.
Liquid Chromatography: Types of liquid chromatography- High pressure Liquid Chromatography (HPLC): Principle- Constructional details.

Textbooks:

1. Instrumental Methods of Analysis, Willard, Merritt, Dean, Settle, CBS Publishers & Distributors, New Delhi, Seventh edition.
2. Handbook of Analytical Instruments, R. S. Khandpur, Tata McGraw–Hill Publications, 3rd edition
3. Principles of Instrumental Analysis, Skoog, Holler, Nieman, Thomson books-cole publications, 5th edition.

Reference books:

1. Instrumental Methods of Chemical Analysis, Galen W. Ewing, McGraw-Hill Book Company, Fifth edition.
2. Introduction to Instrumental Analysis, Robert D. Braun, McGraw-Hill Book Company

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AI010 705

Industrial Instrumentation II

(Common to EI010 705 and IC010 705)

Teaching scheme **Credits: 3**

2 hours lecture and 1 hour tutorial per week

Objectives

- *To provide exposure to various measuring techniques for flow, level, ph, humidity, viscosity, moisture , dimension, sound and thermal conductivity.*
- *At the end of the course the student will have an in depth knowledge in units, different techniques, and significance of measuring devices.*

Module 1

Measurement of flow: Flow characteristics- Flow measuring techniques - Classification of flow meters- Variable head flow meters for incompressible fluids- : Venturi tubes- Square root relationship - Flow nozzle- Orifice plates - Dall tube – Wiers and flumes - Pitot tube. Variable meters for compressible fluids. Installation of flow meters. Quantity flow meters: Positive displacement flow meters- Nutating disc, Rotary vane, Reciprocating piston, Oval gear, Helix type. Mass flow meters: Angular momentum type, Impeller turbine, Twin turbine, Coriollis , Thermal , Radiation type mass flow meters.

Module 2

Inferential type : Variable area flow meters (Rotameters) – Turbine flow meters - Target flow meters- Electrical type flow meters- Electro magnetic type- Comparison of DC and AC excitations- Ultrasonic flow meters - Laser Doppler Anemometer (LDA) - Hot wire anemometer - Other flow meters: Purge flow regulators- Flow meters for solid flow – Vortex flow meters – Calibration of flow meters. Dynamic weighing method – Master meter method- Bell prover system . Factors to be considered for flow meter selection.

Module 3

Level measurement :- Methods of liquid level measurement –Classification of liquid level detectors – Direct method- Hook type, Sight glass technique– Float type level indication — Float level switches - Rope method- Level measurement using displacer and torque tube – Indirect methods : Hydrostatic pressure type- Pressure gauge method- Air bellows- Air purge system. Boiler drum level measurement – Thermal level sensors – Differential pressure method – Electrical types of level gauges using Resistance, Capacitance, Nuclear radiation and Ultrasonic sensors – Laser level sensors- Microwave level switches – Fibre optic level detectors- Calibration of level detectors.

Module 4

Measurement of pH, Viscosity, Humidity and Moisture : - Need for pH measurement - pH electrodes- Viscosity terms – Capillary viscometer- Say bolt viscometer – Rotameter type viscometer- red wood type viscometer. – Humidity terms – Dry and wet bulb psychrometers – Hot wire electrode type hygrometer – Dew cell – Electrolysis type hygrometer – Commercial type dew point meter –Different methods of moisture measurement –Application of moisture measurement.

Smart sensors: block diagram- Smart transmitter. Recent trends in sensor technology – Semiconductor sensors–Film sensors – MEMS - Nanosensors.

Module 5

Measurement of Dimension, Sound and Thermal conductivity : Thickness measurement- Contact type thickness gauge- Inductive methods , Capacitive methods . Non contact type - Radiation type- Laser based thickness gauges- Measurement of coating thickness- Laser based length measurement- Width measurement – Diameter measurement. Measurement of sound using microphones, Measurement of thermal conductivity of solids, liquids and gases.

TEXT BOOKS

1. D. Patranabis, Principles of Industrial Instrumentation Tata McGraw Hill Publishing Co., New Delhi, 1999
2. R.K.Jain, Mechanical and Industrial Measurements, Khanna Publishers, New Delhi 1999.
3. A.K.Sawhney, A course in Mechanical Measurements and Instrumentation – DhanpatRai and Sons, New Delhi, 1999.

REFERENCES

1. Ernest O. Doebelin, Measurement systems application and design international student Edition, Tata McGraw Hill Publishing Co., New Delhi, 1999.
2. Eckman D.P.Industrial Instrumentation – Wiley Eastern Limited, 1990.
3. Liptak B.G. Instrument Engineers Handbook (Measurement), Chilton Book Co., 1994.
4. Padmanabhan T R, Industrial Instrumentation Principles and Design, Springer International

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AI010 706L01

Robotics

Teaching scheme **Credits:** 4

2 hours lecture and 2 hours tutorial per week

Objectives:

- *To familiarize the students with the fundamental concepts of robotics and automation.*
- *To introduce basic elements and subsystems of robots.*
- *To generate an awareness of various applications of robots.*

Module1

Robot Organization

Introduction to robotics: Evolution of robots, laws of robotics, progressive advancements in robots, robot anatomy. Links, joints, degrees of freedom, arm configuration, wrist configuration, end effectors, manipulation and control. Coordinate frames: description of objects in space, transformation of vectors, inverting a homogeneous transform, fundamental rotation matrices, Euler angle representations.
Forward kinematics: mechanical structure and notations, description of links and joints, kinematic modeling of the manipulator, Denavit-Hartenberg notation, kinematic relationship between adjacent links manipulator transformation matrix
Inverse kinematics: Manipulator workspace, solvability of inverse kinematic model.

Module 2

Robot hardware

Robot sensors: proximity sensors ,range sensors, tactile sensors, , position sensors, velocity sensors Visual Sensors and auditory sensors.Robot Manipulators introduction: wrists, robot gripper, manipulator control
Dynamic modeling (proofs not required): Lagrangian mechanics, two degree freedom manipulator, Lagrange Euler formulation, velocity of a point on the manipulator.

Module 3

Introduction to robot control

Control of manipulators: linear control schemes, partitioned PD control scheme,PID control scheme, computed torque control,force control of robotic manipulators,hybrid position force control,impedance force torque control,adaptive control.

Module 4

Robot and Artificial Intelligence

Principles of all basics of Learning, planning movement,basics of knowledge representation, robot programming languages,trajectory planning (only a brief introduction required) and remote manipulation.

Module 5

Robotic Vision Systems

Principles of edge detection, determination of optical flow and shape, image segmentation, pattern recognition, model director sense analysis.

Textbooks

1. R K Mittal , I J Nagrath, Robotics and control,Tata McGraw Hill
2. M.P .Groover,Mitchell Weiss, Roger N.Nagel, Nicholas G Odrey, Industrial Robotics, Tata McGraw Hill.
3. Lee, Gonzalez aqnd Fu "Robotics (11 Ed)", IEEE Press, 1986

References

1. Hall and Hall" Robotics – A User Friendly Introduction", Saunders Publishing Company, 1985
2. Vokobravotic "Introduction to Robotics", Springer 1988
3. Charniakand, Mcdermott, "Roboty Technology ande Applications", Springer 1985
4. Charniac & Mcdermott, "Introduction to Artificial Intelligence", Mc Graw Hill, 1986
5. P Janaki Raman, "Robotics", Tata Mcgraw Hill

AI010 706L02

Real Time Systems

Teaching scheme **Credits:4**

2 hours lecture and 2 hours tutorial per week

Objectives

- *Introduce the concept and principles of real time systems design.*
- *Introduce the working principles of hard real systems.*
- *Also covers topics on reliability of real time systems.*

Module 1

Introduction to Real Time Systems: structure of real time systems, real time computer, task classes – periodic, aperiodic, critical, noncritical, definition of real time systems – real time systems, embedded systems - hard real time systems, soft real time systems, real time design issues; real time kernel: polled loop systems, co-routines, interrupt driven systems, round robin systems, task control block model.

Module 2

Characterizing real time systems: performance measures for real time systems, performability, cost functions and hard dead lines; Estimating program run times. Task assignment and scheduling: uni-processor scheduling: rate monotonic algorithm, EDF algorithm, multiprocessor scheduling: utilization balancing algorithm, next-fit, bin-packing assignment algorithm for EDF.

Module 3

Communication: communication media, message sending topologies, network architecture issues, contention based and token based protocols, stop and go,multihop, polled bus, hierarchal, round robin, fault tolerant routing. Clocks and synchronization: fault tolerant synchronization in hardware, synchronization in software.

Module 4

Fault tolerance – definition, cause of failure, fault types, fault detection and containment, redundancy – hardware, software, time, information, integrated failure handling – reliability – parameter values – series – parallel systems, NMR clusters, combinational model, master chain model, fault latency, transient faults,software error models.

Module 5

Programming Languages – Desired language characteristics, Real time databases characteristics, main memory databases, Transaction, Disk schedule algorithms, Databases for hard real time systems, maintaining serialization constituency.

Text Book

1. C.M Krishna, Kang G. Shini ,Real Time Systems, McGraw Hill
2. Philip Laplante,Real Time Systems, Design & Analysis ,PHI

Reference

1. Krishna, Real Time Systems, Tata McGraw Hill

AI010 706L03

Optimization Techniques

(Common to EC010 706L01, EI010 706L01)

Teaching Schemes **Credits: 4**

2 hours lecture and 1 hour tutorial per week.

Objectives:

Understand the need and origin of the optimization methods. Get a broad picture of the various applications of optimization methods used in engineering. Define an optimization problem and its various components.

Module I (12 hrs)

One Dimensional Unconstrained Minimization techniques, single variable minimization, unimodality, bracketing the minimum, necessary and sufficient conditions for optimality, convexity, steepest descent method.

Module II (12hrs)

Linear programming, introduction, linear programming problem, linear programming problems involving LE (≤) constraints, simplex method, optimality conditions, artificial starting solutions, the M method.

Module III (12hrs)

Transportation models, definition, non traditional models, transportation algorithm, East West corner method, Vogel approximation method. Assignment model, Introduction, Hungarian method.

Module IV (12hrs)

Forecasting Models, moving average technique, regression method, exponential smoothing. Game Theory, two persons zero sum games, mixed strategy games- graphical method.

Module V (12hrs)

Queuing models, elements of queuing model, pure birth and death model, specialized Poisson queues, single server models. Multiple server models, self service model.

References:

1. Ashok D Belegundu, Tirupathi R Chandrupatla, "Optimization concepts and Application in Engineering", Pearson Education.
2. Kalynamoy Deb, "Optimization for Engineering Design, Alogorithms and Examples", Prentice Hall,
3. Hamdy A Taha, "Operations Research – An introduction", Pearson Education,
4. Hillier / Lieberman, "Introduction to Operations Research", Tata McGraw Hill Publishing company Ltd,
5. Singiresu S Rao, "Engineering optimization Theory and Practice", New Age International,

6. Mik Misniewski, "Quantitative Methods for Decision makers", MacMillian Press Ltd.,

AI010 706L04

Fuzzy Logic

Teaching scheme **Credits: 4**

2 hours lecture and 2 hours tutorial per week

Objectives:

- *To teach about the concept of fuzziness involved in various systems.*
- *To provide adequate knowledge about fuzzy set theory. .*
- *To provide adequate knowledge of application of fuzzy logic control to real time systems.*

Module 1

Introduction to Fuzzy sets and systems. Basics of fuzzy sets membership function, support of a fuzzy set, height - normalized fuzzy set, α - cuts (decomposition of a fuzzy set), set theoretic definitions on fuzzy sets, complement, intersection and union equality, subset hood - basic definition based on membership functions. The law of the excluded middle and law of contradiction on fuzzy sets. Properties of fuzzy sets operations (logical proof only). Extension of fuzzy sets concepts - type-2 and level 2 fuzzy sets - examples.

Module 2

Operations on fuzzy sets - intersection, algebraic sum - product, bounded sum - product, drastic sum product, t-norms and t-conorms(s - norms) on fuzzy sets, typical parameterized t - norms and s-norms (with simplified proof). Extension principle and its applications.

Module 3

Fuzzy relation. Resolution form of a binary fuzzy relation. Operations on fuzzy relations - projection, max-min. and min and max, compositions cylindrical extension. Similarity relations - reflexivity, symmetry, transitivity.

Module 4

Further operations on fuzzy sets and proposed by Zadeh - concentration dilation, contrast Intensification, a linguistic hedges, computation of the meaning of values of a linguistic variable, fuzzy algorithms, fuzzy engineering - applications of fuzzy controls, case studies. Fuzzy pattern recognition-feature analysis, partitions, identification, multifeature recognition.

Module 5

Logical operations on fuzzy sets – Negation – Conjunction, disjunction, implication, fuzzy inference. Block diagram of a fuzzy logic system. Fuzzy rule base – simplification of compound rule base – fuzzy inference – max. –min, man product, man drastic product, man bounded product. Defuzzification – Centre of gravity, center of sums, weighted average etc (Defuzzification methods) Simple controllers, General controllers, Stability, Models, Inverted pendulam, Aircraft landing control, Aircondioner control.

References

1. C.T Lin & C S George Lee. Neural Fuzzy Systems, Prentice Hall.
2. Earl Cox. Fuzzy Systems Handbook, Associated Press
3. Klir and Yuan, Fuzzy Sets and Fuzzy Logic: Theory and Applications, Prentice Hall of India.
4. IEEE Trans on Systems, Man & Cybernetics, vol. SMC - 3, No.1, January 1973, pp 28-44
5. Bart Kosko. Fuzzy Engineering, Prentice Hall.
6. Ahamad M. Ibrahim : *Introduction to Applied Fuzzy Electronics*, PHI. (Module 3)
7. S. Rajasekharan, G A Vijayalakshmi Pai : *Neural Networks, Fuzzy logic and Genetic Algorithms,* PHI.
8. Timothy J. Ross, Fuzzy Logic with Engineering Applications, 2/e, McGraw Hill.

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AI010 706L05

Digital Image Processing

(Common to EI010 706L03)

Teaching scheme **Credits:** 4

2 hours lecture and 2 hour tutorial per week

Objectives:

- *To study the fundamentals of image processing*
- *To study various transforms*
- *To get an exposure to image enhancement and restoration*
- *To learn the details of coding techniques*
- *To understand the concept of segmentation*

Module 1

Digital image fundamentals: Two dimensional systems and mathematical preliminaries-Elements of digital image processing system- Structure of the human eye - Image formation and contrast sensitivity – Gray scale and Colour Images-Sampling and Quantization -Image processing applications

Module 2

Image Transforms: Introduction to Fourier transform - Discrete Fourier transform - Properties of two dimensional FT – Separability, Translation, Periodicity, Rotation, Average Value – DFT,FFT,DCT, DST, Walsh, Hadamard, KL transforms and their properties.

Module 3

Image Enhancement: Point Operations - Spatial domain methods - Frequency domain methods -
Histogram Equalization technique - Neighbourhood averaging Median filtering - Low pass filtering
Averaging of multiple Images - Image sharpening by differentiation - High pass filtering.
Image Restoration: Degradation model for continuous functions - Discrete formulation - Diagonalization of circulant and Block-circulant matrices - Effects of Diagonalization - Unconstrained and constrained Restorations - Inverse Filtering - Wiener Filter - Constrained least - square Restoration.

Module 4

Image Compression: Coding and Inter-pixel redundancies - Fidelity criteria - Image Compressions

Models - Elements of Information theory - Variable length coding - Bit plane coding - Lossless
Predictive coding - Lossy predictive coding - Transform coding techniques.

Module 5

Image Segmentation and Representation: The detection of discontinuities - Point, Line and Edge
detections - Gradient operators - combined detection - Thresholding - Representation schemes: chain codes - Polygon approximation - Boundary descriptors: Simple descriptors - Shape numbers Fourier descriptor's - Introduction to recognition and Interpretation.

Text books:

1. Rafael C Gonzalez and Richard E.woods, —Digital Image Processing□,3/e,Addition – Wesley.
2. Anil K Jain, —Fundamentals of Digital Image Processing□, PHI, New Delhi, 1995
3. S Jayaraman,S Esakkirajan,T Veerakumar,□Digital Image Processing□,TMH,2009

References:

1. Kenneth R Castleman, —Digital Image Processing□, PHI, 1995.
2. William K Pratt, —Digital Image Processing□, Wiley India 2/e.
3. Sid Ahmed M A, —Image Processing Theory, Algorithm and Architectures□, McGraw-Hill, 1995.
4. Rafael C Gonzalez and Richard E.woods, —Digital Image Processing Using MATLAB□, Addition - Wesley, 2004.
5. R.M. Haralick, and L.G. Shapiro, Computer and Robot Vision, Vol-1, Addison

AI010 706L06

Advanced Microcontrollers

Teaching Scheme **Credits: 4**

3 Hours lecture and 1 Hour tutorial per week

Aim: To impart the knowledge on advanced microcontrollers.

Objectives:

- *To get introduced with the the ATMEL family architecture.*
- *To study about the TIMERS, ADC and PWM features.*
- *To get introduced with the COP8 family.*
- *To study about the various fetaures of COP8 family.*
- *To study about the features of PIC16 Microcontroller.*

Module 1

Low pin count controllers – Atmel AVR family – ATTiny15L controller - architecture – pin descriptions – features – addressing modes – I/O space – reset and interrupt handling – reset sources - Tunable internal oscillator.

Module 2

Timers – Watch dog timer – EEPROM – preventing data corruption – Analog comparator – A/D converter – conversion timing – ADC noise reduction – PortB – alternate functions – memory programming – fuse bits – high voltage serial programming – algorithm.

Module 3

National semiconductor COP8 family - COP8CBR9 processor – features – electrical characteristics – pin descriptions – memory organization –EEPROM - security – brownout reset – in system programming – boot ROM. Idle timer – Timer1, Timer2, Timer3 -operating modes – PWM mode – event capture mode

Module 4

Power saving modes – Dual clock operation – Multi input wake up – USART – framing formats – baud rate generation – A/D conversion – operating modes – prescaler – Interrupts – interrupt vector table – Watch dog – service window – Micro-wire interface waveforms.

Module 5

Microchip PIC16 family – PIC16F873 processor – features – architecture – memory organization - register file map – I/O ports – PORTA - PORTB – PORTC – Data EEPROM and flash program memory – Asynchronous serial port – SPI mode – I2C mode.

AI010 707

Industrial Instrumentation Lab

Teaching scheme:
3 hours practical per week

Credits: 2

Objective:
To study the characteristics of various physical phenomenons.

Experiments:

1. Measurement of viscosity
   - Plot the characteristics- temperature versus viscosity.
2. Measurement of temperature
   - RTD – Temperature versus resistance.
3. Measurement of pH.
4. Measurement of pressure
   - Strain gauge – input versus output and sensitivity.
5. Measurement of level.
6. Measurement of flow
   - Flow in pipe line.
   - Error analysis.
7. Dynamic response of first order system .
8. Dynamic response of second order system.
9. Pressure to current converter.
   - Plot the characteristics.
10. Current to pressure converters
    - Plot the characteristics.
11. Use of LDR for measurement of physical variations.
    - Light intensity versus resistance.
12. Measurement of strain/force.
    - Resistance versus strain.
    - Error analysis.
13. Measurement of speed- Open loop and closed loop.

14. Calibration of instruments.
    - Pressure gauge.

AI010 708

DIGITAL SIGNAL PROCESSING(DSP) LAB

Teaching scheme
3 hours practical per week

Credits: 2

Objectives:

- *To familiarise with real time signal processing.*
- *To familiarize with signal procesing tools like, Matlab/Octave and TMS 320C 6713 DSP Processor.*
- *Study of charecteristics of analog and digital signals and systems.*
- *Study of practical dificulties in designing a digital system.*

List of Experiments:

1. Introduction to Matlab/Octave for signal processing.
2. Architecture of DSP chips-TMS 320C 6713 DSP Processor.
3. Generation of Test Discrete-Time Signals in the Time Domain- Impulse, step, triangular, sinusoidal, damped sinusoidal, etc.
4. Discrete-Time Systems in the Time Domain- Discrete time system as mathematical operation and analysing for linearity, impulse response, step response.
5. Discrete-Time Signals in the Frequency Domain- Analysis of various signals in frequency domain using Fourier basis using Fourier series, Foureir Transform, DFS DTFT and N-point FFT algorithm.
6. Discrete-Time Systems in the Frequency Domain- Analysis of system in frequency domain and study the frequency response and phase response of a system.
7. Digital Processing of Continuous-Time signals: Sampling Theorem and anti-aliasing filters- Study of sampling theorem by sampling an analog signal and reconstruction for various sampling rate. Design of a signal pre-processing(anti-aliasing filter) system to sample a signal from a transducer.
8. Digital Filter Structures: Realisation of FIR and IIR system and their implementation in direct, cascade, parallel, lattice and lattice-ladder forms and study the finite length effects in various realization.
9. Digital Filter Design -FIR filters using windows and effects of various windows on transition width and maximum attenuation obtained.
10. Digital Filter Design -IIR filters by pole-zero placements and approximation of analog filters like Butterworth, Chebyshev, elliptic filters and comparing their phase charecteristics, magnitude response for various orders.

References:

1. Digital Signal Processing: Laboratory Experiments Using C and the TMS320C31 DSK:Rulph Chassaing

2. DIGITALS IGNALP ROCESSING USING MATLAB by Vinay K. Lngle, John G. Proakis.
3. Digital Signal Processing Laboratory Using MATLABby Sanjit K Mitra.

AI 010 709 Seminar

Teaching scheme **credits: 2**

2 hours practical per week

The seminar power point presentation shall be fundamentals oriented and advanced topics in the appropriate branch of engineering with references of minimum seven latest international journal papers having high impact factor.

Each presentation is to be planned for duration of 25 minutes including a question answer session of five to ten minutes.

The student's internal marks for seminar will be out of 50. The marks will be awarded based on the presentation of the seminar by the students before an evaluation committee consists of a minimum of 4 faculty members. Apportioning of the marks towards various aspects of seminar (extent of literature survey, presentation skill, communication skill, etc.) may be decided by the seminar evaluation committee.

A bona fide report on seminar shall be submitted at the end of the semester. This report shall include, in addition to the presentation materials, all relevant supplementary materials along with detailed answers to all the questions asked/clarifications sought during presentation. All references must be given toward the end of the report. The seminar report should also be submitted for the viva-voce examination at the end of eighth semester.

For Seminar, the minimum for a pass shall be 50% of the total marks assigned to the seminar.

AI 010 710 Project Work

Teaching scheme **credits: 1**

1 hour practical per week

Project work, in general, means design and development of a system with clearly specified objectives. The project is intended to be a challenge to intellectual and innovative abilities and to give students the opportunity to synthesize and apply the knowledge and analytical skills learned in the different disciplines.

The project shall be a prototype; backed by analysis and simulation etc. No project can be deemed to be complete without having an assessment of the extent to which the objectives are met. This is to be done through proper test and evaluation, in the case of developmental work, or through proper reviews in the case of experimental investigations.

- The project work has to be started in the seventh semester and to be continued on to eighth semester.
- Project work is to be done by student groups. Maximum of four students only are permitted in any one group.
- Projects are expected to be proposed by the students. They may also be proposed by faculty member (Guide) or jointly by student and faculty member.
- Students are expected to finalise project themes/titles with the assistance of an identified faculty member as project guide during the first week of the seventh semester.

The progress from concept to final implementation and testing, through problem definition and the selection of alternative solutions is monitored. Students build self confidence, demonstrate independence, and develop professionalism by successfully completing the project.

Each student shall maintain a project work book. At the beginning of the project, students are required to submit a project plan in the project book. The plan should not exceed 600 words but should cover the following matters.

- Relevance of the project proposed
- Literature survey
- Objectives
- Statement of how the objectives are to be tackled

- Time schedule
- Cost estimate

These proposals are to be screened by the evaluation committee (EC- minimum of 3 faculty members including the guide) constituted by the head of department, which will include a Chairman and the EC will evaluates the suitability and feasibility of the project proposal. The EC can accept, accept with modification, request a resubmission, or reject a project proposal.

Every activity done as part of project work is to be recorded in the project book, as and when it is done. Project guide shall go through these records periodically, and give suggestions/comments in writing in the same book.

The students have to submit an interim report, along with project work book showing details of the work carried out by him/her and a power point presentation at the end of the 7th semester to EC. The EC can accept, accept with modification, request a resubmission, or extension of the project.

The student's internal marks for project will be out of 50, in which 30 marks will be based on day to day performance assessed by the guide. Balance 20 marks will be awarded based on the presentation of the project by the students before an evaluation committee consists of a minimum of 3 faculty members including the guide.

For Project, the minimum for a pass shall be 50% of the total marks assigned to the Project work.

AI 010 801

Instrumentation System Design

(common to EI010 801 and IC 010 801)

Teaching scheme **Credits:** 4

3 hours lecture and 2 hours tutorial per week

Objective

To help the students get basic understanding of the following:

- *Design of instrumentation systems for various applications.*
- *Design of electronic and pneumatic controllers.*
- *Piping and instrumentation diagrams.*
- *Procedures for the preparation of an instrumentation project.*
- *Noise and noise reduction techniques in measurement.*

Module 1

Sensing element : Elastic sensing elements - Cantilever and torque elements, Pillar load cell, Strain gauge accelerometer- Inductive push pull displacement sensor -Capacitive level sensor .

Signal conditioning element :Design of resistive and reactive bridges for sensors. Design of the bridge Circuit for RTD- Design of reference junction compensation for thermocouple.- Linearising techniques for thermocouple and thermistor- Design of charge amplifier-Instrumentation amplifier. A.C. carrier systems.- Lock in amplifier.

Module 2

Current transmitters-Concept of 2 and 4 wire transmitters with 4-20mA output- Open loop and closed loop current transmitters. Smart transmitters- Future trends in intelligent devices- Design of pneumatic and electronic PID controllers-Design of ON-OFF controllers with neutral zone -Design of instrumentation servo mechanism- Design of annunciators - Low level and high level annunciators.- Enunciators

Module 3

Orifice meter- Design of orifice for a given flow condition for compressible and incompressible fluids -Design of rotameter- Design of venturi meter- Bourdon gauges-Factors affecting sensitivity- Design of bourdon tubes- Design of square root extractors for variable head flow meters.

Module 4

Piping and instrumentation diagrams – ISA symbols – Process and instrumentation (PI)diagram of typical process plant – Preparation of instrumentation project – Documents to be produced- Process flow sheet – mechanical flow sheets- Instrument index sheet – Instrument specification sheet – Process information required- process information – Bid documents – project procedures – Project schedule – Vendor drawings – Work coordination – Project manager – process engineer – Equipment engineer – Job execution – planning hints- scheduling- Project checklist – equipment delivery - Conclusion Instrument specification sheet for pressure – Choice of temperature – flow – level – analytical instruments and control panels.

Module 5

Signals and noise in instrument systems – Statistical representation – pdf – psd – Auto correlation function – Effects of noise and interference – Series and common mode – Noise sources and coupling mechanisms – Multiple earths – Methods of reduction of noise – Shielding – Screening – Filtering – Modulation – Averaging – Auto correlation .

Text Books

1. John P. Bentley : Principles of measurement systems, Longman 1983
2. Johnson C.D: Process control instrumentation technology, 4/e, PHI, 1995
3. D.Patranabis : Principles of Industrial Instrumentation, Tata McGraw Hill Publishing Ltd. New Delhi, 1999
4. Sheingold D. H.: Transducer interfacing hand book – a guide to analog signal conditioning, analog devices Inc masschusetts, 1980.
5. Anderson N A : Instrumentation for process measurement and control :Chilton book company 1980.
6. Andrew w: Applied Instrumentation in process Industries; Vol. II. Gulf publications, 1990.
7. Doebelin.E.O. Measurement systems applications and design, McGraw Hill, 1975.
8. Tattamangalam R. Padmanabhan : Industrial Instrumentation Principles and Design, Springer International
9. E. Radhakrishnan : Instrumentation, measurements and Experiments in Fluids, Boca Raton, FL : CRC Press

AI 010 802

Instrumentation in Process Industries

(common to EI010 802)

Teaching scheme **Credits:** 4

2 hours lecture and 2 hours tutorial per week

Objectives:

- *To give a basic knowledge about unit operations.*
- *To provide exposure to the process and instrumentation applications in different industries.*

MODULE 1

Basic concepts and principles of commonly used unit operations – Reactors – batch reactors – distillation towers – refrigeration units – steam boilers – furnaces – dryers – crystallizers – centrifuges – heat exchangers – pumps – compressors – evaporators – extruders.

MODULE 2

Instrumentaion in the Food industry : Description of the process – Measurment hardware in the food industries – Analyzers in the food industry – Valves and feeders in the food industry – Controllers and displays in the food industry – Computer applications in the food industry – Typical control systems in the food industry

MODULE 3

Instrumentation in the iron and steel industry: Description of the process – Measurment hardware – analyzers – valves - Controllers and displays in the iron and steel industry – Computer applications in the iron and steel industry – Typical control systems in the iron and steel industry

MODULE 4

Instrumentaion in the Paper industry : Description of the process – Measurment hardware in the Paper industry – Analyzers in the Paper industry – Valves and feeders in the Paper industry – Controllers and displays in the Paper industry – Computer applications in the Paper industry – Typical control systems in the Paper industry.

Instrumentation in the Nuclear industy: Description of the process- Measurement hardware in the nuclear industry – Analysers in the nuclear industry – Valves and control rodes in the nuclear industry – Control panels and displays – Computer applications – Typical control system.

MODULE 5

Instrumentaion in the pharmaceutical industry : Description of the process – Measurment hardware in the pharmaceutical industry – Analyzers in the pharmaceutical industry – Valves and feeders in the pharmaceutical industry – Controllers and displays in the pharmaceutical industry – Computer applications in the pharmaceutical industry – Typical control systems in the pharmaceutical industry.

Text Book:

1. Instrumentation in the Processing Industries , Bela G Liptak (ed.), Chilton Book Company

Reference Books:

1. Unit operation in chemical Engg. McCabe Smith 4/e Mcgrans Hill
2. Outline Chemical Technology M Gopal Rao &M Sitting 3/E East West 1973
3. Chemical Engineering Hand book Peiry,McGrans Hill
4. Chemical reaction Engineering O leven spielJ.Wiley & sons

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AI010 803

Computer Networks

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives:

- *To develop basic knowledge on the mode of operation of different types of computer networks that are used to interconnect a distributed community of computers and various interfacing standards and protocols.*

Module I

Network requirements, Network Architecture –layering and protocol, OSI Architecture, Internet Architecture, Performance-bandwidth and latency , Delay x bandwidth product, high speed networks .

Module 2

Direct Link Network, Hardware Building Block, Framing-Byte Oriented Protocol, Bit Oriented Protocol , Clock Based Framing, Reliable Transmission-Stop and Wait, Sliding Window, Ethernet(802.3)-Physical properties, Access protocol, Wireless-Bluetooth, WiFi, Wimax

Module 3

Packet Switching-Switching and Forwarding- Datagram, virtual circuit switching, Source routing Bridges and LAN Switches-Learning Bridges, Spanning tree Algorithms ,Broadcast and Multicast, Limitations of bridges, Simple Internetworking-Service Model, Global Address, Datagram Forwarding in IP, address translation, Routing-network as graph, distance vector, link state, matrix

Module 4

End to End Protocol, Simple de-multiplexer, Reliable Byte stream, TCP-Issues, segment format, connection establishment and termination sliding window revisited, triggering transmission, adaptive retransmission, RPC-fundamentals ,TCP Congestion control – additive increase, slow start, fast retransmit and fast recovery, congestion avoidance mechanism, DEC bit, Random Early Detection bit, Source Based Congestion avoidance

Module 5

Applications -WWW, E-mail, Name Service, Network Management, Web Services Custom Application protocol, Generic Application Protocol ,Overlay Networks-Peer to Peer Networks.

Reference Books

1. Computer Networks A Systems Approach-Larry L.Peterson and Bruce S.Davie,4th Edition .Morgan Kaufman
2. Introduction to data communication and networking Behrouz Forozan TMH.

B.Tech Applied Electronics and Instrumentation Engg.

3. Computer networks ,Andrew S Tanenbaum ,PHI
4. Data communication, computer networks and open systems, Halsall F ,Addison Wesley.

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AI010 804L01

NEURAL NETWORKS

Teaching scheme **Credits:** 4
2 hours lecture and 2 hours tutorial per week

Objectives:

- to present an overview of the theory and applications of artificial neural networks to engineering applications.
- to create an understanding of various neural network system models and the applications of these models to solve engineering problems

Module 1
Fundamentals of Neural Networks – Human Brain – Model of an artificial neuron - activation functions – Typical architectures – Training and learning methods – Perceptron - Linear separability – XOR problem- Perceptron convergence theorem - Adaline and Madaline Network – Applications of ANNs.

Module 2
Back Propagation – The Single layer ANNs – Multi layered feed forward ANNs – Back propagation network architecture and algorithm – Method of steepest descent – local and global minima - Effect of learning rate – Adding a momentum term - Applications.

Module 3
Associative Memory – Auto associative memory – Storage capacity- Hetero associative memory – Kosko's discrete BAM — Recurrent networks – Discrete Hopfield network stability - Adaptive resonance theory – Vector quantization – ART1 and ART2 architecture.

Module 4
Competitive Networks – Kohonen's self organizing maps – architecture and algorithm – LVQ – architecture and algorithm - Counter Propagation networks: - Full CPN – Forward only CPN.

Module 5
Simulated Annealing - Boltzmann's Machine - Applications to traveling salesman problem.
Simulating ANN using Matlab/Labview – Simple neuron model using hardware, Neural network hardware and VLSI implementation.

Text Books

1. *Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis and Applications* - S. Rajasekaran, G. A. Vijayalakshmi Pai, PHI Learning Pvt. Ltd.
2. *Fundamentals of Neural Networks: Architectures, Algorithms and Applications* - Laurene Fausett, Pearson Education Inc.

3. *Neural Networks: A Classroom Approach* – Satish Kumar, TMH Education Pvt. Ltd.

References

1. *Neural Networks: A Comprehensive Foundation* - Simon Haykins, Prentice Hall
2. *Introduction to Artificial Neural Systems* - J.M. Zurada, Jaico Publishing House.
3. *Artificial Neural Networks* - Robert J. Schalkoff, McGraw Hill
4. *Artificial Neural Networks* - B.Yegnanarayana, Prentice Hall India
5. *Neural Computing: Theory & Practice* - Philip D. Wasserman.

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AI010 804 L02

Advanced Digital Signal Processing

Teaching scheme **Credits:** 4

2 hours lecture and 2 hours tutorial per week

Objective :

- To give a basic foundation to some advanced topics in digital signal processing.
- The students who take this course will be well prepared for pursuing graduate level (masters level) programme in Signal Processing.

Module 1

Vector Spaces :- Complex Numbers, Definition of Vector Space, Properties of Vector Spaces, Subspaces, Sums and Direct Sums, Span and Linear Independence, Bases, Dimension

Inner-Product Spaces :- Inner Products, Norms, Orthonormal Bases, Orthogonal Projections and Minimization Problems

Linear Maps :- Definitions and Examples, Null Spaces and Ranges, The Matrix of a Linear Map, Invertibility, Eigenvalues and Eigenvectors

Module 2

Probability space: Introduction to probability, Sample space, field, σ-field, Borel set, Probability space, Definition of random variable,

Random Vector: - Definition of random vector, joint statistics, independent events and conditional probability, Conditional distributions, Expectation, variance, moments, covariance and correlation, conditional expectation, Fundamental Theorem of expectation.

Random process: - Definition of random process, IID process, statement of weak and strong law of large numbers, Convergence of random sequences- almost sure convergence, convergence in probability, convergence in the mean square sense. [Only notion of convergence is expected, no proofs related to convergence]

Stationarity: - Stationary and ergodic process

Module 3

Introduction to Multi-rate Digital Signal Processing – Sample rate reduction -decimation by integer factors- sampling rate increase – interpolation by integer factor - Design of practical sampling rate converters: Filter Specification- filter requirement for individual stages - Determining the number of stages and decimation factors - Sampling rate conversion using poly-phase filter structure – poly-phase implementation of interpolators.

Module 4

Adaptive Signal Processing – Adaptive filters – Concepts- Adaptive filter as a Noise Canceller - Other configurations of the adaptive filter - Main components of the adaptive filter – Basic Wiener filter theory – The basic LMS adaptive algorithm – Practical limitations of the basic LMS algorithm - Recursive Least Square Algorithm – Limitations - Factorization Algorithm.

Module 5

Introduction to two dimensional signal and systems - 2D impulse and its sifting property, 2D continuous fourier transform pair, 2D sampling and the 2D sampling theorem, 2D DFT Transforms and its inverse, 2D convolution theorem, Discrete Cosine Transform, Sine transform, Haar Transform, Hadamard transform, KL transform - Properties and Applications.

References

1. Sheldon Axler, Linear Algebra Done Right, Springer
2. Gilbert Strang, Linear Algebra and Its Applications, Thomson Learning.
3. Henry Stark , John W Woods, Probability and Random Processes With Application to Signal Processing, 3/e, Pearson Education India
4. Emmanuel C Ifeachor, Barrie W Jrevis, Digital Signal Processing, Pearson Education.
5. A. K. Jain, Fundamentals of digital image processing, Prentice Hall of India, 1989.
6. R. C. Gonzalez, R. E. Woods, Digital Image Processing, Pearson Education.

AI010 804 L03

Embedded Systems

Teaching Schemes **Credits: 4**

2 hours lecture and 2 hour tutorial per week.

Objectives

- *To introduce students to the embedded systems, its hardware and software.*
- *To introduce devices and buses used for embedded networking.*
- *To explain programming concepts and embedded programming in C.*
- *To explain real time operating systems.*

Module I (9hrs)

Introduction to Embedded System, Definition and Classification, Requirements of Embedded Systems, Applications of Embedded Systems in Consumer Electronics, Control System, Biomedical Systems, Handheld computers, Communication devices, Embedded Systems on a Chip (SoC).

Module II (9 hrs)

Embedded Hardware & Software Development Environment, Hardware Architecture, Embedded System Development Process, Embedded C compiler, advantages, code optimization, Programming in assembly language vs. High Level Language, C Program Elements, Macros and functions, Interfacing programs using C language.

Module III (9 hrs)

Embedded Communication System: Serial Communication, PC to PC Communication, Serial communication with the 8051 Family of Micro-controllers, I/O Devices - Device Types and Examples , synchronous and Asynchronous Communications from Serial Devices - Examples of Internal Serial-Communication Devices - UART and HDLC - Parallel Port Devices - Sophisticated interfacing features in Devices/Ports- Timer and Counting Devices - I^2C, USB, CAN and advanced I/O Serial high speed buses- ISA, PCI, PCI-X, and advanced buses. Voice-over-IP, Embedded Applications over Mobile Network.

Module IV (9 hrs)

Matrix key board interface - AT keyboard – commands – keyboard response codes - watch dog timers - DS1232 watch dog timer – real time clocks – DS1302 RTC – interfacing - measurement of frequency - phase angle - power factor – stepper motor interface - dc motor speed control – L293 motor driver - design of a position control system - Interfacing with Displays, D/A and A/D Conversions, interfacing programs using C

Module V (9 hrs)

Definitions of process, tasks and threads – Clear cut distinction between functions – ISRs and tasks by their characteristics – Operating System Services- Goals – Structures- Kernel - Process Management – Memory Management – Device Management – File System Organisation and Implementation – I/O Subsystems – Interrupt Routines Handling in RTOS, REAL TIME OPERATING SYSTEMS : Introduction to Real – Time Operating Systems: Tasks and Task States, Tasks and Data, Semaphores, and Shared Data; Message Queues, Mailboxes and Pipes, Timer Functions, Events, Memory Management, Interrupt Routines in an RTOS Environment

Reference Books

1. Rajkamal, "Embedded Systems Architecture, Programming and Design", Tata McGraw-Hill
2. Steve Heath, "Embedded Systems Design", Newnes.
3. David E.Simon, "An Embedded Software Primer", Pearson Education Asia.
4. Wayne Wolf, "Computers as Components; Principles of Embedded Computing System Design" Harcourt India, Morgan Kaufman Publishers.
5. Frank Vahid and Tony Givargis, "Embedded Systems Design – A unified Hardware /Software Introduction" , John Wiley
6. Kenneth J.Ayala, "The 8051 Microcontroller", Thomson.
7. Labrosse, "Embedding system building blocks", CMP publishers.
8. Ajay V Deshmukhi, "Micro Controllers", Tata McHraw-Hill.

AI010 804L04

Artificial Intelligence

Teaching scheme **Credits:** 4

2 hours lecture and 2 hours tutorial per week

Aim

To present the concepts of intelligent agents, searching, knowledge and reasoning, planning, learning and expert systems.

Objectives

- To study the idea of intelligent agents and search methods.
- To study about representing knowledge.
- To study the reasoning and decision making in uncertain world.
- To construct plans and methods for generating knowledge.
- To study the concepts of expert systems.

Module 1

Introduction

Introduction to AI: Intelligent agents – Perception – Natural language processing –Problem – Solving agents – Searching for solutions: Uniformed search strategies – Informed search strategies.

Module 2

Knowledge And Reasoning

Adversarial search – Optimal and imperfect decisions – Alpha, Beta pruning – Logical agents: Propositional logic – First order logic – Syntax and semantics – Using first order logic – Inference in first order logic.

Module 3

Uncertain Knowledge And Reasoning

Uncertainty – Acting under uncertainty – Basic probability notation – Axioms of probability – Baye's rule – Probabilistic reasoning – Making simple decisions.

Module 4

Planning And Learning

Planning: Planning problem – Partial order planning – Planning and acting in nondeterministic domains – Learning: Learning decision trees – Knowledge in learning –Neural networks – Reinforcement learning – Passive and active.

Module 5

Expert Systems

Definition – Features of an expert system – Organization – Characteristics – Prospector – Knowledge Representation in expert systems – Expert system tools – MYCIN – EMYCIN.

Text Books

1. Stuart Russel and Peter Norvig, 'Artificial Intelligence - A Modern Approach', Second Edition, Pearson Education, 2003 / PHI.

2. Donald A.Waterman, 'A Guide to Expert Systems', Pearson Education.

Reference Books

1. George F.Luger, 'Artificial Intelligence – Structures and Strategies for Complex Problem Solving', Fourth Edition, Pearson Education, 2002.
2. Elain Rich and Kevin Knight, 'Artificial Intelligence', Second Edition Tata McGraw Hill, 1995.
3. Janakiraman, K. Sarukesi, 'Foundations of Artificial Intelligence and Expert Systems', Macmillan Series in Computer Science.
4. W. Patterson, 'Introduction to Artificial Intelligence and Expert Systems', Prentice Hall of India, 2003.

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AI010 804L05

VHDL

Teaching scheme **Credits: 4**
2 hours lecture and 2 hours tutorial per week

Objective:

- To teach about the concept of hardware design.
- To provide adequate knowledge about different method of programming in VHDL.
- To provide knowledge about application of VHDL in digital system design

Module 1

Introduction: Hardware Abstraction- Basic Terminology- Entity Declaration- Architecture Body- Configuration Declaration- Package Declaration- Package Body- Model Analysis- Simulation- Basic Language Elements –Identifiers- Data Objects- Data Types- Operators.

Module 2

Behaviour modelling: entity declaration, architecture body, process statement, variable assignment statement, signal assignment statement, wait statement, if statement, case statement, null statement, loop statement, exit statement, next statement, assertion statement, report statement, other sequential statement, multiple process, postponed process, data flow modeling: concurrent signal assignment statement, concurrent v/s sequential signal assignment, delta delay revisited, multiple drivers, conditional signal assignment statement, selected signal assignment statement, the unaffected value block statement, concurrent assertion statement, value of a signal.-

Module 3

Dataflow Modeling: Concurrent Signal Assignment Statement- Concurrent versus Sequential Signal Assignment- Delta Delay Revisited- Multiple Drivers- Conditional Signal Assignment Statement- Selected Signal Assignment Statement- the UNAFFECTED Value- Block Statement- Concurrent Assertion Statement- Value of a Signal. Structural Modeling: Component Declaration- Component Instantiation- Resolving Signal Values - Generics and Configurations: Generics- Configurations- Configuration Specification- Configuration Declaration- Default Rules - Conversion Functions - Direct Instantiation- Incremental Binding.

Module 4

Generics, configuration specifications, configuration declaration, default rules, converstion functions, direct instantiation, incremental binding. Subprograms and Overloading: Subprograms- Subprogram Overloading- Operator Overloading- Signatures- Default Values for Parameters - Packages and Libraries: Package Declaration- Package Body-Design File- Design Libraries-Order of Analysis- Implicit Visibility- Explicit Visibility.

Module 5

Hardware modeling example: modeling entity interfaces, modeling simple elements, different styles of modeling, modeling regular structures, modeling delays, modeling conditional operations, modeling synchronous logic. State machine modeling, interacting state machines, modeling a Moore FSM, modeling a Mealy FSM, a generic priority encoder, black jack program, a clock divider, a generic binary multiplier, a pulse counter, a barrel shifter, hierarchy in design.

Text Book

1. VHDL Primer Third editions: J. Bhasker, Pearson Education Asia.

Reference

1. Introducing VHDL from simulation to synthesis: Sudhakar Yakmandhiri, Pearson Education Asia

AI010 804 L06

BioInformatics

Teaching Schemes **Credits: 4**

2 hours lecture and 2 hours tutorial per week.

Objective: To cater the needs of students who want a comprehensive study of the principle and techniques of bioinformatics..

Module 1 (12 hrs)

Nature and scope of life science, Various branches of life sciences, Organization of life at various levels, Overview of molecular biology, The cell as basic unit of life-Prokaryotic cell and Eukaryotic cell - Central Dogma: DNA-RNA-Protein, Introduction to DNA and Protein sequencing, Human Genome Project, SNP, **Bioinformatics databases**, - Nucleotide sequence databases, Primary nucleotide sequence databases-EMBL, GeneBank, DDBJ; Secondary nucleotide sequence databases Protein sequence databases- SwissProt. Protein Data Bank

Module 2 (12 hrs)

Basic concepts of sequence similarity, identity and homology, definitions of homologues, orthologues, paralogues. Scoring matrices- PAM and BLOSUM matrices, Pairwise sequence alignments: Needleman & Wuncsh, Smith & Waterman algorithms for pairwise alignments. BLAST and FASTA. Multiple sequence alignments (MSA)- CLUSTALW.

Module 3 (12 hrs)

Phylogeny: Basic concepts of phylogeny; molecular evolution; Definition and description of phylogenetic trees. Phylogenetic analysis algorithms - Maximum Parsimony, UPGMA and Neighbour-Joining. Evaluation of phylogenetic trees-reliability and significance; Boot strapping; Jackknifing

Module 4 (12 hrs)

Computational approaches for bio-sequence analysis - Mapping bio-sequences to digital signals – various approaches – indicator sequences – distance signals – use of clustering to reduce symbols in amino acid sequences - analysis of bio-sequence signals – case study of spectral analysis for exon location.

Module 5 (12 hrs)

Systems Biology: System Concept- Properties of Biological systems, Self organization, emergence, chaos in dynamical systems, linear stability, bifurcation analysis, limit cycles, attractors, stochastic and deterministic processes, continuous and discrete systems, modularity and abstraction, feedback, control analysis, Mathematical modeling; Biological

Networks- Signaling pathway, GRN, PPIN, Flux Balance Analysis, Systems biology v/s synthetic biology

References.

1. Claverie & Notredame, "Bioinformatics - A Beginners Guide", Wiley-Dreamtech India Pvt.
2. Uri Alon, "An Introduction to Systems Biology Design Principles of Biological Circuits", Chapman & Hall/CRC.
3. Marketa Zvelebil and Jeremy O. Baum, "Understanding Bioinformatics", Garland Science.
4. Bryan Bergeron, "Bioinformatics Computing, Pearson Education", Inc., Publication.
5. D. Mount, "Bioinformatics: Sequence & Genome Analysis", Cold spring Harbor press.
6. Charles Semple, Richard A. Caplan and Mike Steel, "Phylogenetics", Oxford University Press.
7. C. A. Orengo, D.T. Jones and J. M. Thornton, "Bioinformatics- Genes, Proteins and Computers", Taylor & Francis Publishers.
8. Achuthsankar S. Nair et al. "Applying DSP to Genome Sequence Analysis: The State of the Art, CSI Communications", vol. 30, no. 10, pp. 26-29, Jan. 2007.
9. Resources at web sites of NCBI, EBI, SANGER, PDB etc

AI010 805 G01

Total quality management

(Common to EI 010 805 G02 and IC 010 805 G03)

Teaching scheme **Credits:** 4

2 hours lecture and 2 hours tutorial per week

Objectives:

1. To understand the Total Quality Management concept and principles and the various tools available to achieve Total Quality Management.
2. To understand the statistical approach for quality control.
3. To create an awareness about the ISO and QS certification process and its need for the industries.

Module 1

Introduction

Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs – Analysis Techniques for Quality Costs, Basic concepts of Total Quality Management, Historical Review, Principles of TQM, Leadership – Concepts, Role of Senior Management, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation.

Module 2

TQM Principles

Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits, Continuous Process Improvement – Juran Trilogy, PDSA Cycle, 5S, Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures – Basic Concepts, Strategy, Performance Measure.

Module 3

Statistical Process Control (SPC)

The seven tools of quality, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma, New seven Management tools.

Module 4

TQM Tools

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of FMEA.

Module 5

Quality Systems
Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System –Elements, Implementation of Quality System, Documentation, Quality Auditing, QS 9000, ISO 14000 – Concept, Requirements and Benefits.

TEXT BOOK
1. Dale H.Besterfiled, et al., Total Quality Management, Pearson Education, Inc. 2003. (Indian reprint 2004). ISBN 81-297-0260-6.

REFERENCE BOOKS
1. James R.Evans & William M.Lidsay, The Management and Control of Quality, (5th Edition), South-Western (Thomson Learning), 2002 (ISBN 0-324-06680-5).
2. Feigenbaum.A.V. "Total Quality Management, McGraw Hill, 1991.
3. Oakland.J.S. "Total Quality Management Butterworth – Heinemann Ltd., Oxford. 1989.
4. Narayana V. and Sreenivasan, N.S. Quality Management – Concepts and Tasks, New Age International 1996.
5. Zeiri. "Total Quality Management for Engineers Wood Head Publishers, 1991.

AI010 805 G02

Human factors engineering

(Common to EI 010 805 G03)

Teaching scheme **Credits: 4**

2 hours lecture and 2 hours tutorial per week

Objectives

- Appreciate the importance of the human factors discipline.
- Apply human factors (HF) methods and principles to the evaluation and design of systems in the world around you.
- Understand human limitations and capabilities and how they impact the design of controls, displays, and related devices.
- Appreciate how human factors can influence the effectiveness of human-system interactions.

Module 1

Introduction to the subject: common examples of human machine interactions/systems – need for engineering approach and attention to human machine systems through simple common place examples like handle positioning on doors, positioning of bath room fittings, stair case dimensions, heights of table and chair in relation, placing of alphabet keys on computer key board; definition of HF.

Module 2

Human machine systems/interfaces, HFE at work place through examples from mechanical fitting shop, electrical machine shop, assembly lines in manufacturing shops, front panels of electronic instruments.

Module 3

Anthropometric Principles: Bertillon's observations - Bergmann's rule - Allen's rule; anthropometric division of body types - anthropometric data.

Module 4

Applied anthropometry and work space design & seating: positive and adverse effects related to work design issues – impact on worker performance and fatigue - illustration through simple examples including dimensions: safe clearances or heights, such as for doorways or walkways, safe reach distances, such as for safety cords or equipment controls, safety features including machine guards and protective shields.

Module 5

Work related health issues, safety aspects and legal aspects: work related musculoskeletal disorders, visual environment, thermal environment, auditory environment, vibrations.

Text Books:

1. McCormick, E.J., Human Factors in Engineering and Design, McGraw-Hill Book Company.

2. Eggleton, E.M. (Ed.), Ergonomic Design for People at Work: Volume 1 and 2, Van Nostrand Reinhold.

References:

1. ILO, Introduction to Work study

2. M. S. Sanders and Ernest J. McCormick, Human Factors Engineering and Design. McGraw Hill Inc.

3. Kroemer, K., H. Kroemer, and Kroemer-Elbert, K., Ergonomics: How to Design for Ease and Efficiency, Prentice Hall

4. Meister, D., Conceptual Aspects of Human Factors. Baltimore, MD, The Johns Hopkins University Press

5. Burgess, J.H., Designing for Humans: The Human Factors in Engineering, Petrocelli Books.

AI010 805G03

SYSTEM ENGINEERING

Teaching scheme **Credits:** 4

2 hours lecture and 2 hours tutorial per week

Objectives

- To familiarise students the modern systems approach to realise complex hardware systems.
- To help students understand the basics of reliability management of complex systems.
- To introduce to the students general concepts and generic descriptions of relevant processes, tools, and techniques.

Module 1 (12 hours)

Introduction to systems engineering (SE): concept of system - meaning of systems engineering - need/ objectives of SE.
System architecture: system, subsystem, assembly, subassembly, component/part.
General approach used in systems engineering – system development life cycle (SDLC) methodology – Introduction to different phases included in the SDLC: system/hardware requirements analysis, hardware requirements analysis, preliminary design, detailed design, fabrication, HWCI testing, system integration and testing.

Module 2 (12 hours).

Introduction to statistical analysis: Distributions of sampling statistics: sample mean – central limit theorem – distribution of sample mean – minimum sample size to use normal distribution – sample variance – joint distribution of mean and sample variance – sampling from a finite population – parameter estimation and confidence; t_ distribution and applicability; error specification in terms of standard deviation and confidence - error propagation – error budgeting.

Module 3 (15 hours)

Engineering specialties: reliability, maintainability, safety.

Introduction to reliability management: QA – QC – TQM – configuration control; system reliability: series configuration – parallel configuration – series parallel combination; designing for reliability: reliability specification and system measurements – system effectiveness; basic concepts of maintainability - economic analysis and life cycle costs – reliability allocation - redundancy concepts; failure mode evaluation and criticality analysis: identification of failure modes – determination of cause – assessment of effects – classification of severity – estimation of probability of occurrence – computation of criticality index; system safety and fault tree analysis: error, mistake and fault – fault tree analysis.

Module 4 ((11 hours).

Systems management:
Need for documented management plan – SE management plan.
Basic concepts of organizational management: planning and control processes – review systems - strategic planning – management control – task control.
Basic concepts of project management.
Role of standards in: what are standards – need for standards – national and international agencies generating standards – examples of standards like standards for design, standards for documentation and standards for testing.

Module 5(10 hours).

System electrical integration and check out: interface design and specifications – types of connectors – types of joints like soldered and crimped joints - electrical integration related issues like ground lifting- types of failures related to integration - ensuring safety of system;
Electrical check out: continuity checks – isolation checks - functionality checks – redundancy verification checks.

Text books:

1. Sage, A.P., *Systems Engineering,* John Wiley and Sons Inc.
2. Charles E. Ebeling, Reliability and maintainability Engineering, Tata McGraw-Hill.
3. Sheldon M. Ross, Introduction to Probability and Statistics for Engineers and Scientists, Academic Press.

References:

1. ANSI/EIA 632, Standard, *Process for Engineering a System,* January 1999.
2. Blanchard, B.S. and Fabrycky, W.J., *Systems Engineering and Analysis,* Prentice-Hall
3. Grady, J.O., *System Integration,* CRC Press, Boca Raton, 1994.
4. Hughes Aircraft Co., *Systems Engineering Handbook,* 1994.
5. ISO/IEC 15288, *System Life Cycle Processes,* October 2002.
6. Sage, A.P. and Rouse, W.B. (Eds), *Handbook of Systems Engineering,* John Wiley & Sons, 1999.

AI 010 805 G 06

Professional Ethics

(common to EI 010805 G06 , EC 010 805 G06 and IC 010 805 G06)

Teaching Schemes **Credit: 4**

2 hours lecture and 2 hours tutorial per week.

Objectives:

- *To create awareness on professional ethics for engineers*
- *To instil human values and integrity*
- *To respect the rights of others and develop a global perspective*

Module 1 (12 hrs)

Understanding Professional Ethics and Human Values Current scenario – contradictions – dilemmas – need for value education and self esteem – Human values – morals – values – integrity – civic virtues - work ethics – respect for others – living peacefully – caring – honesty – courage – valuing time – co operation – commitment – empathy – self confidence - character

Module 2 (12 hrs)

Ethics for Engineers Ethics – its importance – code of ethics – person and virtues – habits and morals – 4 main virtues – ethical theories – Kohlberg's theory – Gilligan's theory – towards a comprehensive approach to moral behaviour – truth – approach to knowledge in technology

Module 3 (12 hrs)

Environmental Ethics and sustainability problems of environmental ethics in engineering - engineering as people serving profession – engineer's responsibility to environment – principles of sustainability - industrial, economic, environmental, agricultural and urban sustainability - Sustainable development.

Module 4 (12 hrs)

Social Experimentation, Responsibility and Rights Engineers as responsible experiments – safety and risk – confidentiality – knowledge gained confidentiality – experimental nature of engineering – Intellectual Property Rights – professional rights – employee rights – occupational crime

Module 5 (12 hrs)

Global Issues Globalisation – unethical behaviour – computer ethics – weapons development – engineers as expert witness and advisors – moral leadership

Reference

1. Mike W Martin, Roland Schinzinger, " Ethics in Engineering", Tata McGraw -Hill, 2003
2. Govindarajan M, Natarajan S, Senthil Kumar V S, "Engineering Ethics" PHI India, 2004
3. P Aarne Vesblind, Alastair S Gunn, " Engineering Ethics and the Enviornment"
4. Edmund G Seebauer, Robert L Barry, " Fundamentals of Ethics for scientists and engineers" Oxford University Press 2001

5. R RGaur, R Sangal, G P Bagaria, " A foundation course in value education and professional ethics"

AI010 805G05

Industrial Pollution control

Teaching scheme **Credits:** 4

2 hours lecture and 2 hours tutorial per week

Objectives:

- To generate an awareness among students about the importance of, and need for pollution control.
- To help the students internalise concern for environment.

Module 1:

Concept of ecosystem: Structure and function of an ecosystem, producers, consumers and decomposers, energy flow in ecosystem, ecological succession, food chains and ecological pyramids, biodiversity and its conservation.

Introductory lessons on environmental pollution: Types of pollution: soil – water – air – causes - types of emissions from chemical industries - effects on environment - greenhouse gases and global warming – climate change - acid rain - ozone layer depletion - nuclear accidents and holocaust.

Module 2:

Mathematics of Growth:
Concern about future – models of population growth – exponential growth – logistic growth – logistic human population curve.
Natural resources: renewable and non-renewable resources - resource consumption - depletion of nonrenewable energy sources - Concept of sustainable development.

Module 3:

Social issues and the environment: population and pollution - consumerism and waste products - environmental ethics - social cost of pollution - 'polluter pays principle' and its relevance. Water pollution: Water resources- properties of water: density, melting point, boiling point, specific heat, dissolved oxygen; water as a solvent, the hydrogen cycle. Water pollutants: pathogens, oxygen demanding wastes, nutrients, salts, thermal pollutants, heavy metals, pesticides,volatile organic compounds.

Air pollution: Overview of emissions– criteria pollutants – toxic air pollutants –motor vehicle emission – basic ideas of influence of air pollution on meteorology - comparison of air pollution in major cities. The carbon cycle: Importance of CO2 in climate change – green house effect and global energy balance.

Module 4:
Pollution monitoring:
Pollution monitoring devices: paper tape sampler - bubbler systems - gas analysers Basics of methods of measuring pollution: principle of sampling air /water/soil for pollution measurement; ambient air sampling: collection of gaseous air pollutants, collection of particulate air pollutants; stack sampling: sampling system, particulate sampling, and gaseous sampling. Analysis of air pollutants: sulphur dioxide, nitrogen oxides, carbon monoxide, oxidants and ozone, hydrocarbons, particulate matter.

Module 5:

Principles and simple methods of pollution abatement and control: Concepts of solid waste management: source reduction – recycling – disposal. Concepts of waste water treatment methods: physical treatments – biological treatments - reuse and recycle of water and waste water. Environmental impact assessment of large scale projects. Legislation and standards for Air, Water and Soil pollution – international nature of pollution and the need for international rules and regulations - air quality regulations – clean air act.

Text Books:

1. R. Rajagopalan, Environmental Studies, Oxford IBH Pub.
2. Benny Joseph, Environmental Studies, McGraw Hill Pub.
3. Erach Bharucha, Text Book for Environmental Studies, Pub., UGC.
4. Masters, Gilbert M. Introduction to Environmental Engineering and Sciences, PHI.

Reference:

India Environmental Port, http://www.indiaenvironmentportal.org.in

Extra reading:

UNESCO, Only One Earth, 1986.

Rachel Louise Carson, Silent Spring, 1962.

AI010 805G06

Simulation and modelling

Teaching scheme: **Credits:** 4

2 hours lecture and 2 hours tutorial per week

Objectives:

- *To provide adequate knowledge to various MODELLING METHODS.*
- *To impart the basic concepts of various system simulation methods.*
- *To give a basic introduction to simulation of different types of systems.*

Module-1

Introduction to modeling and simulation: Nature of Simulation. Systems , Models and Simulation, Continuous and Discrete systems, system modeling, concept of simulation, Components of a simulation study, Principles used in modeling, Static and Dynamic physical models, Static and Dynamic Mathematical models Introduction to Static and Dynamic System simulation, Advantages, Disadvantages and pitfalls of Simulation

Module-2

System Simulation and Continuous System Simulation: Types of System Simulation, Monte Carlo Method, Comparison of analytical and Simulation methods, Numerical Computation techniques for Continuous and Discrete Models, Distributed Lag Models, Cobweb Model. Continuous System models, Analog and Hybrid computers, Digital-Analog Simulators, Continuous system simulation languages, Hybrid simulation, Real Time simulations.

Module-3

System Dynamics & Probability concepts in Simulation: Exponential growth and decay models, logistic curves ,Generalization of growth models , System dynamics diagrams, Multi segment models , Representation of Time Delays.Discrete and Continuous probability functions, Continuous Uniformly Distributed Random Numbers, Generation of a Random numbers, Generating Discrete distributions, Non-Uniform Continuously Distributed Random Numbers, Rejection Method.

Module-4

Simulation of Queuing Systems and Discrete System Simulation Poisson arrival patterns, Exponential distribution, Service times, Normal Distribution Queuing Disciplines, Simulation of single and two server queue. Application of queuing theory in computer system .Discrete Events, Generation of arrival patterns, Simulation programming tasks, Gathering statistics, Measuring occupancy and Utilization, Recording Distributions and Transit times

Module 5

Introduction to Simulation languages and Analysis of Simulation output: GPSS: Action times, Succession of events, Choice of paths, Conditional transfers ,program control statements . SIMSCRIPT: Organization of SIMSCRIPT Program, Names & Labels, SIMSCRIPT statements. Estimation methods, Relocation of Runs , Batch Means , Regenerative techniques , Time Series Analysis , Spectral Analysis and Autoregressive Processes

References:

- Gorden G., System simulation, Prentice Hall.
- Seila, Simulation Modeling, Cengage Learning
- Law .,Simulation Modeling And Analysis, McGraw Hill
- Deo, System Simulation with Digital Computer, PHI
- Harrington, Simulation Modeling methods, McGraw Hill
- Severance, " System Modeling & Simulation, Willey Pub

AI010 806

Process Control Lab

Teaching Scheme:
3 hours practical per week

Credits:2

1. Electronic PID controller and implementation of PID algorithm using high level language
2. Performance Evaluation of Temperature process control station.
3. Performance Evaluation of Pressure process control station
4. Performance Evaluation of Flow process control station
5. Performance Evaluation of Level process control station
6. Characteristics of Differential Pressure Transmitter and Rotameter
7. Characteristics of control valve, with and without positioner
8. Characteristics of I/P and P/I converter
9. Study of process control simulator
10. Study of PLC
11. PLC programming and implementation
12. Control of bottle filling system using PLC
13. Speed controller of a DC motor using PLC
14. Liquid level control using PLC
15. Study of Distributed Control System

MATLAB

1) Experiments using MATLAB SIMULINK package for level control in realtime.
2) Experiments using MATLAB SIMULINK package for pressure control in realtime.
3) Controller tuning for a process– using Ziegler-Nichols and Cohen – Coon rule

LABVIEW

1) LabVIEW Fundamentals I – Data types, Loops, Shift Registers, Case Structures, Sequence Structures, Formula Node.
2) LabVIEW Fundamentals II – Arithmetic Operations, Arrays, Sub-VI, Boolean Operations, Comparison.
3) Development of VI for temperature measurement-with display, and visual and sound alarms
4) Development of VI for level measurement-with display, and visual and sound alarms

AI010 807 Project Work

Teaching scheme **credits: 4**

6 hours practical per week

The progress in the project work is to be presented by the middle of eighth semester before the evaluation committee. By this time, the students will be in a position to publish a paper in international/ national journals/conferences. The EC can accept, accept with modification, and request a resubmission.

The progress of project work is found unsatisfactory by the EC during the middle of the eighth semester presentation, such students has to present again to the EC at the end of the semester and if it is also found unsatisfactory an extension of the project work can be given to the students.

Project report: To be prepared in proper format decided by the concerned department. The report shall record all aspects of the work, highlighting all the problems faced and the approach/method employed to solve such problems. Members of a project group shall prepare and submit **separate** reports. Report of each member shall give details of the work carried out by him/her, and only summarise other members' work.

The student's sessional marks for project will be out of 100, in which 60 marks will be based on day to day performance assessed by the guide. Balance 40 marks will be awarded based on the presentation of the project by the students before an evaluation committee.

For Project, the minimum for a pass shall be 50% of the total marks assigned to the Project work.

AI010 808 Viva -Voce

Teaching scheme **credits: 2**

A comprehensive oral Viva-voce examination will be conducted to assess the student's intellectual achievement, depth of understanding in the specified field of engineering and papers published / accepted for publication etc. At the time of viva-voce, certified bound reports of seminar and project work are to be presented for evaluation. The certified bound report(s) of educational tour/industrial training/ industrial visit shall also be brought during the final Viva-Voce.

An internal and external examiner is appointed by the University for the Conduct of viva voce University examination.

For Viva-voce, the minimum for a pass shall be 50% of the total marks assigned to the Viva-voce.

Note: If a candidate has passed all examinations of B.Tech. course (at the time of publication of results of eighth semester) except Viva-Voce in the eighth semester, a re-examination for the Viva-Voce should be conducted within one month after the publication of results. Each candidate should apply for this 'Save a Semester examination' within one week after the publication of eighth semester results.

Aeronautical Engineering (AN)

AN010 701 Computational Fluid Dynamics

Teaching scheme **Credits: 4**

2 hours lecture and 2 hours tutorial per week

Objectives

- *To develop and understand the major approaches and methodologies used in CFD.*
- *To increase skills in a) implementing and using basic CFD methods b) computer use and programming.*

Module I – Fundamental concepts

Introduction, Basic equation of fluid dynamics, incompressible inviscid flows, Mathematical properties of fluid dynamics equation, elliptical, parabolic and hyperbolic equation – discretisation of partial differential equation, Transformations and grids, explicit infinitesimal difference methods of subsonic , supersonic and viscous flows

Module II – Panel Methods

Introduction, Numerical source panel methods, non lifting flows over arbitrary bodies, vortex panel method, lifting flows over arbitrary bodies, modern low speed aerofoils,- other applications, source and vortex panel methods

Module III – Discretisation

Boundary layer equation and methods of solutions , Implicit time dependant methods for inviscid and viscous compressible flows , concepts of numerical dissipation, stability property of explicit and implicit method, conservative upwind discretisation for hyperbolic system, and further advantages of upwind differencing

Module IV – Finite Element Techniques

Finite element techniques in CFD, Introduction, Strong and weak formulations of boundary value problem. Strong formulation weighted residual formulation- galerkin formulation weak formulation- variational formulation, piecewise defined shape function, implementation of finite element method- solution procedure.

Module V – Finite volume Techniques

Cell- centred formulation, Lav- vendroff time stepping , Runge Kutta time stepping, multi stage time stepping, finite difference method like finite volume techniques, central and upwind type disretisation treatment of derivatives.

References:

1. Fletchre C A, "Computational Techniques for fluid dynamics", Vol I and II, Springer

2. John F Wendt, "Computational fluid dynamics" - An Introduction, springer

3. J D Anderson, "computational fluid dynamics - Mc Graw Hill

AN 010 702 EXPERIMENTAL STRESS ANALYSIS

Teaching scheme **Credits**: 4

2 hours lecture and 2 hours tutorial per week

Objectives:

- *To make students aware of various measurement methods of finding the response of the structure to different types of load.*
- *To make students aware of experimental planning and procedures adopted in laboratory.*

Module I - MEASUREMENTS

Principles of measurements, Accuracy, Sensitivity and range of measurements. Properties of Strain Gage Systems, Types of Strain Gages, Electrical Resistance strain gauges, semiconductor strain gauges, strain gauge circuits Grid- Method of Strain Analysis Transducer applications, Recording instruments for static and dynamic applications.

Module II – EXTENSOMETERS

Mechanical, Optical Acoustical and Electrical extensometers and their uses, Advantages and disadvantages.

Coating Stresses, Failure Theories, Brittle Coating Crack Patterns, Resin and Ceramic Based Brittle Coating, Test Procedure, Analysis of Brittle Coating Data.

Module III - ELECTRICAL RESISTANCE STRAIN GAUGES

Principle of operation and requirements, Types and their uses, Materials for strain gauge. Calibration and temperature compensation, cross sensitivity, Rosette analysis- Three Element Rectangular Rosette, Delta Rosette, Torque gauge, Stress Gage, Plane Shear Gage

Wheatstone bridge and potentiometer circuits for static and dynamic strain measurements, strain indicators.

Module IV – PHOTOELASTICITY

Theory of Photoelasticity: Introduction, Temporary Double Refraction, Stress Optic Law, Relative Retardation, Stressed Model in Plane Polariscope, Effect of Principal Directions, Effect of Principal Stress Difference, Stressed Model in Circular Polariscope, Light and Dark Field arrangements, Tardy Compensation, Fringe Sharpening and Multiplication by Partial Mirrors

Two dimensional photoelasticity, Concepts of light-photo-elastic effects, stress optic law, Interpretation of fringe pattern, Compensation and separation techniques, Photoelastic materials. Introduction to three dimensional photoelasticity.

Module V - NON-DESTRUCTIVE TESTING

Fundamentation of NDT, Radiography, ultrasonics, Magnetic particle inspection, Fluorescent penetrant technique, Eddy current testing, Acoustic Emission Technique, Fundamentals of brittle coating methods, Introdcution to Moire techniques, Holography, ultrasonic C-Scan, Thermography, Fibre-optic Sensors.

Reference :

1. Dally, J.W., and Riley, W.F., " Experimental Stress Analysis ", McGraw Hill Inc., New York, 1978.
2. Hetyenyi, M., " Hand Book of Experimental Stress Analysis ", John Wiley and Sons Inc., New York, 1972.
3. Srinath, L.S., Raghava, M.R., Lingaiah, K.Gargesha, G.Pant B., and Ramachandra, K., " Experimental Stress Analysis ", Tata McGraw Hill, New Delhi, 1984.
4. Pollock A.A., " Acoustic Emission in Acoustics and Vibrations progress ", ed. by Stephens R.W.B., Chapman and Hall, 1983.

AN 010 703 AIRCRAFT DESIGN

Teaching scheme **Credits**: 4

2 hours lecture and 2 hour tutorial per week

Objective:

- To make students aware of the preliminary work that's involved in designing an aircraft.
- To make the students aware of the monitoring principles of each component of an aircraft.

MODULE -1

INTRODUCTION

Literature review-classification based on purpose and configuration, factors affecting configuration-comparative study of aircrafts-phases of airplane design-conceptual design-preliminary design-detail design-seven intellectual pivot points-requirements-weight of airplane-critical performance parameter-configuration layout-better weight estimate-performance analysis-constraint diagram

MODULE -2

WEIGHT ESTIMATION

Take off weight build up-empty weight estimation-fuel fraction estimation-mission profiles-mission segment weight fractions-SFC- L/D estimation-Take off weight calculation- actual weight estimation- approximate weight estimation- comparative study-Thrust to weight ratio

MODULE -3

AEROFOIL AND GEOMETRY SELECTION

Airfoil selection-airfoil geometry-airfoil lift and drag- Aerodynamic forces- aerodynamic coefficients- lift, drag- airfoil families- airfoil design-design lift coefficient-aerofoil thickness ratio-airfoil consideration-airfoil nomenclature-wing geometry-aspect ratio-taper ratio

Peculiarities in layout, Designing for manufacturability, Maintenance, Operational costs, Interactive design

MODULE -4

ENGINE SELECTION LANDING GEAR AND SUB SYSTEM SELECTION

Introduction- Jet engine thrust consideration-Turbojet installed thrust-comparitive performance study of different types of engines

Landing gear arrangements-tyre sizing-shock absorbers-castoring-wheel geometry-gear retraction geometry –seaplanes and sub systems

AREA CALCULATION , TAKE OFF AND LANDING DISTANCE CALCULATION

Wetted area- fuselage-undercarriage-wing tail-1/4 flap deflection-3/4 flap deflection-Performance analysis-power required-rate of climb-range-stalling speed-landing distance-take off distance. - Problems

MODULE -5
DESIGN OF MAJOR AIRPLANE COMPONENTS

a) Wing design:
Airworthiness requirements, V-n diagram, loads, Elements of wing design, Structural features.
b) Fuselage design: Loads on fuselage, Elements of fuselage design, Determination of tail surface areas, Structural features.
c) Landing gear design:
Loads or Landing gear, Preliminary landing gear design
d) Elements of computer Aided Design

References:

1. Torenbeek,E., " Synthesis of Subsonic Airplane Design ", Delft University Press,U.K.1986
2. Kuechemann,D., " Aerodynamic Design of Aircraft ", Pergamon Press,1978
3. Raymer,D.P., " Aircraft Conceptual Design " , AIAA Series,1989.
4. Roskam, J., Aircraft Design, Published by the author as an 8 volume set, 1985-1990.

AN 010 704 Flight Dynamics II

Teaching scheme **Credits:** 4

2 hours lecture and 1 hour tutorial per week

Objectives

- *To familiarize students with dynamics of flight vehicles and*
- *The course introduces students to the performance, stability, and control of an airplane.*

Module I – Airplane Performance: Accelerated flight

Introduction , Level turn, the pull-up and pull-down maneuvers , limiting case for large load factor , the V-n diagram, energy concept, accelerated rate of climb, take off performance, landing performance.

Module II - Airplane Performance: Steady flight

Equation of motion of steady level flight, thrust requirements, fundamental parameters: thrust to weight ratio , wing loading , thrust available and the maximum velocity of the airplane, power required and power available, minimum velocity: stall and high lift devices, rate of climb , service and absolute ceilings , range and endurance .

Module III – Lateral and directional stability

Dihedral effect, lateral control, coupling between rolling and yawing moments, adverse yaw effects, aileron reversal, static directional stability, weather cocking effect, rudder requirements, One engine in operative condition, rudder lock.

Module IV – Dynamic Longitudinal Stability

Equations of motion, Stability derivatives, characteristic equation of stick fixed case, modes and stability criterion, effect of freeing, stick brief description of lateral and directional stability, spiral divergence, Dutch roll, auto rotation and spin.

Module V – Dynamic Lateral Stability

Lateral Stability equation of a disturbed aircraft, stability derivatives , characteristic equation for stick fixed case , effect of reeling , brief description of lateral and directional dynamic stability, spiral divergence, Dutch roll, automatic control, determination of neutral points,

Reference:

1. *John D Anderson, Jr , Performance and Design, Tata Mc Graw Hill , 1999*
2. *Perkins C D and Hage R E , Airplane performance stability and control, Wiley*
3. *Nelson R C, Flight stability and automatic control , Tata Mc Graw Hill*

AN 010 705 Aircraft System And Instrumentation

Teaching scheme **Credits:** 4

2 hours lecture and 1 hour tutorial per week

Objectives

- *To familiarize the student with various systems and instruments used in an aircraft.*

Module I - Engine Systems

Fuel system for piston & Jet engines:- Components and its functions, *Lubrication system for piston and Jet engines:-* Function's of lubrication system, *starting and ignition systems:-*Battery ignition, low tension and High tension ignition systems for piston engines

Module II - Aircraft Systems

Hydraulic System:- Basic hydraulic system with hand pump and power pump; study of typical workable system components, and its operation. *Pneumatic System:-* Working principle, different types, Typical Pneumatic Power System, Components of landing gear system, classification of shock absorbers, landing gear retraction systems ,Brake system: Independent Brake System, power brake control systems.

Module III - Auxilary Systems

Basic Air cycle system, vapour cycle system, Refrigeration cycle, Oxygen system & its types, De icing & anti icing systems, wind shield wiper system, Fire protection system

Module IV- Airplane Control System

Flight control systems,-cable, push-pull & torque tube system flight control system hardware, mechanical linkage & mechanisms, Hydraulic operated control systems, Digital fly by wire system, communication & Navigation system, basic radio principles & equipments, Radio Altimeter, ELT, VHF VOR, Instrument landing system, DME, ADF.

Module V - Aircraft Instruments

General, Aircraft Pressure guage, Pitot static system, Altimeters, Rate –of-limb indicators, Air speed indicator, mach indicator . Turn & Bank indicator, Angle of attack indicator. Tachometers Mechanical & Electrical, Gyroscopic instruments, Gyroscopic inertia & precession; Gyro-horizon indicator, Magnetic compass, Auto pilot system, principle of operation, components, Synchronoscope, Computer & recorders.

References:

(a) *General Hand books of Airframe and Power Plant Mechanics (AC65-15A , 9A)-The English Book Store New Delhi.*

(b) *Pallet EHJ "Aircraft Instruments & Principle", Pitman & Co.*

(c) *Aircraft Electrical Systems E.H.J. Pallet (IIIrd edition)*

AN 010 706L01 Theory of Plates and Shells

Teaching Scheme **Credit:4**

2 hours lecture and 2hours tutorial per week.

Objective :

To develop the skills for the analysis of advanced structures in civil engineering.

Module 1 (12 hrs)

Plates – Introduction – Classification of plates – Thin plates and thick plates – Assumptions in the theory of thin plates – Differential equation for cylindrical bending of rectangular plates – Pure bending of plates – Slope and curvature of slightly bent plates – Relation between bending moment and curvature in pure bending.

Module 2 (12 hrs)

Laterally loaded rectangular plates – Small deflections of laterally loaded thin plates – Differential equation of plates – Derivation of fourth order differential equation – Boundary conditions – Simply supported, built- in and free edges.

Module 3 (12 hrs)

Shells – Structural behaviour of shells – Parts of a shell – Classification of shells – Translational, rotational and ruled surfaces – Gauss curvature – Synclastic and anticlastic surfaces – Hyperbolic paraboloid – Elliptic paraboloid – Conoid.

Module 4 (12 hrs)

Classical theories of shells – Thin shell and thick shell – Stress resultants – Membrane theory of cylindrical shells – Formulation of equilibrium equations – Bending theory of cylindrical shells – Equilibrium equations – Beam theory.

Module 5 (12 hrs)

Circular cylindrical shells – Equilibrium equations – Expression for strain – Deformation of circular cylindrical shell – Cylindrical shell with uniform internal pressure – Pressure vessels – Calculation of bending moment and stresses in pressure vessels – attenuation length of edge effects.

References:

1. S.P Timoshenko, S.W Krieger, *Theory of plates and shells*, Mc Graw Hill.
2. J Ramachandran, *Thin shell theory and problems*, Universities press.
3. Krishna Raju N., *Advanced Reinforced Concrete Design*, CBS Publishers and distributers, New Delhi.
4. G.S Ramaswamy, *Design and Construction of Concrete Shell Roofs*, Tata-McGraw Hill Book Co. Ltd.,.

AN010 706L02 ADVANCED MATERIALS IN AIRCRAFT MANUFACTURING

Teaching scheme **Credits:** 4

2 hours lecture and 2 hour tutorial per week

Objective:

- To make students aware of different materials used inside an aircraft.

Module-1

Aircraft materials

Requirement of aircraft materials, property evaluation of materials for different components, classification of materials, functionality Consideration, factors influencing the selection of materials

Light weight metallic materials

Aluminium and Titanium alloys, different lightweight metals and alloys, analysis of merits and demerits of metallic materials for aircraft applications: Influence forming on material properties, strengthening mechanisms

Module-2

Advanced manufacturing and joining techniques for metallic materials

Casting, forging, sheet metal forming, joining techniques like mechanical fastening, welding, laser welding etc. Advanced welding processes - EBW, LBW, USW

Module-3

Composite materials

Classification and properties of composite materials, PMC and MMCs advantages and disadvantages of composite materials for aircraft applications Manufacturing and joining of composite materials: Preparation of PMC, MMC and laminate structures, hand layup, compression moulding, resin transfer moulding, reaction injection moulding, squeeze casting, gas pressure infiltration ,Joining of laminate structures using adhesives Design of composites for structural, wear resistance and high temperature applications.

Module-4

Mechanics and failure theories of composite materials: Mechanical behaviour of composite materials, laminates, fiber reinforced composites, micro mechanical behaviour of composites, different modes of failure

Non Destructive Testing (NDT) techniques and Failure analysis: Different types of NDT techniques and their application on failure analysis

Module-5

Micro-electro-mechanical (MEMS) systems. Introduction, characteristics of silicon wafers and other materials for MEMS applications. Various manufacturing techniques of MEMS components Materials for high temperature applications: Ni-Cr alloys, ODS materials, Ni base and Co based super alloys, carbon-carbon composites. Diffusion bond coating of high temperature materials. Powder metallurgy: Introduction and feature of powder metallurgy processes. Advanced solidification techniques: directional solidification, single crystal growth and levitation melting.

Books

1. M. F. Ashby, H. Schercliff and D. Cubon. (2007)Materials Engineering Science, Processing and Design, Butterowrth and Heinemann Publications.

2. M. J. Hinton, P. D. Soden and A.S. Kaddour. (2004) Failure Criteria in Fiber Reinforced-Polymer Composites, Elsevier.

3. Robert M. Jones. (2001) Mechanics of Composite Materials, Taylor and Francis.

4. Valery V. Vaseliev and Evgency V. Morozov. (2001) Mechanics and Analysis of Composite Materials, Elsevier.

5. Michael Asbhy. (1999) Materials Selection in Mechanical Design, Butterworth and Heinemann

AN 010 706L03 Failure Analysis and Design

Teaching scheme **Credits: 4**

2 hours lecture and 2 hours tutorial per week

Objectives:

- *To introduce basic concepts of reliability in analysis and design*
- *To study fracture, fatigue and other modes of failure*

Module1 (12 hours)

Reliability: Reliability concept and hazard function, life prediction, condition monitoring, application of Poisson, exponential and Weibull distribution for reliability - bath tub curve - parallel and series system - mean time between failures and life testing.

Stresses in a body: Two dimensional and three dimensional state of stress, Mohr's circle two and three dimensions, hydrostatic stress, Von-mises, maximum shear stress (Tresca), octahedral shear stress, torsional stresses for large plastic strain.

Module 2 (12 hours)

Fracture: Types of fracture, Griffith crack theory, stress analysis of cracks, metallographic aspects of fracture. Brittle, ductile fractures, notch effects, fracture curve, R curve, fracture under combined stresses, effect of hydrostatic pressure on fracture, probabilistic aspects of fracture mechanics, toughness of materials.

Module 3 (12 hours)

Fatigue: Statistical nature of fatigue, S-N curve, low cycle fatigue, strain life equations, structural feature of fatigue, fatigue crack propagation, effect of stress concentration, size, surface properties, metallurgical variables on fatigue, case studies, designing against fatigue, detail design, improvements after failure and service, fatigue of bolts, welded and adhesive joints.

Fatigue tests: Purpose, specimen, fatigue test procedures, evaluation of fatigue test results, crack growth measurement.

Module 4 (12 hours)

Wear failures: Type of wear, role of friction in wear, lubricated and non-lubricated wear, analysing wear failures, wear tests SOAP, ferrography.

Corrosion failures: Factors influencing corrosion failures, analysis of corrosion failures, overview of various types of corrosion, stress corrosion cracking - sources, characteristics of stress corrosion cracking, procedure of analysing stress corrosion cracking, various types of hydrogen damage failures, corrective and preventive action.

Module 5 (12 hours)

Elevated temperature failures: Creep, stress rupture, elevated temperature fatigue, metallurgical instabilities, environmental induced failure, elevated temperature effects on certain gas turbine components and petroleum refinery components, tests for analysis of failure at elevated temperatures.

References

1. Jaap Schijve, "Fatigue of Structures and Materials", Kluwer Academic Publishers, 2001.
2. ASM Metals Handbook, "Failure Analysis and Prevention", ASM Metals Park, USA, Vol. 10, 10th Edition, 1995.
3. Richard W Hertzberg,"Deformation and Fracture Mechanism of Engineering Materials",John Wiley & Sons,Inc.,1995.
4. George E Dieter, "Mechanical Metallurgy", McGraw Hill Book Company, 1988.

AN 010 706 L04 Helicopter Aerodynamics

Teaching scheme **Credits**: 4

2 hours lecture and 2 hours tutorial per week

Objectives

- *To give students essentials of vertical and forward flight of rotary aircraft, the essentials of helicopter aerodynamics and of helicopter design.*

Module I -

Helicopter Basics:- Axes of flight, Movement about vertical, longitudinal and lateral axes.-Control Mechanism's-Directional control pedals, cyclic pitch control, collective pitch control. Articulated rotor head mechanism. Main rotor design-Diameter, Tip speeds, blade area, number of blades, Twist, Tip shape, Taper, Rotor Inertia.

Module II -

Rotor mechanism in vertical flight:- Climbs and descents, conditions of flow, climb & descent power, Vertical auto rotation. Momentum theory for hover, vertical climb and vertical descent. *Blade element theory:-*Basic method, thrust approximations, Non-uniform in flow, ideal twist, Blade mean lift co efficient and tip losses.

Module III -

Rotor mechanism for forward flight:- Edge wise rotor, Trim conditions, Blade flapping and feathering Velocity distributions, flapping blades, rotor controls equivalence of flapping feathering. *Rotor Aerodynamics in forward flight:-* Momentum theory, Blade element theory, In-plane H force.

Module IV - *Aerodynamic Design*

Blade section design, Airfoils for rotor blades, super critical air foils, Peculiar airfoils-Blade tip shapes, parasite drag, Rear fuselage up sweep. Aerodynamic design process. *Tale rotor design:-* Diameter, Tip speed, Blade area, twist maximum pitch, pusher type & puller type, direction of rotation. NOTAR.

Module V-

Performance:- Introduction, hover and vertical flight, forward level flight, climb in forward flight, optimum speeds maximum level speed, Accurate Performance Prediction.Trim, *Stability & Control:-*Trim, Treatment of stability & Control, *Static Stability:-* Incidence disturbance, Forward speed disturbance. Angular velocity disturbance, sideslip disturbance, yawing disturbance. Dynamic stability, special cases of hover, hinge less rotor, control, and Auto Stabilization.

References:

(a) Basic Helicopter Aerodynamics, IInd edition, John Seddon and Simon New man.

(b) Helicopter Aerodynamics by R.W Prouty, Sterling Book House.

AN 010 706 L05 Optimization methods in design

Teaching scheme **Credits: 4**

2 hours lecture and 2 hours tutorial per week

Module 1 (12 hours)

Nonlinear optimization: Introduction - one-dimensional optimization - elimination methods - unrestricted search, exhaustive scare Fibonacci and Golden section methods - Interpolation methods - quadratic and cubic interpolations, direct root methods.

Module 2 (12 hours)

Unconstrained nonlinear optimization: Direct search methods - random search methods - pattern search methods – method of rotating coordinates - descent methods - steepest descent, conjugate gradient, Quasi-Newton, and variable metric methods.

Module 3 (12 hours)

Constrained nonlinear optimization: Direct methods - the complex method, cutting plane method, methods of feasible directions - indirect methods - transformation techniques, interior and exterior penalty function methods.

Module 4 (12 hours)

Non-traditional optimization: Introduction to genetic algorithms, simulated annealing, particle swam optimization and ant colony optimization.

Module 5 (12 hours)

Static Applications: - Structural applications – Design of simple truss members - Design applications – Design of simple axial, transverse loaded members for minimum cost, weight – Design of shafts and torsionally loaded members – Design of springs.
Dynamic Applications:-Dynamic Applications – Optimum design of single, two degree of freedom systems.
Application in Mechanisms – Optimum design of simple linkage mechanisms.

Text Books

1 Singiresu S. Rao, *Engineering optimization: theory and practice,* 3rd Edition, Wiley Interscience, 1996

1. Kalyanmoy Deb, *Optimization for engineering design,* PHI, New Delhi, 2000
2. David E. Goldberg, *Genetic algorithms in search, optimization and machine learning,* Addison Wesley Pub. Co., 1989
3. Harvey M. Salkin, *Integer programming,* Addison-Wesley Pub. Co., 1975
4. Stephen C. Nash and Ariela Sofer, *Linear and nonlinear programming,* McGraw Hill College Div., 1995

Reference Books

1. Fred Glover, Manuel Laguna, and Fred Laguna, *Tabu search,* Kluwer Academic Publishers, 1997
2. Johnson Ray, C., "Optimum design of mechanical elements", Wiley, John & Sons, 1990.
3. Goldberg, D.E., "Genetic algorithms in search, optimization and machine", Barnen, Addison-Wesley, New York, 1989.

AN 010 706 L06 Rotor Dynamics

Teaching scheme **Credits**: 4

2 hours lecture and 2 hours tutorial per week

Objectives

- *To familiarize with rotor dynamic fundamentals, rotating machinery vibrations and rotor dynamic analysis.*

Module I – Torsional vibrations in rotating machinery

Modeling of rotating machinery –critical speed of shafts , transfer matrix analysis of free vibrations, equivalent discrete system, excitation torque, transient response in torsional system

Module II – Hydrodynamic bearings

Viscosity, Mechanism of pressure development in the film, Reynold's No., Journal bearing, Steady state solution of short bearings, squeeze film bearings, and orbital motion, magnetic bearings, auxiliary bearings

Module III – Gyroscopic effects

Gyroscopics of a spinning disk, synchronous whirl of an overhung rotor, non synchronous whirl, rotor system with a coupling, finite element method, whirl speed analysis.

Module IV-

Instability in torsional vibration, Conditional Instability in torsional vibration, Instability due to fluid film forces and hystersis

Module V

Balancing of rigid rotors and flexible rotors, Jeffcot-rotor-Green stodola rotor- external and internal damping-condition monitoring using vibration measurements

Reference:

Rotor Dynamics, J S Rao, New Age Publishers

AN 010 707 Experimental Stress Analysis Lab

Teaching scheme **Credits**: 2

3 hours practical per week

Objectives

- *To experimentally analyze stresses on different structures under various loads using different techniques.*

Experiments

1. Unsymmetric bending of beams.
2. Shear Centre location for open sections.
3. Shear Centre location for closed sections
4. Constant Strength beam.
5. Flexibility matrix for cantilever beam.
6. Beam with combined loading.
7. Calibration of Photo-elastic materials.
8. Stresses in Circular discs and beams using photoelastic techniques.
9. Vibrations of beams.
10. Wagner beams – Tension field beam.

AN 010 708 Vibration Lab

Teaching scheme **Credits:** 2
3 hours practical per week

Objectives

- *To analyze different kinds of vibration on various materials using different apparatus.*

Experiments:

1. Determination of Modulus of elasticity, Rigidity Modulus, Poisson's Ratio of a material of wire – Searle's apparatus.
2. Determination of radius of gyration of the material of the bar about centroidal axis – Bar pendulum.
3. Analysis of damped vibration- viscous damper method.
4. Vibration analysis – vibration measuring instruments and cathode ray oscillograph.
5. Double pendulum.
6. Whirling apparatus critical speed of shaft of using single disc.
7. Un-damped free vibration with non linear spring forces
    - Hard spring
    - Soft Spring
8. Forced vibration experiment
9. Response to pulse input .
    - Rectangular Pulse
    - Half sinusoidal input.

AN 010 709 Seminar

Teaching scheme **credits: 2**

2 hours practical per week

The seminar power point presentation shall be fundamentals oriented and advanced topics in the appropriate branch of engineering with references of minimum seven latest international journal papers having high impact factor.

Each presentation is to be planned for duration of 25 minutes including a question answer session of five to ten minutes.

The student's internal marks for seminar will be out of 50. The marks will be awarded based on the presentation of the seminar by the students before an evaluation committee consists of a minimum of 4 faculty members. Apportioning of the marks towards various aspects of seminar (extent of literature survey, presentation skill, communication skill, etc.) may be decided by the seminar evaluation committee.

A bona fide report on seminar shall be submitted at the end of the semester. This report shall include, in addition to the presentation materials, all relevant supplementary materials along with detailed answers to all the questions asked/clarifications sought during presentation. All references must be given toward the end of the report. The seminar report should also be submitted for the viva-voce examination at the end of eighth semester.

For Seminar, the minimum for a pass shall be 50% of the total marks assigned to the seminar.

AN 010 710 Project Work

Teaching scheme **credits: 1**

1 hour practical per week

Project work, in general, means design and development of a system with clearly specified objectives. The project is intended to be a challenge to intellectual and innovative abilities and to give students the opportunity to synthesize and apply the knowledge and analytical skills learned in the different disciplines.

The project shall be a prototype; backed by analysis and simulation etc. No project can be deemed to be complete without having an assessment of the extent to which the objectives are met. This is to be done through proper test and evaluation, in the case of developmental work, or through proper reviews in the case of experimental investigations.

- The project work has to be started in the seventh semester and to be continued on to eighth semester.
- Project work is to be done by student groups. Maximum of four students only are permitted in any one group.
- Projects are expected to be proposed by the students. They may also be proposed by faculty member (Guide) or jointly by student and faculty member.
- Students are expected to finalise project themes/titles with the assistance of an identified faculty member as project guide during the first week of the seventh semester.

The progress from concept to final implementation and testing, through problem definition and the selection of alternative solutions is monitored. Students build self confidence, demonstrate independence, and develop professionalism by successfully completing the project.

Each student shall maintain a project work book. At the beginning of the project, students are required to submit a project plan in the project book. The plan should not exceed 600 words but should cover the following matters.

- Relevance of the project proposed
- Literature survey
- Objectives
- Statement of how the objectives are to be tackled

- Time schedule
- Cost estimate

These proposals are to be screened by the evaluation committee (EC- minimum of 3 faculty members including the guide) constituted by the head of department, which will include a Chairman and the EC will evaluates the suitability and feasibility of the project proposal. The EC can accept, accept with modification, request a resubmission, or reject a project proposal.

Every activity done as part of project work is to be recorded in the project book, as and when it is done. Project guide shall go through these records periodically, and give suggestions/comments in writing in the same book.

The students have to submit an interim report, along with project work book showing details of the work carried out by him/her and a power point presentation at the end of the 7th semester to EC. The EC can accept, accept with modification, request a resubmission, or extension of the project.

The student's internal marks for project will be out of 50, in which 30 marks will be based on day to day performance assessed by the guide. Balance 20 marks will be awarded based on the presentation of the project by the students before an evaluation committee consists of a minimum of 3 faculty members including the guide.

For Project, the minimum for a pass shall be 50% of the total marks assigned to the Project work.

AN 010 801 Rockets and Missiles

Teaching scheme **Credits:** 4

2 hours lecture and 2 hours tutorial per week

Objectives

- *To familiarize students knowledge of rocket and missiles, their performance and control.*

Module I – Flight performance of Rockets and missiles

Gravity-free Drag-free space flight, Forces acting on a vehicle in the atmosphere, basic relations of motion, space flight, flight maneuvers, Effect of propulsion systems on vehicle performance, flight vehicles, military missiles, flight stability

Module II – Aerodynamics of Rockets and missiles

Airframe components of rockets and missiles force acting on a missile in atmosphere, classification of missiles, aerodynamic forces and moment, Lateral aerodynamic moment, lateral damping moment and longitudinal moment of a rocket, lift and drag forces, body up wash and down wash in missiles and rocket propulsion.

Module III– Rocket Motion in free space and gravitational field

One dimensional and two dimensional rocket motion in free space and homogeneous gravitational fields. Description of vertical , inclined and gravity turn trajectory, Determination of Range and altitude, simple approximation to burn out velocity.

Module IV – Staging and control of rockets

Rocket vehicle control methods, Thrust determination, multi staging of rocket, vehicle optimization stage separation techniques, materials used in rockets, special requirement of material to perform under adverse conditions.

Module V – Selection of rocket propulsion systems and rocket testing methods

Selection process, criteria for selection, types of tests, test facilities and safeguards, Instrument and data management, flight testing.

References:

(a)Sutton G P – Rocket propulsion elements, John Wiley

(b)Parker E P – Materials of missiles and space craft, Mc graw Hill

(c)Philip Hill/ Petersen - Mechanics and thermodynamics of propulsion

AN 010 802 Introduction to Space technology

Teaching scheme **Credits**: 4

2 hours lecture and 2 hours tutorial per week

Objectives

- *To familiarize the students with the various design elements and problems concerned with space travel.*
- *To introduce basic mechanics involved in satellite launches, interplanetary travel and reentry.*

Module I – Basic concepts of general n- body problem

Solar system – reference frames, coordinate system, relation matrix, Euler's angles, spherical celestial coordinates, ecliptic motion of vernal equinox, siderial time, many body problem ,Legrange's equation, Legrange's points, Jacob's integrals circular restricted three body problem, libration points, relative motion in n body problem, Satellite orbit, relation between position and time, orbit elements,

Module II – Fundamentals of orbital mechanics

Two body problem- energy and angular momentum, orbit equation , Keppler's equations, escape velocity, conic section geometry , motion in elliptical , hyperbolic , parabolic orbits, basic orbital maneuvers ,

Module III – Satellite injection and orbit transfer

Various cases of orbit deviation due to injection errors, Special and general perturbations , Cowell's method, Enckes method, Method of vibration of orbital elements, General perturbation approach,

Module IV – Interplanetary trajectory

Two dimensional interplanetary trajectories , fast interplanetary trajectories, three dimensional interplanetary trajectories , launch windows and mission duration , departure and arrival , planetary fly by optimal planetary capture ,

Module V – Entry Flight Mechanics

Rocket propulsion fundamentals , Atmospheric entry, Entry heating, altitude determination and controls , review of rotational dynamics, disturbance torque, passive altitude control, active control, thermal control, spacecraft control, telecommunication

References:

i) *Ashish Tewari, Atmospheric and space Flight dynamics., Springer*
ii) *William E Wiesel , Space flight dynamics, Mc Graw Hill*
iii) *Vandekamp P , Elements of astromechanics, Pitman*
iv) *Cemmelisse J W , Rocket propulsion and space dynamics, W H Freeman*
v) *Sutton, Rocket propulsion, Mc Graw Hill*

AN 010 803 Air transportation and Aircraft Maintenance

Teaching scheme **Credits**: 4
2 hours lecture and 2 hours tutorial per week

Objectives

- *To familiarize students with various aspects of aviation industry including airline economics, operations and maintenance.*

Module I - INTRODUCTION

Development of air transportation, comparison with other modes of transport - Role of IATA, ICAO – The general aviation industry airline - Factors affecting general aviation, use of aircraft, airport: airline management and organisation - levels of management, functions of management, Principles of organisation planning the organisation - chart, staff departments & line departments.

Module II - AIRLINE ECONOMICS

Forecasting - Fleet size, Fleet planning, the aircraft selection process, operating cost, passenger capacity, load factor etc. - Passenger fare and tariffs - Infuence of geographical, economic & political factors on routes and route selection.
FLEET PLANNING: The aircraft selection process - Fleet commonality, factors affecting choice of fleet, route selection and Capitol acquisition - Valuation & Depreciation - Budgeting, Cost planning - Aircrew evaluation -Route analysis - Aircraft evaluation.

Module III - PRINCIPLES OF AIRLINES SCHEDULING

Equipment maintenance, Flight operations and crew scheduling, Ground operations and facility limitations equipments and types of schedule - hub & spoke scheduling, advantages / disadvantages & preparing flight plans- Aircraft scheduling in line with aircraft maintenance practices.

Module IV - AIRCRAFT RELIABILITY

Aircraft reliability - The maintenance schedule & its determinations - Condition monitoring maintenance - Extended range operations (EROPS) & ETOPS - Ageing aircraft maintenance production.

Module V - TECHNOLOGY IN AIRCRAFT MAINTENANCE

Airlines scheduling (with reference to engineering) - Product support and spares - Maintenance sharing - Equipments and tools for aircraft maintenance - Aircraft weight control - Budgetary control.On board maintenance systems - Engine monitoring - Turbine engine oil maintenance - Turbine enginevibration monitoring in aircraft - Life usage monitoring - Current capabilities of NDT - Helicopter miantenance -Future of aircraft maintenance.
Total No of periods: 45

References:

(a) Fedric J.H., " Airport Management ", English Book House, New Delhi-I.
(b) Gene Krope, " Airline Procedures ", English Book House, New Delhi-I.

(c) Wilson & Bryon, " Air Transportation ", English Book House, New Delhi-I.
(d) Philip Lockin D, " Economics of Transporation ", English Book House, New Delhi-I.
(e) " Indian Aircraft manual ", Published by DGGA, English Book House, New Delhi-I.
(f) Alexander T Wells, " Air Transporation ", Wadsworth Publishing Company, California, 1993.
(g) C.H. Friend, " Aircraft Maintenance Management ", English Book House, New Delhi-I

AN 010 804 L01 Project Management And Total Quality Management

Teaching scheme **Credits: 4**

2 hours lecture and 2 hours tutorial per week

Objectives

- *To introduce students best practices in improving quality, quality management principles and various quality management tools.*
- *To familiarize students with various quality systems used such as ISO.*

Module I – INTRODUCTION

Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs - Analysis Techniques for Quality Costs, Basic concepts of Total Quality Management, Historical Review,Principles of TQM, Leadership – Concepts, Role of Senior Management, Quality Council,Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation.

Module II – TQM PRINCIPLES

Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality,Customer Retention, Employee Involvement – Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits, Continuous Process Improvement – Juran Trilogy,PDSA Cycle, 5S, Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection,Supplier Rating, Relationship Development, Performance Measures – Basic Concepts, Strategy,Performance Measure.

Module III – STATISTICAL PROCESS CONTROL (SPC)

The seven tools of quality, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes,Process capability, Concept of six sigma, New seven Management tools.

Module IV – TQM TOOLS

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment(QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of FMEA.

Module V – QUALITY SYSTEMS

Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System – Elements, Implementation of Quality System, Documentation, Quality Auditing, QS 9000, ISO 14000 – Concept, Requirements and Benefits.

References:

1. Dale H.Besterfiled, et at., Total Quality Management, Pearson Education Asia, 1999. (Indian reprint 2002).

REFERENCES:

2. James R.Evans & William M.Lidsay, The Management and Control of Quality, (5th Edition), South-Western (Thomson Learning), 2002 (ISBN 0-324-06680-5).

3. *Feigenbaum.A.V. "Total Quality Management, McGraw-Hill, 1991.*
4. *Oakland.J.S. "Total Quality Management Butterworth – Hcinemann Ltd., Oxford. 1989.*
5. *Narayana V. and Sreenivasan, N.S. Quality Management – Concepts and Tasks, New Age International 1996.*
6. *Zeiri. "Total Quality Management for Engineers Wood Head Publishers, 1991.*

AN 010 804L02 Air Navigation

Teaching scheme **Credits: 4**

2 hours lecture and 2 hours tutorial per week

Objectives

- *To introduce students with basic terminologies used in navigation of aircraft.*
- *To familiarize students with various navigational methods and systems used in different phases of flight.*

Module I

(a) Form of the Earth, Linear Distance and Departure --Introduction, The earth's size and shape, The geographic poles, Properties of a great circle, Describing positions on the earth, Spacing of meridians, GC tracks and distances on the earth, Geographic / Geodetic and geocentric latitudes, Kilometers , Statute mile, Comparison of units of length.

(b) The Velocity Triangle--Introduction, Speed and velocity, True airspeed (TAS), The velocity triangle, The aircraft velocity triangle , Drift, Finding heading and ground speed, Wind components, True wind components, Effective wind components, Effective along track wind component with wind at 900 to track.

(c) Temperatures, Airspeeds and Altitudes--Introduction, Static air temperature (SAT), Effects of compressibility on air temperature measurement, Total air temperature (TAT) , Ram air temperature (RAT) , Obtaining the COAT, Airspeeds, Density correction when TAS in under 300kt and using navigational circular slide rule (CSR) , Using airspeed correction scale when TAS is over 300 knots, Obtaining TAS from Mach Number, Altitudes and pressure settings, Altimeter settings.

Module II

(a) DR Navigation--Introduction, Mental estimation of head/tailwind components and drift, Mental estimation to revise estimated times of arrival (ETAs), Findings an approximate DR position, Finding DR position with a tack plot, Factors affecting accuracy of DR positions, Resolving DR error, Minimizing fix errors, Plotting on various charts.

(b) Maximum Range, Radius of Action and Point of No Return--Introduction, Still air range (SAR), Radius of action (R of A) or point of no return (PNR), When PNR is required, Calculating PNR by simple formula, Calculating PNR with engine failure, Tabular solution to the PNR, PNR in still air, PNR in wind conditions, Effect of endurance on PNR distance , Effect of performance on PNR distance.

(c) Point of Equal Time or Critical Point --Introduction, The point of equal time (PET) , Importance, Engine failure PET, Still air PET, The effect of along track wind components, PET Formula, Calculating ETA at cirtical points, Calculating PET for engine Failure, Effect of reduced TAS on PET ,The PET compared with the PNR, Relationship between the PET and PNR.

Module III - Visual Navigation

Introduction, Map Reading, Useful checkpoints, Identifying a checkpoint (pinpoint), Special uses of line features, Lines of Position (LOP) , Doubling the angle on the bow, A running fix, Assessing distance away from an aircraft, Type of terrain, Mountainous areas, The effect of the seasons, Inadequately mapped areas, Effect of times of the day on map reading, Procedure when lost, Orientation of maps.

Module IV--Navigation in Climb and Descent

Introduction, Obtaining a mean TAS for the climb, Obtaining the correct mean TAS for a climb, Obtaining the Mean TAS for climbs from Higher levels, Obtaining the mean W/V for a climb, obtaining the DR position at the top of climp (TOC), Establishing TOC position, Navigation on the descent, W/V for the descent, Obtaining the DR position for the top of descent (TOD), Fixing position at the TOD, Obtaining climb and descent gradients, Relationship between vertical speed, GS and angle of climb / descent, The importance of an accurate position at TOD.

Module V - Inertial Navigation Systems (INS)

Introduction, The principle of the INS, Inertia, Accelerometers, Integrators, Using two accelerometers, The stable platform , The structure of the stable platform, The operation of the system, The Inertial Navigation Unit (INU) , keeping the platform level, Allowing for altitude, Initial alignment , Pre-departure Procedure, In-Flight Presentations, Action at waypoints, Errors of the INS, Strapdown systems, Ring laser gyros (RLG) , Connection of INS to other aircraft systems, Checking inertial presentation.

Reference:

(a)Air Navigation, C W Martin

AN 010 804 L03 Aircraft Rules and Regulations

Teaching scheme **Credits: 4**
2 hours lecture and 2 hours tutorial per week

Objectives

- *To impart knowledge of various rules and regulations governing the civil aviation in India.*

MODULE I - The Aircraft Rules, 1937

Definitions and interpretations, Rules 5, Rule 7, 7A & 7B, Rule 15, Rule 25 A, Rule 30, Rule 49 ,Rule 50, Rule 55, and Rule 61.

MODULE II - CAR Series -A, Band C

CAR series A-procedure for Civil Airworthiness requirements, and responsibility of operators vis-à-vis Airworthiness directorate: Responsibility of operators/ owners, procedure and CAR issue, amendments etc., objectives and targets of Airworthiness directorate. CAR series B:- Preparation of MEL, and its approval, preparation and use of cock pit check list and Emergency check list.CAR Series C: Defect recording, reporting, investigation, rectification and analysis. Analytical study of in flight instrument reading and recording. Maintenance control by reliability method.

MODULE III - CAR Series D,E and F

Car series D:- Aircraft Maintenance Programs, reliability program (Engines), Aircraft Maintenance program and their approvals. TBO- revision program-reciprocating engines. CAR Series E: - Approval of organizations in categories A,B,C, D, E, F & G, release and rejection notes. CAR Series F:- Procedure relating to registration & Aircrafts, issue, validation and renewal of certificate Of Airworthiness, procedure for issue, revalidation of type certificate of Aircraft and its engines.

MODULE IV - CAR series L, M, T and X

CAR Series L- Issue of AME License, its classification, experience requirements, issue of BAMEC and its classifications. CAR Series T & X:- Flight testing of series of Aircraft for issue of COA, Registration Markings & Aircraft, weight & balance control, provision of First aid kit and physician's kit, documents to be carried on board on Indian registered aircraft. Aircraft log books.

MODULE V - CAR 21

Sub part B, Application for a type certificate & its procedures, sub part G- production organization approval, sub part I-Noise certificate, subpart JA- Design organization approval, subpart L-Export Airworthiness approvals, Sub part O- Indian Technical Standard Order (ITSO)

References:-

(a) *Aircraft Manual (India) Volume I-Sterling Book House*

(b) Civil Aviation Requirements-section 2-Airworthiness Volume I & II. Issued by DGCA- English Book Store, New Delhi

(c) CAR 21-issued by DGCA

AN 010 804L04 INDUSTRIAL AERODYNAMICS

Teaching scheme **Credits**: 4

2 hours lecture and 2 hour tutorial per week

Objective:

- *To make students aware of various atmospheric changes and its effect in flight vehicles.*
- *Also to plot out the trajectory of Aerodynamics on each structure.*

MODULE-1: ATMOSPHERE

Types of Winds, Causes of variation of winds, Atmospheric Boundary layer, Effect of terrain, Gradient height, Structure of Turbulent flows.

MODULE-2: WIND ENERGY COLLECTORS

Horizontal and vertical axis machines, Power coefficient, Betz coefficient by momentum theory. Basic shape factors, bluff body aerodynamics, Wind tunnels and measurement techniques

MODULE-3: VEHICLE AERODYNAMICS

Power requirements and Drag coefficients of Automobiles, Effects of cut back angle, Aerodynamics of trains, Aerodynamics of Hovercraft. Dynamic effects, aeroelastic phenomena, Application to buildings, chimneys, towers, bridges, automobiles, etc.

MODULE-4 BUILDING AERODYNAMICS

Pressure distribution on low rise buildings, Wind forces on buildings, Environmental winds on City blocks, Special problems of Tall buildings, Building codes, building ventilation and Architectural aerodynamics.

MODULE-5 FLOW INDUCED VIBRATION

Effects of Reynolds number on wake formation of bluff shapes, Vortex induced vibrations, Galloping and stall flutter. Design practice, case studies.

References:

1. Scorer, R.S.," Environmental aerodynamics " , Ellis Harwood Ltd., England, 1978.

2. Sovran, M., " Aerodynamic Drag Mechanisms of Bluff Bodies and Road Vehicles " , Plenum Press, N.Y.,

1978.

3. Sachs. P., " Wind Forces in Engineering ", Pergamon Press, 1988.

4. Blevins, R.D., " Flow Induced Vibrations ", Van Nostrand, 1990.

5. Calvert, N.G., " Wind Power Principles", Charles Griffin & Co., London, 1979

AN 804 L05 Acoustic and Noise Control

Teaching scheme **Credits: 4**

2 hours lecture and 2 hours tutorial per week

Objectives:

- *Elementary physical acoustics in 1D and its extension to simple 3D situations*
- *The significance of human factors in acoustics*
- *Fundamentals of architectural acoustics and noise control*

Module1 (12 hours)

Longitudinal wave propagation in a rod-Derivation of wave equation-Physical interpretation of the wave equation solution-One Dimensional Waves in a Gas-Acoustic Energy and Acoustic Intensity-Energy in a plane progressive wave-Acoustic Impedance

Module 2 (12 hours)

Sound Perception and the Decibel Scale-The ear-The decibel Scale-Combining Sound Levels in Decibels-Octave Bands-Loudness-The "A" Weighting-Legal requirements for noise control

Module 3 (12 hours)

Acoustic Resonance-Resonance of a pipe closed at both ends-Resonance of a pipe closed at one end, open at the other-Reflection & Transmission of Plane Acoustic Waves-Sound Transmission through layers and partitions-Transmission through a layer-Transmission through solid partitions

Module 4 (12 hours)

Room Acoustics-Acoustic Absorption-Reverberation Time-Sound Transmission between Rooms

The wave equation in 3 dimensions-Acoustic impedance of a spherical wave - near and far field effects-Source efficiency

Module 5 (12 hours)

Directionality of acoustic sources and receivers-Directivity index-Screens-Silencers

Helmholtz resonator design-Expansion chamber silencer design-Dissipative silencers

Active control of noise

References

1. Turner and Pretlove, Acoustics for Engineers, Macmillan, 1991
2. Kinsler, Frey, Coppens & Sanders. Fundamentals of Acoustics. 3rd Edition. John Wiley, 1982
3. Smith, Peters and Owen, Acoustics and Noise Control, Addison-Wesley-Longman, 2nd edition 1996
4. Bies and Hanson, Engineering Noise Control, theory and practice E&FN Spon, 2nd edition, 1996

AN010 804 L06 Transport process on Reacting Flows

Teaching scheme **Credits:** 4

2 hours lecture and 2 hours tutorial per week

Objectives

- *To impart knowledge of principles of reacting flows based on thermodynamics, kinetics and transport.*
- *To give an understanding of dynamics of reacting flows based on the principles of heat, mass and momentum transfer including an introduction to combustion chemistry.*

Module I – Principles of heat transfer

Conduction-basic concepts-steady state one dimensional-steady state two dimensional and three dimensional-unsteady heat conduction

Convection-introduction to hydrodynamics-dimensional analysis-forced and free convection

Radiation-basic relation-thermal radiation

Module II – Mass and Momentum transfer

Elements of mass diffusion

Heat and mass transfer

basic concept-diffusion mass transfer-frick s law of diffusion-steady state molecular diffusion-convective mass transfer-momentum,heat and mass transfer analogy-convective mass transfer correlations

Module III

Chemical Kinetics, and equilibrium reaction kinetics, reactive collision potential, activation energy. The collision process, fast reaction – relaxation process. Chemical equilibrium dependence of equilibrium constant with temperature effect of condension on equilibrium calculation of exploration temperature

Module IV – Reactive Gas dynamics

General equations for reactive gas dynamics, approximations to general equations laminar flow, compressible inviscid reactive gas dynamics steady one dimensional inviscid flow. Quasi one dimensional inviscid flow . Non steady one dimensional inviscid flow, turbulence on a homogeneous fluid. Turbulent mixing with reaction

Module V - Combustion chemistry

Adiabatic thermal explosion, vessel explosion, thermal combustion chemistry, chain reaction, vessel explosion branching chain unfied theory of vessel explosion, flame temperature and burning velocity, laminar theory ionization in flame, laminar flame holding laminar flame shape, turbulent get diffusion flame extinction of diffusion flames, flammability limb

Reference:

(a)Heat and Thermodynamics, Zemansky

(b)Physical Chemistry, Gladston

(c)Combustion fundamental, Royer A Strehlow, Mc Graw Hill.

(d)Chemical Engineering, Juliust Banchero , Tata Mc Graw Hill.

AN 010 805 G01 Boundary layer Theory

Teaching scheme **Credits:** 4

2 hours lecture and 2 hours tutorial per week

Objectives

- *To cover fundamentals of viscous flow.*
- *To understand, analyze and formulate equations for laminar, transition and turbulent boundary layers including a study of numerical methods used to solve the governing equations.*

Module I -Viscous flow and fundamentals of boundary layer theory

Viscosity- Reynold's No. – Laminar and turbulent flow, boundary layer concept- Laminar boundary layer on a flat plate at zero incidence, turbulent boundary layer at zero incidence, boundary layer on an aerofoil separation of boundary layer.

Module II – Laminar boundary layer

Boundary layer equation in plane flow, setting up of boundary layer equation, wall friction, separation and displacement, dimensional representation of the boundary layer equation, friction drag, plate boundary layer, general properties of boundary layer equation , their solutions, Derivation of ordinary differential equation of a) boundary layer with outer flow, b) boundary layer without outer flow, wedge flow, flow in a convergent channel, mixing layer, moving plate, free jet, wall jet .

Module III – Laminar Turbulent transition

Some experimental results on the laminar turbulent transition – Transition in pipe flow, transition in boundary layer,- fundamentals of primary stability theory, Orr- sommerfield equation curve of neutral stability, and the indifference Reynold's no. plate boundary layer , effect of pressure, gradient effect of suction, effect of compressibility, effect of wall roughness, - Instability of boundary layer of three dimension – boundary layer at curved wall, boundary layer at rotating disc.

Module IV – Turbulent boundary layer

Fundamentals of turbulent flows- basic equations for the mean motion of turbulent flows – continuity equation ,momentum equation , equations for kinetic energy of turbulent fluctuations, Thermal energy equation- Description of turbulent fluctuations, correlations, spectra and eddies turbulent of outer flows, Internal flow - Couette flow, Two layer structure of the velocity flow, universal laws of the wall, friction law, turbulence models , heat transfer, fully developed internal flows, channel flow, coutte – poiseuille's flow, pipe flow

Module V – Numerical methods in boundary layer theory

Numerical integration of the boundary layer- Note on boundary layer transformations- explicit and implicit discretisation, solution of implicit difference equation, Integration of continuity equation, boundary layer edge and wall shear stress, Integration of transformed boundary layer using box scheme, Turbulent boundary layer method of wall function

Reference:

(a) *A Schlitching K Gersten , Boundary Layer theory, Mc Graw Hill*
(b) *J D Anderson, Fluid mechanics , Mc Graw Hill*

AN 010 805 G02 Disaster Management

Teaching scheme **Credits:** 4

2 hours lecture and 2 hours tutorial per week

MODULE 1 (12 hours)

Importance of disaster management - Types of emergencies – major industrial disasters – Components of a major hazard control system – identification of major hazard control installations – purpose and procedures – safe operation of major hazard installations – mitigation of consequences – reporting to authorities. Implementation of major hazard control systems – group of experts – training – checklists – inspection – evaluation of major hazards – information to the public – manpower requirements – sources of Information

MODULE 2 (12 hours)

Emergency planning – On-site emergency planning – formulation of the plan and emergency services – Identification of resources – actions and duties – emergency procedure – mock drills. Off-site emergency planning – objectives and elements of off-site plan – role of administrative machinery – role of major hazard works management – role of the local authority. Emergency preparedness at local level – Awareness and preparedness for emergencies at local level (APELL) – The process and its partners.

MODULE 3 (12 hours)

Requirements of emergency plan as per Indian legislations like Factories Act, Manufacture, Storage and Import of Hazardous Chemicals Rules, Chemical Accidents (Emergency planning, Preparedness and Response) Rules-Applications of remote sensing and GIS in disaster management

MODULE 4 (12 hours)

Emergency planning and preparedness in international standards like ISO 14001, OHSAS 18001 and OSHA's Process Safety Management System, Emergency Planning in Seveso II directive – elements of emergency planning in IS : 18001 – Hazardous Materials / Spills Emergencies – contingency plans for road transportation of hazardous chemicals – contingency plans for oil spills in marine environment.

MODULE 5 (12 hours)

Natural Hazards – potentially hazardous natural phenomena – earthquakes – landslides – flooding – cyclones – hazards in arid and semi-arid areas – nature of the hazard – hazard management activities – disaster mitigation – natural hazard prediction – emergency preparedness – disaster, rescue and relief – post disaster rehabilitation and reconstruction – education and training activities – vulnerable elements to be considered in the development planning for natural hazard management .

TEXT BOOKS:

1. Petak, W.J and Atkisson, A.A.: *Natural Hazard Risk Assessment and Public Policy:*
Anticipating the Unexpected

2. Frank P Lees, '*Loss prevention in process industries*', Vol I, II, III, Butterworth, London, 1980

REFERENCES:

1. ILO, Geneva: *Major Hazard Control – a Practical Manual.*
2. UNEP, Paris : *APELL - A Process for responding to technological accidents , A Handbook,* Industry & Environment Office., 1998
3. *Accident Prevention Manual for Business and Industry, Vol. I* – National Safety Council, USA.
4. *Oil spill Response : The National Contingency Plan* - Institute of Petroleum, London
5. U.R. Rao : *Space Technology for Sustainable Development*

AN 010 805 G03 Cryogenics

Teaching scheme **Credits: 4**

3 hours lecture and 1 hour tutorial per week

Objectives

- *To impart the basic concepts of Cryogenic Engineering*
- *To provide the learner with the fundamental knowledge about the properties of cryogenic materials, its storage and transfer systems*
- *To develop an understanding of various cryogenic liquefaction and refrigeration systems and their performances*

Module 1 (8 hours)

Introduction: Historical development- application of cryogenics -present areas involving cryogenic engineering-cryogenics in space technology- cryogenics in biology and medicine- superconductivity applications.

Module 2 (12 hours)

Basic thermodynamics applied to liquefaction and refrigeration process – isothermal, adiabatic and Joule Thomson expansion process -efficiency to liquefaction and coefficient of performances- irreversibility and losses. Low temperature properties of engineering materials: mechanical properties – thermal properties -electrical and magnetic properties. Properties of cryogenic fluids- superconductivity and super fluidity - materials of constructions for cryogenic applications.

Module 3 (15 hours)

Gas liquefaction systems: Production of low temperatures – general liquefaction systems- liquefaction systems for neon, hydrogen and helium.

Module 4 (15hours)

Cryogenic refrigeration systems: ideal refrigeration systems- refrigerators using liquids and gases as refrigerants- refrigerators using solids as working media - adiabatic demagnetization method.

Module 5 (10 hours)

Cryogenic storage and transfer systems: Cryogenic fluid storage vessels- cryogenic fluid transfer systems-cryo pumping.

Text Books

1. Barron R., *Cryogenic Systems*, Oxford Science Publications
2. Scott R.B., *Cryogenic Engineering*, Van Nostrand Co.

Reference Books

1. Mamata Mukhopadyay., *Fundamentals of Cryogenic Engineering*, PHI Learning
2. Haseldon G.G., *Cryogenic Fundamentals*, Academic Press
3. Flynn T.M., *Cryogenic Engineering*, Marcel Dekker.

AN010 805 G04 Advanced strength of materials

Teaching scheme **Credits: 4**

2 hours lecture and 2 hour tutorial per week

Objectives

- *To analyse the stresses and deformations through advanced mathematical models.*
- *To estimate the design strength of various industrial equipments.*

Module 1 (12 -hours)

ANALYSIS OF PLATES Mathematical modeling of plates with normal loads – Point and Distributed Loads – Support conditions – Rectangular plates - Stresses along coordinate axes – Plate deformations – Axi-symmetric plates – Radial and tangential stresses – plate deflections.

.

Module II (14-hours)

THICK CYLINDERS AND SPHERES Equilibrium and compatibility conditions - Lame's Theorem – Boundary conditions – distribution of radial and tangential stresses – compound cylinders – Interference fits - Stresses due to temperature distributions. piston, oscillating motor-characteristics.

Module III (12 -hours)

ROTATING DISCS Lame-Clayperon Theorem – radial and tangential stresses in discs due to centrifugal effects – boundary conditions – solid and hollow discs – Interference fit on shafts – Strengthening of the hub – residual stresses – Autofrettege – Discs of variable thickness – Disc profile for uniform strength.

Module IV (12 - hours)

BEAMS ON ELASTIC FOUNDATION Infinite beam subjected to concentrated load – Boundary Conditions – Infinite beam subjected to a distributed load segment – Triangular load – Semi infinite beam subjected to loads at the ends and concentrated load near the ends – Short beams.

Module V (10 - hours)

CURVED BEAMS AND CONTACT STRESSES Analysis of stresses in beams with large curvature – Stress distribution in curved beams – Stresses in crane hooks and C clamps – Contact Stresses – Hertz equation for contact stresses – applications to rolling contact elements.

Text Books

1. Boresi A.P., Schmidt R.J., "Advanced Mechanics of Materials", John Wiley and Sons, Sixth edition, 2003.
2. Dally J.W. and Riley W.F, "Experimental Stress Analysis", John Wiley and Sons 2003

Reference Books

1. Burr A. H., CheathAm J.B., "Mechanical Analysis and Design", Prentice Hall of India, Second edition, 2001.
2. Den-Hartog J.P., "Strength of Materials", John Wiley and Sons..

AN 010 805 G05 HIGH TEMPERATURE GAS DYNAMICS

Teaching scheme **Credits**: 4

2 hours lecture and 2 hours tutorial per week

Objectives

- *To give conceptual understanding of equilibrium and non-equilibrium processes in a gas (energy exchange between molecules) and their effect on macroscopic flow of gases.*

Module I – INTRODUCTION (10)

Nature of high temperature flows – Chemical effects in air – Real perfect gases – Gibb's free energy and entropy by chemical and non equilibrium – Chemically reacting mixtures and boundary layers.

Module II – STATISTICAL THERMODYNAMICS (10)

Introduction to statistical thermodynamics – Relevance to hypersonic flow - Microscopic description of gases – Boltzman distribution – Cartesian function

Module III – KINETIC THEORY AND HYPERSONIC FLOWS (12)

Chemical equilibrium calculation of equilibrium composition of high temperature air – equilibrium properties of high temperature air – collision frequency and mean free path – velocity and speed distribution functions.

Module IV – INVISCID HIGH TEMPERATURE FLOWS (14)

Equilibrium and non – equilibrium flows – governing equations for inviscid high temperature equilibrium flows – equilibrium normal and oblique shock wave flows – frozen and equilibrium flows – equilibrium conical and blunt body flows – governing equations for non equilibrium inviscid flows.

Module V – TRANSPORT PROPERTIES IN HIGH TEMPERATURE GASES (14)

Transport coefficients – mechanisms of diffusion – total thermal conductivity – transport characteristics for high temperature air – radiative transparent gases – radiative transfer equation for transport, absorbing and emitting and absorbing gases.

Text books

1. John D. Anderson, Jr., Hypersonic and High Temperature Gas Dynamics, McGraw-Hill Series, New York, 1996.

2. John D. Anderson, Jr., Modern Compressible Flow with Historical perspective McGraw-Hill Series, New York, 1996.

References

1. William H. Heiser and David T. Pratt, Hypersonic Air breathing propulsion, AIAA Education Series.

2. John T. Bertin, Hypersonic Aerothermodynamics publishers - AIAA Inc., Washington, D.C.,1994.

3. T.K.Bose, High Temperature Gas Dynamics

AN010 805 G06 Turbo machines

Teaching scheme **Credits:** 4

2 hours lecture and 2 hour tutorial per week

Objectives

- *To impart the basic concepts of various turbo machines like blowers, fans, compressors and turbines.*

Module I (12 hours)

Principles: Energy transfer between fluid and rotor, classification of fluid machinery, dimensionless parameters, specific speed, applications, stage velocity triangles, work and efficiency for compressors and turbines.

Module II (12 hours)

Centrifugal Fans and Blowers: Types, stage and design parameters, flow analysis in impeller blades, volute and diffusers, losses, characteristics curves and selection, fan drives and fan noise.

Module III (12 hours)

Centrifugal Compressor: Construction details, types, impeller flow losses, slip factor, diffuser analysis, losses and performance curves.

Module IV (12 hours)

Axial Flow Compressor: Stage velocity triangles, enthalpy-entropy diagrams, stage losses and efficiency, work done factor, simple stage design problems and performance characteristics.

Module V (12 hours)

Axial and Radial Flow Turbines: Stage velocity diagrams, reaction stages, losses and coefficients blade design principles, and testing and performance characteristics.

Text Books

1) Yahya, S.H., *Turbines, Compressor and Fans*, Tata Mc Graw Hill Publishing Company, 1996.
2) B K Venkanna, *Fundamentals of Turbomachinery*, Prentice Hall of India, 2009

Reference Books

1. Bruneck, *Fans*, Pergamom Press, 1973.
2. Earl Logan, Jr., *Hand book of Turbomachinery*, Marcel Dekker Inc., 1992.
3. Dixon, S.I., *Fluid Mechanics and Thermodynamics of Turbomachinery*, Pergamom Press, 1990.
4. Shepherd, D.G., *Principles of Turbomachinery*, Macmillan, 1969.
5. Stepanff, A.J., *Blowers and Pumps*, John Wiley and Sons Inc., 1965
6. Ganesan .V. *Gas Turbines*, Tata Mcgraw Hill Pub.Co., New Delhi, 1999.

AN 010 806 Aerodynamic Lab

Teaching scheme **Credits**: 2

3 hours practical per week

Objectives

- *To study experimentally the flow properties over various bodies by finding the pressure distribution and from which Lift, Drag and various moments are calculated.*

Experiments:

1. Measurement of centre of pressure and keep them in centre of pressure position.
2. Study of pressure distribution over circular cylinders.
3. Study of pressure distribution over symmetric airfoils.
4. Study of load distribution on a given wing.
5. Study of flow over a flat plate at different angle of incidence.
6. Study of pressure distribution over thin airfoils.
7. Flow studies in low speed flows over cylinders.
8. Experiment that shows the real flow field around a slender delta wing showing vortex structure and surface flow pattern.
9. Estimation of lift, drag and pitching moment by knowing pressure distributions.
10. Study of live aircraft (Piston Engine).
11. Study of Jet plane.
12. Study of Helicopter.

AN010 807 Project Work

Teaching scheme **credits: 4**

6 hours practical per week

The progress in the project work is to be presented by the middle of eighth semester before the evaluation committee. By this time, the students will be in a position to publish a paper in international/ national journals/conferences. The EC can accept, accept with modification, and request a resubmission.

The progress of project work is found unsatisfactory by the EC during the middle of the eighth semester presentation, such students has to present again to the EC at the end of the semester and if it is also found unsatisfactory an extension of the project work can be given to the students.

Project report: To be prepared in proper format decided by the concerned department. The report shall record all aspects of the work, highlighting all the problems faced and the approach/method employed to solve such problems. Members of a project group shall prepare and submit **separate** reports. Report of each member shall give details of the work carried out by him/her, and only summarise other members' work.

The student's sessional marks for project will be out of 100, in which 60 marks will be based on day to day performance assessed by the guide. Balance 40 marks will be awarded based on the presentation of the project by the students before an evaluation committee.

For Project, the minimum for a pass shall be 50% of the total marks assigned to the Project work.

AN010 808 Viva -Voce

Teaching scheme **credits: 2**

A comprehensive oral Viva-voce examination will be conducted to assess the student's intellectual achievement, depth of understanding in the specified field of engineering and papers published / accepted for publication etc. At the time of viva-voce, certified bound reports of seminar and project work are to be presented for evaluation. The certified bound report(s) of educational tour/industrial training/ industrial visit shall also be brought during the final Viva-Voce.

An internal and external examiner is appointed by the University for the Conduct of viva voce University examination.

For Viva-voce, the minimum for a pass shall be 50% of the total marks assigned to the Viva-voce.

Note: If a candidate has passed all examinations of B.Tech. course (at the time of publication of results of eighth semester) except Viva-Voce in the eighth semester, a re-examination for the Viva-Voce should be conducted within one month after the publication of results. Each candidate should apply for this 'Save a Semester examination' within one week after the publication of eighth semester results.

Civil Engineering (CE)

EN010 501A ENGINEERING MATHEMATICS IV
(Common to all branches except CS & IT)

Teaching scheme **Credits: 4**

2 hours lecture and 2 hour tutorial per week

Objectives: *Use basic numerical techniques to solve problems and provide scientific techniques to decision making problems.*

Module 1 (12 hours)
Function of Complex variable : Analytic functions – Derivation of C.R. equations in cartision co-ordinates – harmonic and orthogonal properties – construction of analytic function given real or imaginary parts – complex potential – conformal mapping of z^2 , $\frac{1}{z}$ - Bilinear transformation – cross ratio – invariant property (no proof) – simple problems.

Module 2 (12 hours)
Complex integration: Line integral – Cauchy's integral theorem – Cauchy's integral formula – Taylor's series- Laurent's series – Zeros and singularities – types of singularities – Residues – Residue theorem – evaluation of real integrals in unit circle – contour integral in semi circle when poles lie on imaginary axis.

Module 3 (10 hours)
Numerical solution of algebraic and transcendental equations: Successive bisection method – Regula –falsi method – Newton –Raphson method - Secant method – solution of system of linear equation by Gauss – Seidel method**.**

Module 4 (10 hours)
Numerical solution of Ordinary differential equations: Taylor's series method – Euler's method – modified Euler's method – Runge – Kutta method (IV order) - Milnes predictor – corrector method.

Module 5 (16 hours)
Linear programming problem: Definition of L.P.P., solution, optimal solution, degenerate solution – graphical solution –solution using simplex method (non degenerate case only) Big -M method – Duality in L.P.P. – Transportation problem –Balanced T.P. – initial solution using Vogel's approximation method - modi method (non degenerate case only)

References

1. B.V. Ramana – Higher Engg. Mathematics – Mc Graw Hill
2. M.R.Spicgel , S.Lipschutz , John J. Schiller, D.Spellman – Complex variables, schanm's outline series - Mc Graw Hill
3. S.Bathul – text book of Engg.Mathematics – Special functions and complex variables – PHI
4. B.S. Grewal – Numerical methods in Engg. and science - Khanna Publishers

5. Dr.M.K Venkataraman- Numerical methods in science and Engg -National publishing co
6. S.S Sastry - Introductory methods of Numerical Analysis -PHI
7. P.K.Gupta and D.S. Hira – Operations Research – S.Chand
8. Panneer Selvam– Operations Research – PHI
9. H.C.Taneja – Advanced Engg. Mathematics Vol II – I.K.International

CE010 502 COMPUTER PROGRAMMING

Teaching Scheme **Credit: 4**
3 hours lecture and 1hour tutorial per week**.**

Objective:
To provide a strong foundation in the basics of C-Programming so that students can develop the ability to design software's.

Module I (15 Hours)

Introduction to C: The C character set- identifiers and keywords- data types-user defined data types-constants and variables-declarations- operators-expressions-statements-library input-output functions
Control statements: if, if-else, switch, -conditional and comma operators.

Module II (15 Hours)

Iterative statements: 'while', 'do-while', for 'statements-nested loops, break and continue statements.
Functions: Declarations, definition and access-passing arguments to a function –pass by value and pass by reference-recursion.
Storage classes: automatic variables-external variables-register variables-scope and lifetime of variables-macros

Module III (12 Hours)

Arrays: Single dimensional arrays-multidimensional arrays-definition-initializing arrays-passing arrays to a function- matrix operations-addition, transpose and multiplication. Pointers-declaration-operations.
Strings: definition –string handling function-comparison, concatenation and sorting of strings

Module IV (10 Hours)

Structures and union: definition –initialization-accessing structure members-array of structures-passing structure to a function –sorting of structures –binary files-reading and writing of data blocks-union.
Dynamic memory allocation - self referential structures - basic concepts of linked lists.

Module V (8 Hours)

Files :File pointers-data files-opening and closing-reading and writing-appending-error handling function-handling data in blocks-command line arguments.

References

1.B.S. Gotterfield Theory and Problems of Programming with C.TMH
2. Balaguruswamy, Programming in C, Tata Mc Graw Hill.
3. Kern Ingham , Ritchie, The C programming language, Prentice Hall.
4. Byron S Gottfried, Programming with C, Tata Mc Graw Hill.

5. Y. Kenetker, Let us C, BPB Publications.
6. V. Rajaraman, Programming with C.
7. Y. Kenetker, Exploring C, BPB Publications.

CE010 503 DESIGN OF CONCRETE STRUCTURES – I

Teaching Scheme **Credit: 4**
2 hours lecture and 2 hours tutorial per week**.**

Objective

- ***To provide the students with the knowledge of behaviour of reinforced concrete structural elements in flexure, shear, compression and tension and to enable them to design such elements.***

Module 1 (12 hours)

Working stress method: Introduction- permissible stresses-factor of safety –behaviour of R.C.C beams –assumptions-under reinforced –over reinforced and balanced sections. Theory of singly and doubly reinforced beams.

Module 2 (12 hours)

Limit state method: Concepts-assumptions –characteristic strength and load partial safety factors-limit states-limit state of collapse –limit state of serviceability. Theory of singly and doubly reinforced rectangular sections in flexure-design of simply supported and flanged beams.

Module 3 (15 hours)

Behaviour and design of one way and two way slabs-Continuous slabs-analysis using method recommended by BIS -arrangements of reinforcement in slabs. Design of flat slab (Concept only).

Module 4 (8 hours)

Design of columns: Limit state method- I S specifications-design of columns with lateral and helical reinforcement-members subjected to combined axial load and bending.

Module 5 (13 hours)

Design of footings-Isolated footing with axial and eccentric loading-combined footing. Stair cases-introduction to different types-design of simply supported flights-cantilever steps.

Note: Sketches only required for reinforcement details. Detailed drawing in drawing sheets not required.

References

1. Relevant IS codes. (I.S 456, I.S 875,SP 16)
2. Park R and Pauloy T, Reinforced concrete structures, John Wiely & sons Inc.
3. Purushothaman P, Reinforced concrete structural elements-Behaviour, Analysis and Design, Tata McGraw Hill publishing company Ltd.
4. Unnikrishna Pillai S. & D.Menon, Reinforced concrete design, Tata McGraw Hill

Publishing company Ltd.
5. Mallick S.K., Reinforced concrete, Oxford & IBH Publishing company.
6. Varghese P.C., Limit state design of Reinforced concrete, Printice Hall of India Pvt Ltd.
7. Ashok .K. Jain, Reinforced concrete- Limit state design, New Chand & Bose.
8. S.S Bhavikatti, Design of Reinforced concrete structures, I.K.International Publishing house Pvt.Ltd

CE010 504 GEOTECHNICAL ENGINEERING – I

Teaching scheme: **Credits: 4**
3 hour lecture and 1 hour tutorial per week

Objective:
Geotechnical Engineering is one of the important disciplines of Civil Engineering involving the study of behaviour and engineering properties of soil.
The objective of the course is to present different laws and principles of Soil Mechanics so that the strength and settlement of the foundation soil can be evaluated.

Module 1 (15 Hours)

Soil formation and soil types: Residual soil and transported soil-Soil structure-Basic structural units of clay minerals. Simple soil properties: three phase systems - void ratio - porosity - degree of saturation - moisture content - specific gravity - unit weight relationships.
Laboratory and field identification of soils: Determination of water content, specific gravity, determination of field density by core cutter and sand replacement method, grain size analysis by sieve, hydrometer analysis - Atterberg limits and indices - field identification of soils.
Classification of soils: Principles of classification - I. S. classification - plasticity chart.

Module 2 (13 Hours)

Permeability of soils: Darcy's law - factors affecting - constant head and falling head test - permeability of stratified deposits. soil- water system - classification of soil water - capillarity of soils - principles of effective stress.
Seepage of soils: seepage pressure, critical hydraulic gradient - quick sand condition - flownet diagram for isotropic and anisotropic soils
.

Module 3 (10 Hours)

Shear strength: Shear strength parameters - Mohr's circle – Mohr Coulomb strength theory -direct, triaxial, unconfined and vane shear tests- Drainage conditions - UU, CD and CD tests - choice of test conditions for field problems - measurement of pore pressure-critical void ratio and liquefaction. - Activity ,sensitivity and thixotropy

Module 4 (12 Hours)

Compaction: Objects of compaction - proctor test and modified proctor test - concept of OMC and Max. dry density - Zero air void line - factors affecting compaction - effect of compaction on soil properties - field methods-.of compaction - control of compaction.
Stability of slopes: types of failures of soil slopes - Analysis of finite slopes only-Swedish circle method - = 0 analysis and c - analysis. -Taylor's stability number and stability charts
.

Module 5 (10 Hours)

Compressibility and consolidation of soils: void ratio - pressure relationship - concept of coefficient of compressibility - coefficient of volume change and compression index - normally loaded and pre loaded deposits - determination of preconsolidation pressure - Terzaghi's theory of one dimensional consolidation - time rate of consolidation - time factor - degree of consolidation - square root time and log time - fitting methods - coefficient of consolidation - calculation of void ratio - height of solids methods and change in void ratio method - settlement analysis.

References

1. Murthy V. N.S, Soil Mechanics and Foundation Engineering, Nai Sarak, Delhi.
2. Gopal Ranjan and A .S .R .Rao, Basic and Applied Soil Mechanics, New Age International Publishers.
3. Punmia B. C., Soil Mechanics and Foundation Engineering, Laxshmi Publications, New Delhi.
4. Arora K. R., Soil Mechanics and Foundation Engineering, Standard Publishers, Distributors.
5. V. Narasimha Rao and Venkatramaiah, Numerical Problems, Examples and Objective Questions in Geotechnical Engineering, Orient LongMan Publishers.
6. Lambe & Whitman, Soil Mechanics, John Wiely Publications
7. S. K. Garg, Soil Mechanics and Foundation Engineering, Khanna Publishers.

CE010 505 QUANTITY SURVEYING AND VALUATION

Teaching Scheme **Credit: 4**

3 hours lecture and 1hour tutorial per week**.**

Objective

To make the students proficient in preparing the rates and thereby adapting them to estimate the entire project.

Module 1 & 2 (26 Hours.)

Purpose of estimates- different methods-Preparation of detailed estimates and abstracts for RCC Single storey buildings - R C. Footings, Columns – T- Beams. Preparation of bar bending schedule for R. C. works such as beams and slabs.

Module 3 (12 hours.)

Preparation of specification for common materials of construction and its items of works with reference to IS specifications. Cost of materials at source - different types of conveyance and rates - head loads - preparation of conveyance statement- cost of materials at site.

Module 4 (12 hours)

Analysis of rates for earth works, mortars, RCC Works, plastering, brick works, stone works, laterite work, Pointing, form work, flooring - different types, wood works - reinforcement works.

Module 5 (10 hours)

Valuation - explanation of terms - material value, rate, years purchase - freehold and lease hold purchase - depreciation - methods of calculating depreciation - straight line method - constant percentage method, sinking fund method - and quantity survey method. Methods of valuation of land - comparative method - abstractive method. Methods of valuation of property - rental method - direct comparison with capital cost - valuation based on profit - valuation based on cost - development method - depreciation method.

References

1. Schedule of rates, KPWD
2. PWD Data Book
3. Dutta, Estimating and costing,S Dutta & Company, Lucknow
4. Rangawala S.C., Estimating & costing, Charator Anand, Delhi
5. I.S: 1200- 1968 - Methods of measurements of building and civil engineering

University Examination Pattern

Module1&2

Quantity calculation-4 items	**4x10 marks**

Module 3

Specification of any 4 items or conveyance statement as per PW D norms and cost of any 6 materials at source	**4x5 marks**

Module 4

Rate analysis of any two items	**2x10 marks**

Module 5

Problem connected with depreciation of cost	**2x10 marks**

Note:-choice should be given to questions from all the 5 modules

CE 010 506 STRUCTURAL ANALYSIS I

Teaching scheme: **Credits: 4**

3hour lecture and 1 hour tutorial per week

Objective:

To study the force and displacement methods of structural analysis of indeterminate structures , the influence line diagrams and an introduction to Finite Element Method.

Module 1 (12 hours)

Indeterminate structures- force and displacement methods of structural analysis.
Force method of analysis of indeterminate structures - static indeterminacy
Method of consistent deformation, Clapyron' s theorem of three moments- analysis of fixed and continuous beams

Module 2 (12 hours)

Displacement method of analysis: Kinematic indeterminacy
Slope deflection method-fundamental equations-analysis of continuous beams & portal frames (with sway and without sway)
Moment distribution method - analysis of continuous beams & portal frames (with sway and without sway).

Module 3 (14 hours)

Matrix methods: Stiffness method-stiffness-equilibrium equation
Direct stiffness method - structure stiffness matrix-assembly of structure stiffness matrix from element stiffness matrix-equivalent joint load – incorporation of boundary conditions –analysis of beams and pin-jointed frames.

Module 4 (10 hours)

Flexibility method: Flexibility **–**compatibility equation-flexibility influence coefficients – force transformation matrix-flexibility matrix-analysis of beams & frames (rigid and pin-jointed).

Module 5 (12hours)

Finite element method: Introduction to FEM-Historical development-Idealization of actual structures- Boundary conditions. General procedure of FEA-Displacement approach - shape functions

References

1.Devdas Menon, Structural Analysis, Vol.1&II, Narosa, Chennai.
2. Bhavikatti S.S , Structural Analysis Vol. I, Vikas Publishing House (P) Ltd.
3. Weaver &Gere, Matrix Analysis of Structures, East West Press.
4. Moshe F. Rubinstein – Matrix Computer Analysis of Structures- Prentice Hall, 1969.
5. Meek J.L., Matrix Structural Analysis, McGraw Hill,1971.
6. Reddy C.S., Basic Structural Analysis, Tata McGraw Hill Publishing Co.1996.

7. Smith J.C. Structural Analysis, Macmillian Pub.Co.1985.
8. Rajesekharan & Sankarasubramanian,G., Computational Structural Mechanics, Prentice Hall of India, 2001.
9. Mukhopadhyay M., Matrix Finite Element Computer and Structural Analysis, Oxford & IBH,1984.
10. Wang C.K.& Solomon C.G., Introductory Structural Analysis, McGrawHill.1968.

11. Pezemieniecki, J.S, Theory of Matrix Structural Analysis, McGraw Hill Co., 1984
12. Sadhu Sindh, Strength of Materials, Khanna Publishers, 1988.
13. Seeli F.B.&Smith J.P., Advanced Mechanics of Materials, John Wiley &Sons, 1993.
14. Norris & Wilbur, Elementary Structural Analysis, McGraw Hill.
15. Junarker S.R., Mechanics of Structures, Vol. II, Charorbar Book Stall.
16.O C Zienkiewicz,.Finite Element Method, fourth Edition,McGraw Hill,
17. R.D.Cook, Concepts and Applications of Finite Element Analysis, John Wiley &Sons.
19. C.S.Krishnamoorthy, Finite Element Analysis, Tata McGraw Hill .New Delhi, 1987.
20. S.Rajasekharan, Finite Element Analysis, Wheeler Publishing Co., &Sons.1993.

CE010 507COMPUTING TECHNIQUES LAB

Teaching Scheme **Credit: 2**
3 hours Practical per week**.**

Objective:
To make the students aware of recent application softwares and to develop programming skills in C language.

List of Experiments:

1. Familiarization of computer hardware, peripherals and network components. Study of operating systems like DOS, Windows. Linux etc. Commands for use of files and directives.
2. Familiarization with packages like MS Word, MS Excel, and power point.
3. Programming examples related to control statements, arrays, structures, functions, pointers and files in accordance with syllabus of C like,
   a. Solution of quadratic equations
   b .Preparation of conversion tables
   c. Summation of series
   d. Arrays manipulation
   e. Functions
   f. Recursive functions
   g. String manipulations
   h. Matrix operations
   i. .Preparation of mark lists of students, bills etc. using structures
   j. Input and out using files
   k. Simple programs of linked lists and command lime arguments

References

1. Balaguruswamy, Programming in C, Tata Mc Graw Hill.
2. Kern Ingham , Ritchie, The C programming language, Prentice Hall.
3. Byron S Gottfried, Programming with C, Tata Mc Graw Hill.
4. Y. Kenetker, Let us C, BPB Publications.
5. V. Rajaraman, Programming with C.

CE010 508 GEOTECHNICAL ENGINEERING LABORATORY

Teaching Scheme **Credit:2**
3 hours practical per week**.**

Objective:
To practice the different experiments for determination of index properties and strength of soil and to develop confidence in students to assess the suitability of soil for various construction activities

List of Experiments:

1. Determination of specific gravity, water content and particle size distribution by hydrometer method / pipette method.
2. Determination of field density of soil by sand replacement method and core cutter method.
3. Determination of Atterberg limits.
4. Proctor's compaction tests (light and heavy).
5. Permeability tests for cohesive and cohesionless soil.
6. Direct shear test.
7. Triaxial shear test.
8. Unconfined Compression test.
9. Vane shear Test.
10. Consolidation test.
11. Study on Collection and Field Identification of Soil and Sampling Techniques.

References

1. Gopal Ranjan and A .S .R .Rao, Basic and Applied Soil Mechanics, New Age International Publishers.
2. Punmia B. C., Soil Mechanics and Foundation Engineering, Laxshmi Publications, New Delhi.
3. Arora K. R., Soil Mechanics and Foundation Engineering, Standard Publishers, Distributors.
4. V. Narasimha Rao and Venkatramaiah, Numerical Problems, Examples and Objective Questions in Geotechnical Engineering, Orient LongMan Publishers.

CE010 601 DESIGN OF STEEL STRUCTURES

Teaching scheme: **Credits: 4**

2 hour lecture and 2 hour tutorial per week

Objective:

To familiarize the fundamental aspects of structural behaviour and design of steel structures satisfying the requirements such as safety,feasibility and economy of steel structures.

Module 1 (12 hours)

Loading standards - I.S structural sections - I.S specifications –Design Philosophies-Working stress method and Limit state method - design of tension members –bolted and and welded connections - design of simple and compound beams - laterally supported and unsupported.(Design examples based on Limit state method only.)

Module 2 (12 hours)

Compression members - design of columns - short and long columns - axial and eccentric loading - built up columns-moment resisting connections - lacing and battening - column base - slab base - gusseted base.

Module 3 (15 hours)

Water tanks – rectangular and circular steel tanks – connections - analysis and design of supporting towers.

Module 4 (10 hours)

Light gauge steel structures - introduction - type of sections - local buckling - stiffened and multiple stiffened elements – Design of beams with lateral supports only.

Module 5 (11 hours)

Chimneys- types - self supporting and guyed – stresses in chimneys – design of chimney stack, breech opening, base plate, connections and foundations.(Design of self supporting chimney only.)

Note: Only Sketches required. Detailed drawing in drawing sheets not required

References

1. Relevant IS Codes. (IS 800-2007 , IS 875, IS 805, IS 801, IS 811,IS 6533 Part 1, Part 2,Steel Tables)
2. Subramanian N, Design of steel structures,Oxford University Press
3.S.S Bhavikatti, Design of steel structures, I.K.International Publishing house Pvt.Ltd.
4. Ramchandra, Design of steel structures Vol. I & II, Standard book house, Delhi.
5. S.K. Duggal, Design of steel structures ,Tata Mc Graw-Hill
6. B.C.Punmia, Design of steel structures, Laxmi publications.

CE010 602 GEOTECHNICAL ENGINEERING – II

Teaching scheme: **Credits: 4**
2 hour lecture and 2 hour tutorial per week

Objective:
Civil Engineer has many diverse and important encounters with soil. The knowledge of soil Mechanics is helpful in the design of foundations, earth retaining structures ,pavements ,excavations, embankments and dams.
The objective of the course is to make the students aware of various soil investigation methods, theoretical and practical approach to calculate the bearing capacities of different foundations and the design of various sub structural elements.

Module 1 (12 Hours)

Site investigation and Soil exploration: Objectives - Planning – Stages of Explorations-- Depth and spacing of borings-Methods of explorations- test pits, borings (auger boring and wash boring)- sub surface soundings (standard penetration and cone penetration) - geophysical methods (seismic refraction and electrical resistivity methods) –Samples- disturbed and undisturbed samples -sampling tools- - Bore log - Soil profile - Location of water table.

Stress Distribution: Boussinesque's equations for vertical pressure due to point loads, line load and uniformly loaded circular area. - assumptions and limitations - Pressure bulb- Newmark charts and their use.Wetergaard's equation for point loads-appriximate methods of stress distribution.

Module 2 (12 Hours)

Earth Pressure: General & local State of plastic equilibrium. Earth pressure at rest , active and passive. Rankine's and Coulomb's theories of cohesion less and cohesive soils - Iinfluence of surcharge and water table.Rehban's and Culman's graphical methods. Sheeting and bracings in excavations.

Sheet Piles**:** Common types of sheet Piles – Uses of sheet pile walls

Module 3 (12 Hours)

Bearing capacity: Definitions - ultimate and allowable - plate load test -- Terzaghi's and Skempton's analysis - bearing capacity factors and charts - effect of water table - bearing capacity from building codes and SPT values- Methods of improving bearing capacity - vibroflotation and sand drains.

Settlement analysis: Distribution of contact pressure- estimation of immediate and consolidation settlement - causes of settlement - permissible, total and differential settlement - methods of reducing differential settlement.

Module 4 (12 Hours)

Foundation: General consideration - Functions of foundation - shallow and deep foundation - different types of foundation -Selection of type of foundation-steps involved.

Footings: Design of individual, continuous and combined footings - footings subjected to eccentric loading - proportioning footings for equal settlement.

Module 5 (12 Hours)

Raft foundation: Types of rafts- bearing capacity equations - design procedure – floating foundation.

Pile foundation: Uses of piles - Classification of piles - Determination of load carrying capacity of axially loaded single vertical pile (static & dynamic formulae) -Pile load tests - Negative skin friction - Group action & pile spacings - Settlement of pile group.

Caissons: Open, box, and pneumatic caissons, construction details of well foundation - problems of well sinking.

Note: Structural design of foundations is not contemplated in this course.

References

1. Arora K. R, Soil Mechanics & Foundation Engineering, Standard Publishers , Distributors.
2. Joseph E.Bowles, Foundation Analysis and Design, McGraw Hills Publishing Company.
3. Ninan P. Kurian, Modern Foundations, Tata McGraw Hills Publishing Company.
4. Peck, Hansen & Thornburn, Foundation Engineering.Wiley Eastern Limited
5. W.C. Teng, Foundation Design.Prentice Hall of India
6. Hans. F. Winterkorn & Hsai Yang Fang, Foundation Engineering Hand Book, Van Nostrand Reinhold Company.
7. B. C Punmia,Soli Mechanics and Foundation Engineering,Laxmi Publications.
8. V.N.S. Murthy,Text book of Soil Mechanics and Foundation Engineering,CBS Publishers

CE010 603 STRUCTURAL ANALYSIS II

Teaching scheme **Credits: 4**

3 hour lecture and 1 hour tutorial per week

Objective:

To equip the students with the comprehensive methods of structural analysis of indeterminate structures

To give an introduction to Theory of Elasticity and Structural Dynamics.

Module 1 (10 hours)

Plastic theory – ductility of steel- plastic bending of beams- evaluation of fully plastic moment – plastic hinge – load factor – method of limit analysis- basic theorems- collapse load for beams and portal frames.

Module 2 (12 hours)

Approximate methods of frame analysis: Frames under lateral loading-portal method – cantilever method. Frames under vertical loading –substitute frame method.

Space frames – tension coefficients-tension coefficient method applied to space frames

Module 3 (12 hours)

Kani's method-continuous beams & frames (without sway only).

Influence line diagrams for statically indeterminate structures: Muller Breslau' s principle-Influence lines for reactions-shear force-bending moment-propped cantilever& two span continuous beams.

Module 4 (14 hours)

Elementary theory of elasticity: State of stress at point- stress tensor-equilibrium

Equations - stresses on arbitrary plane- principal stresses-strain components – strain tensor- compatibility equations- boundary condition equations Two dimensional problems- plane stresses - plane strain – compatibility equations in two dimensional cases- Airy's stress functions

Module 5 (12 hours)

Introduction to Structural Dynamics-Dynamic systems and loads-Free or natural vibrations-Natural Frequency- Inertia force- -D'Alembert's principle-Mathematical modeling of single degree of freedom systems- equivalent spring stiffness of combination of springs

References

1. Timoshenko S.P., Theory of Elasticity, McGraw Hill.
2. Sreenath L. S, Advanced Mechanics of Solids, Tata McGraw Hill Education P. Ltd.
3. Sadhu Sindh, Strength of Materials, Khanna Publishers, 1988.

4. Bhavikatti S.S , Structural Analysis Vol. II, Vikas Publishing House (P) Ltd.
5. Seeli F.B.&Smith J.P., Advanced Mechanics of Materials, John Wiley & Sons, 1993.
6. Vazirani & Ratwani, Analysis of Structures, Khanna Publishers, New Delhi.
7. B.C. Punmia, Theory of Structures, Vol. II, Laxmi Publishers, New Delhi.
8. Prakash Rao D.S., Structural Analysis, Universal Press Ltd, Hyderabad, 1997.
9. Ameen A, Computational Elasticity, Narosa Publishers.
10. Ray W Clough, Joseph Penzien, Dynamics of structures, Mc Graw Hill, Kogabusha Ltd.
11. Madhujith Mukopathyay, Structural Dynamics, vibrations&systems, Ane Books Pvt. Ltd, 2008.
12. V.K.Manicka Selvam, Elementary Structural Dynamics, Dhanpat Rai Publications Pvt.Ltd.
13. Mario Paz, William Leigh, Structural Dynamics, Springler.

CE010 604 TRANSPORTATION ENGINEERING - I

Teaching scheme: **Credits: 4**
3 hour lecture and 1 hour tutorial per week

Objective: *To gain an in-depth knowledge on operating characteristics of facilities such as railways and water transportation*

Module 1(15 hours)

Introduction: Transportation modes **-** comparison and characteristics of highway and railway. Modern developments – Surface, elevated and tube railways, light rail transit, high speed tracks - technologies

Railway track: Alignment- basic requirements and factors affecting selection, Component parts of a railway track - requirements and functions - Typical cross section - Rails – functions and requirements, Type of rail sections, rail fastenings, wear and creep of rails - coning of wheels, Train resistances and evaluation of hauling capacity and tractive effort of locomotive.

Geometric design of railway track: Horizontal curves, radius – super elevation - cant deficiency - transition curves - gradients - different types - Compensation of gradients.

Module 2 (10 hours)

Railway operation and control: Points and Crossings – Design features of a turn out – Details of station yards and marshalling yards – Signaling, interlocking of signals and points - Principles of track circuiting - Control systems of train movements – ATC, CTC – track circuiting

Module 3 (10 hours)

Tunnel Engineering: Tunnel - sections - classification - tunnel surveying - alignment, transferring centre, grade into tunnel – tunnel driving procedure - shield method of tunneling, compressed air method, tunnel boring machine, Tunnel lining, ventilation - lighting and drainage of tunnels.

Module 4 (15 hours)

Harbour Engineering: Harbours – classification, features, requirements, winds and waves in the location and design of harbours.

Break waters - necessity and functions, classification, alignment, design principles, forces acting on break water – construction, general study of quays, piers, wharves, jetties, transit sheds and warehouses - navigational aids - light houses, signals - types - Moorings .

Module 5 (10 hours)

Dock Engineering: Docks - Functions and types - dry docks, wet docks – form and arrangement of basins and docks – design and construction – dock entrances - floating dry docks, slip ways, dock entrances and caissons. Dredging – functions -

general study of dipper dredger, grapple dredger, ladder dredger and hydraulic dredger.

References

1. Rao G. V, Principles of Transportation and Highway Engineering, Tata McGraw Hill
2. Mundrey J. S, Railway Track Engineering, Tata McGraw Hill
3. S.C. Rangawala, Railway Engineering, Charotor Publishing House
4. S. C Saxena and S. P Arora., Railway Engineering, Dhanpat rai & Sons
5. Subhash C. Saxena, Railway Engineering, Dhanpat rai & Sons
6. R. Srinivasan, Harbour, Dock & Tunnel Engineering, Charotor Publishing House
7. S.P.Bindra, A course in docks and Harbour Engineering, Dhanpat rai & Sons

CE010 605 WATER RESOURCES ENGINEERING

Teaching scheme: **Credits:4**

3 hours lecture and 1 hour tutorial per week

Objective :

Students are expected to realize the importance of water resources and its application in irrigation engineering.

Module 1 (15 hours)

Irrigation: Definition-necessity of irrigation - environmental effects of irrigation - sources of water - irrigation systems- lift and flow irrigation – modes of irrigation - layout of irrigation schemes -historical development of irrigation in India through ages. Soil-water-plant relation – water requirement for crop -optimum moisture for crop growth - depth of water and frequency of irrigation -crop seasons and important crops in India. Crop period and base period - duty,delta and their relationship - factors affecting duty - commanded areas and intensity of irrigation. Consumptive use of water - evapotranspiration -determination of consumptive use - irrigation efficiencies.

Module 2 (15 hours)

Basic concepts of hydrology: Hydrological cycle and its components - rainfall - rain gauge- mean precipitation over a catchment area - run off - factors affecting runoff - hydrograph - direct run off and base flow - unit hydrograph - S. hydrograph – applications of unit hydrograph.

Estimation of runoff: Empirical formula, infiltration method, rational method - flood estimation - flood frequency, unit hydrograph method and empirical formula.

Module 3 (15 hours)

Ground water: Definitions- porosity - specific yield - specific retention - storage coefficient-coefficient of permeability and transmissibility. Ground water velocity- Darcy's equation - flow towards wells - Dupit's theory of aquifers. Wells-shallow wells - deep wells - yield of an open well - constant level pumping test and recuperation test - tube wells - strainer, cavity and slotted tube wells- factors governing the selection of site and type of tube wells. Infiltration galleries and wells.

Module 4 (15 hours)

Flow irrigation: canal system - classification of canals and their alignment - requirements of a good distribution system-balancing depth - section of canal. Design of canals in alluvial soils - silt theories - non silting and non scouring velocity. Kennedy's theory -Lacey's theory - design of unlined canal using the two theories in alluvial soils - bed load and suspended load - canal outlets - requirements of good canal outlets - non modular - semi modular - modular outlets.

Module 5 (12 hours)

Reservoir planning: Investigation - selection of site - storage zones in a reservoir - mass inflow curve - demand curve - calculation of reservoir capacity and safe yield from mass inflow curve - reservoir sedimentation - reservoir sediment control - single purpose reservoirs - multi purpose reservoirs - useful life of a reservoir. River training works: guide banks, groynes and marginal bunds – flood control - causes - methods of flood control - principles of flood routing. Soil conservation: water logging and its control - reclamation of salt affected land.

References

1. P.M.Modi, Irrigation-water recourses and water power, Standard book house, Delhi.
2. S.K Garg, Irrigation and hydraulic structures, Khanna Publishers, Delhi
3. R.K.Linsley, M.A.Kholar&J.L.H.Paulhur, Hydrology for Engineers, Mc Grawhill bookco., New York.
4. Bharat Singer, Fundamentals of Irrigation Engineering.
5. V.B.Priyani, Irrigation and Waterpower Engg, Charota Book stall Anand.
6. Dr.B.C.Punmia&Dr.Pande.B.B.Lal, Irrigation & Water Power Engineering, Laxmi Publications

CE010 606L01 ADVANCED SURVEYING
(ELECTIVE I)

Teaching Scheme **Credit:4**

2 hours lecture and 2 hours tutorial per week**.**

Objective:

To make the students aware of the advanced methods of surveying.

Module 1(12 Hours)

Total station surveying-study of instrument-measurement of parameters-methods of surveying-transferring data-software's-auto plotter-plotting (assignment).

Module 2 (12 Hours)

Arial photogrammetry: Definition- types of photographs- geometry of photographs – parallax - pair of photographs- height determination- flight planning- stereoscopy.

Module 3 (12 Hours)

Remote sensing: Introduction and definition of remote sensing terminology- principles and methods of remote sensing- electro-magnetic radiation and spectrum- radiation sources-interference- atmospheric effects on remote sensing- atmospheric window –energy interaction with surface features-different types of platforms- sensors and their characteristics-orbital parameters of a satellite- multi concepts in remote sensing.

Module 4 (12 Hours)

Interpretation of images: Aerial photo interpretation – basic elements -techniques of photo interpretation- application of aerial photo interpretation-photographs versus maps- interpretation of satellite images- ground truth collection and interpretation and verification- advantages of multi date and multi band images.

Module 5 (12 Hours)

Applications: Applications in water resources management- land use mapping and monitoring- soil sciences- geology- agriculture- forestry - oceanography.

References

1. Thomas M. Lillesand & Raiph W. Kiefer, “Remote sensing and image interpretation”, John Wiley Sons.
2. Floyd F. Sabins, “Remote sensing principles and interpretation”, Freeman and company.
3. Campbell J. B, “Introduction to remote sensing”, The Guilford press, London.
4. Curran P.J., “Principles of remote sensing”, Longman, London.
5. Engmen E.T and Gurnay R. J.,”Remote sensing in hydrology”, Chapman and Hall.
6. Wolf P.R., “Elements of photogrammetry”, McGraw Hills.

CE010 606L02 OPEN CHANNEL AND COASTAL HYDRAULICS (ELECTIVE - 1)

Teaching Scheme **Credit:4**
2 hours lecture and 2 hours tutorial per week**.**

Objective:
***To develop theoretical and practical knowledge on open channel flow and to acquire basic knowledge on Ocean Engineering* and related applications**.

Module 1(12 Hours)

Open channel flow-Definition-Importance-Classification of flows
Uniform flow- Resistance equation-Chezy's and Manning's equation-roughness coefficient.-factions affecting roughness coefficient- normal depth and its computation-conveyance – section factor - specific energy - specific force - diagram – critical flow - section factor -hydraulic exponent for critical flow computation and its use for trapezoidal channel-Application of specific energy and specific force in open channel
.

Module 2(12 Hours)

Non-uniform flow - friction slope - differential equation of non-uniform flow - types of surface profiles - the point of control - computation by Bresse's method and the simplified step method.

.**Module 3(12 Hours)**

Hydraulic jump - sequent depths - dimensionless equation of the jump - loss of head - the jump at the foot of a spillway - criteria for the formation of a jump - use of jump as an energy dissipater. Control of jump by sills - stilling basins

Module 4(12 Hours)

Water waves - classification into periodic oscillatory, periodic progressive, uniformly progressive, solitary and stationary waves.
Ocean waves – Introduction-characteristics-classification based on wave period. Small amplitude wave theory .expression for the celerity of deep water gravity wave and shallow water gravity wave - determination of the wave length and celerity for any water depth given the deep water wave amount as wave energy (no proof).
Wave Transformations –shoaling- refraction- reflection-diffraction –wave breaking (description only.

Module 5(12 Hours)

Long period waves-astronomical tide-tsunami, basin oscillations, storm surge, climatologic effects, geologic effects(description only)
Wave forecasting - SMB method.
Coastal erosion with special reference to the Kerala Coast

Shore protection measures – break waters of different types-sea walls – tetrapods, groynes and beach nourishment.

References

1. S.M.Woodword, C.J.Posey, Hydraulic of Steady Flow in Open Channels
2. F. N. Henderson, Open Channel Flow
3. A. I. Ippen, Estuary and Coast line Hydrodynamics
4. K. E. R. I. Peechi, Coastal Engineering Publications
5. V. T. Chow, Open Channel hydraulics, Mc Graw Hill
6. Robert .M. Sorensen, Basic coastal engineering, John Willey & Sons

CE010 606 L03 AIRPORT ENGINEERING (ELECTIVE I)

Credits 4

Teaching scheme: 2 hour lecture and 2 hour tutorial per week

Objective: *To understand the various aspects of air transportation and airport operation and design.*

Module 1 (15 hours)

Introduction – history of air transport - structure and organization –- selection of site – surveys – drawings to be prepared - Airport planning – components of airport system – airport planning studies – elements of study – forecasting - levels – methodologies – extrapolation methods – market analysis models – forecasting requirements – applications
Aero plane component parts - Aircraft characteristics – classification of airports
Airport obstructions - clear zone and turning zone - zoning laws - regional planning – airport architecture – environmental considerations

Module 2 (12 hours)

Runway design – orientation - windrose and layout of runways - basic runway length and corrections required - geometric design - balanced field concept - Terminal area – planning and design – passenger flow – size of apron – apron turntable - hangars – protection from jet blast

Module 3 (12 hours)

Airport capacity – capacity and delay – runway capacity related to and not related to delay - Air traffic control – flight rules - service station – Air Traffic Control network – aids for the control of air traffic – automation in air traffic control

Module 4 (11 hours)

Airport pavements – design factors – design methods for flexible and rigid pavements – CBR method – McLoad method – Burmister method – Analytical method –design charts – Load Classification Number System – Joints in cement concrete pavements

Module 5 (10 hours)

Taxiway design - loading aprons - holding aprons - separation clearances – visual aids - airport markings - marking of runways, taxiways - Airport lighting - lighting of runways approaches, taxiways and aprons.

References

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1. S.K. Khanna, M. G. Arora, S.S. Jain, Airport Planning & Design, Nem Chand Publishers
2. S. C. Rangwala, Airport Engg., Charotar Publishing Co.
3. Robert Horenjeff & Francis X McKelvy, Planning and design of airports, Mc Graw Hill.

CE010 606L04 ADVANCED MECHANICS OF MATERIALS (ELECTIVE-1)

Teaching Scheme **Credit:4**

2 hours lecture and 2 hours tutorial per week**.**

Objective

To review and make more useful methods and results presented in the previous courses on Mechanics of materials.

To understand the limitations of the ordinary formula of Strength of materials and to extend the subject to include a variety of important topics more complex than those usually involved in earlier courses**.**

Module 1 (13 Hours)

Basic concepts – Body force – Surface force – Stresses and strains – Three dimensional stresses and strains – Transformation equations of 3D stresses and strains – Principal stresses & strains – States of stresses and strain – Equilibrium equations – Generalised Hooke's Law – Compatibility Conditions – Boundary conditions.

Module 2 (13Hours)

Two dimensional problems – Plane stress and plain strain – Transformation equations – Stress–strain relations – Equilibrium equations in cartesian and polar co-ordinates – Airy's stress function – Biharmonic Equilibrium – 2D problems in Cartesian coordinate – Cantilever with concentrated load at free end – Simply supported beam with uniformly distributed load.

Module 3 (12Hours)

Torsion – Torsion of prismatic bar – General solution – Warping function approaches – St. Venant's theory – Membrane analogy – Sand heap analogy – Torsion of Non Circular sections – Torsion of multi cell and thin walled open and closed sections.

Module 4 (11Hours)

Curved flexural members – Winkler- Bach formula – Equivalent area methods – Circumferential stress in curved beams having, I,T or similar cross sections – Closed ring with circumferential load and uniform loads – Chain links.

Module 5 (11Hours)

Beam on Elastic foundation – General theory – Infinite beam subjected to concentrated load – Beam with uniformly distributed loads – Short beams.

References:–

1. Timoshenko S P and Goodier J. N, *Theory of Elasticity*, Tata Mcgraw Hill International Student Edition.
2. Sadhu Singh, *Theory of elasticity*, Khanna Publishers, Delhi.
3. Srinath L. S, *Advanced mechanics of solids*, Tata McGraw– Hill Publishing Company Ltd., New Delhi.

4. Arthur P Boresi & Omar M SideBottom, *Advanced Mechanics of Materials*, John Wiley & Sons.
5. Hetenyi, *Beam on elastic foundation*

CE010 606L05 CONCRETE TECHNOLOGY
(ELECTIVE - I)

Teaching scheme: **Credits: 4**
2 hour lecture and 2 hour tutorial per week

Objective:
Concrete technology is one of the important disciplines of Civil Engineering involving the study of engineering properties and behaviour of concrete.

Module 1(13 hours)

Concrete materials: cement: Bough's chemical compositions, Additives, Test for properties of cement- Physical, Chemical, Relevance and IS specification. Hydration – Product of hydration, Phases of concrete, Structure of Hydrated cement paste (HCP), Solids in HCP, Voids in HCP, Water in HCP. Structure property relationship in HCP: Strength, Dimensional stability and Durability. Transition Zone in concrete:- Significance of transition zone, Structure of transition zone ,Strength of transition zone and Influence of transition zone. Aggregates: - requirements, size , shape and texture, Grading of aggregate, Aggregates crushing strength, Specific gravity, Flakiness index, Elongation Index, Impact value, Abrasion value, IS specification. Alkali aggregate reaction. Water: - General requirement, Quality.

Module 2 (12 hours)

Fresh Concrete: Workability - factors affecting - measurement of workability - different tests for workability - segregation - bleeding - process of manufacture of concrete - Batching - mixing - transportation - compaction - curing of concrete - curing methods - admixtures in concrete - air entraining agents - Accelerators – Retarders -workability agents - Damp proofing agents - Miscellaneous admixtures - quality control.

Module 3 (12 hours)

Elastic properties of Concrete - factors affecting modulus of elasticity – Strength of concrete: w/c ratio - gel/space ratio - Gain of strength with age. - accelerated curing tests - maturity concept of concrete - effect of maximum size of aggregate on strength - relation between compressive and tensile strength - revibration - high speed slurry mixing - creep - shrinkage - factors affecting.

Module 4 (12 hours)

Durability of concrete: - sulphate attack - methods of controlling sulphate attack. Durability of concrete in sea water - action of organic acids, mineral oils, sugar etc. on hard concrete - thermal properties of concrete - Fire resistance cracks in concrete–Remedies, Testing of Hardened concrete, flexural strength - comparison of cuube test and cylinder test - Indirect tension test methods -concrete mix design - IS methods - ACI methods - mean strength - characteristic compressive strength - Non distructive testing of concrete.

Module 5 (11 hours)

Special aggregates: light weight - artificial - natural - special concrete - no - fine concrete- high density concrete - Sulphur infilterated concrete - fibre reinforced concrete - polymer concrete polymer impregnated concrete - polymer cement concrete - properties of polymer concrete - special concreting methods - cold Weather concreting, hot weather concreting - Ferrocement.

References

1. Krishna Raju N, Concrete Technology
2. A.M. Neville, Properties of concrete
3. M.S. Shetty, Concrete Technologyeferences:
4. A.R Santhakumar-Concrete Technology- Oxford University Press

CE010 606L06 SOIL STABILITY ANALYSIS
(ELECTIVE - 1)

Teaching Scheme **Credit:4**
2 hours lecture and 2 hour tutorial per week.

Objective:
Slope stability problem like,slides,flows and falls often produce extensive property damage and therefore geotechnical engineers frequently need to evaluate the stability of existing slopes and proposed slopes. The objective of the course is to make the students aware of various causes of failures of slopes and study the remedial measures
.

Module 1 (12 hrs.)

Ground water seepage- Laplace' s equations for two dimensional flow- quick sand condition- construction of flownets- confined and unconfined flow-seepage in anisotropic soil conditions-piping-design of filters.

Module 2 (12 hrs.)

Stability of earth slopes-modes of slope stability- analysis of slope stability problems- Swedish circle method- Friction circle method- Taylor' s stability chart-
Bishop' s method- stabilization measures- instrumentation.

Module 3 (12 hrs.)

Landslides: Introduction- movements associated with landslides-causes of landslides-consequences, classification and analysis of landslides-investigation of landslides-instrumentation-methods of preventing landslides.

Module 4 (12 hrs.)

Earthquake effects on soil foundation system: earth quakes- ground shakingliquefaction-ground deformations-seismic provisions in building codes

Module 5 (12 hrs.)

Underpinning: Introduction-reasons-pit underpinning-pile underpinning-driven underpinning piles-shoring-special underpinning methods-moving structures

References

1. Hans.F.Winterkorn and Hsai Yang Fang Foundation Engineering handbook - Van Nostrand Reinhold Company
2. Bowles E.J. Foundation analysis and Design. Mc Graw Hill Publishing Co.
3. Gopal Ranjan and A.S.R.Rao Basic and applied Soil mechanics New Age International Publishing Company
4. Donald.P.Coduto Geotechnical Engineering –Principlesand practices, Prentice Hall India

CE010 607 COMPUTER AIDED DESIGN AND DRAFTING LAB

Teaching Scheme **Credit: 2**
3 hours practical per week

Objective
To provide familiarity with functional requirements and regulations related to buildings and to enable students to prepare neat building drawings with CAD software so as to minimize effort and maximize output.

Exposure to different categories of building (Private, Public, Residential, Flats, Offices, Clubs/Recreational buildings etc.- **Local visit and preparation of sketches**

Functional requirements of buildings – Different functional units of a building- Requirements regarding Area, Height, Head room, Width of passage way, Lighting, Ventilation, Public amenities, Setback, Parking, clearance from electric lines, Provision and location of septic Tank- clearance from well, Familiarity with norms in National Building Code and local building rules. **Study of building plans** (Residential / Commercial / Public buildings / Office/Flats / Cottages etc.) **sanctioned by local authority**.

Preparation of 2D drawing- Advantages of CAD over manual drafting- Features of CAD software-menus and tool bars-Concept of drawing in true size- Drawing units- Drawing tools- Editing tools- Controlling display-(zoom, pan, regeneration, redraw) Productivity tools- mirror,copy,block,array,Detailing-layers,color,linetype,ltscale,hatch Inquiry –area, dimension Plotting- scale. Specifications for drawings

Preparation of 3D drawings- Concept of 3D drawing- viewpoint, real-time 3D rotation, 3D modeling techniques- wire modeling, surface modeling, surface revolution, 3D face. Elevation and thickness - addition and subtraction of 3d objects. Shading - rendering.

Application of CAD to Civil Engineering Drawing with emphasis on architectural appearance. Residential, Public buildings complete in all aspect including layout plan, section, elevation, details/specifications/joinery and site plan taken in standard scale with title block.

Exposure to 3D studio and 3D Max

A term project submitted individually and suitable for submitting to local bodies for approval incorporating local building rules and NBC provisions is compulsory for external evaluation.

Assignments:- Submission of neat dimensioned line sketches from local visit
Collection and study of approved building plan
Preparing an Elevation for given plans
Preparing Plans based on requirements of clients.

References

1. Reference manual of the package.

2. National building code of India.
3. Shah & Kale, Building Drawing, Tata McGraw Hill.
4. Balgopal T.S.Prabhu, Building Drawing and Detailing, SPADES Calicut.
5. Sham Tickoo, Understanding Auto CAD2002, Tata McGraw Hill.
6. Sham Tickoo, Auto CAD2002 with applications, Tata McGraw Hill.

CE010 608 MATERIAL TESTING LABORATORY - II

Teaching scheme **Credits: 2**

3 hours practical per week

Objective:

To study properties of concrete and its various constituent materials.

1. Tests on cement.

a) Standard consistency, initial and final setting time.
b) Compressive strength of mortar cubes.
c) Specific gravity. d) Soundness. e) Fineness.

2. Tests on fresh concrete.

a) Compaction factor test.
b) Slump test.
c) Vee-Bee test.
d) Flow table test.
e) Ball penetration test.

3. Tests on hardened concrete.

a) Compressive strength of concrete cubes.
b) Compressive strength of concrete cylinder.
c) Splitting tensile strength.
d) Modulus of elasticity.
e) Flexural strength.

4. Tests on RC beam

5. Tests on aggregates.

a) Aggregate crushing value for coarse aggregate.
b) Specific gravity of coarse and fine aggregate.
c) Bulking of fine aggregate.
d) Bulk density and percentage voids of coarse aggregate.
e) Grain size analysis of coarse and fine aggregate.

6. Tests on bricks.

a) Compressive strength. b) Water absorption. c) Efflorescence.

7. Tests on roofing tiles.

a) Transverse strength. b) Water absorption.

8. Tests on flooring tiles.

a) Transverse strength. b) Water absorption. c) Abration tests.

9. Compression tests on Laterite blocks

10. Study of

a) Strain measurements using electrical resistance- strain gauges.
b) Nondestructive test on concrete.

Note

All tests should be done as per relevant BIS.

References

1.A.R.Santhakumar,Concrete Technology,Oxford University Press,Chennai.
2. M. S. Shetty, Concrete technology, S.Chand & Co.

CE010 701 DESIGN OF HYDRAULIC STRUCTURES

Teaching scheme: **Credits: 4**

2 hours lecture and 2 hours tutorial per week

Objective: *Students are expected to know the details of major and minor irrigation structures and their design. A student, who successfully completes the course, should be able to carry out design of various hydraulic structures in the given field conditions.*

Module 1 (13 hours)

Dams: classifications - factors governing the selection of the type of dam and site of the dam- **Gravity dam**: forces acting - modes of failure and stability requirements - elementary profile and practical profile - principal and shear stress - base width of elementary profile by stress and stability criteria-stresses developed in the elementary profile - low and high gravity dam – design of gravity darn (introduction only) – galleries ,joints , keys ,water stops –foundation treatment - brief description on types of spill ways.

Module 2 10 hours)

Arch dams: types of arch dams –forces acting –design methods-design of arch dams on thin cylinder theory only– central angle for min. concrete- limitations -Introduction of other methods of design - thick cylinder theory, trial load analysis and elastic theory.

Buttress dam - types - advantages and disadvantages.

Earthen dam - types of earth dams - causes of failure - design criteria -- phreatic line in an earth dam with horizontal drainage filter - different dam sections to suit available materials and foundation.

Rock fill dam –materials of construction-impervious membrane type and earth core type (brief description only)

Module 3 (13 hours)

Diversion head works: function and component parts of diversion head works -effect of construction of weir on the regime of river- causes of failure of weirs on permeable foundation. Bligh's creep theory and its limitations - Lane's weighted creep theory - Khosla's theory and design of impermeable foundation - design of vertical drop weir - silt control devices - silt excluder, silt ejector.

Module 4 (13 hours)

Canal regulation works-design of head regulator and cross regulator- Canal falls-necessity and location of falls-types-design of vertical drop fall- Sarda type only and siphon well drop . (Design emphasizing the hydraulic aspects only)

Module 5 (11 hours)

Cross drainage works –necessity-types-design of aqueduct and syphon aqueduct.

Water power engineering: Classification of hydel plants- runoff river plants, storage plants and pumped storage plants - low, medium and high head schemes -investigation and planning - fore bay – intakes - surge tanks - penstocks -powerhouse – selection of turbine-Scroll casing - draft tube – tail race- definition of gross head - operating head - effective head - firm power –secondary power- load factor, capacity factor and utilization factor.

Note:

Only sketches are required for all designs.

References

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1. S. K.Garg, Irrigation and hydraulic structures, S. K.Garg, Khanna publishers
2. P. M. Modi, Irrigation-water resourses and water power, Standard book house.
3. B C Punmia, Pande B B Lal, Irrigation and water power engineering, Laxmi Publications
4 R. K. Linsley, M. A. Kholer, L. H. Paulhur, Hydrology for Engineerers, Tata Mc Graw Hill
5. V. B. Priyani, Irrigation and water power Engg. , Charotar Book stall.
6 G.L. Asawa , Irrigation and water resources Engg. ,New Age International Limited Publishers.
7 Sathyanarayana Murthy , Water Resources Engineering , Wiley Eastern
8 R.S.Varshney, S.C.Guptha, R.L.Guptha, Theory and design of irrigation Structures, Vol II, Nemchand &brothers, Roorkee.

CE010 702 ENVIRONMENTAL ENGINEERING - I

Teaching scheme: **Credits: 4**

2 hour lecture and 2 hour tutorial per week

Objective:

- *To understand the basic principles of Water Supply Engineering*
- *To develop knowledge in unit operations and design of water treatment systems*

Module 1(10hrs)

Scope of **Environmental Engg**. Water supply Engineering: Rural and Urban water supply systems - **water demand** - percapita demand, factors affecting percapita demand, variations in the rate of consumption, fire demand, design period, forecasting population. **Quality of water**: impurities in water and their importance - water borne diseases - analysis of water - physical, chemical and bacteriological tests - MPN total coliforms, fecal coliforms. WHO and Indian standards for drinking water.

Module 2 (10hrs)

Collection of water: intakes - location, types, pipe materials **-** hydraulics-of flow - design of pipes - **Pumps**: Classification - selection of pumps - location of pumping stations. **Appurtenances** in the distribution system - meters, valves, fire hydrants etc. pipe laying, testing & disinfections of mains. **Storage of water** - effect of storage on quality of water

Module 3 (15hrs)

General **layout** of treatment plant - surface water and ground water. **Aeration**, purpose of aeration. **Sedimentation** - plain sedimentation, theory of sedimentation, continuous flow sedimentation tanks. **Chemically aided sedimentation** - necessity, theory of coagulation and flocculation - generally used coagulants, dosage of coagulants- clariflocculators, design of flash mixers clarifiers and clarifloculators.

Module 4 (15hrs)

Filtration - Theory of filtration, filter media - sand for filtration. Classification of filters - design, construction, control, operation and maintenance of rapid sand filters and slow sand filters, pressure filters.

Disinfection: requirements of a good disinfectant, chlorination - action, application, and dosage chlorine demand, pre-chlorination, post chlorination, double chlorination, super chlorination, breakpoint chlorination. Other disinfectants.

Module 5(10hrs)

Miscellaneous treatment methods: color, odour and taste removal, iron and manganese removal, deflouridation, removal of hardness, desalination.

Distribution of water: pumping system, gravity system, pumping and storage system, distribution reservoirs -storage capacity of balancing reservoir, pipe grids, methods of analysis of network. Detection and prevention of leaks in distribution system-cleaning and maintenance of distribution system, pipe corrosion and its control.

References:

1. Peavy, Rowe, Tchobanoglous, Environmental Engineering, Mc Graw Hill International Editions.
2. M.N. Rao & H.V.N. Rao, Air Pollution, Tata Mc Graw Hill Pvt. Ltd., New Delhi.
3. S. K. Garg, Environmental Engineering Vol. l & ll, Khanna Publishers, New Delhi.
4. B.C. Punmia, Water supply Engineering, Arihant Publications, Jodpur.
5. B.C. Punmia, Waste water Engineering, Arihant Publications, Jodpur.

CE010 703 DESIGN OF CONCRETE STRUCTURES – II

Teaching Scheme **Credit: 3**

2 hours lecture and 1 hour tutorial per week**.**

Objective

*To provide knowledge in the structural design of selected structures***.**

Module 1 (10 Hrs)

Prestressed Concrete: I S specifications- general principles- analysis of prestress and bending stress -methods and systems of prestressing – losses of prestress- design of simply supported rectangular beams with constant eccentricity only.

Module 2 (10 Hrs)

Retaining walls: Types-Earth pressure diagrams- modes of failure-design of cantilever and counter fort retaining walls (“L” not included)

Module 3 (8 Hrs)

Design of continuous beams: Using coefficients given in IS 456.

Circular beams:Uniformly loaded and supported on symmetrically placed columns

Module 4 (8 Hrs)

Domes: Membrane stresses in spherical and conical domes-design of domes with uniformly distributed and concentrated loads-openings-ring beams

Module 5 (9 Hrs)

Water Tanks: types-design of ground supported and overhead water tanks- circular with flat bottom-flexible and rigid joints-design of staging-columns and bracings-IS code method.

References

1. Relevant IS codes (IS 456, IS 875, IS 1343, IS 3370 Part 2 and Part 4 ,SP 16)
2. Park R and Pauloy T, Reinforced concrete structures, John wiley & sons Inc
3. Purushothaman P, Reinforced concrete structural elements –Behaviour, analysis and design, Tata Mc Graw Hill Publishing Company Ltd
4. Unnikrishna Pillai S & Devdas Menon, Reinforced concrete, Tata Mc Graw Hill Publishing Company Ltd
5. Mallick S K, Reinforced concrete, oxford & IBH publishing company
6. Varghese P C Limit state design of reinforced concrete structures, Prentice Hall of India pvt Ltd
7. Ashok K Jain Reinforced concrete –Limit state design, new chand & bose
8. Krishna Raju, prestressed concrete oxford and ibh publishing company ltd
9. Ramamrutham S, Design of reinforced concrete structures, Dhanpat Rai publishing co
10. Punmia B C Reinforced concrete structures vol 2. Laxmi publications

CE010 704 ARCHITECTURE AND TOWN PLANNING

Teaching scheme: **Credits: 3**

2 hour lecture and 1 hour tutorial per week

Objective:

- *To understand the basic principles of architectural design and functional planning of buildings*
- *To develop knowledge in town planning concepts and related principles*

Module 1 (10 hrs)

Architecture - Definition - factors influencing architectural development, characteristic features of a style - historical examples, Theory of architectural design – pragmatic, iconic, canonic and analogic design, Creative principles - function, strength, aesthetics, primary elements in architectural design, Design principles - unity, balance, proportion, scale, rhythm, character, contrast, texture, form perception, characteristics of form, form expressive of function- form related with material and structural system. Concept of space - activity space, circulation space and tolerance space

Module 2 (15 hrs)

Functional planning of buildings: Occupancy classification of buildings -general requirements of site and building - building codes and rules - licensing of building works. Functional planning of residential, institutional, commercial, process of identifying activity areas and linkages - circulation diagrams - checking for circulation, ventilation, structural requirements and other constraints, preparing site plan and working drawings

Module 3 (10 hrs)

Building Services:- Vertical transportation: Stairs -lay out and details of timber, masonry, metal, concrete and precast-concrete stairs-Elevators-drum and traction type, passenger and service goods elevators, design constraints of passenger elevators-handling capacity, arrangement of lifts, Escalators- features, operation arrangements, location - moving walk and moving ramp.

Ventilation and Air conditioning - ventilation requirements -natural and mechanical ventilation - cross ventilation - effect of orientation - calculation of air conditioning load - summer and winter air conditioning- consideration of comfort factors such as acoustics, lighting, and thermal aspects.

Module 4 (13 hrs)

Town planning - Evolution of towns-objectives and principles of town planning- growth of towns - problems of urban growth- garden city movement, conservative surgery and comprehensive planning, Radburn plan - evolution in town planning acts and legislation - forms of planning - requirements of new towns - surveys – zoning - transportation network and planning – housing, neighbourhood unit planning, - legislation on environmental pollution - land use planning and theories.

Module 5 (12 hrs)

Planning process:- Master plan, preparation and execution- -planning standards for different land use allocation for commerce, industries, public buildings, parks and play grounds.-implementation of development plans - land acquisitions - slums - causes and clearance schemes

References:

1. G.K Hiraskar The great Ages of World Architecture – Dhanpat Rai Publications (P) Ltd.
2. Satish Chandra Agarwala – Architecture and Town Planning- Dhanpat Rai and Co
3. Banister Fletcher, History of World Architecture, Taraporevalas.
4. Broadbent, Theory of Architecture Design, John Wiley Sons
5. V.K Jain – Hand book of Designing and installation of services in building complex – khanna publishers
6. Rangwala – Town planning – charotar publishing house.
7. G.K Hiraskar – Fundamentals of Town planning – Dhanpat Rai publications.
8. Abir Bandyopadhyay – Text book of Town planning – Books and Allied (P) Ltd.
9. N.K Gandhi – Study of Town and Country planning in India – Indian Town and Country planning Association.

CE010 705 TRANSPORTATION ENGINEERING - II

Teaching scheme: **Credits :3**

2 hour lecture and 1 hour tutorial per week

Objective*: To understand the principles and design of highway, traffic and airport engineering*

Module 1 (8 hours)

Classification, alignment and surveys -classification of highways - typical cross section of roads in urban and rural areas - requirements and factors controlling alignment of roads, engineering surveys for highway location.

Geometric Elements of highways: Highway cross sectional elements - pavement surface characteristics, camber and width requirements, median, kerbs, road margins – right of way, Sight distances - over taking zone requirements and related problems.

Module 2 (14 hours)

Geometric Design of Highways

Design of horizontal alignment - speed – horizontal curves, super elevation - methods of attainment of super elevation - related problems, radius - extra widening - transition curves Design of vertical alignment - gradient and grade compensation – Vertical curves - sight distance requirements on summit and valley curves - simple problems on design of vertical alignment.

Module 3 (8 hours)

Traffic Engineering: Traffic characteristics - traffic studies and their applications Traffic control devices- Traffic signs, traffic signals, road markings and traffic islands. Types of road intersection - kerb parking (Design of traffic signals not expected).

Module 4 (8hours)

Highway materials: Aggregates - desirable properties and tests - Bituminous materials - properties and tests - sub grade soil - desirable properties.

Pavement design: Basic difference between flexible and rigid pavements -factors affecting their design – design of flexible pavements-CBR & IRC Introduction to performance grading and superpave. Types and causes of failures in flexible and rigid pavements, highway drainage.

Highway construction and maintenance: Bituminous surface dressing, bituminous macadam.

Module 5 (10 hours)

Airport Engineering: Classification of airports - Aircraft characteristics- planning, selection of site for airport - factors to be considered. Runway orientation and layout of runways: use of wind rose diagrams, basic runway length and corrections required - Imaginary surfaces - approach zone and turning zone, obstructions and zoning laws - Stop way, clearway.

Aprons: factors controlling size and number of gate positions - holding apron aircraft parking systems – passenger terminal building- typical airport layout - airport markings - marking of runways, taxiways etc. Airport lighting: lighting of runways approaches, taxiways and aprons. Air traffic control - airways, navigational aids and landing aids.

References

1. S. K. Khanna, C. E. G. Justo, Highway engineering, Nem Chand Publications.
2. L .R. Kadiyali, Traffic Engineering and Transport Planning, Khanna Publishers.
3. L.R. Kadiyali, Principles and Practices of Highway Engineering, Khanna Publishers.
4. S.K. Khanna, M. G. Arora, S.S. Jain, Airport Planning & Design, Nem Chand Publishers
4. S. C. Rangwala, Airport Engg., Charotar Publishing Co.
5. Horenjeft, Robert & Francise Mc Kelvy, Planning and design of airports, Mc Graw Hill
6. G.V. Rao, Principles of transportation and High way Engineering, Tata Mc Graw Hill, New Delhi.
7. Robert. G. Hennes, Martin Ekse, Fundamentals of Transportation engineering, Tata Mc Graw Hill.
8. Theodore M Matson, Wilbur. S. Smith, Frederick.W.Hurd, Traffic Engineering, Mc Graw Hill.

CE010 706L01 BUILDING AUTOMATION AND SMART STRUCTURES
(Elective II)

Teaching Scheme **Credit:4**

2 hours lecture and 2 hours tutorial per week**.**

Objective:

The course is designed to give an insight into the latest developments in construction field regarding the automated building services, smart materials and their use in structures.

Module 1 (14 hours)

Building Automation: Introduction, Building automation in residential buildings and commercial buildings, Difference between building automation and building control, Systems in building automation and building control, Structure of building automation and control networks, Energy management functions at management level, Room automation.

Module 2 (12 hours)

Building service control systems: Introduction, Building Management System (BMS)-control theory, benefits, Safety systems- life safety system, access control system, smoke detection system, fire sprinkler system, Comfort systems- occupancy sensors, temperature sensors, smart glass, light control system

Module 3 (12hours)

Eco friendly buildings – concepts of Green building, sustainable sites, brown field development, water conservation, energy conservation, ozone depletion, eco friendly building materials and resources, indoor environment quality maintenance, new innovative building designs for eco friendliness.

Module 4 (11hours)

Smart materials: Introduction, Piezoelectric materials, Piezoelectric properties, Vibration control, Embedded actuators, Fiber optics, Fiber characteristics, Fiber optic strain sensors, Applications of optical fibers, Electrorheological and Magnetorheological fluids, mechanism and properties, Applications.

Module 5 (11 hours)

Control of structures: Control strategies and limitations, Classification of control systems, Classical control, Modern control, Optimal control and Digital control.

References;

1. Clements-Croome D.J., *Intelligent Buildings: Design, management and operation*, Thomas Telford, London, 2004.
2. Craighead G., *High-rise security & fire life safety*, Butterworth-Heinemann, Boston, Amsterdam, 2003.
3. Atkin B., *Intelligent Buildings: Application of IT and Building Automation to High Technology Construction Projects*, Kogan Page, Michigan, USA, 1988.

4. Shengwei Wang, *Intelligent Buildings and Building Automation,* Taylor & Francis, New York, 2010.
5. H. Merz, T. Hansemann, C. Hübner, *Building automation: communication systems with EIB/KNX, LON and BACnet*, Carl Hanser Verlag, Germany, 2009.
6. IGBC, *Leadership in Energy and Environmental Design* (LEED-INDIA) Green Building Rating System.

CE010 706L02 GROUND IMPROVEMENT TECHNIQUES (Elective -II)

Teaching Scheme **Credit: 4**
2 hours lecture and 2 hours tutorial per week.

Objective:
The rapid urban and industrial development pose an increasing demand for land reclamation and utilization of unstable and environmentally affected ground.
*The objective of the course is to provide an opportunity to the students to familiarize with the recent developments and techniques in geo technical Engineering to improve the properties of such problematic /difficult soils***.**

Module 1 (15 Hrs)
Necessity of soil improvement-selection of improvement method- mechanical stabilization-effect on engineering properties-dewatering-well-point system electro osmosis-pre-loading- sand drains- methods of installation-vibroflotation and stone columns.

Module 2 (11 Hrs)
Chemical stabilization- cement stabilization- factors affecting soil cement mixing-admixtures- lime stabilization-effect of lime on soil properties -construction of cement / lime stabilized bases-bituminous stabilization- thermal stabilization- electrical stabilization.

Module 3 (11 Hrs)
Introduction to grouts and grouting- basic functions –classification of grouts-suspension grout and solution grout- groutability ratio –-properties of grouts- fluidity and viscosity, bleeding and stability,, rigidity and thixotropy, strength and permeance- grouting applications-seepage control in soil and rock under dams and for cut off walls- stabilization grouting for underpinning.and other applications

Module 4 (12 Hrs)
Earth Reinforcement- mechanism and concept- advantages-factors affecting-uses -design theories and stability analysis of retaining wall-external and internal stability-tie back analysis-coherent gravity analysis- application areas of earth reinforcement

Module 5 (11 Hrs)
Geotextiles: Soil improvement with geotextiles- classification- concepts-geotextiles as reinforcement, separators, filters, and drainage media-damage and durability of geotextiles

References
1.Purushotama Raj,P. Ground Improvement Techniques, Laxmi Publications
2.Koerner, R.M.,Construction and Geotechnical Methods in Foundation Engineering. Prentice Hall
3. Koerner, R.M.,Designing with Geosynthetics,Prentice Hall

4.Swami Saran., Reinforced soil and its Engineering applications, I K International Publishing house
5.Sivakumar Babu., An Introduction to Soil reinforcement and Geosynthetics.,University Press.
6.Shroff A.V. and Shah D.L.,Grouting Technology in Tunelling and Dam construction. Oxford and IBH Publishing Co

CE010 706 L03 PRESTRESSED CONCRETE (Elective II)

Teaching Scheme **Credit: 4**

2 hours lecture and 2 hours tutorial per week.

Objective:

Pre stressed concrete constructions are gaining its importance in Civil engineering .
To under stand the analysis, systems and applications of pre stressed concrete structures.

Module 1 (10 hrs)

Introduction – Basic concept of prestressing – Materials for prestressed concrete - Classification of prestressed concrete – Advantages of prestressed concrete over reinforced concrete – Modes of failure of prestressed concrete – Systems of prestressing – Tensioning devices – Pretensioning – Post tensioning - Thermo elasic and chemical prestressing.

Module 2 (10 hrs)

Analysis of prestress – Extreme fibre stresses – profile of tendons – Concept of load balancing – pressure line or thrust line – Internal resisting couple – Deflection of beams – Load ddeflection curve.

Module 3 (12 hrs)

Losses of prestress – Loss due to elastic shortening, shrinkage, creep, relaxation of steel – Loss due to anchorage slip – Loss due to friction – Overcoming friction loss – Design of tension members.

Module 4 V(14 hrs)

Elastic design of sections for flexure – sections and sections unsymmetrical about one axis – Design without tension and with tension – Design for shear and torsion – Ultimate moment of resistance.

Module 5 (14 hrs)

Anchorage zone – Stress distribution in end block – anchorage zone reinforcement – design of end block as per IS :1343 only – continuous beam – primary moment, secondary moment and resultant moment – concordant cable profile – Guyon's theorem – Evaluation of secondary moment.

References:–

1. N.Krishnaraju *Prestressed Concrete*, Tata McGraw-Hill Publishing Company 3rd Ed. (1985)
2. T.Y. Lin,*Design of Prestressed Concrete Structures*, John Wiley & Sons.
3. R. Rajagopalan, *Prestressed Concrete*, Narosa Publishers
4. IS: 1343, *Code of Practice for Prestressed Concrete*, Bureau of Indian Standards, New Delhi

CE 010 706L04 ENVIRONMENTAL IMPACT ASSESSMENT (Elective II)

Teaching Scheme **Credit:4**
2 hours lecture and 2hours tutorial per week**.**

Objective:

- *To understand the basic principles of Environmental Impact Assessment*
- *To develop knowledge in various processes involved in EIA with case studies.*

Module 1 (14 hours)

Introduction: Concepts of environmental impact analysis, key features of National environmental policy act, Environmental protection acts, EIA methodologies - Screening and scoping - matrix and network methodologies for impact identification, description of the affected environment – environmental indices. Rapid EIA and Comprehensive EIA

Module 2 (14 hours)

Prediction and Assessment of Impact on Air and Water Environment: Basic information on air quality, sources and effects of air pollutants, key legislations and regulations, impact prediction approaches, assessment of significance of impacts, identification and incorporation of mitigation measures
Assessment of impact on water quality (surface and ground water), Vegetation and wildlife.

Module 3 (12 hours)

Prediction & Assessment of Impact on Noise & Social Environment: Basic information on noise, key legislation and guidelines, impact prediction methods, assessment of significance of impacts, identification and incorporation of mitigation measures, Environmental Risk Analysis, Definition of Risk, Consequence Analysis.

Module 4 (10 hours)

Decision Methods for Evaluation of Alternative: Development of decision matrix. Public participation in environmental decision making, techniques for conflict management and dispute resolution, verbal communication in EIA studies.

Module 5 (10 hours)

Introduction to Environmental Management Systems, Environmental Statement-procedures, Environmental Audit: Cost Benefit Analysis, Life cycle Assessment, Strategic EIA

References:

1. Canter L.W., Environmental impact assessment, McGraw-Hill, 1997
2. Betty Bowers Marriott, Environmental Impact Assessment: A Practical Guide, McGraw-Hill Professional, 1997.
3. Peter Morris & Riki Therivel, Methods of Environmental Impact Assessment, Routledge, 2001.
4. Denver Tolliver, Highway Impact Assessment, Greenwood Publishing Group, 1993.
5. R. K. Jain, L. V. Urban, G. S. Stacey, H. E. Balbach, Environmental Assessment, McGraw-Hill Professional, 2001.
6. Relevant IRC & CPCB codes.

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CE010 706L05 THEORY OF PLATES AND SHELLS (Elective-II)

Teaching Scheme **Credit:4**
2 hours lecture and 2hours tutorial per week**.**

Objective :
To develop the skills for the analysis of advanced structures in civil engineering.

Module 1 (12 hrs)
Plates – Introduction – Classification of plates – Thin plates and thick plates – Assumptions in the theory of thin plates – Differential equation for cylindrical bending of rectangular plates – Pure bending of plates **–** Slope and curvature of slightly bent plates – Relation between bending moment and curvature in pure bending.

Module 2 (12 hrs)
Laterally loaded rectangular plates – Small deflections of laterally loaded thin plates – Differential equation of plates – Derivation of fourth order differential equation – Boundary conditions – Simply supported, built- in and free edges.

Module 3 (12 hrs)
Shells – Structural behaviour of shells – Parts of a shell – Classification of shells – Translational, rotational and ruled surfaces – Gauss curvature – Synclastic and anticlastic surfaces – Hyperbolic paraboloid – Elliptic paraboloid – Conoid.

Module 4 (12 hrs)
Classical theories of shells – Thin shell and thick shell – Stress resultants – Membrane theory of cylindrical shells – Formulation of equilibrium equations – Bending theory of cylindrical shells – Equilibrium equations – Beam theory.

Module 5 (12 hrs)
Circular cylindrical shells – Equilibrium equations – Expression for strain – Deformation of circular cylindrical shell – Cylindrical shell with uniform internal pressure – Pressure vessels – Calculation of bending moment and stresses in pressure vessels – attenuation length of edge effects.

References:

1. S.P Timoshenko, S.W Krieger, *Theory of plates and shells*, Mc Graw Hill.
2. J Ramachandran, *Thin shell theory and problems*, Universities press.
3. Krishna Raju N., *Advanced Reinforced Concrete Design*, CBS Publishers and distributers, New Delhi.
4. G.S Ramaswamy, *Design and Construction of Concrete Shell Roofs*, Tata- McGraw Hill Book Co. Ltd.,.

CE010 706L06 TRAFFIC ENGINEERING AND MANAGEMENT (ELECTIVE-II)

Teaching Scheme **Credit:4**

2 hours lecture and 2hours tutorial per week**.**

Objective

The basic objective of this course is to introduce to the students the knowledge of traffic surveys and studies . The course also tries to expose the students, traffic management, capacity studies design of intersections, safety studies and the theories of traffic flow. They also become familiar with various traffic control and traffic management measures.

Module 1 (12 hrs)

Traffic management - scope of traffic management measures - restrictions to turning movements - one way streets - tidal flow operation - regulation of traffic - Need and scope of traffic regulations- Motor Vechicle Act - Speed limit at different locations- regualtion of the vechicle - regulations concerning the driver rules of the road enforcement.

Module 2 (12 hrs)

Highway capacity: Its importance in transportation studies - basic, possible and practical capacity - determination of theoretical maximum capacity -passenger car units - level of service - concept in HC manual - factors affecting level of service.

Module 3 (12 hrs)

Design of Intersection: Design of at grade & grade seperated intersection – rotary intersection - capacity of rotary intersection - traffic signals - design of fixed timesignal - pretimed signalised intersection - performance - Websters approach for the design.

Module 4 (12 hrs)

Traffic Safety: causes of road accidents - collection of accident data – influence of road, the vehicle .the driver, the weather and other factors on road accident - preventive measures.

Module 5 (12 hrs)

Traffic Flow: theory of traffic flow - scope - definition and basic diagrams of traffic flow- basic concepts of light hill - Whitham’s theory - Car ’following theory and queuing

References

1. Khadiyali L.R. Traffic Engineering and Transport planning, Khanna Tech Publishers
2. Khanna O.P and Jesto C.G; Highway Engineering, Nem Chand Publishers
3. Martin, Whol, Traffic system Analysis for Engineers
4. Donald Drew, Traffic Flow Theory

CE010 707 COMPUTER APPLICATIONS LAB

Teaching scheme: **Credits: 2**
3 hour practical per week

Objective:
To familiarize the students on the software packages for analysis , design and project management

Module I & II

- INTRODUCTION

Overview and the Environment of STAAD pro Package.

- GENERAL DESCRIPTION

Type of structure, Unit systems, structure geometry and Co-ordinate systems, global co- ordinate system, Local co-ordinate systems

- STAAD III -Commands- Using Edit Input-Command Formats-Text Input.
- STAAD PRE- Graphical Input Generation-"Concurrent" Verifications-Library- Geometry Generation – Dimensioning.
- STAAD POST – Graphical Post Processing – Animation – Icons – Isometric View – Zooming-Results of Analysis & Design – Query reports.
- LOAD – Member Load, Element Load, Joint Load, Floor Load, Self weight Command, Load case no, Load Combination .Load Generation for Wind Load, Seismic Load and Moving Load
- FINITE ELEMENT ANALYSIS & Dynamic Analysis.
- DESIGN for Concrete and Steel Structures using IS: 456 and IS 800 respectively.

Note

The student has to practice the above topics by working out problems in
1. Analysis and design of beams and trusses, Steel and RCC framed structures.
2. Analysis and design of multi-storied framed structures.

Module III & IV

Project management using CPM/PERT Software
(Microsoft Project /PRIMAVERA software)
1. Practice on the GUI of the software and Input of Date
2. Practice on Creating Bar Charts/Ghant charts
3. Practice on creating CPM/PERT charts and finding out critical path.
4. Practice on resource allocation and leveling of resources.
5. Practice on Project Monitoring (Cost &Time)
6. Plotting and printing of various charts and project

Note

The student has to practice the above topics by doing Project Management for Turn key projects related to Civil Engineering applications.

References

1. STAAD III Reference Manual
2. MS Project/PRIMAVERA Reference Manual

CE010 708 TRANSPORTATION ENGINEERING LAB

Teaching scheme: **Credits: 2**
3 hour practical per week

Objective:
To make the students aware of the properties of various materials used in road constructions.

TEST ON SOIL
1.Califormia bearing ratio method.
TEST ON BITUMEN
2. Softeningpoint of Bitumen
3. Ductility test on Bitumen
4. Specific gravity of Bitumen
5. Flash and fire point test
6. Stripping value test
7. Viscosity using Viscometer
TESTS ON ROAD AGGREGATES
8. Aggregate crushing value test
9. Impact value test
10. Specific gravity test
11. Shape tests - Flakiness index and elongation index
12. Los angles abrasion test
13. Bulk density, specific gravity, void ratio and porosity of coarse aggregate, water absorbtion.
TESTS ON MIXES
14. Marshell stability value
15. Determination of bitumen content by bitumen extractor.

References

1. S. K.Khanna, C. E. G. Justo, Highway engineering, Nem Chand Publications.
2. L .R. Khadiyali, Principles and Practices of Highway Engineering, Khanna Publishers.

CE 010 709 Seminar

Teaching scheme **credits: 2**

2 hours practical per week

The seminar power point presentation shall be fundamentals oriented and advanced topics in the appropriate branch of engineering with references of minimum seven latest international journal papers having high impact factor.

Each presentation is to be planned for duration of 25 minutes including a question answer session of five to ten minutes.

The student's internal marks for seminar will be out of 50. The marks will be awarded based on the presentation of the seminar by the students before an evaluation committee consists of a minimum of 4 faculty members. Apportioning of the marks towards various aspects of seminar (extent of literature survey, presentation skill, communication skill, etc.) may be decided by the seminar evaluation committee.

A bona fide report on seminar shall be submitted at the end of the semester. This report shall include, in addition to the presentation materials, all relevant supplementary materials along with detailed answers to all the questions asked/clarifications sought during presentation. All references must be given toward the end of the report. The seminar report should also be submitted for the viva-voce examination at the end of eighth semester.

For Seminar, the minimum for a pass shall be 50% of the total marks assigned to the seminar.

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CE 010 710 Project Work

Teaching scheme **credits: 1**

1 hour practical per week

Project work, in general, means design and development of a system with clearly specified objectives. The project is intended to be a challenge to intellectual and innovative abilities and to give students the opportunity to synthesize and apply the knowledge and analytical skills learned in the different disciplines.

The project shall be a prototype; backed by analysis and simulation etc. No project can be deemed to be complete without having an assessment of the extent to which the objectives are met. This is to be done through proper test and evaluation, in the case of developmental work, or through proper reviews in the case of experimental investigations.

- The project work has to be started in the seventh semester and to be continued on to eighth semester.
- Project work is to be done by student groups. Maximum of four students only are permitted in any one group.
- Projects are expected to be proposed by the students. They may also be proposed by faculty member (Guide) or jointly by student and faculty member.
- Students are expected to finalise project themes/titles with the assistance of an identified faculty member as project guide during the first week of the seventh semester.

The progress from concept to final implementation and testing, through problem definition and the selection of alternative solutions is monitored. Students build self confidence, demonstrate independence, and develop professionalism by successfully completing the project.

Each student shall maintain a project work book. At the beginning of the project, students are required to submit a project plan in the project book. The plan should not exceed 600 words but should cover the following matters.

❖ Relevance of the project proposed
❖ Literature survey
❖ Objectives
❖ Statement of how the objectives are to be tackled

- Time schedule
- Cost estimate

These proposals are to be screened by the evaluation committee (EC- minimum of 3 faculty members including the guide) constituted by the head of department, which will include a Chairman and the EC will evaluates the suitability and feasibility of the project proposal. The EC can accept, accept with modification, request a resubmission, or reject a project proposal.

Every activity done as part of project work is to be recorded in the project book, as and when it is done. Project guide shall go through these records periodically, and give suggestions/comments in writing in the same book.

The students have to submit an interim report, along with project work book showing details of the work carried out by him/her and a power point presentation at the end of the 7th semester to EC. The EC can accept, accept with modification, request a resubmission, or extension of the project.

The student's internal marks for project will be out of 50, in which 30 marks will be based on day to day performance assessed by the guide. Balance 20 marks will be awarded based on the presentation of the project by the students before an evaluation committee consists of a minimum of 3 faculty members including the guide.

For Project, the minimum for a pass shall be 50% of the total marks assigned to the Project work.

CE010 801 ADVANCED STRUCTURAL DESIGN

Teaching scheme: **Credit: 4**
3hours lecture and 2 hours tutorial per week

Objective:

To familiarize students with behavior and design procedure of some of the special structural elements so that they can perform better in the analysis and design of these structures in practical situations.

Module 1 (15 Hrs)
Road bridges: IRC Loadings and Specifications-T beam bridges – box culvert (Design forIRC Class A Loading only**)**- Bearings(Theory only)

Module 2 (15 Hrs)
Shell structures: general principles for membrane theory for symmetrical uniformly distributed load- design of a simply supported single barrel cylindrical shell for membrane stresses. Folded plates: general principles- structural behaviour of plates (design not required)

Module 3 (14 Hrs)
Industrial buildings: roof loads- design of trusses (analysis not required) -design of purlins-design of bracings and supporting system. (Problems not expected.)

Module 4 (15 Hrs)
Design of Plate girders and gantry girders- welded compound sections

Module 5(16 Hrs)
Steel bridges: IS specifications-design of highway and railway bridges of plate girder type.(Design of bracings not required.)
Note:
Sketches only required for reinforcement details. Detailed drawing in drawing sheets not required.

REFERENCES

1. IRC Bridge code,Indian railway bridge code, IS 456.IS 800,IS 875
2. Victor J D, Design of concrete bridges, oxford & IBH publishing company,new delhi
3. Krishna Raju, Advanced design of concrete structures, oxford & IBH publishing company,new delhi
4. Ramchandra, Design of steel structures vol 2 standard book house, delhi
5. Ramaswamy G S Design and construction of concrete shell roofs, Mc Graw Hill

CE010 802 BUILDING TECHNOLOGY AND MANAGEMENT

Teaching scheme: **Credits: 4**
2 hours lecture and 2 hours tutorial per week

Objective: *To impart theoretical knowledge as well as awareness to practical concepts in project implementation giving emphasis on three essentials of project management; (1) avoiding time over-run, (2) avoiding cost over-run, (3) maintaining total quality management*

Module 1 (12 Hrs)
Concrete Mix Design: General concepts. BIS method of mix design, American standards of mix design, IS-method of mix design, Durability concepts in mix design - Requirements and tests of materials required for mix design.-Fibre reinforced concrete- High performance concrete.
Form work. General arrangements – general requirements – common faults – materials for form work – form work arrangements – form work design – loads on forms – design procedure – form work vibration for compaction of concrete – stripping time and shoring.

Module 2 (12 Hrs)
Prefabricated construction: Advantages, foundation units, wall panels, frames for opening, walls–units for roofs and floors – low cost roof systems. Hollow concrete blocks, Ferro cement – use and application – modular co-ordination – method of production – flow line method – station method – manufacturing process for structural units.
Codification and Standerdisation- Value analysis: Various methods and techniques. Cost time analysis in Network Planning.

Module 3 (12 Hrs)
Construction company organization: Different types of organizational set up – construction team – objectives of civil engineering management – duties and responsibilities of a civil engineer – functions of construction management. Technical planning.
Site organization: Organization of labour, resources, materials, method of execution of the project – inspection and quality control- safety in construction.

Module 4 (12 Hrs)
Materials Management: Functions of materials management – inventory control techniques.
Construction contracts: Item rate contract – Lump-sum contract –Labour contract – Negotiated contract – Global contract – Percentage contract – Cost plus percentage contract- Cost plus fixed fee contract- Cost plus fluctuating fee contract – Target contract – All in contract.

Module 5 (12 Hrs)

Claims manual for a construction organization: Law of contract - Extra work and deviation order – claims – owner' s claim – sub contractor' s claim – disputes and arbitration – consequences of mistake in contracts – terms and conditions of contract – contract documents – earnest money – security deposit – warranty period – contract signed under coercion – contract signed by minors, insane or drunken persons – authority to agree and find, validity of an oral agreement – conditions and warranties – express terms and implied terms – voidable contracts and their performance – illegal and voidable contracts – liability for tort in contract- litigation – breach of contract and remedies – discharge of contract – equity, privity of contract – transfer of contractual rights and obligations.

References

1. Gambhir. M. L, Concrete Technology, Mcgrawhill
2. M .S Shetty, concrete technology, S. Chand & Co.
3. A.R Santhkumar-Concrete Technology-Oxford University Press
4. S. P Arora, Building constructions, Dhanpat Rai & sons, New Delhi.
5. B. L Gupta, Amit Gupta, Construction Management and accounts, standard publishers and Distributions.
6. Construction Management and accounts – V .N Vazirani.
7. Construction Engineering & Management, S. Seetharaman, Umesh Publications, Delhi.
8. Donald S Barrie & Boyd C Paulson - Professional Construction Management, Mc Graw Hill
9. P.S. Gahlot & B.M.Dhir , Construction Planning and Management, New agw International
10. Knatson, Conctruction Management fundamentals, McGraw Hill.

CE010 803 ENVIRONMENTAL ENGINEERING - II

Teaching scheme: **Credits: 4**

2 hours lecture and 2 hours tutorial per week

Objective:

- *To understand the basic principles of Wastewater Engineering*
- *To develop knowledge in unit operations and design of wastewater treatment systems*

Module 1 (10hrs)

Introduction to sanitary engineering. Sewerage systems – separate, combined and partially combined systems.

Quantity of sewage: sanitary sewage - sources, factors affecting. Fluctuations in sewage flow, peak factor.

Characteristics of sewage: physical, chemical and biological characteristics and analysis. population equivalent, relative stability.
Storm sewage: Factors affecting, intensity of rainfall, rational and empirical formula, time of concentration, intensity - duration curve and formula.

Design of sewers: Flow formula, minimum and maximum velocity of flow, effect of variation of discharge on velocity, use of partial flow diagrams, design of circular sewers, longitudinal and cross section of sewer lines.

Module 2 (10hrs)

Construction of sewers: Materials of sewers, crown corrosion.

Sewer appurtenances: inlets, catch basins, clean outs, manholes, drop manholes, lamp holes/flushing tanks, grease and oil traps, inverted siphons, storm regulators.
Sewage pumping: classification and capacity of pumps.

Natural methods of wastewater disposal: land disposal -. Sewage farming - disposal by dilution - self purification of streams - oxygen sag curve - dilution into sea, comparison of disposal methods.

Module 3 (10hrs)

Objectives of waste water treatment - Effluent standards, KSPCB Standards, BIS Standards. **Layout** of conventional treatment plant - preliminary, primary, secondary and tertiary treatments in general.

Screens - types of screens, design, disposal of' screenings; comminutors. **Grit chamber** - function, design, construction and operation, disposal of grit, detritus tank. **Skimming tank** -function, design and operation, disposal of skimmings **Sedimentation**: Theory of sewage sedimentation - design, construction and operation, rectangular and circular tanks, disposal of sludge.

Module 4 (15hrs)

Biological process: principle and theory of biological treatment**.** Sewage filtration: **Trickling filters** - design, construction and operation. **Activated sludge process**: Design, construction and operation of conventional and extended aeration, aeration methods. **Miscellaneous methods**- Stabilization ponds, Oxidation ditch, Aerated lagoons, rotating biological contactors; disinfection of sewage effluents.

Module 5 (15hrs)

Sludge treatment and disposal: quantity of sludge, characteristics of sludge, sludge thickening, digestion, conditioning and disposal, design of sludge digesters only. **Septic Tanks**: Design (as per Ministry of urban development) construction, disposal of effluents, cleaning of tanks, Imhoff tanks. Sewage treatment by **high rate anaerobic methods**: Anaerobic digestion, suspended growth, contact process, UASB, attached growth, filters, expanded bed - only basics.

References

1. Peavy, Rowe, Tchobanoglous, Environmental Engineering, Mc Graw Hill International Editions.
2. S. K. Garg, Environmental Engineering Vol. l & ll, Khanna Publishers, New Delhi.
3. B.C. Punmia, Water supply Engineering, Arihant Publications, Jodpur.
4. B.C. Punmia, Waste water Engineering, Arihant Publications, Jodpur.
5. Metcalf & Eddy, Waste water Engg.- Treatment and Reuse, 4th Edn., Mc Graw Hill International Editions.
6. Mark J Hammer, Water and waste water technology, John Wiley and sons, Inc.

CE010 804L01 ADVANCED FOUNDATION DESIGN (Elective III)

Teaching scheme: **Credit: 4**

2 hours lecture and 2 hours tutorial per week

Objective:

After acquiring the basic knowledge in soil mechanics and foundation engineering, this course is offered as an elective with the objective of giving in depth knowledge in the design of foundations for different structures and in difficult soils.

Module 1 (12 hrs)

Well foundations: Introduction- Applications-Different shapes of wells-grip length-scour depth-design depth-forces acting on well foundation-Terzaghi's method of analysis (only general case)-bearing capacity based on N value(only IS recommendation)-design of individual components of well-sinking of wells-measures for rectification of tilts and shifts. Features of Box(floating) caisson and pneumatic caisson

Module 2 (12 hrs)

Soil dynamics and Machine foundations: Introduction- Soil behavior under dynamic loads and application-Difference between static and dynamic load behavior-soil properties relevant for dynamic loading- free vibrations and forced vibrations- determination of dynamic soil constants in laboratory and field based on IS code provisions Types of machines-Types of machine foundations -vibration analysis of a machine foundation-general design criteria for machine foundations- Design criteria for foundation for reciprocating machines(only IS specifications) -vibration isolation and control

Module 3 (12 hrs)

Sheet Pile walls and Cofferdams: types and uses of sheet piles-design of cantilever sheet pile walls in granular and cohesive soils-anchored bulkhead-free earth support and fixed earth support method-coffer dams-uses- braced and cellular cofferdams

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Module 4 (12 hrs)

Special Foundations: Foundation for special structures such as water tanks, silos, cooling towers, guyed structures, ground storage tanks, chimneys, telecommunication towers, transmission line towers-foundation for under ground conduits- foundation for coastal and offshore structures-pre-stressed foundations. Shell Foundations-structural form and efficiency-different types.

Module 5 (12 hrs)

Foundations in Special soils: Foundation in expansive soil, soft and compressible soils, problems associated with foundation installation- ground water lowering and drainage- shoring and underpinning-different methods-damage and vibrations due to constructional operations

References

1. Bowles.J.E, Foundation Analysis and DesignMc Graw Hill Publishing Company.
2. N.P.Kurian, Modern foundations Tata Mc Graw Hill Publishing company
3. Srinivasulu P, Vaidyanathan C.V Handbook of Machine foundations
4. 11Teng W.C., *Foundation Design*, PHI
5 . P.C.Varghese, Foundation Engineering,Prentice-Hall of India Private Ltd, New Delhi
6 . Shashi K. Gulhati and Manoj Dutta, Geotechnical Engineering, Tata McGraw-Hill P ublishing Compay Limited,New Delhi.
7. Leonards G.A., *Foundation Engineering*, McGraw Hill
8 Arora K.R., *Soil Mechanics & Foundation Engg.,* Standard Publications
9 Punmia B. C., *Soil Mechanics & Foundations*, Laxmi Publications
10. Venkatramiah, *Geotechnical Engineering*, New Age International Publishers
11 Teng W.C., *Foundation Design*, PHI
12. Tomlinson M.J., *Foundation Design & Construction*, Pitman
13 .Coduto, *Geotechnical Engineering Principles and Practices,* Pearson Education

University of Calicut

CE010 804L02 ENVIRONMENTAL GEOTECHNIQUES (Elective III)

Teaching scheme: **Credit: 4**

2 hours lecture and 2 hours tutorial per week

Objective:

Waste disposal is a major issue for which we need different effective and innovative methods. The objective is to familiarise the students, the different types of wastes generated , composition of the wastes, and the problems they pose on environment due to improper disposal. It also includes the different effective methods for the disposal for the different types of wastes.

Module 1 (12 hours)

Clay mineralogy and soil structure: Gravitational and surface forces-inter sheet and inter layer bonding in the clay minerals- Basic structural units of clay minerals- isomorphous substitution – kaolinite mineral- montmorillonite mineral -illite mineral- electric charges on clay minerals – base exchange capacity ,diffused double layer- adsorbed water- soil structure- methods for the identification of minerals (introduction only).

Module 2 (15 hours)

Effect of environment on Geotechnical properties of soils: Effect of drying on Atterberg limits.-Volume change behaviour- factors controlling resistance to volume change- general relationship between soil type, pressure and void ratio.- importance of mineralogical composition in soil expansion. Activity- sensitivity ,causes of sensitivity-Influence of exchangeable cations , pH and organic matter on properties of soils. Permeability of soils- hydraulic conductivity of different types of soils – Darcy' s law and its validity- factors affecting permeability

Module 3 (10hours)

Wastes and Contaminants (introduction only): sources of wastes-types of wastes composition of different wastes- characteristics and classification of hazardous wastes- generation rates- ground water contamination- sources of ground water contamination- transport mechanisms-potential problems in soils due to contaminants.

Module 4 (12 hours)

Disposal and containment technics: Criteria for selection of sites for waste disposal- hydrological aspects of selection of waste disposal sites- disposal facilities- subsurface disposal technics-disposal systems for typical wastes (sketches only)

Module 5 (12 hours)

Containment control systems-Liners and covers for waste disposal- rigid liners, flexible liners. Ground modification technics in waste management – waste modification- ground modification- mechanical modification-hydraulic modification- chemical modification.

References

1. Mitchell, J (1976), “ Fundamentals of soil behaviour”, John Wiley and sons, NewYork
2. Lambe, T. W & Whitman, R. V (1979), “ Soil Mechanics “, John Wiley and Sons, New York.
3. Gopal Ranjan & A.S.R Rao (1991), “ Basic and Applied Soil Mechanics, Wiley Eastern Ltd., New Delhi.
4. Wilson, M. J (1987), “ A Hand book of Determinative methods in Clay Mineralogy”, Chapman and Hall, New York.
5. Robert M. Koerner (1984), “Construction and Geotechnical methods in Foundation Engineering”, McGraw Hill Book Co., New York.

CE010 804L03 EARTHQUAKE ENGINEERING AND DESIGN (Elective III)

Teaching scheme: **Credit: 4**

2 hours lecture and 2 hours tutorial per week

Objective: *To have a general awareness about effects of earthquake and study of seismic design of structures*.

Module 1 (9 hrs)

Causes of Earthquakes: The earth and its interior, the circulations, plate tectonics. Types of earthquakes.

Seismic waves, measuring instruments, locating focus of earthquakes from wave velocity strong ground motions, characteristics of strong ground motion, magnitude, intensity and energy release. Direct and indirect effects of earthquake.

Module 2 (8 hrs)

Past earthquakes in India, basic geography and tectonic features of India, seismic zones of India.

Inertia forces in structures, flow of inertia, forces to foundations, effect of deformation in structures.

Building forms for earthquake resistance, Architectural features, size of buildings, horizontal and vertical layout of buildings.

Module 3 (14 hrs)

Torsion in buildings, Rigid and flexible floor diaphragm, Torsionally coupled and uncoupled system, earth design philosophy. importance of ductility, capacity design concept-Strong column weak beam concept, weak storey, flexibility of long and short period structures.

Module 4 (16 hrs)

Equivalent static lateral earthquake force analysis based on IS: 1893-2002, capacity design and detailing of R.C. building.

Flexible and rigid floors. Role of shear wall, load distribution among shear walls.

Module 5 (13 hrs)

Behaviour of brick masonary walls, Box action of masonary buildings, role of horizontal and vertical bands, retrofitting techniques of R.C.C. and masonry Buildings.

References

1. Earthquake resistant design of structures, P. Agarwal and. **M.**Shrikande, PHI Learning Pvt. Ltd., New Delhi
2. Earthquake resistant Design of structures, S.K. Duggal, Oxford University Press, New Delhi

3. Geo technical Earthquake Engineering, S. L. Kramer, Pearson Education.
4. Earthquake Tips, C. V. R. Murthy, BMTPC, New Delhi
5. Bureau of Indian Standards
   I S: 1893(Part I 2002)
   I S: 113920-1993
   I S: 13935-1993
   I S: 13828 -1993
6. Earthquakes, Bruce A. Bolt, W. H. Freeman & Company
7. Basic Geotechnical Earthquake Engineering. Dr.Kamalesh Kumar, New age International Pvt. Ltd.l

CE 010 804L04 ADVANCED HYDROLOGY AND SYSTEM ANALYSIS (Elective -III)

Teaching scheme: **Credit: 4**

2 hours lecture and 2 hours tutorial per week

Objective: *To increase knowledge on the application of advanced hydrologic methods to water resources problems. Hydrologic analysis emphasizes computational methods in hydrology for specific tasks. The level of understanding should, upon completion of the course, be sufficient to understand and appreciate the important issues in the current literature where statistical and optimization methods are used in prediction and interpretation of hydrologic processes.*

Module 1 (10hrs)

Introduction: Hydrologic cycle- Weather and hydrology: Thermal circulation - effects of earth's rotation - effect of' land and water distribution - migratory systems - fronts - measurement of temperatures –- geographic distribution of temperatures - time variations of temperatures - properties of water vapour- Measurement of humidity – geographic distributions of humidity - time variations in humidity-geographic variations of wind - time variations of wind - scanning and predicting weather.

Module 2 (10 hrs)

Precipitation: Measurement of precipitation- recording gauges - automatic gauges radars - estimation of missing data and adjustment of records - mean areal depth of precipitation - rain gauge network- design principles-depth area duration curves – Hyetograph, hydrograph and mass curve of rainfall - analysis of rainfall data - moving average curves - design storms – probable maximum precipitation curves snowfall and measurement. Determination of snow melts. Water Losses: Evaporation-evaporation pans – evapometre, control of' reservoir evaporation - soil evaporation - transpiration - estimation of evapo transpiration - infiltration - infiltration curves - determination of infiltration indices - water shed leakage - water balance.

Module 3 (10 hrs)

Runoff: Catchments characteristics - classification of streams- run off estimation by empirical formulae, curves, infiltration method, rational method, overland flow hydrograph and unit hydrograph method.

Hydrographs**:** Separation of stream, flow components - - unit hydrograph - assumption - derivations of unit hydrograph - unit hydrograph of complex storms - instantaneous unit hydrograph - synthetic unit hydrograph-applications.

Module 4 (15hrs)

Floods: Definition of standard project flood –Frequency analysis- maximum probable flood – probable maximum precipitation and design flood - estimation of peak flood-flood control. Measures - flood forecasting techniques- flood routing - analytical and graphical methods of flood routing. The erosion process - factors controlling erosion - reservoir sedimentation - control of reservoir sedimentation.

Module 5 (12 hrs)

System analysis: Basic system analysis concepts, scope and steps in system engineering-system approach-need for system approach-concept of models-classification of models-General system model, Descriptive vs Predictive, Single vs Multiple events and Stochastic vs Deterministic Models-simulation models- applications

Probability analysis of hydrological data**:** mean, median, mode, mean-deviation, standard deviation, variances and skewness of data normal, gamma, poisons, log normal and pears and type III distributions - flood, frequency by fuller's, Gumbel's, Powel and Ven Te chow methods.

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References

1. H. M.Reghunath, Hydrology, Wiley Easten Ltd., New Delhi.
2. Santhosh Kumar Garg, Hydrology and flood control engineering, Khanna Publishers.
3. R.K. Linsley, M. A. Kholar, Hydrology for engineers, Tata Mc Graw Hill.
4. Ven Te Chow, Maidment, D. R., and Mays, L. W., Applied Hydrology, McGraw-Hill, 1988.
5. Vijay P. Singh, Elementary Hydrology, Prentice Hall, 1992.
6. Viessman and lewis, introduction to hydrology, Harper Collin college publisher, 1996
7. Nathabandu T. Kottegoda and Renzo Rosso, Statistics, Probability, and Reliability for Civil and Environmental Engineers, The McGraw-Hill Companies, Inc., 1997.
8. Alfredo H.S. Ang and Wilson H. Tang, Probability Concepts in Engineering Planning and Design Vol. I Basic Principles and Vol. II Decision, Risks and Reliability, Wiley, 1975.
9. D.R. Helsel and R.M. Hirsch, Statistical Methods in Water Resources, USGS, 2002, http://pubs.usgs.gov/twri/twri4a3/.
10. C. T. Hann, Statistical Methods in Hydrology, The Iowa State University Press, 1977.
11. George P. Box and Gwilym M. Jenkins, Time Series Analysis: Forecasting and Control, Holden Day, 1976.

CEO10 804L05 HIGHWAY AND AIRFIELD PAVEMENTS (Elective III)

Teaching scheme: **Credit: 4**

2 hours lecture and 2 hours tutorial per week

Objective:

To equip the students to carry out design and evaluation of flexible and rigid pavements in varied field conditions.

Module 1 (12hrs)

Pavement types: stress distribution in pavements - theoretical subgrade conditions and traffic loadings Basic difference between flexible and rigid pavements - design factors - wheel load - equivalent single wheel load - repetition of loads - elastic modulii - climatic variations.

Module 2 (12hrs)

Design of flexible pavements: group index method - CBR method - IRC recommendations - Me Load method - Burmister's layer theory.

Module 3 (12hrs)

Design of rigid pavements: radius of relative stiffness - critical load positions - Westergaard's stress equation - Bradley's stress coefficients - design charts.

Module 4 (12hrs)

Temperature stresses in concrete pavements: Westergaard's concept - wrapping stress - functional stress - combination of stresses.

Design of joints in concrete pavements: expansion joints - construction joints - design of dowel bars - tie bars - IRC recommendation.

Module 5 (12hrs)

Evaluation of pavement condition: pavement instrumentation - types of pavement distress - roughness and skid resistance. Environmental influence and effects-pavements maintenance and overlays.

References

1. Bindra B.S, Highway Engineering, Danpat Rai and Sons.
2. H.J.Yoder, Principles of Pavement Design, John wiley and sons
3. Khanna O.P, Justo C.G., Highway Engineering, Nem Chand Publishers
4. IRC Standard specifications for Construction of Flexible and rigid pavements

CE010 804 L06 STRUCTURAL DYNAMICS AND STABILITY ANALYSIS
(Elective III)

Teaching scheme: **Credit: 4**

2 hours lecture and 2 hours tutorial per week

Objective:

To study 1. the basic concepts of stability.
2.the comprehensive methods of dynamic analysis.

Module 1 (12 hours)

Introduction-problems in nature-steady state problem-dynamic problem-stability problem (Eigen value problem)-introduction to dynamic loading-D'Alembert' s equation of equilibrium-inertia force-effect of damping-Hamilton' s principle.

Module 2 (12 hours)

Single degree of freedom system-idealisation-free vibration-natural frequencyresonance-forced vibration-lumped mass-consistent mass.
solution techniques-determinant search procedure-Householders method

Module 3 (12 hours)

Introduction to stability analysis-energy principles-stable, unstable and neutral equilibrium-fourth order differential equation for generalized bending problemselastic instability of columns-Euler' s theory-assumptions-limitations. General treatment of column stability problem as an Eigen value problem-various modes of failure for various end conditions- both ends hinged-both ends fixed-one end fixed other end free- one end fixed other end hinged

Module 4 (13 hours)

Beam column-beam column equation-solution of differential equation for various lateral loads-udl and concentrated loads-solutions for various end conditions-both ends hinged-both ends fixed-one end fixed other end free- one end fixed other end hinged.

Module 5 (11 hours)

Finite element application to dynamics-element stiffness matrix and mass matrix of a beam element. Finite element application to stability analysis- finite element stability analysis-element stiffness matrix –geometric stiffness matrix-derivation of element stiffness matrix and geometric stiffness matrix for a beam element.

References

1. Ray W Clough, Joseph Penzien, Dynamics of structures, Mc Graw Hill,Kogabusha Ltd.
2. Ziegler H, Principles of structural stability, Blarsdell, Wallham, Mass, 1963.
3. Thompson J M, G W Hunt, General stability of elastic stability, Wiley, NewYork.
4. Timoshenko, Gere, Theory of elastic stability, Mc Graw Hill, New York.
5. Don O Brush, B O O Almorth, Buckling of Bars, plates and shells,
6. Cox H L, The buckling of plates and shells, Macmillam, New York, 1963.
7. O C Zienkiewicz ,.Finite Element Method ,fourth Edition,McGraw Hill,
8. R.D.Cook, Concepts and Applications of Finite Element Analysis, John Wiley&Sons.

CE010 805G01 FINITE ELEMENT ANALYSIS (Elective IV)

Teaching scheme: **Credit: 4**

2 hours lecture and 2 hours tutorial per week

Objective:

To make the back ground, basic concepts and basic formulation of finite element method

Module I (12hrs)

Introduction to FEM-Historical development-Idealization of actual structures-Mathematical model-General procedure of FEA-Displacement approach. Solution techniques- Gauss Elimination – Frontal solver (concepts only)

Module 2 (12hrs)

Finite element analysis- -Energy principles- Principle of Stationary Potential Energy- Complementary Energy - Variational approach -Stable- Unstable-Neutral equilibrium-Virtual work- Principle of virtual forces – Principle of virtual displacements.

Module 3 (12hrs)

Shape functions-Lagrangian and Hermition Interpolation – Polynomials – General coordinates-Area coordinates-Compatibility –C_0 and C_1 elements-convergence criteria- conforming & nonconforming elements – Patch test

Module 4 (12hrs)

Stiffness matrix-Bar element-Beam element-Triangular elements - Constant Strain Triangle-Linear Strain Triangle- Isoparametric elements-Numerical Integration - Gauss Quadrature.

Module 5 (12hrs)

General plate bending elements- Plate bending theory – Kirchhoff's theory – Mindlin's theory – Introduction to locking problems- preventive measures – reduced integration – selective integration. Axysymmetric elements- Introduction to shell elements

References

1. O C Zienkiewicz,.Finite Element Method, fourth Edition,McGraw Hill,
2. R.D.Cook, Concepts and Applications of Finite Element Analysis, John Wiley &Sons.
3. Stephen P.Timoshenko& Krieger, S.W., Theory of Plates and Shells, McGraw Hill.
4. C.S.Krishnamoorthy, Finite Element Analysis, Tata McGraw Hill .New Delhi, 1987.
5. S.Rajasekharan, Finite Element Analysis, Wheeler Publishing Co., &Sons.1993.
6. T.Kant, Finite Element Methods in Computational Mechanics, Pergamons Press.
7. K.J.Bathe, Finite Element Procedures in Engineering Analysis, Prentice Hall,
8. Mukhopadhyay M., Matrix Finite Element Computer and Structural Analysis,

Oxford &IBH, 1984.
9. Irving H.Shames, Energy &Finite Element Methods in Structural Mechanics.
10. Desai C.S.&Abel J.F., Introduction to Finite Element Methods, East West Press

CE010 805G02 ENVIRONMENTAL POLLUTION CONTROL TECHNIQUES (ELECTIVE IV)

Teaching scheme: **Credit: 4**

2 hours lecture and 2 hours tutorial per week

Objective:

- *To understand the basic concept of various forms of Environmental Pollution*
- *To develop knowledge in control techniques for Environmental Pollution*

Module 1 (12hrs)

Introduction to environmental pollution

Air pollution – Sources – Criteria pollutants – Control of gaseous pollutants (adsorption, absorption, reaction and other methods) – Control of particulate pollutants (settling chambers, cyclone separation, Wet collectors, fabric filters, electrostatic precipitators)– Automobile pollution control

Module 2 (12hrs)

Water pollution – Sources – Various Pollutants – Treatment and control methods – Physico-chemical and Biological Treatments – Screening, skimming, sedimentation, coagulation, Filtration, Trickling Filters, Activated sludge process, Oxidation ponds, high rate anaerobic methods (design not needed)

Module 3 (12hrs)

Industrial Pollution - Characteristics of industrial wastes**:** physical, chemical and biological. Pretreatment of industrial wastes**:** waste volume reduction, waste strength reduction - neutralization, equalization and proportioning.

Theories of treatments processes**:** sedimentation flotation coagulation - evaporation & ion exchange – lagooning - activated sludge treatment - High rate anaerobic treatment.

Module 4 (12hrs)

Solid waste management: Type and source of solid waste, characteristics, collection, transportation and processing- Waste minimization strategies – Reduction - Recycling – Reuse – Disposal - composting, sanitary landfill, incineration, .

Module 5 (12hrs)

Noise pollution: Sources, effects of noise pollution, control measures.

Administrative and Legislative control of environmental pollution. Important Environmental rules and regulations, environmental protection laws and acts.

References

1. Peavy, Rowe, Tchobanoglous, Environmental Engineering, Mc Graw Hill International Editions.
2. M.N. Rao & H.V.N. Rao, Air Pollution, Tata Mc Graw Hill Pvt. Ltd., New Delhi.
3. S. K. Garg, Environmental Engineering Vol. l & ll, Khanna Publishers, New Delhi.
4. B.C. Punmia, Water supply Engineering, Arihant Publications, Jodpur.
5. B.C. Punmia, Waste water Engineering, Arihant Publications, Jodpur.
6. Nelson Leonard Nemerow, Theories and practices of industrial waste treatment, Addison-Wesley Publishing Co., Inc.

7. W Wesley Eckenfelder Jr., Industrial water pollution control, International Edition, Mc Graw Hill Inc, New Delhi.
8. M Narayana Rao, Waste water treatment, Rational methods of design and Industrial practice, Oxford & IBH Publishing Co. Pvt. Ltd, Bombay.
9. C.S. Rao, Environmental Pollution Control Engineering, New Age International (P)Ltd, New Delhi.
10. Warren Viessman and mark J Hammer, Water Supply and Pollution Control, Pearson Education, Inc.
11. Gilbert M.Masters, Kurian Joseph and R. Nagendran, Introduction to Environmental Engineering and Science.
12. Ruth F. Weiner and Robin Matthews, Environmental Engineering, Butterworth-Heinemann, Elsevier.

CE010 805G03 OPTIMIZATION TECHNIQUES (Elective IV)

Teaching scheme: **Credit: 4**

2 hours lecture and 2 hours tutorial per week

Objective:

To make the students aware of scientific methods and techniques to decision making problems and provides the best optimal solutions.

Module 1 (12hrs)

Classical optimization techniques

Single variable optimization – Multivariable optimization with no constraints – Hessian matrix – Multivariable saddle point – Optimization with equality constraints – Lagrange multiplier method - Multivariable optimization with inequality constraints – Kuhn-Tucker conditions.

Module 2 (12hrs)

One-dimensional unconstrained minimization

Elimination methods – unrestricted search method – Fibonacci method – Interpolation methods – Quadratic interpolation and cubic interpolation methods.

Module 3 (12hrs)

Unconstrained minimization

Gradient of a function – Steepest descent method – Newton's method – Powells method – Hooke and Jeeve's method.

Module 4 (12hrs)

Integer – Linear programming problem

Gomory' s cutting plane method – Gomory' s method for all integer programming problems, mixed integer programming problems.

Module 5 (12hrs)

Network Techniques

Shortest path model – Dijkstra`s Algorithm – Floyd`s Algorithm – minimum spanning tree problem – PRIM algorithm – Maximal Flow Problem algorithm.

References

1. S.S. Rao, Optimization theory and application, New Age International P. Ltd.
2. A.D. Belegundu, T.R. Chandrupatla, Optimization Concepts and applications in Engineering, Pearson Education Asia.
3. F. S. Budnick, D. McLeavey, R. Mojena, Richard D, Principles of Operations Research for Management, Irwin, INC.
4. H. A. Taha, Operation Research an introduction, Eastern Economy Edition.
5. R. Panneerselvam, Operations Research, PHI.

CE010 805G04 LAND USE PLANNING (Elective IV)

Teaching scheme: **Credit: 4**

2 hours lecture and 2 hours tutorial per week

Objectives:

The basic objective of this course is to introduce to the students of planning the various theories of planning and city design along with necessary details in terms of population projection, formulation of activity structure, formulation of goals and objectives for any planning work to be carried out. This course is also aimed at students getting enough theoretical background to carry concurrent laboratory exercise in area planning and city planning. Attempt has been made to include several case studies and relate them to the theories of planning to develop better understanding of urban planning.

Module 1 (10 Hrs)

Introduction: Brief Study of Urban Travel Patterns and Urban Transportation Technologies; Land use-Transportation Planning Process

Module 2 (13 Hrs)

Urban Forms and Urban Structure: Hierarchy of Urban Activity System, Hierarchy of Urban Transportation Network and Technology; Relationship between Movement and Accessibility Functions of Transportation Network; Urban Structure and its Characteristics such as Centripetal, Grid Iron, Linear and Directional Grid types, Study of Urban Forms such as Garden City, Precincts, Neighbourhoods, Linear City, MARS Plan, LeCorbusier Concept, Radburn Concept, Environmental Area Concept.

Module 3 (13 Hrs)

Demographic and Employment Forecasting Models: Demographic Models- Linear, Exponential and Logistic Models,; Cohort Survival Models-Birth, Aging and Migration Models; Employment Forecasting Models- Economic base Mechanism; Population and Employment Multiplier Models- Input and Output Models - Dynamic Models of Population and Employment

Module 4 (12 Hrs)

Land use-Transportation Models: Lowry based Land use-Transportation Models – Allocation Function, Constraints, Travel Demand Estimation – Iterative Solutions, Matrix Formulation

Module 5 (12 Hrs)

Evaluation of Land use – Transportation Plans: Operational, Environmental and Economic Evaluation – Concept of Demand and Supply for Transportation Projects – Benefit and Cost – B/C and Cost Effective Approach for Economic Evaluation.

References

1) Hutchinson B.G., Principle of Transportation Systems Planning, McGraw-Hill.
2) Oppenheim N., Applied Models in Urban and Regional Analysis, Prentice-Hall.
3) Dickey J.W., *et. al*., Metropolitan Transportation Planning, Tata McGraw-Hill.
4) Gallion A.B and Eisner S., The Urban Pattern, Affluated East-West Press, New Delhi.
5) Heggei, I.G., Transportation Engineering Economics, Mc-Graw Hill Book Company, New York.
6) Wilson, A.G, Urban and Regional Models in Geography and Planning, John Wiley and Sons.

CE 010 805G05 NUMERICAL METHODS (Elective IV)

Teaching scheme: **Credit: 4**

2 hours lecture and 2 hours tutorial per week

Objective

To impart the basic concepts of mathematical modeling of problems in science and engineering and to know procedures for solving different kinds of problems.

To understand the various numerical techniques which provide solutions to non linear equations, partial differential equations etc that describe the mathematical models of problems.

Module I (10 hours)

Solution of linear equations:- Review of Gaussian elimination and Cholesky methods- storage schemes – substructure concept- sub matrix equation solver

Module 2 (12 hours)

Solution technique for Eigen value problem:- Introduction – forward iteration, inverse iteration, Jacobi's method

Module 3 (13 hours)

Numerical Interpolation& Integration – Introduction – Lagrange, Hermitian and isoparametric style of interpolation. Numerical integration - trapezoidal rule - Simpson 1/3 rule - Simpson 3/8 rule - Gauss quadrature formula – weights and Gauss points

Module 4 (12 hours)

Finite difference techniques:-Finite difference method, ,Newton's method, Variational and weighted residual methods

Module 5 (13 hours)

Statistical Computations - frequency Chart - method of least square curve fitting procedures - fitting a straight line - curve fitting by sum of exponential - data fitting with cubic splines - approximation of functions. Regression Analysis - linear regression

References

1. Balagurusamy E , *Numerical Methods*, Tata McGraw-Hill Pub.Co.Ltd, New Delhi, 1999.
2. Gerald C.F. and Wheatley P.O., *Applied Numerical Analysis, 6th Ed.*, Pearson Education Asia, New Delhi, 2002.
3. Rajasekharan S, Numerical Methods in Science and Engineering, A practical Approach, A.H. Wheeler &Co
4. K.J. Bathe, Finite Element Procedures in Engineering Analysis, Prentice Hall,
5. Jain M.K., Iyengar S.R.K. &Jain R.K, Numerical Methods for Science and Engineering, Prentice Hall of India
6. Saumyen Guha& Rajesh Srivastava, Numerical Methods for Engineering and Science, Oxford University Press.

CE010 805G06 REMOTE SENSING AND GIS APPLICATIONS (Elective IV)

Teaching scheme **Credit: 4**

2 hours lecture and 2 hours tutorial per week.

Objective

To make the students aware of the technological developments in the geographical database management and its advantages.

Module 1 (13hours)

Remote sensing: definition- components of remote sensing- energy sensor, interacting body-active and passive remote sensing- platforms- Arial and space platforms- balloons, helicopters, aircrafts and satellites- electromagnetic radiation(EMR)- EMR spectrum- visible, infrared(IR) ,near IR, middle IR, thermal IR and microwave- black body radiation- Plancks Law- Stefan-Boltzman law.

Module 2 (12hours)

Atmospheric characteristics- scattering of EMR- Raliegh, Mie, Non-selective and Raman scattering- EMR interaction with water vapour and ozone- atmospheric windows- significance of atmospheric windows- EMR interaction with earth surface material, radiance, irradiance, incident, reflected, absorbed and transmitted energy- reflectance- specular and diffused reflection surfaces- spectral signature- spectral signature curves- EMR interaction with water, soil and earth surface.

Module 3 (12hours)

Optical and Microwave Remote sensing:

Satellites- classification- based on orbits- sun synchronous and geo synchronous- based on purpose- earth resources satellites, communication satellites, weather satellites, spy satellites-satellite sensors- resolution- spectral, spatial, radiometric and temporal resolution- description of multi-spectral scanning- along and across track scanners- description of sensors in IRS series-current satellites- radar- speckle- back scattering- side looking air borne radar- synthetic aperture radar- radiometer radar- geometrical characteristics. Principles of thermal remote sensing-Principles of microwave remote sensing.

Module 4 (12hours)

Geographic information system- components of GIS- hardware, software and organizational context- data- spatial and non spatial maps- types of maps- projection- types of projection- data input- digitizer, scanner, editing- raster and vector data structures- comparison of raster and vector data structure- analysis using raster and vector data- retrieval, reclassification, overlaying, buffering- data output- printers and plotters.

Module 5 (12hours)

Miscellaneous topics: interpretation of satellite images- elements of interpretation- visual interpretation- digital image processing techniques- image enhancement- filtering- image classification- FCC composites- supervised and unsupervised integration of GIS and remote sensing- application of remote sensing and GIS- urban applications- water resources- urban analysis- watershed management- resources information system- hazard mitigation.

References:

1. Thomas M.Lillesand &Raiph W.Kiefer,"remote sensing and image interpretation",John Wiley Sons.
2. Floyd F. Sabins, "Remote sensing principles and interpretation", Freeman And Company.
3. Anji Reddy,"Remote sensing and geographical systems",BS Publications.
4. M.G.Srinivas (Edited by),"Remote Sensing Applications", Nerusa publications.
5. Jensan J.R.,"Introductory Digital Image Processing",Prentice Hall of India.

CE010 806 ENVIRONMENTAL ENGINEERING LAB

Teaching scheme **Credits: 2**

3 hours practical per week

Objective:

To make students familiar with laboratory tests for water and waste water quality assessment.

List of Experiments

1. Determination of alkalinity of water.
2. Determination of hardness of water.
3. Determination of acidity of water.
4. Determination of iron.
5. Determination of sulphates.
6. Determination of Chlorine demand and residual chlorine.
7. Determination of chlorides in water.
8. M. P. N. of Fecal coliforms using A-l medium
9. D.O. and Biochemical Oxygen Demand.
10. Chemical oxygen demand.
11. Determination of solids - total, suspended, dissolved, fixed, volatile, settleable and SVI.
12. Determination of Turbidity and estimation of optimum coagulant dosage by jar test.
13. Determination of pH

Reference:

1. "Standard methods for the examination of water and wastewater" 1995, ALPHA, AWWA, WPCF Publication.
2. "Chemistry for Environmental Engineering"- Sawer and McCarty, McGraw Hill.
3. "Manual of standards of quality for Drinking Water Supplies"- Indian Council of Medical Research, New Delhi.
4. "International Standards of Drinking Water" – W.H.O.
5. "IS 2490-1981, IS 3306- 1974, IS 3307-1977, IS 7968-1976, IS 2296-1974, IS 10500-1991" Bureau of Indian Standards, New Delhi, Effluent Standard KSPCB.

CE010 807 Project Work

Teaching scheme **credits: 4**

6 hours practical per week

The progress in the project work is to be presented by the middle of eighth semester before the evaluation committee. By this time, the students will be in a position to publish a paper in international/ national journals/conferences. The EC can accept, accept with modification, and request a resubmission.

The progress of project work is found unsatisfactory by the EC during the middle of the eighth semester presentation, such students has to present again to the EC at the end of the semester and if it is also found unsatisfactory an extension of the project work can be given to the students.

Project report: To be prepared in proper format decided by the concerned department. The report shall record all aspects of the work, highlighting all the problems faced and the approach/method employed to solve such problems. Members of a project group shall prepare and submit **separate** reports. Report of each member shall give details of the work carried out by him/her, and only summarise other members' work.

The student's sessional marks for project will be out of 100, in which 60 marks will be based on day to day performance assessed by the guide. Balance 40 marks will be awarded based on the presentation of the project by the students before an evaluation committee.

For Project, the minimum for a pass shall be 50% of the total marks assigned to the Project work.

CE010 808 Viva -Voce

Teaching scheme **credits: 2**

A comprehensive oral Viva-voce examination will be conducted to assess the student's intellectual achievement, depth of understanding in the specified field of engineering and papers published / accepted for publication etc. At the time of viva-voce, certified bound reports of seminar and project work are to be presented for evaluation. The certified bound report(s) of educational tour/industrial training/ industrial visit shall also be brought during the final Viva-Voce.

An internal and external examiner is appointed by the University for the Conduct of viva voce University examination.

For Viva-voce, the minimum for a pass shall be 50% of the total marks assigned to the Viva-voce.

Note: If a candidate has passed all examinations of B.Tech. course (at the time of publication of results of eighth semester) except Viva-Voce in the eighth semester, a re-examination for the Viva-Voce should be conducted within one month after the publication of results. Each candidate should apply for this 'Save a Semester examination' within one week after the publication of eighth semester results.

Computer Science and Engineering (CS)

CS010 701: Web Technologies

Teaching scheme **Credits:** 4
2 hours lecture and 2 hours tutorial per week

Objectives

- *To impart the new concepts in Web Technologies*
- *To develop understanding about the different technologies used in the World Wide Web including XML, Perl,*

Module I (15hours)

XHTML

Evolution of HTML and XHTML- Standard XHTML Document Structure- Basic Text Markup- Images-Hypertext Links-Lists- Tables- Forms- Frames.

Cascading Style Sheets

Introduction to CSS – Levels of Style Sheets- Style Specification Formats- Selector Forms- Property Value Forms – Font Properties- List Properties – Color- Alignment of Text – Background Images- Span and Div Tags.

Module II (12 hours)

XML

Introduction to SGML – features of XML - XML as a subset of SGML – XML Vs HTML – Views of an XML document - Syntax of XML- XML Document Structure – Namespaces- XML Schemas- simple XML documents – Different forms of markup that can occur in XML documents - Document Type declarations – Creating XML DTDs – Displaying XML Data in HTML browser – Converting XML to HTML with XSL minimalist XSL style sheets – XML applications

Module III (12hours)

Perl

Origin and Use of Perl- Scalars and their Operations – Assignment Statements and Simple Input and Output – Control Statements- Fundamentals of Arrays – Hashes- References- Functions- Pattern Matching – File Input and Output – Simple programs in Perl -Using Perl for CGI Programming.

Module IV (12 hours)

PHP

Origin and Use of PHP- Overview of PHP- General Syntactic Characteristics- Operations and Expressions- Control Statements- Arrays- Functions-Pattern Matching- Form Handling- Files-Cookies-Session Tracking - Simple programs in PHP.

Module V (9 hours)

Rails

Overview of Rails- Document Requests- Processing Forms- Rails Application with Databases – Layouts.

Ajax

Overview of Ajax – Basics of Ajax – Rails with Ajax.

Reference Books

1) Robert W Sebesta, Programming with World Wide Web , 4th ed., Pearson Education ,New Delhi, 2009
2) Deitel & Deitel Internet & World Wide Web *How To Program* 4th ed., Pearson International Edition Education ,New Delhi, 2009
3) Deitel & Deitel, Nieto, Lin, Sadhu, XML How to Program, Pearson Education ,New Delhi, 2011
4) Kogent Learning Solutions Inc, Web Technologies Black Book, Dreamtech Press, New Delhi, 2009
5) Chris Bates, Web Programming Building Internet Applications 3rd ed., Wiley India Edition, New Delhi, 2009
6) Phil Ballard, Michael Moncur, Sams Teach Yourself Ajax, JavaScript and PHP, Pearson Education ,New Delhi, 2009.
7) Achyut S Godbole , Atul Kahate, Web Technologies TCP/IP Architecture and Java Programming, 2nd ed., Tata McGraw Hill Education Private Limited, New Delhi, 2010
8) Pankaj Sharma, Introduction to Web Technology, Katson Books, New Delhi, 2008
9) Bankim Patel, Lal Bihari Barik, Introduction to Web Technology & Internet, Acme Learning Private Limited, New Delhi, 2009

CS010 702: COMPILER CONSTRUCTION

Teaching scheme **Credits:** 4

2 hours lecture and 2 hours tutorial per week

1.) • *To introduce the various techniques involved in the translation of source programs into object programs by a compiler.*
2.) · *To understand the inner working of a compiler using the various data structures used in the translation process.*

Module 1 (12Hrs)

Introduction to compilers:-Phases of a compiler-Analysis and synthesis phases-Lexical analysis and its role-Review of finite automation and Regular Expressions-Specification of tokens using regular expressions-Implementing lexical analyzer using finite automation-Design of lexical analyzer using LEX

Module 2 (12 Hrs)

Syntax analyzer-Role of syntax analyzer-Review of context free grammar-derivation and parse trees-Basic parsing approaches-Top down parsing-Recursive Descent parsing –LL(1) parsing-Bottom up parsing-Shift reduce parsing-Operator precedence parsing-LR parsing-Simple LR, Canonical LR and LALR parsers- Design of syntax analyzer using YACC

Module 3 (12 Hrs)

Semantic analysis-Need for semantic analysis-Syntax directed definitions-S attributed definitions- L- attributed definitions-Translation schemes-Type system and Type checking-Design of a simple type checker

Storage Management:-Memory allocation strategies (static, stack and heap allocations)-Memory allocation in block structured languages-Accessing local and non local data-Array allocation and access-Procedure calls-Parameter passing methods-Runtime stack and storage management

Module 4(12 Hrs)

Synthesis phase:-Intermediate Code Generation (ICG)-Need for ICG-IC Formats-3 Address code-Triples and quadruples

Code optimization:-Need for code optimizer-Basic blocks and program flow graph-Machne dependent and machine independent optimizations-Optimization transformations-Local and global optimizations

Module 5(12 Hrs)

Code Generation-Basic issues in code generation-Data descriptors-Expression trees-Generating target code from expression trees-Symbol table handling-Symbol table requirements and organization. Error handling-Types of errors-Compile time errors and recovery-Runtime errors-Runtime Error Handling ,Cross Compilers and Incremental Compilers(Brief idea only)

Reference Books

1.) .Aho A Ravi Sethi and J D Ullman, Compilers Principles Techniques and Tools,Addison Wesley
2.) Kenneth C Louden, “Compiler Construction Principles and Practice”, Cenage Learning Indian Edition
3.) D M Dhamdhare, System programming and operating system, Tata McGraw Hill & Company
4.) Tremblay and Sorenson, The Theory and Practice of Compiler Writing - Tata McGraw Hill & Company

Mahatma Gandhi University

CS010 703: COMPUTER GRAPHICS

Teaching scheme **Credits:** 3

2 hours lecture and 1 hour tutorial per week

Objectives:-

To understand the basic concepts of Computer Graphics & display techniques.

Module I (3 Hrs)

Introduction: Applications of Computer Graphics, Raster scan and Random scan displays **[1]**– Video Display Devices, Display files – graphical input & output devices-Flat panel displays, Hardcopy Output Devices, Physical Interactive Devices , Data generation devices.**[2]**

Module II (10 Hrs)

2D Graphics: Output primitives-Line drawing algorithms – DDA, Bresenham's – Bresenham's Circle drawing algorithm – Other curves,polynomials and spline curves-2D viewing transformation-clipping-Cohen-Sutherland line clipping –polygon clipping-2D Transformations**[1]**

Module III (12 Hrs)

3D Graphics: 3D Transformations, 3D display methods, 3D Object Representation – Polygon Surfaces – Curved lines and surfaces-Quadric surfaces – Spline Representations – Cubic Spline Interpolation Methods-Bezier Curves and Surfaces – B-Spline Curves and Surfaces, Sweep representation,Octrees.**[1]**

Module IV (10 Hrs)

3D Rendering: Three-Dimensional Viewing – Projections **[3]**, Visible Surface Detection – Classification of Visible surface detection algorithms – Back-face Detection, Depth- Buffer Method, Scan-line Method. **[1,3]**

Module V (10 Hrs)

Rendering: Surface Rendering Methods- Basic illumination Models – Polygon–rendering Methods,Interpolative shading methods-Constant shading, Gouraud shading,Phong shading, Texture Mapping.**[3]**

Fractal Geometry Methods – Classification of Fractals – Self-Squaring Fractals, Ray Tracing and Ray Casting.**[1]**

REFERENCES:

1. Computer Graphics (C version) - Donald Hearn & Pauline Baker (Pearson Education Asia)
2. Procedural Elements for Computer Graphics –David F. Rogers, TATA McGraw Hill edition-second edition.
3. Computer Graphics - Zhigang Xiang & Roy A Plastack, Schaum’s Series McGraw Hill edition.

CS010 704 : Object Oriented Modeling and Design

Teaching scheme **Credits:** 3
2 hours lecture and 1 hour tutorial per week

Objective

- *To impart ideas on building systems through the object oriented modelling approach using the Unified Modelling Language.*

Module 1 (10 hours)

Introduction: object oriented development-modeling concepts – object oriented methodology – models – object oriented themes-Object Modeling– links and associations – advanced links and association concepts – generalization and inheritance - grouping constructs – a sample object model

Advanced Object Modeling: aggregation – abstract classes – generalization as extension and restriction – multiple inheritance – metadata – candidate keys – constraints.

Module 2 (10 hours)

Dynamic modeling: Events and states – Operations – Nested state diagrams – Concurrency – Advanced dynamic modeling concepts – A sample dynamic model – Relationship of Object and Dynamic models.

Functional modeling: Functional models – Data Flow Diagrams - Specifying operations – Constraints – A sample functional model – Relation of functional to Object and Dynamic models.

Module 3 (10 hours)

Analysis: Analysis in object modeling, dynamic modeling and functional modeling, Adding operations- Iterating the analysis

System Design: Breaking system into subsystems - Identifying concurrency-allocating subsystems to processors and tasks, managing of data stores. Handling of global resources- handling boundary conditions-Common Architectural Frameworks

Module 4 (8 hours)

Object Design: Overview of Object design – Combining the three models – Designing algorithms – Design optimization – Implementation of control – Adjustment of inheritance - Design of association – Object representation – Physical packaging – Documenting design decisions-Comparison of methodologies

Module 5 (7 hours)

Unified Modeling language: Introduction, UML Diagrams – Class diagrams, Sequence diagrams, Object diagrams, Deployment diagrams, Use case diagrams, State diagrams, Activity diagram, Component diagrams – Case Study.

Reference Book

1. Object Oriented Modeling and Design -James Rumbaugh, Prentice Hall India
2. UML Distilled – Martin Fowler, Addison Wesley
3. Object- oriented Systems analysis and design using UML- 4th ed., Simon Bennet,Stephen McRobb, Ray Farmer. TMH.
4. Object Oriented Analysis and Design with Applications - Grady Booch, Pearson Education Asia

CS010 705: PRINCIPLES OF PROGRAMMING LANGUAGES

Teaching scheme **Credits:** 3

2 hours lecture and 1 hour tutorial per week.

Objectives

- *To provide an overview of the key paradigms used in developing modern programming languages.*
- *To explore the implementation details of languages to provide an understanding of the source program and its execution behavior.*

Module I (9 Hours)

Introduction – Role of programming languages - Programming domains - Language evaluation criteria - Influence on language design - Implementation methods - Virtual computers - Bindings - Concept of binding.

Module II (9 Hours)

Data types - Implementation of data types - Primitive, User defined – Names –Variables - Type checking - Strong Typing - Type compatibility -Scope – Lifetime - Referencing environments - Named constants – Virtualization - Heap management.

Module III (8 Hours)

Expressions , Assignments and Control Structures – Arithmetic expressions – Assignment statements-Compound statements - Selection statements - Iterative statements – Unconditional branching – Guarded commands.

Module IV (10 Hours)

Subprograms-Fundamentals-Design issues-Local Referencing Environment-Parameter passing methods –Subprogram names as parameters – Overloaded Subprograms – Generic Subprograms – Separate & independent compilation – Design issues for functions – Accessing non-local environments – User defined overloaded operators – Co-routines.

Module V (9 Hours)

Implementation of Subprograms – General semantics of calls & returns- Activation Records – Blocks – Recursion

Exceptions and Programming Paradigms - Exception handling in C++, Java, PL/I, Ada , Fundamentals of Functional programming language – Examples – LISP Interpreter -Overview of Logic programming - Basic elements of Prolog.

References

1. Robert W. Sebesta , "Concepts of Programming Languages" 4th Ed,2001.
2. Ravi Sethi "Programming Languages-concepts and constructs", Addison Wesley, 2nd Ed,1996.
3. Terrence W. Pratt , "Programming Languages" , Prentice Hall, 9th Ed,1996.
4. Michael L. Scott, "Programming Language Pragmatics" ,Elsevier, New Delhi,2009.
5. Thomson Learning, Kenneth .C. Louden, "Programming Languages: Principles And Practices" , 2nd Ed,2011.
6. Bjarne StroutStrup ,"Design and Evolution of C++", Addison Wesley,1991.
7. James Gosling, "Java Programming Language ", Addison Wesley,2000.

CS010 706L01 : Real Time Systems
(Common to IT010 706L04 Real Time Systems)

Teaching scheme **Credits:** 4
2 hours lecture and 2 hour tutorial per week

Objectives

- *to learn , real-time operating systems, task scheduling, communication, fault tolerant techniques and , programming languages*

Module 1 (12 hours)

Introduction to Real Time Systems: Structure of real time systems, real time computer, task classes – Periodic, Aperiodic, critical, Non-critical, definition of real time systems – real time systems, embedded systems - Hard real time systems, soft real time systems, real time design issues.

Module 2 (12 hours)

Task Assignment and Scheduling: Uniprocessor scheduling algorithms –Rate monotonic Scheduling, Preemptive Earliest Deadline First (EDF), IRIS Tasks. Scheduling Aperiodic and Sporadic jobs in Priority Driven Sytems, Task Assignment-Utilization Balancing algorithm, Next Fit Algorithm for RM scheduling, Bin Packing for EDF, Myopic Offline Scheduling(MOS), Focused Addressing and Bidding, Buddy strategy. Fault Tolerant scheduling.

Module 3 (12 hours)

Communication – Communication Media and message sending topologies, network architecture issues, protocols – contention – based, token - based, stop and go multi loop, polled bus, hierarchal round robin, fault tolerant routing – clocks and synchronization– fault tolerant synchronization in hardware, synchronization in software.

Module 4 (12 hours)

Fault tolerance – definition, cause of failure, fault types, fault detection and containment, redundancy – hardware, software, time, information, integrated failure handling. Reliability Evaluation techniques- Obtaining parameter values, Reliability models for Hardware redundancy, software error models.

Module 5 (12 hours)

Programming Languages and Real Time databases – Desired language characteristics, Data Typing, Control Structures. Real time databases, characteristics, main memory databases, Transaction, Disk schedule algorithms, Databases for hard real time systems, maintaining serialization constituency.

References

1. Real Time Systems - C.M Krishna, Kang G. Shini (Tata McGraw Hill)
2. Real Time Systems- Jane W.S. Liu(Pearson)

CS010 706L02: DATA MINING AND DATA WAREHOUSING

Teaching scheme **Credits:** 4

2 hours lecture and 2 hours tutorial per week

Objectives

- *To impart an introduction to Data Mining.*
- *To develop basic knowledge of how data is transformed to Data Warehouses .*

Module I (12 hours)

Data Mining- Data Mining Funtionalities-Classification of Data Mining Systems-Data Mining Task Primitives- Major Issues in Data Mining
Data Preprocessing- Descriptive Data Summarization- Data Cleaning- Data Integration and Transformation- Data Reduction- Data Discretization and Concept Hierarchy Generation

Module II (14 hours)

Data Warehouse- A Multidimensional Data Model- Data Warehouse Architecture- Data Warehouse Implementation
Data Cube Computation and Data Generalization- Efficient methods for Data Cube Computation- Data Cube and OLAP Technology- Attribute Oriented Induction

Module III (10 hours)

Mining Frequent Patterns-Associations- Correlations-Basic Concepts-Efficient and Scalable Frequent Itemset Mining methods- Mining various kinds of Association Rules- From Association Mining to Correlation Analysis- Constraint Based Association Mining.

Module IV (12 hours)

Classification and Prediction- Issues regarding Classification and Prediction- Classification by Decision Tree Induction- Bayesian Classification – Rule Based Classification- Classification by Backpropagation- Support Vector Machines- Classification by Association Rule Analysis- Learning from Neighbors- Prediction- Accuracy and Error measures- Evaluating the accuracy of a Predictor- Ensemble methods- Model Selection.

Module V (12 hours)

Cluster Analysis- Types of Data in Cluster Analysis- Catagorization of Major Clustering methods- Partitioning methods- Hierarchical methods- Density based methods- Grid based methods- Model based Clustering methods- Clustering High Dimensional Data- Constraint based Cluster Analysis- Outlier analysis

Reference Books

1) Jiawei Han, Micheline Kamber, Data Mining Concepts and Techniques, 2nd edtn. , Elsevier New Delhi 2010
2) Alex Berson, Stephen J. Smith, Data Warehousing, Data Mining & OLAP Tata McGraw-Hill Publishing Company Limited, New Delhi, 2008
3) Pieter Adriaans, Dolf Zantinge, Data Mining, Pearson Education Ltd., New Delhi, 2008
4) Thomas W Miller, Data and Text Mining, A Business Applications Approach, Pearson Education Ltd., New Delhi, 2008
5) Galit Shmueli, Nitin R. Patel, Peter C. Bruce, Data Mining for Business Intelligence, Wiley India Pvt. Ltd.,New Delhi 2009.

CS010 706L03: Operating System Kernel Design
(common to IT010 706L05 Operating System Kernel Design)

Teaching scheme **Credits:** 4
2 hours lecture and 2 hours tutorial per week

Objectives

- *To provide knowledge about the operating system working principles.*
- *To discuss most of the significant data structures and algorithms used in the kernel.*

Module I (13 hours)

Basic Operating System Concepts – Kernel – Types: monolithic, microkernel – An Overview of Unix Kernels-The Process/Kernel Model, Reentrant Kernels – Signals sending and receiving – System calls – System Call Handler and Service Routines - Interrupts and Exceptions - Interrupt Handling - The Timer Interrupt Handler.

Module II (13 hours)

Processes - Process Descriptor - Process State, Process relationship – Creating Processes - Process Termination - Process Scheduling – Scheduling algorithm – SMP Scheduler.
Kernel Synchronization - Synchronization Techniques - Process Communication - System V IPC.

Module III (10 hours)

Paging in Linux - Memory Management - Page Frame Management - The Buddy System Algorithm - The Process's Address Space - The Memory Descriptor - Memory Regions - Page Fault Exception Handler.

Module IV (14 hours)

Overview of the Unix File System - The Virtual File System - role of the VFS - VFS Data Structures – File system Mounting.
The Ext2 File system - Disk Data Structures - Creating the File system - Data Blocks Addressing - Allocating a Data Block.

Module V (10 hours)

Managing I/O Devices - Associating Files with I/O Devices - Device Drivers - Character Device - Block Device.
Disk Caches - Buffer Cache - Writing Dirty Buffers to Disk - Page Cache.

Reference Books

1) Daniel P. Bovet, Marco Cesati, *Understanding the Linux Kernel*, First ed., O'Reilly, 2000
2) M Bech et al., *Linux Kernel Internals*, 2nd ed., Addison-Wesley, 1998
3) Maurice J. Bach, *The Design of the Unix Operating System*, First Edition, Pearson Education, 1999.
4) Abraham Silberschatz, Peter B.Galvin and Greg Gagne, "*Operating System Concepts*", John Wiley & Sons Inc, 8th Edition 2010.

CS010 706L04 : Digital image processing

Teaching scheme **Credits:** 4
2 hours lecture and 2 hour tutorial per week

Objectives

- *To learn the image fundamentals and mathematical transforms necessary for image processing.*
- *To learn the image enhancement techniques and image restoration procedures.*
- *To learn the image segmentation and representation techniques.*

Module I (14 hours)

Digital image representation : Elements of digital image processing systems **-** Image digitizers & scanners **-** Elements of visual perception **-** Brightness & contrast **-** colour perception & processing **-** pixel based transformation – geometric transformation – image file formats
Image sampling & Quantization - Two dimensional Sampling theorem **-** Reconstruction of image from its samples – Aliasing

Module II (14 hours)

Image Transforms : Two dimensional DFT & its properties - Walsh Transform, Hadamard Transform, Discrete Cosine Transform, Haar, Slant, and Karhunen – Loeve transforms

Module III (10 hours)

Image Enhancement : Point processing **-** Histogram processing **-** Spatial Filtering – image subtraction - image averaging **-** Enhancement in the frequency domain **-** colour Image processing.

Module IV (12 hours)

Image Restoration : Degradation model – Diagonalization of circulant matrices **-** Inverse filtering **-** Wiener filter methods – Constrained least mean square filtering
Image Coding & Compression- basic principles Image compression: Run length coding , predictive coding ,Basics of Image compression standards:

Module V (10 hours)

Image analysis : Segmentation – Thresholding – point, line and edge detection – Boundary detection **-** Region Based segmentation - image reconstruction – radon transform – projection theorem – convolution filter back projection **-** Fourier reconstruction method – applications of image processing.

References

1. Rafael C. Gonzalez - Richard E. Woods, *Digital Image Processing*, Pearson Education
2. Dutta Majumdar - *Digital Image Processing and Applications,* PHI
3. Madhuri A. Joshi – Digital Image Processing,PHI, New Delhi,2010
4. Anil K. Jain - Fundamentals of Digital Image processing," Prentice Hall India, 1989.
5. William K. Pratt - Digital Image Processing, John Wiley and sons, New delhi, 2010.
6. S.Jayaraman, S. Esakkiarajan. T. Veerakumar- Digital Image Processing,TMH,New Delhi, 2010.
7. Rosenfield and A. C. Kak - Digital Picture Processing, 2nd edition, Vols. 1 & 2,
   a. Academic Press, New York, 1982.

CS010 706L05: DATA PROCESSING AND FILE STRUCTURES

Teaching scheme

Credits: 4

2 hours lecture and 2 hour tutorial per week

Objectives

- *To develop an understanding about basic concepts of data processing in mainframe system.*
- *To enable the students to learn the detailed features of COBOL, database concepts.*

Module I (10 hours)

Introduction to mainframe system

Introduction—Evolution of Mainframe Systems, Introduction to COBOL & JCL, COBOL/JCL Relation ,Compiling and Linking Programs in Mainframes, VSAM—VSAM Data Sets—Mainframes Operating Systems(over view), z/OS , OS/2 , MVS --Features

Module II (14 hours)

Programming Concept

Mainframe P**rogramming**—Introduction to COBOL, Structure of COBOL Programs, COBOL words, Identification and Environment Division, Configuration Section, Input-output Section, Data Division, Level Structure— File section, Assign to clause, Working Storage section-Editing, Special-names paragraph, Usage clause—Synchronized, Justified, Redefines, Renames clauses

Module III (11hours)

Data Processing Concept

Procedure division—Data movement, Arithmetic, Sequence control , Input/Output Conditional verbs, Group moves, Compute verb, Conditions, Table handling, Occur clause—Perform verb, Set verb, Writing simple COBOL programs

Module IV (14 hours)

File Handling in Mainframes

File types — Sequential, Direct, Indexed files, Using Files in COBOL Programs, File Manipulation Verbs, **JCL Basics**—Writing to disk, DSN, DISP, Unit, Space, DCB Parameters, Job statement and Parameters –Positional and keyword Parameters, EXEC statement, EXEC Parameters, Concept of Compile and Run JCL s.

Module V (11 hours)

DataBase Concepts

Introduction to DB2—Relational DBMS Concept, Writing DB2/COBOL programs, Compilation and Binding of DB2 Programs , Concepts of DBRM, Bind JCL, Introduction to CICS – Case study (library information system in COBOL/JCL/DB2—to be taken along with all modules as example)

Reference Books

1. M K Roy, D Ghosh Dastidar ,*Cobol Programming* ,Tata McGraw Hill,New Delhi,1999,Second Edition
2. M K Roy, D Ghosh Dastidar ,*Cobol Programming : problems & Solutions*, Tata McGraw Hill, New Delhi
3. Saba Zamir**,** Chander Ranade ,*The MVS JCL Primer (J Ranade IBM Series)*, McGraw-Hill
4. C.J. date, Colin J White, *A Guide to DB2*, Pearson Education , New Delhi,4th Edition, 2006.
5. Craig S. Mullins, *DB2 Developers Guide*, Pearson education , New Delhi, 5th Edition,2008
6. Andreas S Philippakis, Leonard J Kazmier ,*Information System through COBOL*, McGraw-Hill

CS010 706L06 CLIENT SERVER ARCHITECTURE AND APPLICATIONS

Teaching scheme **Credits:** 4
2 hours lecture and 2 hour tutorial per week

Objectives

- *To impart an introduction Client-Server system.*
- *To develop basic knowledge on securing Client-Server system.*
- *To have exposure to applications of Client-Server system.*

Pre-requisites: *Computer Networks and Operating Systems*

Module I (10 hours)
Introduction: History-uses-Client Server Computing& Heterogeneous Computing Cross Platform Computing Distributed Computing - The costs of Client Server Computing - Advantages and Disadvantages - Client Server Databases.

Module II (12 hours)
Design: Fundamentals of client server design - Managing the interaction of client and server - Communications Techniques protocols & Client server interaction protocols - Preparing applications for client server - Optimizing applications for client server - Example client server implementations - Request acceptance dispatching - Execution of requests - Client server interaction using message.

Module III (14 hours)
Multitasking: Multi programming vs multitasking - Processor - Advantages and draw backs of multiple processor - Child and parent processor - Case study Novell Netware and Windows NT - Developing server applications - Threads - Server communication model.

Module IV (12 hours)
Synchronization: Scheduling implementations - processing queues - context switching pre-emptive systems - critical sections - mutual exclusion - semaphores – semaphore implementations in NT & Netware

Module V (12 hours)
Communications: Network communication - Inter process communication - Building portable client server applications - Introduction to Client/server security concepts- Secure client/server communications – password security at system level and application level

Reference Books

1. Jeffrey D.Schank, *“ Novell's Guide to Client-Server Application & Architecture”* Novell Press.
2. Robert Orfali,Dan Harkey, Jeri Edwards,”Clien/Server Survival Guide”,Wiley-India Edition,Third Edition,2007
3. Dawna Travis Dewire, ”*Client Server Computing*“, McGraw Hill
4. W.H.Inman,*”Developing Client Server Applications”* , BPB
5. Joe Salemi, “*Guide to Client Server Databases*”, BPB.
6. David Vaskevitch, ”*Client Server Strategies*“,Galgotia.
7. Peter T.Davis, ”Securing Client/Server Computer Networks”, McGraw Hill
8. Subhash Chandra Yadav, Sanjay Kumar Singh,”An Introduction to Client/Server Computing”, New Age International Publishers,2009

CS010 707: Systems Programming Lab

Teaching scheme **Credits:** 2
3 hours practical per week

Objectives

- *To familiarize the design of all phases of compilers up to a stage of intermediate code generation.*

- *To enable the students to design and implement modern compilers for any environment.*

Section 1 (Compiler Design)

1. Design of a Lexical Analyzer using Finite Automation (including Symbol table)
(The program should be designed for a specific number of keywords, identifiers, numbers,
operators, punctuators etc. Finite automata should be designed for each type of token)
2. Design of lexical analyzer using LEX
3. Design of recursive descent and LL (1) parsers (including syntax tree)
(The programme should be designed for a subset of PL features (For example Arithmetic
expressions with operators +, -, *, /, ↑ etc)
4. Implementation of Operator precedence Parsing (including syntax tree)
5. Design of parser for arithmetic expressions using YACC
6. Design of a simple type checker (For eg for the primitive types of C)
7. Generation of IC for arithmetic expressions
8. Simple code optimization strategies (For example Constant folding, Loop invariant elimination, common sub expression elimination etc)
9. Design of a code generator for arithmetic expressions using Expression tree
(The program should take a set of IC as the input and produce the target code for some
machine such as Intel 8086 Microprocessor)
10. Writing a simple Compiler for a subset of Language features

Section 2:-

1.Design of 2-Pass Assembler(The Program should be designed for the generation for machine code of any simple processor such as Intel 8005)
2.Design of Absolute Loader
3.Design of Macro Pre-processor(The program should be designed for a simple preprocessor such as the # define in C)

4 Design of Device Drivers (Implementation of Simple Device Drivers such as one for the PC Speaker.)

Remark:

At Least 8 experiments from Section 1 and 2 experiments from section

CS010 708: Networking Lab

Teaching scheme **Credits:** 2
3 hours practical per week

Objectives

- *To provide experience on design, testing, and analysis of Java Programs.*
- *To acquaint the students with the Networking Protocols and Communication using ports and sockets.*

1) Basic Java Programming
2) Programs to create Applets
3) Programs to create Graphic User Interfaces
4) Programs to implement Client and Server Sockets
5) Programs for Chatting using TCP and UDP
6) Programs for Remote Procedure Call
7) Programs for Remote Method Invocation
8) Programs to interface with XML
9) Programs to implement Sliding Window Protocols
10) Programs for Multicasting
11) Programs to interface with Databases
12) Programs for Image Processing
13) Programs in Perl and PHP
14) Programs to create Dynamic Web Pages

Any experiment according to the syllabus of CS010 602 Internet Computing, CS010604 Computer Networks, CS010701 Web Technologies may be substituted subjected to permission from competent authority.

CS 010 709 Seminar

Teaching scheme **credits: 2**

2 hours practical per week

The seminar power point presentation shall be fundamentals oriented and advanced topics in the appropriate branch of engineering with references of minimum seven latest international journal papers having high impact factor.

Each presentation is to be planned for duration of 25 minutes including a question answer session of five to ten minutes.

The student's internal marks for seminar will be out of 50. The marks will be awarded based on the presentation of the seminar by the students before an evaluation committee consists of a minimum of 4 faculty members. Apportioning of the marks towards various aspects of seminar (extent of literature survey, presentation skill, communication skill, etc.) may be decided by the seminar evaluation committee.

A bona fide report on seminar shall be submitted at the end of the semester. This report shall include, in addition to the presentation materials, all relevant supplementary materials along with detailed answers to all the questions asked/clarifications sought during presentation. All references must be given toward the end of the report. The seminar report should also be submitted for the viva-voce examination at the end of eighth semester.

For Seminar, the minimum for a pass shall be 50% of the total marks assigned to the seminar.

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CS 010 710 Project Work

Teaching scheme **credits: 1**

1 hour practical per week

Project work, in general, means design and development of a system with clearly specified objectives. The project is intended to be a challenge to intellectual and innovative abilities and to give students the opportunity to synthesize and apply the knowledge and analytical skills learned in the different disciplines.

The project shall be a prototype; backed by analysis and simulation etc. No project can be deemed to be complete without having an assessment of the extent to which the objectives are met. This is to be done through proper test and evaluation, in the case of developmental work, or through proper reviews in the case of experimental investigations.

- The project work has to be started in the seventh semester and to be continued on to eighth semester.
- Project work is to be done by student groups. Maximum of four students only are permitted in any one group.
- Projects are expected to be proposed by the students. They may also be proposed by faculty member (Guide) or jointly by student and faculty member.
- Students are expected to finalise project themes/titles with the assistance of an identified faculty member as project guide during the first week of the seventh semester.

The progress from concept to final implementation and testing, through problem definition and the selection of alternative solutions is monitored. Students build self confidence, demonstrate independence, and develop professionalism by successfully completing the project.

Each student shall maintain a project work book. At the beginning of the project, students are required to submit a project plan in the project book. The plan should not exceed 600 words but should cover the following matters.

❖ Relevance of the project proposed
❖ Literature survey
❖ Objectives
❖ Statement of how the objectives are to be tackled

- Time schedule
- Cost estimate

These proposals are to be screened by the evaluation committee (EC- minimum of 3 faculty members including the guide) constituted by the head of department, which will include a Chairman and the EC will evaluates the suitability and feasibility of the project proposal. The EC can accept, accept with modification, request a resubmission, or reject a project proposal.

Every activity done as part of project work is to be recorded in the project book, as and when it is done. Project guide shall go through these records periodically, and give suggestions/comments in writing in the same book.

The students have to submit an interim report, along with project work book showing details of the work carried out by him/her and a power point presentation at the end of the 7th semester to EC. The EC can accept, accept with modification, request a resubmission, or extension of the project.

The student's internal marks for project will be out of 50, in which 30 marks will be based on day to day performance assessed by the guide. Balance 20 marks will be awarded based on the presentation of the project by the students before an evaluation committee consists of a minimum of 3 faculty members including the guide.

For Project, the minimum for a pass shall be 50% of the total marks assigned to the Project work.

CS010 801 : HIGH PERFORMANCE COMPUTING

Teaching scheme **Credits:** 4
3 hours lecture and 2 hour tutorial per week

Objectives

- *To design a powerful and cost-effective computer system.*
- *To provide the basic concepts of parallel processing on high performance computers.*

Module I (15 hours)
Introduction to parallel processing - Trends towards parallel processing - Parallelism in uniprocessor - Parallel computer structures-Architecture classification schemes ,Amdahl's law,Indian contribution to parallel processing

Module II (15 hours)
Principles of pipelining and vector processing - Linear pipelining - Classification of pipeline processors - General pipelines - Instruction and Arithmetic pipelines –Design of Pipelined instruction unit-Principles of Designing Pipeline Processors- Instruction prefetch and branch handling- Data Buffering and Busing Structure-Internal forwarding and register tagging-Hazard detection and Resolution,Dynamic pipelines and Reconfigurability

Module III (15 hours)
Array processors - SIMD array processors - Interconnection networks - Static vs dynamic networks - mesh connected networks - Cube interconnection networks - Parallel algorithms for array processors - SIMD matrix multiplication-Parallel sorting on array processors - Associative array processing - Memory organization.

Module IV (15 hours)
Multiprocessor architectures and Programming - Loosely coupled and Tightly coupled multiprocessors - Interconnection networks - Language features to exploit parallelism -Inter process communication mechanism-Process synchronisation mechanisms,synchronization with semaphores.

Module V (15 hours)
Dataflow computers - Data driven computing and Languages, Data flow computers architectures - Static data flow computer , Dynamic data flow computer ,Data flow design alternatives.

References:

1. Computer Architecture & Parallel Processing - Kai Hwang & FayeA.Briggs,McGraw Hill
2. Computer architecture A quantitative approach - John L Hennessy and David A. Patterson-ELSEVIER,Fourth Edition
3. Elements of Parallel computing - V. Rajaraman - PHI
4. Super Computers - V. Rajaraman - Wiely arstern
5. Parellel Processing for Super Computers & AI Kai Hwange & Douglas Degneot Mc Graw Hill
6. Highly parallel computing - George S. Almasi,Allan Gottlieb. - Benjamin Cumings Publishers.
7. HIgh Performance Computer Architecture - Harold S. Stone, Addison Wesley.
8. Advanced Computing- Vijay P.Bhatkar, Asok V.Joshi, Arirban Basu, Asok K.Sharma.

CS010 802: ARTIFICIAL INTELLIGENCE

Teaching scheme **Credits:** 4
2 hours lecture and 2 hour tutorial per week

Objectives

- *To provide introduction to the basic knowledge representation, problem solving, and learning methods of Artificial Intelligence.*
- *To familiarize with Fuzzy Logic and knowledge processing in expert systems*
- *To give exposure to problem solving in AI using Python*

Module 1 (14 hours)

Problems- problem spaces and search, production systems, Problem characteristics, Searching strategies – Generate and Test, Heuristic Search Techniques- Hill climbing– issues in hill climbing, General Example Problems.
Python-Introduction to Python- Lists Dictionaries & Tuples in Python- Python implementation of Hill Climbing

Module 2 (12 hours)
Search Methods- Best First Search- Implementation in Python- OR Graphs, The A * Algorithm, Problem Reduction- AND-OR Graphs, The AO* algorithm, Constraint Satisfaction. Games as search problem, MINIMAX search procedure, Alpha–Beta pruning.

Module3 (12 hours)
Knowledge representation -Using Predicate logic- representing facts in logic, functions and predicates, Conversion to clause form, Resolution in propositional logic, Resolution in predicate logic, Unification, Question Answering, forward and backward chaining.

Module 4 (12 hours)
Learning- Rote Learning – Learning by Advice- Learning in Problem Solving - By Parameter Adjustment with Macro Operators, Chunking, Learning from Examples- Winston's Learning Program, Version Spaces- Positive & Negative Examples – Candidate Elimination- Decision Trees-ID3 Decision Tree Induction Algorithm.

Module 5 (10 hours)
Fuzzy Sets – Concept of a Fuzzy number- Operations on Fuzzy Sets – Typical Membership Functions – Discrete Fuzzy Sets.
Expert System –Representing and using Domain Knowledge – Reasoning with knowledge– Expert System Shells –Support for explanation- examples –Knowledge acquisition-examples.

References

1. Elaine Rich, Kevin Knight, Shivashankar B Nair
Tata McGraw Hill- Artificial Intelligence, 3rd Edn ,2004.
2. Stuart Russell – Peter Narang, Pearson Education Asia - Artificial Intelligence- A modern approach.
3. George F Luger - Artificial Intelligence, Pearson Education Asia
4. Allen B. Downey – (Think Python) Python for software design- How to think like a computer scientist, Cambridge University press, 2009 .

Web Reference

1. http://code.google.com/p/aima-python/ - Website for search strategy implementation in python

CS010 803: Security in Computing

Teaching scheme **Credits:** 4
2 hours lecture and 2 hours tutorial per week

Objectives
- *To impart an essential study of computer security issues*
- *To develop basic knowledge on cryptography*
- To impart an essential study of various security mechanisms

Module 1 (12 hours)

Introduction: Security basics – Aspects of network security – Attacks Different types –Security attacks -Security services and mechanisms.
Cryptography: Basic Encryption & Decryption – Classical encryption techniques – symmetric encryption, substitution ciphers – Caesar cipher – Monoalphabetic Cipher, Playfair Cipher, Polyalphabetic cipher - Vigenère – Cipher, Transposition ciphers - Rail Fence cipher, Row Transposition Ciphers.

Module 2 (12 hours)

Modern Block Ciphers - Fiestel Networks , DES Algorithm – Avalanche Effect. **Introduction to Number Theory -** Prime Factorisation, Fermat's Theorem, Euler's Theorem, Primitive Roots, Discrete Logarithms.
Public key Cryptography:- Principles of Public key Cryptography Systems, RSA algorithms-Key Management – Diffie-Hellman Key Exchange, Elliptic curve cryptography.

Module 3 (12 hours)

Message Authentication-Requirements- Authentication functions- Message authentication codes-Hash functions- Secure Hash Algorithm, MD5, Digital signatures- protocols- Digital signature standards, Digital Certificates.
Application Level Authentications- Kerberos, X.509 Authentication Service, X.509 certificates.

Module 4 (12 hours)

Network Security: Electronic Mail Security, Pretty Good Privacy, S/MIME, IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload. **Web Security:** Web Security considerations- Secure Socket Layer -Transport layer Security-Secure electronic transaction. Firewalls-Packet filters- Application Level Gateway- Circuit Level Gateway.

Module 5 (12 hours)

Operating System Security: Memory and Address Protection, Control of Access to General Objects, File Protection Mechanisms, Models of Security – Bell-La Padula Confidentiality Model and Biba Integrity Model.
System Security: Intruders, Intrusion Detection, Password Management, Viruses and Related Threats, Virus Countermeasure.

Reference Books

1. William Stallings, “Cryptography and Network Security – Principles and Practices”, Pearson Education, Fourth Edition, 2006.
2. Charles P. Pfleeger, “Security in Computing”, Pearson Education, Third Edition, 2005.
3. Behrouz A. Forouzan, Dedeep Mukhopadhyay “Cryptography & Network Security”, Second Edition,Tata McGraw Hill, New Delhi, 2010.
4. Andrew S. Tanenbaum, “Modern Operating Systems”, Pearson Education, Second Edition, 2002.
5. Atul Kahate, “Cryptography and Network Security”, Second Edition, Tata McGraw Hill
6. Wenbo Mao, “ Modern Cryptography- Theory & Practice”, Pearson Education, 2006.
7. Bruce Schneier, “Applied Cryptography”, John Wiley and Sons Inc, 2001.

CS010 804L01: E-COMMERCE

Teaching scheme **Credits:** 4

2 hours lecture and 2 hours tutorial per week

Objectives

- *To impart an introduction to Elecronic Commerce.*
- *To develop basic knowledge of Business in Internet and Electronic Payment.*

Module I (12 hours)

Introduction to Electronic Commerce:- E-Commerce Framework, Anatomy of E-Commerce Applications, E-Commerce Consumer & Organization Applications. **E-Commerce and World Wide Web** – Internet Service Providers, Architectural Framework for Electronic Commerce, WWW as the Architecture, Hypertext publishing.

Module II (14 hours)

Network Security:- Client-Server Network Security, CS Security Threats, Firewalls, Data & Message Security, Encrypted Documents, Security on the Web.

Consumer Oriented Electronic Commerce:- Consumer Oriented Applications, Mercantile Process Models, Mercantile Models from the Consumer's Perspective, Mercantile Models from the Merchant's Perspective

Module III (10 hours)

Electronic Payment Systems :- Types of Electronic Payment Systems, Digital Token Based Electronic Payment System, Smart Cards, Credit Cards, Risk in Electronic Payment Systems, Designing Electronic Payment Systems.

Module IV (12 hours)

Electronic Data Interchange:- EDI Application in Business, EDI-Legal, Security and Privacy Issues, EDI standardization, EDI Envelope for Message Transport, Internet based EDI, Internal Information System, Work-flow Automation and Coordination, Supply Chain Management, Document Library, Types of Digital Documents, Corporate Data Warehouses.

Module V (12 hours)

Recent Trends in E-Commerce:- Multimedia in E-Commerce, Video Conferencing with Digital Videos, Broad Band Telecommunication, Frame & Cell Relays, Switched Multimegabit Data Service (SMDS), Asynchronous Transfer Mode, Mobile Computing and Wireless Computing.

Reference Books

1) Ravi Kalakota, Andrew B Whinston, Frontiers of Electronic Commerce, Pearson Education Inc., New Delhi, 2009
2) Ravi Kalakota, Andrew B. Whinston, Electronic Commerce A Manager's Guide, Pearson Education Inc., New Delhi, 2007
3) P. T. Joseph, E-Commerce An Indian Perspective, PHI Learning Private Limited, New Delhi, 2009

CS010 804L02: GRID COMPUTING
(Common to IT010 804L06:Grid Computing)

Teaching scheme **Credits:** 4

2 hours lecture and 2 hours tutorial per week

Objectives

- *To impart an introduction to Grid Computing.*
- *To develop basic knowledge about the Open Grid Service Architecture.*

Module I (12 hours)

Grid Computing – Introduction- Grid Activities- Overview of Grid Business Areas- Grid Applications- Grid Infrastructure.

Module II (12 hours)

Grid Computing Organizations and their roles- Grid Computing Anatomy- Grid Problem- Concept of Virtual Organizations- Grid Architecture- Autonomic Computing- Business on Demand and Infrastructure Virtualization- Semantic Grids.

Module III (12 hours)

Merging the Grid Services Architecture- Service Oriented Architecture- Web Service Architecture- XML relevance to Web Services- Service Message Description Mechanisms- Relationship between Web Service and Grid Service.

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Module IV (12 hours)

Open Grid Services Architecture- OGSA Platform Components- Open Grid Services Infrastructure- Introduction to Service Data Concepts- Grid Service- OGSA Basic Services- Common Management Model- Policy Architecture- Security Architecture.

Module V (12 hours)

Grid Computing Toolkits- GLOBAS GT3 Toolkit Architecture- GLOBAS GT3 Toolkit Programming Model- GLOBAS GT3 Toolkit High Level Services.

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Reference Books

1) Joshy Joseph, Craig Fellenstein, Grid Computing, Pearson Education Inc, New Delhi 2004.
2) D Janakiram, Grid Computing A research Monograph, Tata McGraw-Hill Publishing Company Limited New Delhi, 2005.

CS010 804L03: Bioinformatics

Teaching scheme Credits: 4
2 hours lecture and 2 hour tutorial per week

Objectives

- *To understand the science of storing, extracting, organizing, analysing and interpreting biological data.*

Module 1 (12 hours)
Basic Concepts of Molecular Biology: Cells - Chromosomes, DNA, RNA, Proteins,
Central dogma of molecular biology, RNA classification – coding and non coding RNA- mRNA, tRNA, miRNAand sRNA , Genomes and Genes - Genetic code, ORFs,Slice varients,Transcription ,Translation and Protein synthesis.

Module 2 (12 hours)
Sequence alignments – - local/global, pairwise/multiple Sequence alignment- Smith-Waterman algorithm, NeedlemanWunch algorithm, Multiple sequence alignment –Sum-of-Pairs measure - Star and tree alignments ,Scoring matrices: basic concept of a scoring matrix, Matrices for nucleic acid and proteins sequences, PAM and BLOSUM ,Phylogenetic Trees

Module 3 (12 hours)
Informational view of Genomic data, Gene expression, Microarrays-cDNA arrays,Oligo Arrays, Data analysis methodologies-Normalization,Principal Componenet Analysis,Clustering-Hierarchical,K-meana,FCM,Application of Microarrays.
Gene regulation, Gene Ontology, metabolic pathways, and gene set enrichment analysis.

Module 4 (12 hours)
Evolution of Protein Structures, Classification of Protein Structures- primary,secondary,ternary and quatenary,Protein Structure prediction and modeling, Assignment of protein structures to genomes, Prediction of protein function, Protein folding problem, Protein Threading, Drug discovery and development

Module 5 (12 hours)
Biological data bases: Pubmed,Swissport,EMBL,DDBJ,Genbank,
Software Tools: Use of Tools for basic and specialized sequence processing such as: BLAST, FASTA, RasMol, Phylip, ClustalW

References

1. Setubal & Meidanis, “Introduction to Computational Molecular Biology”, Brooks/Cole Cengage Learning 2009.
2. Arthur M Lesk, “Introduction to Bioinformatics”, Oxford University Press, India, 2004
3.Vittal R. Srinivas “Bioinformatics a mordern Approach”,PHI Learning 2009 .
4.Shuba Gopal,Rhys Price Jones,Paul Thymann,Anne Haake,”Bioinformatics with fundamentals of Genomics and proteomics, Tata McGraw Hill
3.Zoe Lacroix,Terence Critchlow “Bioinformtics managing scientific Data”,Morgan Koufmann Publishers
4.B.G Curran,R J walker,SC Bhattia”Bioinformatics”,CBS Publishers,2010
5.Harshawardhana P. Bal “Bioinformatics Principles and Applications”,Tata MacGraw Hill

CS010 804L04 :Optimization Techniques

Teaching Schemes **Credits: 4**
2 hours lecture and 2 hour tutorial per week.

Objectives:

- *To understand the need and origin of the optimization methods.*
- *To get a broad picture of various applications of optimization methods used in engineering.*
- *To define an optimization problem and its various components.*

Module I (12 Hrs)
One Dimensional Unconstrained Minimization techniques, single variable minimization, unimodality, bracketing the minimum, necessary and sufficient conditions for optimality, convexity, steepest descent method.

Module II (12Hrs)
Linear programming, introduction, linear programming problem, linear programming problems involving LE (?) constraints, simplex method, optimality conditions, artificial starting solutions, the M method.

Module III (12hrs)
Transportation models, definition, non traditional models, transportation algorithm, East West corner method, Vogel approximation method. Assignment model, Introduction, Hungarian method.

Module IV (12Hrs)
Forecasting Models, moving average technique, regression method, exponential smoothing. Game Theory, two persons zero sum games, mixed strategy games-graphical method.

Module V (12Hrs)
Queuing models, elements of queuing model, pure birth and death model, specialized Poisson queues, single server models. Multiple server models, self service model.

References:

1. Ashok D Belegundu, Tirupathi R Chandrupatla, optimization concepts and Application in Engineering, pearson Education.
2 Kalynamoy Deb, "Optimization for Engineering Design, Alogorithms and Examples", Prentice Hall,
3. Hamdy A Taha, "Operations Research – An introduction", Pearson Education,
4. Hillier / Lieberman, "Introduction to Operations Research", Tata McGraw Hill Publishing company Ltd,
5. Singiresu S Rao, "Engineering optimization Theory and Practice", New Age International,
6. Mik Misniewski, "Quantitative Methods for Decision makers", MacMillian Press Ltd.

CS010 804L05: MOBILE COMPUTING

Teaching scheme **Credits:** 4
2 hours lecture and 2 hours tutorial per week

Objectives

- *To study the relevance and underlining infrastructure of multimedia system.*
- *To enable the students to apply contemporary theories of multimedia learning to the development of multimedia products.*

Module I (10 hours)
Introduction to wireless communication system:- 2G cellular network,2G TDMA Standards,3G wireless networks,wireless local loop and LMDS, Broadcast Systems-Broadcast transmission, Digital Audio Broadcasting-Multimedia Object Transfer Protocol. Digital Video Broadcasting.
Cellular concepts-channel assignment strategy-hand off strategy-interface and system capacity-trunking –improving coverage and capacity in cellular system.

Module II (12 hours)
Wireless Communication Systems:-Telecommunication Systems-GSM-GSM services & features,architecture,channel type,frame structure,signal processing in GSM & DECT-features & characteristics,architecture,functional concepts & radio link,personal access communication system(PACS)-system architecture-radio interface,
Protocols.Satellite Systems-GEO, LEO, MEO.

Module III (11 hours)
Wireless LAN and ATM:- Infra red and Radio Transmission, Infrastructure and ad hoc networks ,802.11- Bluetooth- Architecture, Applications and Protocol, Layers, Frame structure. comparison between 802.11 and 802.16.

Wireless ATM- Services, Reference Model, Functions, Radio Access Layer. Handover-Reference Model, Requirements, Types, handover scenarios.
Location Management, Addressing, Access Point Control Protocol (APCP).

Module IV (14 hours)
Mobile Network and Transport Layers:- Mobile IP- Goals, Requirements, IP packet delivery, Advertisement and discovery. Registration, Tunneling and Encapsulation, Optimization, Reverse Tunneling, IPv6, Dynamic Host configuring protocol, Ad hoc networks – Routing, DSDV, Dynamic source routing. Hierarchical Algorithms.
Traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP, Transmission.

Module V (13 hours)
Wireless Application Protocol & World Wide Web
WAP- Architecture, Protocols-Datagram, Transaction, Session.-Wireless Application Environment-WML- Features, Script- Wireless Telephony Application.
WWW- HTTP, Usage of HTML, WWW system architecture.

References

1. Jochen Schiller "Mobile Communications " , Preason Education Asia
2.Wireless communications Principles and practice-second edition-Theodore S.Rappaport,PHI,Second Edition ,New Delhi, 2004

3. Computer Networks – Andrew S. Tanenbaum , PHI

4.. Communication Networks -Fundamental Concepts and Key Architectures Leon-Garcia & Indra Widjaja, Tata McGraw Hill

CS010 804L06 : Advanced Networking Trends

Teaching scheme **Credits:** 4

2 hours lecture and 2 hours tutorial per week

Objectives

- *To acquaint the students with the application of networking.*
- *To understand the variousTCP/IP protocols and the working of ATM and its performance, Network security and authentication, and variousalgorithms related to it has been dealt, to get a practical approach ,advanced topics in the design of computer networks and network protocols*

Module 1 (12 hours)

Ethernet Technology – Frame format – Interface Gap – CSMA/CD – 10 mbps Ethernet, Fast Ethernet, Gigabit Ethernet, Wire
less Ethernet.

ISDN - Definition - Protocol architecture - System architecture - Transmission channels - ISDN interface, B-ISDN.

Module 2 (12 hours)

ATM – ATM Principles – BISDN reference model – ATM layers – ATM adaption Layer – AAL1, AAL2, AAL3/4, AAL5 – ATM addressing – UNI Signaling – PNNI Signaling

Module 3 (12 hours)

Wireless LAN – Infrared Vs Radio transmission – Infrastructure & ad hoc n/w – IEEE 802.11 – Physical Layer – MAC layer.

Bluetooth – Physical Layer – MAC layer – Networking - Security

Module 4 (12 hours)

Mesh Networks- Necessity for Mesh Networks – MAC enhancements – IEEE 802.11s Architecture –Opportunistic Routing – Self Configuration and Auto Configuration - Capacity Models –Fairness – Heterogeneous Mesh Networks – Vehicular Mesh Networks

Module 5 (12 hours)

Sensor Networks- Introduction – Sensor Network architecture – Data Dissemination – Data Gathering –MAC Protocols for sensor Networks – Location discovery – Quality of Sensor Networks– Evolving Standards – Other Issues – Recent trends in Infrastructure less Networks

References

1. An introduction to Computer Networking - Kenneth C Mansfield, Jr., James L. Antonakos, PHI
2. Communication Networks Fundamental Concepts & Key Architecture - Leon-Garcia – Widjaja, Tata McGraw Hill
3. Mobile Communication - Jochen Schiller, Pearson Education Asia
4. C. Siva Ram Murthy and B.S.Manoj, “Ad hoc Wireless Networks – Architectures and Protocols’, Pearson Education, 2004
5. C.K.Toh, “Adhoc Mobile Wireless Networks”, Pearson Education, 2002.

CS010 805G01: MULTIMEDIA TECHNIQUES

Teaching scheme **Credits:** 4
2 hours lecture and 2 hours tutorial per week

Objectives

- *To study the relevance and underlining infrastructure of multimedia system.*
- *To enable the students to apply contemporary theories of multimedia learning to the development of multimedia products.*

Module I (10 hours)
Multimedia Basics: Multimedia and Hypermedia, Multimedia Software, Editing and Authoring Tools, VRML.
Graphics and Image Data Representation— Graphics/Image Data Types, Popular File Formats.
Concepts in Video and Digital Audio— Color Science, Color Models in Images, Color Models in Video. Types of Video Signals, Digitization of Sound, MIDI - Musical Instrument Digital Interface, Quantization and Transmission of Audio.

Module II (12 hours)
Lossless & Lossy Compression Algorithms— Introduction, Basics of Information Theory, Run-Length Coding, Variable-Length Coding, Dictionary-Based Coding, Arithmetic Coding, Lossless Image Compression. Distortion Measures, The Rate-Distortion Theory, Quantization, Transform Coding, Wavelet-Based Coding, Wavelet Packets, Embedded Zerotree of Wavelet Coefficients, Set Partitioning in Hierarchical Trees (SPIHT).

Module III (11 hours)
Image, Video and Audio Compression — Image Compression -JPEG , JPEG-LS.
Basic Video Compression Techniques - Introduction to Video Compression, Video Compression Based on Motion Compensation, MPEG
Video Coding— **Audio Compression Techniques-**—MPEG, ADPCM in Speech Coding, Vocoders, Psychoacoustics, Audio Codecs.

Module IV (14 hours)
Storage and Retrieval of Images — Content-Based Retrieval in Digital Libraries: Image retrieval, CBIRD. A Case Study, Image Search Systems, Quantifying Results, Querying on Videos, Querying on Other Formats, Outlook for Content-Based Retrieval.
Image Databases— Raw Images, Compress Image Presentations, Image Processing Segmentation, Similarity- Based Retrieval, Alternating Image DB Paradigms, Representing Image DBs with Relations and R Trees, Retrieving Images by Special Layout, Implementations, Selected Commercial Systems.

Module V (13 hours)
Multimedia Databases
Text/Document Databases— Precision and Recall, Stop Lists, Word Stems and Frequency tables, Latent Semantic Indexing, TV-Trees, Other Retrieval Techniques.
Multimedia Databases—Design and Architecture of a Multimedia Database, Organizing Multimedia Data based on the Principle of Uniformity, Media Abstractions, Query Languages for Retrieving Multimedia Data , Indexing SMDSs with Enhanced Inverted Indices, Query Relaxation/ Expansion.

References

1. .Ze-Nian Li and M. S. Drew, .*Fundamental of Multimedia*., Pearson Education,2004
2. V. S. Subrahmanian, .*Principles of Multimedia Database Systems*., Morgan Kaufmann Publication.
3. K. R. Rao, Zoran S. Bojkovic, D. A. Milovanovic, .*Introduction to Multimedia Communications.*, Wiley.
4. R. Steinmetz and K. Nahrstedt .*Multimedia: Computing*, *Communication & Applications*, Pearson Education.
5. Buford, .*Multimedia Systems*., Pearson Education.
6. C. T. Bhunia, .*Multimedia and multimedia Communications*., New Age International Publishers.
7. Prabhat K. Andheigh, Kiran Thakrar, *Multimedia Systems design*., PHI.
8. Koegel Buford, *Multimedia Systems*., Pearson Eduaction.
9. J. D. Gibson, .*Multimedia Communications: Directions and Innovations.*, Academic
10. Press, Hard-court India.

CS010 805G02 :Neural networks
(Common to IT010 805G05 Neural Networks)

Teaching scheme Credits: 4
2 hours lecture and 2 hours tutorial per week

Objectives

To understand the fundamental building blocks of Neural networks

Module 1 (14 hours)

Biological Neurons and Neural Networks, Basic Structures and Properties of Artificial Neural Networks, Basic Neuron Models-McCulloch-Pitts -Nearest Neighbour- Radial Basis Function, Activation Functions ,Singe Layer Perceptrons-Linear Seperability, Learning and Generalization in Single Layer Perceptron-Hebbian Learning-Gradient Descent Learning-Widrow-Hoff Learning-The Generalized Delta rule, Practical Considerations

Module 2 (12 hours)

Multi Layer Perceptron Learning,Back Propogation Algorithim -Applications – Limitations– Network Paralysis – Local Minima – Temporal Instability, Pattern Analysis Tasks- Classification- Regression- Clustering, Pattern Classification and Regression using Multilayer Perceptron.

Module 3 (10 hours)

Radial Basis Function Networks: Fundamentals, Algorithms and Applications, Learning with Momentum, Conjugate Gradient Learning, Bias and Variance. Under-Fitting and Over-Fitting, Stochastic neural networks, Boltzmann machine.

Module 4 (12 hours)

Network based on competition:- Fixed weight competitive Network-Maxnet, Mexican Hat and Hamming Net, Counter Propagation Networks- Kohonen’s self-organizing map – Training the Kohonen layer – Training the Grossberg layer – Full counter propagation network – Application, Adaptive resonance theory – classification- Architecture – Learning and generalization.

Module 5 (12 hours)

Pattern Association: - training algorithm for pattern association - Hetro Associative Network, Auto Associative Network, Architecture of Hopfield nets – stability analysis ,General Concepts of Associative Memory, Bidirectional Associative Memory (BAM) Architecture, BAM training algorithms.

References

1. B. Yegnanarayana, "Artificial Neural Networks", PHI.
2. Simon Haykin, Neural Networks, 2/e, Prentice Hall
3. Neural Computing & Practice – Philip D. Wasserman
4. Neural Networks in Computer Intelligence-Limin Fu,Tata Mc.Hill Edition

CS010 805G03 : Advanced Mathematics

(common to IT010 805G02 Advanced Mathematics)

Teaching Schedule: **Credits: 4**

2 hour Lecturer and 2 hour Tutorial per week

Objectives

- *To provide an understanding of Green's Function, Integral Equations, Gamma, Beta functions, Power Series solution of differential equation, Numerical solution of partial differential equations*

Module 1 (12 Hours)
Green's Function
Heavisides, unit step function – Derivative of unit step function – Dirac delta function – properties of delta function – Derivatives of delta function – testing functions – symbolic function – symbolic derivatives – inverse of differential operator – Green's function – initial value problems – boundary value problems – simple cases only

Module 2 (12 Hours)
Integral Equations
Definition of Volterra and Fredholm Integral equations – conversion of a linear differential equation into an integral equation – conversion of boundary value problem into an integral equation using Green's function – solution of Fredhlom integral equation with separable Kernels – Integral equations of convolution type – Neumann series solution.

Module 3 (12 Hours)
Gamma, Beta functions
Gamma function, Beta function – Relation between them – their transformations – use of them in the evaluation certain integrals – Dirichlet's integral – Liouville's extension of Dirichlet's theorem – Elliptic integral – Error function.

Module 4 (12 Hours)
Power Series solution of differential equation
The power series method – Legendre's Equation – Legendre's polynomial – Rodrigues formula – generating function – Bessel's equation – Bessel's function of the first kind – Orthogonality of Legendre's Polynomials and Bessel's functions.

Module 5 (12 Hours)
Numerical solution of partial differential equations
Classification of second order equations- Finite difference approximations to partial derivatives – solution of Laplace and Poisson's equations by finite difference method – solution of one dimensional heat equation by Crank – Nicolson method – solution one dimensional wave equation.

References
1. S.S Sasthri, “Introductory methods of Numerical Analysis”,Prentice Hall of India.
2. Ram P.Kanwal, Linear Integral Equation, Academic Press, New York.
3. Allen C.Pipkin, Springer, A Course on Integral Equations, Verlag.
4. H.K.Dass, Advanced Engg. Mathematics, S.Chand.
5. Michael D.Greenberge, Advanced Engg. Mathematics, Pearson Edn. Asia.
6. B.S.Grewal, Numrical methods in Engg.&science, Khanna Publishers.
7. R.F. Hoskins, Generalized functions, John Wiley and Sons.
8. Bernard Friedman, Principles and Techniques of Applied Mathematics, John Wiley and sons
9. James P.Keener, Principles of Applied Mathematics, Addison Wesley.
10. P.Kandasamy, K.Thilagavathy, K.Gunavathy Numerical methods, S.Chand & co

CS010 805G04: Software Architecture
(Common to IT010 805G01 Software Architecture)

Teaching scheme **Credits:** 4
2 hours lecture and 2 hour tutorial per week

Objectives

- *To understand the role of a software architecture in the development of an enterprise application system.*
- *To develop the ability to understand the models that are used to document a software architecture.*

Module I (13 hours)
Software Architecture—Software Architecture, Software Design Levels, The status of Software Engineering and Architecture.
Architecture Styles—Use of Patterns and Styles in Software Design, Common Architectural Styles -Pipes and Filters, Data Abstraction and Object Orientation, Event Based Implicit Invocation, Layered Systems, Repositories, Interpreters, **Process Control Paradigms**—Case Studies to Illustrate the use of Architectural Principles.

Module II (11 hours)
Architectural Design—Guidelines for User Interface Architectures, Design Space and Rules, Applying Design Space with an Example, A Validation Experiment. **The Quantified Design Space**—Background, Quantified Design Space.

Module III (11 hours)
Formal models and Specifications— Formalizing the Architecture of a Specific System-Architectural Formalism and its Applications, Formalizing Various Architectural Styles, Filters, Pipes, Pipe-and-Filter System, Formalizing Architectural Design Space.

Module IV (14 hours)
Architectural Description Languages—Requirements for Architectural Description Languages, The Linguistic Character of Architectural Description, Desiderata for Architecture Description Languages, Problems.
First-Class Connectors—Current practice, Software System Composition . Adding Implicit Invocation to Traditional Programming Languages

Module V (11 hours)
Architectural Design Tools— UniCon A Universal Connecting Language, Components, Abstraction and Encapsulation, Types and Type checking.
Architectural Design - Exploiting Styles , Architectural Interconnection

References

1. Mary Shaw & David Garlan," *Software Architecture"*, Prentice Hall India Private Limited, Third Edition, New Delhi, 2000.
2. Len Bass, Paul Clements, & Rick Kazman, "*Software Architecture in Practice"*, Pearson Education.

CS010 805G05: Natural Language Processing

Teaching scheme **Credits**: 4

2 hours lecture and 2 hours tutorial per week

Objectives

- *To acquire a general introduction including the use of state automata for language processing*
- *To understand the fundamentals of syntax including a basic parse*
- *To explain advanced feature like feature structures and realistic parsing methodologies*
- *To explain basic concepts of remotes processing*
- *To give details about a typical natural language processing applications*

Module I (12 hours)

INTRODUCTION: Introduction: Knowledge in speech and language processing – Ambiguity – Models and Algorithms – Language, Thought and Understanding. Regular Expressions and automata: Regular expressions – Finite-State automata. Morphology and Finite-State Transducers: Survey of English morphology – Finite-State Morphological parsing – Combining FST lexicon and rules – Lexicon-Free FSTs: The porter stammer – Human morphological processing

Module II (12 hours)

SYNTAX: Word classes and part-of-speech tagging: English word classes – Tagsets for English – Part-of-speech tagging – Rule-based part-of-speech tagging – Stochastic part-of-speech tagging – Transformation-based tagging – Other issues. Context-Free Grammars for English: Constituency – Context-Free rules and trees – Sentence-level constructions – The noun phrase – Coordination – Agreement – The verb phase and sub categorization – Auxiliaries – Spoken language syntax – Grammars equivalence and normal form – Finite-State and Context-Free grammars – Grammars and human processing. Parsing with Context-Free Grammars: Parsing as search – A Basic Top-Down parser – Problems with the basic Top-Down parser – The early algorithm – Finite-State parsing methods.

Module III (12 hours)

ADVANCED FEATURES AND SYNTAX : Features and Unification: Feature structures – Unification of feature structures – Features structures in the grammar – Implementing unification – Parsing with unification constraints – Types and Inheritance. Lexicalized and Probabilistic Parsing: Probabilistic context-free grammar – problems with PCFGs – Probabilistic lexicalized CFGs – Dependency Grammars – Human parsing.

Module IV (12 hours)

SEMANTIC: Representing Meaning: Computational desiderata for representations – Meaning structure of language – First order predicate calculus – Some linguistically relevant concepts – Related representational approaches – Alternative approaches to meaning. Semantic Analysis: Syntax-Driven semantic analysis – Attachments for a fragment of English – Integrating semantic analysis into the early parser – Idioms and compositionality – Robust semantic analysis. Lexical semantics: relational among lexemes and their senses – WordNet: A database of lexical relations – The Internal structure of words – Creativity and the lexicon.

Module V (12 hours)

APPLICATIONS: Word Sense Disambiguation and Information Retrieval: Selectional restriction-based disambiguation – Robust word sense disambiguation – Information retrieval – other information retrieval tasks. Natural Language Generation: Introduction to language generation – Architecture for generation – Surface realization – Discourse planning – Other issues. Machine Translation: Language similarities and differences – The transfer metaphor – The interlingua idea: Using meaning – Direct translation – Using statistical techniques – Usability and system development.

References:

1. Daniel Jurafsky & James H.Martin, " Speech and Language Processing", Pearson Education(Singapore)Pte.Ltd.,2002.
2. James Allen, "Natural Language Understanding", Pearson Education, 2003

CS010 805G06 :Pattern Recognition

Teaching Schemes **Credits:4**

2 hours lecture and 2 hours tutorial per week

Objectives:

- *To impart a basic knowledge on pattern recognition and to give a sound idea on the topics of parameter estimation and supervised learning, linear discriminant functions and syntactic approach to PR.*
- *To provide a strong foundation to students to understand and design pattern recognition systems.*

Module I (12 hours)

Introduction: introduction to statistical, syntactic and descriptive approaches, features and feature extraction, learning and adaptation. Bayes Decision theory, introduction, continuous case, 2-categoryclassification, minimum error rate classification, classifiers. Discriminant functions and decision surfaces.

Module 2(12 hours)

Introuction- Maximum likelihood estimation - General principle,Gaussian case ; bias. Bayesian estimation – class conditioned density, parameterdistribution, Bayesian Parameter estimation – General Theory,Gibb's Algorithm – Comparison of Bayes Method with Maximum likelihood.

Module 3(12 hours)

Introduction,Density Estimation. Parzen Windows – Convergence of mean, variance,Kn – Nearest Neighbourestimation,Nearest neighbor rule,Converge error rate, error bound , partial distance.

Module 4(12 hours)

Linear discriminate functions and decision surfaces:-Introduction, training error, Threshold weight, discriminate function – two category case, multicategory case. Generalized discriminant function, Quadratic discriminant functions, Polynomial discriminant, PHI functions. Augmented vector.Two category linearly separable case: weight space, solution region, margin, learning rate ,algorithm(Gradient descent – newton)Relaxation procedures.

Module 5(12 hours)

Syntactic approach to PR : Introduction to pattern grammars and languages ,higher dimensional grammars, tree, graph, web, plex, and shape grammars, stochastic grammars , attribute grammars, Parsing techniques, grammatical inference.

References

1. R.O Duda, Hart P.E, “Pattern Classification And Scene Analysis”, John Wiley
2. Gonzalez R.C. & Thomson M.G., “Syntactic Pattern Recognition - An Introduction”, Addison Wesley.
3. J. T. Tou and R. C. Gonzalez, “Pattern Recognition Principles”, Wiley, 1974
4. Fu K.S., “Syntactic Pattern Recognition And Applications”, Prentice Hall,
5. Rajjan Shinghal, “Pattern Recognition: Techniques and Applications”, Oxford University Press, 2008.

CS010 806: Computer Graphics Lab

Teaching scheme **Credits: 2**
3 hours practical per week

Objectives

- *To acquaint the students with the implementation of fundamental algorithms in Computer Graphics.*

I. Experiments to implement the following: (**first 3 weeks**)

1. DDA Algorithm
2. Bresenham's Line drawing Algorithm for any slope.
3. Mid-point Circle Algorithm.
4. 2D Transformations

II. Experiments to implement the following:

1. 3D Rotations on a cube (about any axis, any general line) controlled by keyboard navigation keys.
2. 3D Rotations on a cube with hidden surface elimination.(keyboard controlled)
3. Composite transformations
4. Bezier cubic splines like screen saver
5. Any Fractal Construction (Koch curve)
6. Animations using the above experiments.(eg.moving along curved path)

Any experiment according to the syllabus of CS010 702 Computer Graphics can be substituted subjected to permission from competent authority.

CS010 807 Project Work

Teaching scheme **credits: 4**

6 hours practical per week

The progress in the project work is to be presented by the middle of eighth semester before the evaluation committee. By this time, the students will be in a position to publish a paper in international/ national journals/conferences. The EC can accept, accept with modification, and request a resubmission.

The progress of project work is found unsatisfactory by the EC during the middle of the eighth semester presentation, such students has to present again to the EC at the end of the semester and if it is also found unsatisfactory an extension of the project work can be given to the students.

Project report: To be prepared in proper format decided by the concerned department. The report shall record all aspects of the work, highlighting all the problems faced and the approach/method employed to solve such problems. Members of a project group shall prepare and submit **separate** reports. Report of each member shall give details of the work carried out by him/her, and only summarise other members' work.

The student's sessional marks for project will be out of 100, in which 60 marks will be based on day to day performance assessed by the guide. Balance 40 marks will be awarded based on the presentation of the project by the students before an evaluation committee.

For Project, the minimum for a pass shall be 50% of the total marks assigned to the Project work.

CS010 808 Viva -Voce

Teaching scheme **credits: 2**

A comprehensive oral Viva-voce examination will be conducted to assess the student's intellectual achievement, depth of understanding in the specified field of engineering and papers published / accepted for publication etc. At the time of viva-voce, certified bound reports of seminar and project work are to be presented for evaluation. The certified bound report(s) of educational tour/industrial training/ industrial visit shall also be brought during the final Viva-Voce.

An internal and external examiner is appointed by the University for the Conduct of viva voce University examination.

For Viva-voce, the minimum for a pass shall be 50% of the total marks assigned to the Viva-voce.

Note: If a candidate has passed all examinations of B.Tech. course (at the time of publication of results of eighth semester) except Viva-Voce in the eighth semester, a re-examination for the Viva-Voce should be conducted within one month after the publication of results. Each candidate should apply for this 'Save a Semester examination' within one week after the publication of eighth semester results.

Electronics and Communication Engineering (EC)

EC010 701 VLSI DESIGN

Teaching Schemes **Credits: 4**
2 hours lecture and 2 hours tutorial per week.

Objective: To cater the needs of students who want a comprehensive study of the principle and techniques of modern VLSI design and systems.

Module 1(12 hrs)

Process steps in IC fabrication: Silicon wafer preparation-Diffusion of impurities-physical mechanism-ion implantation- Annealing process- Oxidation process-lithography-Chemical Vapour Deposition -epitaxial growth –reactors-metallization-patterning-wire bonding -packaging

Module 2 (12 hrs)

Monolithic components: Isolation of components-junction isolation and dielectric isolation. Monolithic diodes- schottky diodes and transistors-buried layer-FET structures- JFET-MOSFET-PMOS and NMOS. Control of threshold voltage-silicon gate technology- monolithic resistors-resistor design-monolithic capacitors-design of capacitors- IC crossovers and vias.

Module 3 (12 hrs)

CMOS technology: CMOS structure-latch up in CMOS, CMOS circuits-combinational logic circuit-invertor- NAND-NOR-complex logic circuits, full adder circuit. CMOS transmission gate(TG)T-realization of Boolean functions using TG. Complementary Pass Transistor Logic (CPL)-CPL circuits: NAND, NOR-4 bit shifter. Basic principle of stick diagrams.

Module 4 (12hrs)

CMOS sequential logic circuits: SR flip flop, JK flip flop, D latch circuits. BiCMOS technology-structure-BiCMOS circuits: inverter, NAND, NOR-CMOS logic systems-scaling of MOS structures-scaling factors-effects of miniaturization.

Module 5 (12hrs)
Gallium Arsenide Technology: Crystal structure-doping process-channeling effect-MESFET fabrication-Comparison between Silicon and GaAs technologies. Introduction to PLA and FPGA

References:

1. N Weste and Eshrangian, “Principles of CMOS VLSI Design: A system perspective”, Addison Wesley
2. S M SZE, “VLSI Technology”, Mc Graw Hill
3. Douglass Pucknell, “Basic VLSI design”, Prentice Hall of India.
4. K R Botkar,” Integrated circuits”, Khanna Publishers

5. Jan M Rabaey, Anantha Chandrakasan and Borivoje Nikolic, “Digital Integrated Circuits- a Design perspective”, Prentice Hall.
6. S M Kang & Y Leblebici, “CMOS digital integrated circuits”, Mc Graw Hill.

EC010 702 INFROMATION THEORY AND CODING

Teaching Schemes **Credits: 4**

2 hours lecture and 2 hour tutorial per week.

Objectives

- *To give a basic idea about the information theory.*
- *To get a knowledge about various coding schemes.*

Module 1(12 hrs)

Concept of amount of information-Entropy-Joint and Conditional Entropy-Relative Entropy-Mutual information-Relationship between Entropy and Mutual information-Rate of information-Channel capacity-Redundancy and efficiency of channels.

Module 2 (12 hrs)

Data compression:-Examples of codes- Krafts inequality, optimal codes-Bounds on optimal code length-Huffman codes-Shannon-Fanno Elias coding-Arithmetic coding-ZIP coding.

Module 3 (12 hrs)

Channel capacity:-Noiseless binary channel, BSC, BEC-Symmetric channels-Shannons Channel capacity theorem, Properties of channel capacity-Trade off between SNR and Bandwidth-Channel coding theorem-Zero Error Codes.
The Gaussian Channel:-Band limited channel-Gaussian multiple user channels

Module 4 (12 hrs)

Channel coding:-Concepts of group and fields-Binary field arithmetic-Construction of Galois field-Vector spaces-Matrices
Linear Block Codes:-Encoding-Decoding-Syndrome and error detection-Minimum distance of a block code-Error detection and correction-Capabilities of a linear block code-Standard array and syndrome decoding.

Module (12 hrs)

Important Linear block code:-Hamming codes-Cyclic code-BCH code-Convolution codes-Systematic and non systematic codes –Encoding-Decoding-Viterbi algorithm-Stack (ZJ) decoding algorithm-Turbo codes-LDP codes.

References:

1. T M.Cover,J A.Thomas-“Elements of Information Theory”-Wiley Inter Science.
2. Lin,Costello-“Error Control Coding”-Pearson Education.
3. Singh,Sapre-“Communication systems”-Tata McGraw Hill.
4. T K.Moon-“Error correction coding”-Wiley Inter science.

EC010 703 MICROWAVE ENGINEERING

Teaching Schemes **Credit : 3**

2 hours lecture and 1 hour tutorial per week.

Objectives

- *To give the basic ideas about the characteristics and applications of microwave frequency bands*
- *To understand the working of various microwave passive and active devices and circuits*

Module 1: (12 hours)

Microwave network Characterization and passive devices: Characteristic, features and applications of microwaves- Circuit and S parameter representation of N port microwave networks - Reciprocity Theorem- Lossless networks and unitary conditions- ABCD parameters-Cascaded networks-Relations between S- Y and ABCD parameters. Properties and s-matrices for typical network such as section of uniform transmission line, 3-port networks (reciprocal and nonreciprocal), T-junctions directional coupler, magic tee, ferrite devices, isolator, circulators.

Module 2 :(15 hours)

Microwave Tubes: Generation of microwaves by tubes, limitations of conventional tubes, klystron amplifiers - analysis, reflex klystron oscillator-analysis, magnetrons, traveling wave tube (TWT), backward wave oscillator (BWO)-basic principles. Millimetre wave tubes-introduction

Module 3: (13 hours)

Microwave semiconductor: High frequency limitations of transistors, microwave transistors (theory only), Manley Rowe relations, parameteric amplifiers and frequency multipliers, tunnel diodes, Gunn effect, Gunn Diode oscillators, Avalanche effect, IMPATT & TRAPATT diodes, PIN diodes and their applications, Schottky barrier and backward diodes.

Module 4: (10 hours)

Microwave Measurements: VSWR measurement, microwave power measurement, impedance measurement, frequency measurement, measurement of scattering parameters Return loss measurement using directional couplres-introduction to vector network analyzer and its uses.

Module 5: (10 hours)

Planar Transmission Lines: Planer transmission lines such as stripline, microstrip line, slotline and coplanar waveguides. Characteristics of planar transmission lines. Losses in Microstrip Lines- Quality Factor Q of Microstrip Lines- Substrate materials.

Introduction to MIC's:-Technology of hybrid MICs, monolithis MICs. Comparison of both MICs.

Reference Books:

1. Liao S.Y."Microwave devices and Circuits", Prentice Hall Of India, New Delhi, 3rd Ed. 2006
2. Rizzi P.A,"Microwave Engineering,Passive Circuits" Prentice Hall of India
3. Pozar D.M .," Microwave Engineering", John Wiley
4. Annapurna Das and Sisir Das, "Microwave Engineering", Tata-McGraw Hill , New Delhi, 2008.
5. R.E. Collin : Foundations for Microwave Engg- – IEEE Press Second Edition.

EC010 704 ELECTRONIC INSTRUMENTATION

Teaching Schemes **Credits: 3**
2 hours lecture and 1 hour tutorial per week.

Objective: To cater the needs of students who want a comprehensive study of the electronic measurements, technology and instruments.

Module **1(12 hrs)**

Objectives of engineering measurement-Basic measuring system-block diagram and description-Performance characteristics of instruments-Static and Dynamic. Errors in measurement – error analysis. Units-Dimensions – Standards. Instrument calibration.

Module 2 (13 hrs)

Transducers-parameters of electrical transducers-types-active and passive-analogue and digital types of transducers. Electromechanical type-potentiometric, inductive, thermocouple, capacitive, resistive, piezo electric, strain gauge, ionization gauge,LVDT,hall effect sensor,thin film sensor, proximity sensor, displacement sensor, load cell, nano sensors and Ultrasonic transducers. Opto electrical type-photo emissive, photo conductive and photo voltaic type. Digital encoders- optical encoder-selection criteria for transducers.

Module 3 (13 hrs)

Intermediate elements- instrumentation amplifier, isolation amplifier, opto-couplers. DC and AC bridges- Wheatstone bridge - guarded Wheatstone bridge - Owen's bridge - Shering Bridge - Wein Bridge - Wagner ground connection. Data transmission elements-block diagram of telemetry system-Electrical telemetering system--voltage, current and position type-RF telemetery-pulse telemetery (analog and digital).FDM-TDM.

Module 4 (12 hrs)

End devices –Digital voltmeter and ammeter. Recording techniques-strip chart recorders-XT and XY recorders. Basic principles of digital recording. Basic principles of Signal Analyzers-Distortion analyzer, wave analyzer, spectrum analyzer, DSO. Control system-electronic control-analog-digital-Basic principles of PLC. Basic principles of data acquisition system.

Module 5(10 hrs)

Basic measurements – Resistance, Capacitance, Inductance, Voltage, Current, Power, Strain, Pressure, Flow, Temperature, Force, Torque, mass, conductivity, PH.

References:

1. Doeblin, “Measurement Systems”, MCGraw Hill.
2. H S Kalsi, “Electronic Instrumentation”, Tata McGraw Hill
3. W D Cooper, “Modern Electronic Instrumentation and Measurement techniques”, Prentice Hall of India
4. Morris, “Principles of Measurement & Instrumentation”, Prentice Hall of India
5. D.U. S Murthy, “Transducers & Instrumentation”, Prentice Hall of India.
6. David A Bell, “Electronic Instrumentation and Measurements”, Oxford
7. Rangan, Sarma & Mani, “Instrumentation-devices and systems”, Tata McGraw Hill.

EC010 705 EMBEDDED SYSTEMS

Teaching Schemes **Credits: 3**
2 hours lecture and 1 hour tutorial per week.

Objectives

- *To introduce students to the embedded systems, its hardware and software.*
- *To introduce devices and buses used for embedded networking.*
- *To explain programming concepts and embedded programming in C.*
- *To explain real time operating systems.*

Module I (9hrs)
Introduction to Embedded System**,** Definition and Classification, Requirements of Embedded Systems, Applications of Embedded Systems in Consumer Electronics, Control System, Biomedical Systems, Handheld computers, Communication devices, Embedded Systems on a Chip (SoC).

Module II (9 hrs)
Embedded Hardware & Software Development Environment, Hardware Architecture, Embedded System Development Process, Embedded C compiler, advantages, code optimization, Programming in assembly language vs. High Level Language, C Program Elements, Macros and functions, Interfacing programs using C language.

Module III (9 hrs)
Embedded Communication System: Serial Communication, PC to PC Communication, Serial communication with the 8051 Family of Micro-controllers, I/O Devices - Device Types and Examples , synchronous and Asynchronous Communications from Serial Devices - Examples of Internal Serial-Communication Devices - UART and HDLC - Parallel Port Devices - Sophisticated interfacing features in Devices/Ports- Timer and Counting Devices - 1^{2}C, USB, CAN and advanced I/O Serial high speed buses- ISA, PCI, PCI-X, and advanced buses. Voice-over-IP, Embedded Applications over Mobile Network.

Module IV (9 hrs)
Matrix key board interface - AT keyboard – commands – keyboard response codes - watch dog timers - DS1232 watch dog timer – real time clocks – DS1302 RTC – interfacing - measurement of frequency - phase angle - power factor – stepper motor interface - dc motor speed control – L293 motor driver - design of a position control system - Interfacing with Displays, D/A and A/D Conversions, interfacing programs using C

Module V (9 hrs)
Definitions of process, tasks and threads – Clear cut distinction between functions – ISRs and tasks by their characteristics – Operating System Services- Goals – Structures- Kernel - Process Management – Memory Management – Device Management – File System Organisation and Implementation – I/O Subsystems – Interrupt Routines Handling in RTOS, REAL TIME OPERATING SYSTEMS : Introduction to Real – Time Operating Systems: Tasks and Task States, Tasks and Data, Semaphores, and Shared Data; Message Queues, Mailboxes and Pipes, Timer Functions, Events, Memory Management, Interrupt Routines in an RTOS Environment

Reference Books

1. Rajkamal, “Embedded Systems Architecture, Programming and Design”, Tata McGraw-Hill
2. Steve Heath, “Embedded Systems Design”, Newnes.
3. David E.Simon, “An Embedded Software Primer”, Pearson Education Asia.
4. Wayne Wolf, “Computers as Components; Principles of Embedded Computing System Design” Harcourt India, Morgan Kaufman Publishers.
5. Frank Vahid and Tony Givargis, “Embedded Systems Design – A unified Hardware /Software Introduction” , John Wiley
6. Kenneth J.Ayala, “The 8051 Microcontroller”, Thomson.
7. Labrosse, “Embedding system building blocks”, CMP publishers.
8. Ajay V Deshmukhi, “Micro Controllers”, Tata McHraw-Hill.

EC010 706L01 OPTIMIZATION TECHNIQUES

Teaching Schemes **Credits: 4**

2 hours lecture and 1 hour tutorial per week.

Objectives:

Understand the need and origin of the optimization methods. Get a broad picture of the various applications of optimization methods used in engineering. Define an optimization problem and its various components.

Module I (12 hrs)

One Dimensional Unconstrained Minimization techniques, single variable minimization, unimodality, bracketing the minimum, necessary and sufficient conditions for optimality, convexity, steepest descent method.

Module II (12hrs)

Linear programming, introduction, linear programming problem, linear programming problems involving LE (≤) constraints, simplex method, optimality conditions, artificial starting solutions, the M method.

Module III (12hrs)

Transportation models, definition, non traditional models, transportation algorithm, East West corner method, Vogel approximation method. Assignment model, Introduction, Hungarian method.

Module IV (12hrs)

Forecasting Models, moving average technique, regression method, exponential smoothing. Game Theory, two persons zero sum games, mixed strategy games-graphical method.

Module V (12hrs)

Queuing models, elements of queuing model, pure birth and death model, specialized Poisson queues, single server models. Multiple server models, self service model.

References:

1. Ashok D Belegundu, Tirupathi R Chandrupatla, “Optimization concepts and Application in Engineering”, Pearson Education.
2. Kalynamoy Deb, “Optimization for Engineering Design, Alogorithms and Examples”, Prentice Hall,
3. Hamdy A Taha, “Operations Research – An introduction”, Pearson Education,
4. Hillier / Lieberman, “Introduction to Operations Research”, Tata McGraw Hill Publishing company Ltd,
5. Singiresu S Rao, “Engineering optimization Theory and Practice”, New Age International,
6. Mik Misniewski, “Quantitative Methods for Decision makers”, MacMillian Press Ltd.,

EC010 706L02 – SPEECH AND AUDIO PROCESSING

Teaching Schemes **Credits: 4**
2 hours lecture and 2 hours tutorial per week

Objectives

- *To study the theory and applications of speech processing, to study the success and limitation of different methods in speech processing.*

Module 1 (12hrs)
Production and Classification of Speech Sounds: Brief anatomy and physiology of speech production – categorisation of speech sounds – vowels, nasals, fricatives and plosives – prosody – **Analysis and Synthesis of Pole -zero speech models :** time dependent processing – all pole modelling of deterministic signals – formulation – error minimisation - autocorrelation method – the Levinson recursion – linear prediction analysis of stochastic speech sounds - formulation – error minimisation – autocorrelation method – pole-zero estimation – linearization – application to speech.

Module 2 (12 hrs)
Homomorphic signal processing: Concept – Homomorphic systems for convolution **– Short Time Fourier Transform Analysis and Synthesis:** introduction – short time analysis – Fourier transform view – filtering view – time-frequency resolution tradeoffs – short time synthesis – formulation – FBS method – OLA method – time-frequency sampling – STFT magnitude – time scale modification and enhancement of speech – time scale modification – noise reduction.

Module 3 (10 hrs)
Filter-Bank Analysis/Synthesis: Introduction – FBS method – phase vocoder – constant-Q analysis/synthesis –wavelet transform – DWT – applications – **Sinusoidal Analysis/Synthesis:** sinusoidal speech model – estimation of sinewave parameters – voiced speech- unvoiced speech – analysis systems – synthesis.

Module 4 (14hrs)
Frequency-Domain Pitch Estimation: Introduction – correlation based pitch estimator – pitch estimation based on comb filter – **Speech coding:** Introduction – statistical models – scalar quantization – fundamentals – quantization noise – companding – adaptive quantization - differential and residual quantization – vector quantization – approach – VQ distortion measure – use of VQ in speech transmission - frequency-domain coding – subband coding – sinusoidal coding – model-based coding – basic linear prediction coder – VQ LPC coder.

Module 5(12 hrs)
Speech Enhancement : Intoduction - problem formulation – spectral subtraction – Wiener filtering - basic approaches to estimating the object spectrum – **Speaker Recognition:** Introduction – spectral features for speaker recognition – formulation – mel-cepstrum – sub-cepstrum – speaker recognition algorithms – minimum distance classifer – vector quantization - GMM.

References:

1. Thomas F. Quatieri, “Discrete-Time Speech Signal Processing”, Pearson Education.
2. L R Rabiner, R W Schafer, “Digital Processing of Speech Signals”, Pearson Education.
3. J R Deller, J H L Hansen, J G Proakis, “Discrete-time Processing of Speech Signals”, IEEE

EC010 706L03 DIGITAL IMAGE PROCESSING

Teaching Schemes **Credits : 4**
2 hours lecture and 2 hour tutorial per week.

OBJECTIVES
- *To study the image fundamentals and mathematical transforms necessary for image processing.*
- *To study the image enhancement techniques*
- *To study image restoration procedures.*
- *To study the image compression procedures.*
- *To study the image segmentation and representation techniques.*

Module 1 (12 hrs)

Introduction to Image Processing:-2D sampling, quantization, resolution, brightness, contrast, Machband effect, classification of digital images, image processing system, image file formats.

Module 2 (16 hrs)
2D transforms: 2D signals, 2D systems, 2D transforms -convolution, Z transform, correlation, DFT, its properties, Walsh transform, Hadamard transform, Haar transform, Slant transform, DCT, KL transform and Singular Value Decomposition.

Module 3 (10hrs)
Image enhancement in spatial line, enhancement through point operation, types of point operators, histogram manipulation, linear gray level transformation, local and neighbourhood operation, median filter, Image sharpening, image enhancement in frequency domain, homomorphic filter.

Module 4 (10 hrs)
Classification of Image segmentation techniques, region approach, clustering techniques, segmentation based on thresholding, edge based segmentation, classification of edges, edge detection, hough transform, active contour.

Module 5 (12 hrs)
Image compression: need for compression, redundancy, classification of image compression schemes, Huffman coding, arithmetic coding, dictionary based compression, transform based compression, image compression standards, vector quantization, wavelet based image compression

Reference

1. S Jayaraman, S Esakkirajan, “Digital image processing” Tata Mc Graw Hill.
2. Rafael C Gonzalez, R Woods, “Digital image processing” Pearson Education.
3. Kenneth R Castleman, “Digital image processing”. Pearson Education.
4. Anil K Jain, “Fundamentals of Digital image processing” Prentice Hall of India.
5. J Lim, “2 dimensional signal and image processing” Pearson Education

6. Tamal Bose, “Digital signal and image processing”, John Wiley & sons.
7. W K Pratt, “Digital image processing” John Wiley.

EC010 706L04 – WAVELETS AND APPLICATIONS

Teaching Schemes **Credits: 4**

2 hours lecture and 2 hours tutorial per week.

Objective: To study the theory and applications of multirate DSP, filter banks and wavelets

Module 1(14 hrs)

Multirate Digital Signal Processing – Basic sampling rate alteration devices- Sampling rate reduction by an integer factor: Down sampler - Time and frequency domain characterization of downsampler – Anti-aliasing filter and decimation system – Sampling rate increase by an integer factor: Upsampler –Time and frequency domain characterization of upsampler – Anti-imaging filter and interpolation system – Gain of anti-imaging filter – Changing the sampling rate by rational factors – Transposition theorem- Multirate identities - Direct and Transposed FIR structures for interpolation and decimation filters – The Polyphase decomposition - Polyphase implementation of decimation and interpolation filters – Commutator models - Multistage implementation of sampling rate conversion – Filter requirements for multistage designs – Overall and individual filter requirements.

Module 2 (10 hrs)

Two channel analysis and synthesis filter banks- QMF filter banks – Two channel SBC filter banks – Standard QMF banks – Optimal FIR QMF banks – Filter banks with PR – Conditions for PR – Conjugate Quadrature filters – Valid Half-band filters –Transmultiplexer filter banks – Uniform M channel filter banks – Tree structured filter banks.

Module 3 (12 hrs)

Short time Fourier Transform – Filtering interpretation of STFT – Filter bank implementation - Time frequency resolution tradeoff –Sampling of STFT in time and frequency - Motivation for Wavelet transform - The Continuous Wavelet Transform - scaling - shifting – Filtering view – Inverse CWT – Discrete Wavelet transform – dyadic sampling – Filter bank implementation – Inverse DWT.

Module 4 (12 hrs)

Multiresolution formulation of Wavelet systems – Scaling function and wavelet function – dilation equation –Filter banks and the DWT - Analysis – from fine scale to coarse scale – Analysis tree – Synthesis – from coarse scale to fine scale – Synthesis tree - Input coefficients – Lattices and lifting.

Module 5 (12 hrs)

Wavelet based signal processing and applications: Wavelet packets – Wavelet packet algorithms – Thresholding – Interference suppression – Signal and image compression – Application to communication – OFDM multicarrier communication, Wavelet packet based MCCS.

References

1. R E Crochiere, L E Rabiner, “Multirate Digital Signal Processing”, Prentice Hall
2. P PVaidyanathan, “Multirate Systems and Filter Banks”, Pearson
3. N J Fliege, “Multirate Digital Signal Processing”, Wiley
4. S K Mitra, “Digital Signal Processing: A computer based approach”, Tata Mc.Graw Hill
5. A V Oppenheim, R W Shaffer, “Discrete time Signal Processing”, Pearson
6. C S Burrus, R A Gopinath, H Guo, “Introduction to Wavelets and Wavelet Transforms”, Aprimer, Prentice Hall
7. J C Goswami, A K Chan, “Fundamentals of Wavelets: Theory, Algorithms and Applications”, Wiley.
8. G Strang and T Q Nguyen, “Filter banks and Wavelets”, Wellesly Cambridge press.

EC010 706 L05 ANTENNA THEORY AND DESIGN

Teaching Schemes **Credit : 4**
2 hours lecture and 2 hour tutorial per week.

Objectives

- *To impart the concepts different types of antennas and antenna-arrays-analysis & synthesis*
- . *To develop understanding about design and modeling of antenna using computational methods.*

Pre-requisites: EC010 603 Radiation & Propagation

Module 1: (10 hrs)

Antenna Fundamentals: Radiation mechanism – over view, Electromagnetic Fundamentals, Solution of Maxwell's Equations for Radiation Problems, Ideal Dipole, Radiation Patterns, Directivity and Gain, Antenna Impedance, Radiation Efficiency. Antenna Polarization.

Module 2: (10 hrs)
Antenna Arrays: Array factor for linear arrays, uniformly excited, equally spaced Linear arrays, pattern multiplication, directivity of linear arrays, non uniformly excited -equally spaced linear arrays, Mutual coupling, multidimensional arrays, phased arrays, feeding techniques, perspective on arrays.

Module 3: (15 hrs)
Types of Antennas: Traveling - wave antennas, Helical antennas, Biconical antennas, sleave antennas, and Principles of frequency independent Antennas, spiral antennas, and Log - Periodic Antennas. Aperture Antennas- Techniques for evaluating Gain, reflector antennas - Parabolic reflector antenna principles, Axi - symmetric parabolic reflector antenna, offset parabolic reflectors, dual reflector antennas, Gain calculations for reflector antennas, feed antennas for reflectors, field representations, matching the feed to the reflector, general feed model, feed antennas used in practice. Microstrip Antennas-Introduction, rectangular patch, circular patch, bandwidth, coupling, circular polarization, arrays and feed network.

Module 4: (15 hrs)
Antenna Synthesis: Formulation of the synthesis problem, synthesis principles, line sources shaped beam synthesis, linear array shaped beam synthesis — Fourier Series, Woodward — Lawson sampling method, comparison of shaped beam synthesis methods, low side lobe narrow main beam synthesis methods Dolph Chebyshev linear array, Taylor line source method.

Module 5: (10 hrs)
Computational Electromagnetic for Antennas: Introduction to computational electromagnetics, Introduction to method of moments-Pocklington's integral equation, source modeling, weighted residuals. Introduction to Finite Difference Time Domain Method- Finite difference and Yee's algorithm, cell size, numerical stability and dispersion. Absorbing boundary conditions.

References:

1. Warren L Stutzman and Gary A Thiele, "Antenna Theory and Design", 2nd Edition, John Wiley and Sons Inc. 1998.
2. Constantine. A. Balanis: "Antenna Theory- Analysis and Design", Wiley India, 2nd Edition,2008
3. Kraus, "Antennas", Tata McGraw Hill, NewDelhi, 3rd Edition, 2003
4. R.E.Collin, "Antennas and Microwave propagation", Tata Mc-Graw Hill,2004
5. R.C.Johnson and H.Jasik, "Antenna Engineering hand book", Mc-Graw Hill,1984
6. I.J.Bhal and P.Bhartia, "Micro-strip Antennas, Design Handbook", Artech house,1980

EC 010 706L06 SYSTEM SOFTWARE

Teaching Schemes **Credits: 4**

2 hours lecture and 2 hours tutorial per week.

Objectives:

- *To introduce the students about the Operating systems and the processes*

Module I (12 hrs)

System Software - Language processors: Introduction, Language processing activities, fundamentals of Language processing, fundamentals of Language specifications.
Assemblers: Elements of assembly language programming, A simple assembly scheme, Pass structure of assemblers. Macros and Macro pre processors: Macro definition and call, Macro expansion, Nested macrocalls

Module II (12 hrs)

Compilers and Interpreters: Interpreters: Phases of compilation, scanning, parsing, Intermediate codes, optimization. Memory allocation, Linkers and Loaders: Relocation and linking concepts. Software tools: Software tools for program development, Language processor development tools.

Module III (12 hrs)
Operating systems - Evolution of OS systems. Operating systems structures
Process Management:
Processes: Process definition, Process control, Interacting Processes, Implementation of interacting Processes, Threads. Scheduling: Scheduling policies, Job Scheduling, Process Scheduling. Deadlocks: Definitions, Handling Deadlocks, Deadlock detection and resolution, Deadlock avoidance. Process synchronization, Implementing control, synchronization , critical sections, Semaphores.

Module IV (12 hrs)

Memory management& Information Management: Memory allocation preliminaries, Contiguous Memory allocation, noncontiguous Memory allocation, Virtual memory using paging, Virtual memory using segmentation. Over view of file processing, files and file operations, fundamentals of file organizations and access methods, Directories, file protections, File processing file system reliability. Implementation of file operations.

Module V(12 hrs)

Protection and security : Encryption of data, Protection and security mechanisms. Distributed operating systems: Definition and examples, Design issues of Distributed operating systems , Networking issues ,Communication protocols, Resource allocation.

References

1. D M Dhamdhere, “System programming and Operating systems 2nd revised edition”, Tata McGraw-Hill
2. Milan Milenkovic, “Operating Systems”, 2nd edition, Tata McGraw-Hill.
3. John J Donovan, “System Programming”, 2nd edition, Tata McGraw-Hill.
4. Leland L Beck, “System Software: An Introduction to System Programming”, 3rd edition, Pearson Education.

EC010 707 ADVANCED COMMINCATION LAB

Teaching Schemes **Credits : 2**
3 hour practical per week

List of Experiments

1. Delta Modulation & Demodulation.
2. Sigma delta modulation.
3. PCM (using Op-amp and DAC).
4. BASK (using analog switch) and demodulator.
5. BPSK (using analog switch).
6. BFSK (using analog switch).
7. Error checking and correcting codes.
8. 4 Channel digital multiplexing (using PRBS signal and digital multiplexer).
9. Microwave experiments (Experiments based on subject EC010 703)

MATLAB or LABview Experiments:

1. Mean Square Error estimation of a signals.
2. Huffman coding and decoding.
3. Implementation of LMS algorithm.
4. Time delay estimation using correlation function.
5. Comparison of effect in a dispersive channel for BPSK, QPSK and MSK.
6. Study of eye diagram of PAM transmission system.
7. Generation of QAM signal and constellation graph.
8. DTMF encoder/decoder using simulink.
9. Phase shift method of SSB generation using Simulink.
10. Post Detection SNR estimation in Additive white Gaussian environment using Simulink.

EC010 708 SIGNAL PROCESSING LAB

Teaching Schemes **Credits : 2**
3 hour practical per week

List of Experiments

Experiments based on MATLAB

1. Generation of Waveforms (Continuous and Discrete)

2. Verification of Sampling Theorem.

3. Time and Frequency Response of LTI systems.

4. Implement Linear Convolution of two sequences.

5. Implement Circular convolution of two sequences.

6. To find the DFT and IDFT for the given input sequence.

7. To find the DCT and IDCT for the given input sequence.

8. To find FFT and IFFT for the given input sequence.

9. FIR and IIR filter design using Filter Design Toolbox.

10. FIR Filter Design (Window method).

11. IIR Filter Design (Butterworth and Chebychev).

Mini Project based on digital signal processing or control systems or communication applications.

EC 010 709 Seminar

Teaching scheme **credits: 2**

2 hours practical per week

The seminar power point presentation shall be fundamentals oriented and advanced topics in the appropriate branch of engineering with references of minimum seven latest international journal papers having high impact factor.

Each presentation is to be planned for duration of 25 minutes including a question answer session of five to ten minutes.

The student's internal marks for seminar will be out of 50. The marks will be awarded based on the presentation of the seminar by the students before an evaluation committee consists of a minimum of 4 faculty members. Apportioning of the marks towards various aspects of seminar (extent of literature survey, presentation skill, communication skill, etc.) may be decided by the seminar evaluation committee.

A bona fide report on seminar shall be submitted at the end of the semester. This report shall include, in addition to the presentation materials, all relevant supplementary materials along with detailed answers to all the questions asked/clarifications sought during presentation. All references must be given toward the end of the report. The seminar report should also be submitted for the viva-voce examination at the end of eighth semester.

For Seminar, the minimum for a pass shall be 50% of the total marks assigned to the seminar.

EC 010 710 Project Work

Teaching scheme **credits: 1**

1 hour practical per week

Project work, in general, means design and development of a system with clearly specified objectives. The project is intended to be a challenge to intellectual and innovative abilities and to give students the opportunity to synthesize and apply the knowledge and analytical skills learned in the different disciplines.

The project shall be a prototype; backed by analysis and simulation etc. No project can be deemed to be complete without having an assessment of the extent to which the objectives are met. This is to be done through proper test and evaluation, in the case of developmental work, or through proper reviews in the case of experimental investigations.

- The project work has to be started in the seventh semester and to be continued on to eighth semester.
- Project work is to be done by student groups. Maximum of four students only are permitted in any one group.
- Projects are expected to be proposed by the students. They may also be proposed by faculty member (Guide) or jointly by student and faculty member.
- Students are expected to finalise project themes/titles with the assistance of an identified faculty member as project guide during the first week of the seventh semester.

The progress from concept to final implementation and testing, through problem definition and the selection of alternative solutions is monitored. Students build self confidence, demonstrate independence, and develop professionalism by successfully completing the project.

Each student shall maintain a project work book. At the beginning of the project, students are required to submit a project plan in the project book. The plan should not exceed 600 words but should cover the following matters.

❖ Relevance of the project proposed
❖ Literature survey
❖ Objectives
❖ Statement of how the objectives are to be tackled

- Time schedule
- Cost estimate

These proposals are to be screened by the evaluation committee (EC- minimum of 3 faculty members including the guide) constituted by the head of department, which will include a Chairman and the EC will evaluates the suitability and feasibility of the project proposal. The EC can accept, accept with modification, request a resubmission, or reject a project proposal.

Every activity done as part of project work is to be recorded in the project book, as and when it is done. Project guide shall go through these records periodically, and give suggestions/comments in writing in the same book.

The students have to submit an interim report, along with project work book showing details of the work carried out by him/her and a power point presentation at the end of the 7th semester to EC. The EC can accept, accept with modification, request a resubmission, or extension of the project.

The student's internal marks for project will be out of 50, in which 30 marks will be based on day to day performance assessed by the guide. Balance 20 marks will be awarded based on the presentation of the project by the students before an evaluation committee consists of a minimum of 3 faculty members including the guide.

For Project, the minimum for a pass shall be 50% of the total marks assigned to the Project work.

EC010 801 WIRELESS COMMUNICATION

Teaching Schemes **Credits: 4**
2 hours lecture and 2 hours tutorial per week.

Objective: To give the students an idea about the cellular communication theory and technology.

Module 1 (12 hrs)
Cellular concept-frequency reuse, channel assignment, hand off, interference, trunking and grade of service, cell splitting, sectoring, microcell concept.

Module 2 (12 hrs)
Introduction to radio wave propagation-free space propagation model, round reflection (2-ray) model, impulse response model of a multipath channel, parameters o mobile multipath channels, type of small scale fading, fading effect due to multipath time delay spread and Doppler spread, diversity technique for mobile wireless radio system.

Module 3 (12 hrs)
Multiple access technique for wireless communication-FDMA, TDMA, spread spectrum multiple access-FHMA, CDMA, hybrid spread spectrum technique-space division multiple access- packet radio.

Module 4 (12 hrs)
GSM-GSM network architecture, GSM channel type, frame structure for GSM,(signal processing in GSM-speech coding, channel coding, interleaving, ciphering, burst formatting, modulation, frequency hopping, demodulation) authentication and security in GSM, GSM call procedures, GSM hand off procedures.

Module 5 (12 hrs)
CDMA digital cellular standards- Introduction, frequency and channel specification, forward and reverse CDMA channel, CDMA call processing, soft hand off, performance of a CDMA system, comparison of CDMA with GSM, digital cellular standards- DECT, PDC, PHS

References:

1. Andrea Goldsmith, “Wireless Communications”, Cambridge University Press, 2005.
2. Simon Haykin & Michael Moher, “Modern Wireless Communications”, Person Education, 2007.
3. T. S. Rappaport, “Wireless Communication, Principles & Practice”, Dorling Kindersley (India) Pvt. Ltd., 2009.
4. G. L. Stuber, “Principles of Mobile Communications”, 2nd Edition, Springer Verlag. 2007.
5. Kamilo Feher, 'Wireless Digital Communication', Dorling Kindersley (India) Pvt. Ltd., 2006.

6. R. L. Peterson, R. E. Ziemer & David E. Borth, “Introduction to Spread Spectrum Communication”, Prentice Hall, 1995.
7. A. J. Viterbi, “CDMA- Principles of Spread Spectrum”, Prentice Hall, 1995.

EC010 802 COMMUNICATION NETWORK

Teaching Schemes **Credits:4**
2 hours lecture and 2 hours tutorial per week

Objectives:

- *To impart a basic knowledge on networking techniques.*
- *To provide a strong foundation to students about the internet protocols and network security.*

Module 1 (12 hrs)
Network services and layered architecture.Network topology, Switching: basics of message switching, packet switching, circuit switching and cell switching. :Layering architecture, the OSI reference model, Layers, protocols and services, overview of TCP/IP architecture, TCP/IP protocol.

Module2 (12 hrs)
Multiple access communications, local area networks (LAN) structure, the medium access control sub layer, the logical link control layer, random access, ALOHA, slotted ALOHA, CSMA, CSMA/CD, scheduling approaches to medium access control, reservation systems, polling, token passing rings, comparison of random access and scheduling. Medium access controls, IEEE 802.3 standards for 10Mbps and 1000 Mbps LANs, repeaters and hubs, LAN bridges, transparent bridges, source routing bridges, mixes media bridges, LAN switches.

Module 3 (12 hrs)
Internetworking: Inter network, datagram forwarding in IP, ARP, DHCP, ICMP, Virtual networks and Tunnels. Routing: Distance vector routing, Link state Routing. Routing for Mobile hosts. Global internet: Subnetting, CIDR, BGP. IPV4 and IPV6.

Module4 (12 hrs)
Asynchronous Transfer Mode (ATM):Addressing, signaling and routing. ATM header structure, ATM adaptation layer, management and control, Internetworking with ATM. Control of ATM networks.

Module 5 (12 hrs)
Network security: Symmetric and asymmetric key cryptography. Security services, Digital signature, IPsecurity(IPsec),SSL/TLS,PGP, Firewalls.

References:

1. Jean Walrand & Pravin Varaiya, “High Performance Communication Networks” , Elsevier
2. Behrouz.a. Forouzan, “Data Communication and Networking”, Tata McGraw Hill
3. Larry L. Peterson, Bruce S. Davie, “Computer networks”, 4^{th} edition, Elsevier
4. Andrew S Tanenbaum, “Computer Networks”, Pearson Education
5. William Stallings,”Data and computer communication”, Pearson Education

EC010 803 LIGHT WAVE COMMUNICATION

Teaching Schemes **Credits: 4**

2 hours lecture and 2 hours tutorial per week

Objectives

- *To understand the behaviour of light wave*
- *To know principle of light wave communication and the characteristics of optical devices.*

Module 1 (12hrs)

Recollection of basic principles of optics: ray theory- critical angle- total internal reflection - Optical wave guides - Propagation in fibre- expression for acceptance angle-numerical aperture- V number – modes, mode coupling - SI fibre and GI fibre - single mode fibers

Module 2 (12 hrs)

Transmission characteristics – Attenuation – absorption losses – scattering losses – bend losss –Dispersion- chromatic dispersion – intermodal dispersion –Optical fiber cables – cable design -- Optic fibre connections– fibre alignment and joint loss - splicing techniques- optical fibre connectors – fiber couplers

Module 3 (12 hrs)

Optical sources- LEDs – LED structures – LED characteristics –semiconductor injection LASER- LASER structures- LASER characteristics – Optical detectors - principles of photo detection –quantum efficiency, responsivity - PIN diode – APD – operating principles – source to fibre power launching – lens coupling to fiber.

Module 4 (12 hrs)

Optical amplifiers- Semiconductor optical amplifiers – Erbium doped fiber amplifiers-comparison between semiconductor and fiber amplifiers - wavelength conversion – Optical modulation – Mach Zender interferometer – MZ optical modulator – operating requirements.

Module 5 (12 hrs)

Optical networks – wavelength routing networks – wavelength switching networks – network protection and survivability - Optical fiber link design – long haul systems, power budget, time budget, maximum link length calculation.

References

1. John M Senior, “Optical fiber Communications Principles and Practice:”, Pearson Education
2. Djafer K Mynbaev, “Fibre optic communication technology:”, Pearson Education.
3. Franz and Jain , “Optical Communications Components and Systems”,: Narosa
4. Harold Kolimbiris, “Fiber Optics Communications”, Pearson Education
5. John Gower , “Optical communication system”, Prentice Hall of India
6. Sharma, “Fibre optics in telecommunication”, Mc Graw Hill
7. Subir Kumar Sarkar, “Optical fibre and fibre optic communication”, S Chand & co. Ltd

8. M Mukund Rao , “Optical communication”, Universities press.
9. Palais, “Fiber Optic Communication”, Pearson Education.
10. Black, “Optical Networks - 3rd Generation Transport systems”, Pearson Education.

EC010 804L01 NANO ELETCRONICS

Teaching Schemes **Credits: 4**

2 hours lecture and 2 hours tutorial per week.

Objectives

- *To introduce students to the nano electronics and the systems.*
- *To understand the basic principles of carbon nano tubes.*

Module I (12hrs)

Challenges going to sub-100 nm MOSFETs Oxide layer thickness, tunnelling, power density, non-uniform dopant concentration, threshold voltage scaling, lithography, hot electron effects, sub-threshold current, velocity saturation, interconnect issues, fundamental limits for MOS operation.

Module II (12 hrs)

Novel MOS-based devices Multiple gate MOSFETs, Silicon-on-insulator, Silicon-on-nothing, Fin FETs, vertical MOSFETs, strained Si devices.

Module III (12 hrs)

Quantum structures quantum wells, quantum wires and quantum dots, Single electron devices charge quantization, energy quantization, Coulomb blockade, Coulomb staircase, Bloch oscillations.

Module IV (12 hrs)

Hetero structure based devices Type I, II and III hetero junctions, Si-Ge hetero structure, hetero structures of III-V and II-VI compounds - resonant tunnelling devices.

Module V (12 hrs)

Carbon nanotubes based devices CNFET, characteristics; Spin-based devices spin FET, characteristics.

Reference Books:

1. Mircea Dragoman and Daniela Dragoman, “ Nano electronics Principles & devices”, Artech House Publishers, 2005.
2. Karl Goser, “Nanoelectronics and Nanosystems: From Transistors to Molecular and Quantum Devices”, Springer 2005.
3. Mark Lundstrom and Jing Guo, “Nanoscale Transistors: Device Physics Modelling and Simulation”, Springer, 2005.
4. Vladimir V Mitin, Viatcheslav A Kochelap and Michael A Stroscio, “Quantum hetero structures”, Cambridge University Press, 1999.
5. S M Sze (Ed), “ High speed semiconductor devices”, Wiley, 1990.

EC010 804L02MICRO ELECTRO MECHANICAL SYSTEMS

Teaching Schemes **Credits: 4**
2hours lecture and 2 hours tutorial per week

Objectives

- *To introduce students to the MEMS systems, its hardware.*
- *To introduce devices and their working principles..*

Module I (12hrs)
Overview of MEMS and Microsystems –Typical MEMS product – Evolution of Microfabrication – Multidisciplinary nature of MEMS – Applications.

Module II (12 hrs)
Working Principle of Microsystems – Microsensors – Microactuation – Microaccelerometers - Microfluidics

Module III (12 hrs)
Engineering Science for Microsystem Design - Atomic Structure of Matter – Ions – Molecular Theory – Intermolecular Force – Doping of Semiconductors – Diffusion Process – Electrochemistry – Quantum Physics – Materials for MEMS and Microsystems – Substrate and Wafer – Silicon as Substrate Material – Silicon compounds – Silicon Piezoresistors – Gallium Arsenide – Quartz – Piezoelectric Crystals – Polymers.

Module IV (12 hrs)
Micro system Fabrication Process – Photolithography – Ion implantation – Diffusion – Oxidation – Chemical Vapour Deposition – Physical Vapour Depostion – Deposition of Epitaxy - Etching

Module V (12 hrs)
Overview of Micromanufacturing – Bulk Micromanufacturing – Surface Micromachining – The LIGA Process.

Reference Books:

1. Tai-Ran Hsu , “MEMS & Microsystems Design and Manufacture”, Mc Graw Hill.
2. Nitaigur Premchand Mahalik , “MEMS”, Tata Mc Graw Hill
3. James D. Plummer, Michael D.Deal, Peter B. Griffin, “Silicon VLSI Technology’, Pearson Education.

EC010 804L03 SECURE COMMUNICATION

Teaching Schemes **Credits: 4**
2 hours lecture and 2 hours tutorial per week.

Objective: To impart the students about the theory and technology behind the secure communication..

MODULE 1 (12 hrs)
Modular arithmetic : Groups, Ring, Fields. The Euclidean algorithm-Finite fields of the form GF(p). Polynomial arithmetic: Finite fields of the form GF(2^n).

MODULE 2 (12 hrs)
Introduction, security attacks-security services- Symmetric Ciphers-Symmetric Cipher Model-Substitution Techniques-Caesar Cipher-Mono alphabetic Cipher-Play fair cipher-Hill cipher-Poly alphabetic Cipher – one time pad.

MODULE 3 (12 hrs)
Transposition techniques- Block Ciphers.
Data encryption Standards- DES Encryption-DES decryption-Differential and Linear Crypt analysis Advanced Encryption standard- The AES Cipher- substitute bytes transformation-Shift row transformation-Mix Column transformation.

MODULE 4 (12 hrs)
Public key cryptosystem- Application for Public key cryptosystem- Requirements-RSA algorithm. Key management-Distribution of public key, public key certificates ,Distribution of secret keys.

MODULE 5 (12 hrs)
Intruders: Intrusion techniques, Intrusion detection, Statistical anomaly detection, Rule based intrusion detection, Distributed intrusion detection, Honey pot, Intrusion detection exchange format.
Password management: Password protection, password selection strategies.

Reference:

1. William Stallings, “Cryptography and Network Security” ,4th Edition, Pearson Education ,2009
2. Ferouzen,’ Cryptography and network security”, Tat Mc GrawHill
3. Tyagi and Yadav ,” Cryptography and network security”, Dhanpatrai
4. Douglas A. Stinson, “Cryptography, Theory and Practice”, 2nd Edition, Chapman & Hall, CRC Press Company, Washington, 2005.
5. Lawrence C. Washington, “Elliptic Curves: Theory and Cryptography”, Chapman & Hall, CRC Press Company, Washington, 2008.
6. David S. Dummit & Richard M Foote, “Abstract Algebra”, 2nd Edition, Wiley India Pvt. Ltd., 2008.

EC010 804L04 MANAGEMENT INFORMATION SYSTEMS

Teaching Schemes **Credits :4**
2hours lecture and 2 hours tutorial per week.

Objectives:

Describe the various types of information systems by breadth of support. Identify the major information systems that support each organizational level. Describe how information resources are managed, and discuss the roles of the information systems

Module I (12hrs)
Information systems, dimensions of information systems, approaches to information systems, information processing systems, characteristics, types, impacts and applications, moral dimensions of information systems, information rights, property rights

Module II (12 hrs)
Information Technology infrastructure, levels, infrastructure components, competitive model for information technology infrastructure, types of information system controls, risk assessment, security, auditing

Module II (12hrs)
Enterprise systems, architecture, process, supply chain management systems, push verses pull based supply chain management, internet driven enterprise integration.

Module IV (12hrs)
Knowledge management systems, dimensions, organizational learning, knowledge management value chain, types of knowledge management systems, enterprise wide KMS, structured KMS, semi structured KMS, knowledge network, knowledge work systems, intelligent techniques, expert systems, fuzzy logic, neural networks, genetic algorithms

Module V (12hrs)
Decision support systems, decision making, systems and technologies in decision making and business intelligence, decision making levels, types of decisions, stages in decision making process, difference between MIS and DSS, types of DSS, components of DSS, group decision making systems, Executive support systems

Reference:

1. Kenneth C. Laudon and Jane Price Laudon, “Management Information systems Managing the digital firm”, Pearson Education Asia.
2. James AN O’ Brein, “Management Information Systems”, Tata McGraw Hill, New Delhi,
3. Gordon B.Davis, “Management Information system: Conceptual Foundation, Structure and Development”, McGraw Hill,
4. Joyce J. Elam, “Case series for Management Information System Silmon and Schuster”, Custom Publishing.

5. Steven Alter, “Information system – A Management Perspective” – Addison – Wesley,
6. Ralph M.Stair and George W.Reynolds “Principles of Information Systems – A Managerial Approach Learning”,

EC010 804 L05 : PATTERN RECOGNITION

Teaching Schemes **Credits:4**
2 hours lecture and 2 hours tutorial per week

Objectives:

- *To impart a basic knowledge on pattern recognition and to give a sound idea on the topics of parameter estimation and supervised learning, linear discriminant functions and syntactic approach to PR.*
- *To provide a strong foundation to students to understand and design pattern recognition systems.*

Module I (12 hrs)
Introduction: introduction to statistical, syntactic and descriptive approaches, features and feature extraction, learning and adaptation. Bayes Decision theory, introduction, continuous case, 2-categoryclassification, minimum error rate classification, classifiers. Discriminant functions and decision surfaces.

Module 2 (12 hrs)
Introuction- Maximum likelihood estimation - General principle,Gaussian case ; bias. Bayesian estimation – class conditioned density, parameterdistribution, Bayesian Parameter estimation – General Theory,Gibb's Algorithm – Comparison of Bayes Method with Maximum likelihood.

Module 3 (12 hrs)
Introduction,Density Estimation. Parzen Windows – Convergence of mean, variance,Kn – Nearest Neighbourestimation,Nearest neighbor rule,Converge error rate, error bound , partial distance.

Module 4 (12 hrs)
Linear discriminate functions and decision surfaces:-Introduction, training error, Threshold weight, discriminate function – two category case, multicategory case. Generalized discriminant function, Quadratic discriminant functions, Polynomial discriminant, PHI functions. Augmented vector.Two category linearly separable case: weight space, solution region, margin, learning rate ,algorithm(Gradient descent – newton)Relaxation procedures.

Module 5 (12 hrs)
Syntactic approach to PR : Introduction to pattern grammars and languages ,higher dimensional grammars, tree, graph, web, plex, and shape grammars, stochastic grammars , attribute grammars, Parsing techniques, grammatical inference.

Reference Books

1. R.O Duda, Hart P.E, "Pattern Classification And Scene Analysis", John Wiley
2. Gonzalez R.C. & Thomson M.G., "Syntactic Pattern Recognition - An Introduction", Addison
Wesley.
3. J. T. Tou and R. C. Gonzalez, "Pattern Recognition Principles", Wiley, 1974
4. Fu K.S., "Syntactic Pattern Recognition And Applications", Prentice Hall,

5. Rajjan Shinghal, “Pattern Recognition: Techniques and Applications”, Oxford University Press, 2008.

EC010 804L06: RF CIRCUITS

Teaching Schemes **Credit: 3**

2 hours theory and 1 hour tutorial per week.

Objectives

- *To give the basic ideas about the characteristics of components in Radio frequency*
- *To understand the working of various active devices and circuits in Radio frequency*

Module 1: (10 hrs)

Introduction, Components and systems : Wire – Resistors – Capacitors – Inductors – Toroids – Toroidal Inductor Design – Practical Winding Hints. Resonant Circuits: Some Definitions – Resonance (Lossless Components) – Loaded *Q* – Insertion Loss – Impedance Transformation – Coupling of Resonant Circuits.

Module 2: (15 hrs)

Filter Design: Background – Modern Filter Design – Normalization and the Low-Pass Prototype – Filter Types – Frequency and Impedance Scaling – High-Pass Filter Design – The Dual Network – Bandpass Filter Design –Bandpass Filter Design Procedure – Band-Rejection Filter Design – The Effects of Finite *Q*.

Module 3: (12 hrs)

Impedance Matching: Background – The L Network – Dealing With Complex Loads – Three-Element Matching – Low-*Q* or Wideband Matching Networks – The Smith Chart – Impedance Matching on the Smith Chart.

Module 4: (15 hrs)

Small-Signal and Large signal RF Amplifier Design: RF Transistor Materials – The Transistor Equivalent Circuit – Y Parameters – S Parameters. Transistor Biasing – Design Using Y Parameters – Design Using S Parameters. RF Power Transistor Characteristics – Transistor Biasing – RF Semiconductor Devices – Power Amplifier Design – Matching to Coaxial Feed lines.

Module 5: (8 hrs)

RF Front-End Design and RF Design Tools: Higher Levels of Integration, Basic Receiver Architectures, ADC'S Effect on Front-End Design, Software Defined Radios. Design Tool Basics – RFIC Design Flow – RFIC Design Flow, Modelling – PCB Design – Packaging.

References:

1. Christopher Bowick, John Blyler and Cheryl Aljuni , " RF Circuit Design", 2nd Edition, Elsevier ,2008.
2. Reinhold Ludwig & Powel Bretchko, "RF Circuit Design – Theory and Applications", 1st Ed., Pearson Education Ltd., 2004.
3. Davis W. Alan, "Radio Frequency Circuit Design", Wiley India, 2009.
4. Joseph J. Carr, "RF Components and Circuits", Newnes, 2002.
5. Mathew M. Radmanesh, "Advanced RF & Microwave Circuit Design-The Ultimate Guide to System Design", Pearson Education Asia, 2009.
6. David M. Pozzar , " Microwave Engineering", 3r Ed., Wiley India, 2007.
7. Ulrich L. Rohde & David P. NewKirk, "RF / Microwave Circuit Design", John Wiley & Sons, 2000.

EC010 805 G01 TEST ENGINEERING

Teaching Schemes **Credits : 4**

2 hrs lecture and 2 hrs tutorial per week

Objectives

1. *To provide an insight into multi-disciplinary approach to test engineering including test economics and management.*
2. *To understand practical, concise descriptions of the methods and technologies in modern mechanical, electronics and software testing.*
3. *To provide an insight into the developing interface between modern design analysis methods and testing practice.*
4. *To understand why products and systems fail, which testing methods are appropriate to each stage of the product life cycle and how testing can reduce failures.*
5. *To provide an overview of international testing regulations and standards.*

Module 1 (12 hrs)

Introduction: need for test, analysis and simulation, good and bad testing, test economics, managing the test programme

Stress, Strength and Failure of Materials: mechanical stress and fracture, temperature effects, wear corrosion, humidity and condensation, materials and component selection

Electrical and Electronics Stress, Strength and Failure: stress effects, component types and failure mechanisms, circuit and system aspects

Module 2 (12 hrs)

Variation and Reliability: variation in engineering, load-strength interference, time-dependent variation, multiple variations and statistical experiments, discrete variations, confidence and significance, reliability

Design Analysis: Quality Function Deployment, design analysis methods, analysis methods for reliability and safety, design analysis for processes, software for design analysis, limitations of design analysis, using analysis results for test planning

Module 3 (12 hrs)

Development Testing Principles: functional testing, testing for reliability and durability, testing for variation, process testing, ‘Beta’ testing

Materials and Systems Testing: materials, assemblies and systems, system aspects, data collection and analysis, standard test methods, test centres

Testing Electronics: circuit test principles, test equipment, test data acquisition, design for test, electronic component test, EMI / EMC testing

Module 4 (12 hrs)

Software: software in engineering systems, software errors, preventing errors, analysis of software system design, data reliability, managing software testing

Manufacturing Test: manufacturing test principles, manufacturing test economics, inspection and measurement, test methods, stress screening, electronics manufacturing test options and economics, testing electronic components, statistical process control and acceptance sampling

Testing in Service: in-service test economics, test schedules, mechanical and systems, electronic and electrical, sotaftware, reliability centred maintenance, stress screening of repaired items, calibration

Module 5 (12 hrs)

Data Collection and Analysis: FRACAS, acceptance sampling, probability and hazard plotting, time series analysis, software for data collection and analysis, reliability demonstration and growth measurement, sources of data

Laws, Regulations and Standards: safety and product liability, main regulatory agencies in USA, Europe and Asia, International standards, BIS, ISO standards, industry / technology standards

Management: organization and responsibilities, procedures for test, development test programme, project test plan, training and education for test, future of test.

References:

1. Patrick D. T. O'connor, "A Concise Guide to Cost-effective Design, Development and Manufacture", John Wiley & Sons, 2001
2. Patrick D. T. O'connor, "Practical Reliability Engineering", Wiley India, 2008
3. Naikan V. N. A., "Reliabilty Engineering and Life Testing", PHI Learning, 2008
4. Kapur K. C., Lamberson L. R., "Reliability in Engineering Design", Wiley India, 2009
5. Srinath L. S., "Reliability Engineering", East West Press, 2005

EC010 805G02 E-LEARNING

Teaching scheme **Credits : 4**
2 hrs lecture and 2 hrs tutorial per week

Objectives

1. *To understand the basic concepts of e-learning.*
2. *To understand the technology mediated communication in e-learning.*
3. *To learn the services that manage e-learning environment.*
4. *To know the teaching and learning processes in e-learning environment.*

Module 1 (12 hrs) – Introduction
Evolution of Education – Generations of Distance Educational Technology – Role of e-learning – Components of e-learning: CBT, WBT, Virtual Classroom – Barriers to e-learning

Roles and Responsibilities: Subject Matter Expert – Instructional Designer – Graphic Designer – Multimedia Author – Programmer – System Administrator – Web Master

Module 2 (12 hrs) – Technologies
Satellite Broadcasting – Interactive Television – Call Centres – Whiteboard Environment

Teleconferencing: Audio Conferencing – Video Conferencing – Computer Conferencing

Internet: e-mail, Instant Messaging, Chat, Discussion Forums, Bulletin Boards, Voice Mail, File Sharing, Streaming Audio and Video

Module 3 (12 hrs)– Management
Content: e-content, Dynamic Content, Trends – Technology: Authoring, Delivery, Collaboration – Services: Expert Service, Information Search Service, Knowledge Creation Service – Learning Objects and E-learning Standards

Process of e-learning: Knowledge acquisition and creation, Sharing of knowledge, Utilization of knowledge – Knowledge Management in e-learning

Module 4 (12hrs) – Teaching-Learning Process
Interactions: Teacher-Student – Student-Student – Student-Content – Teacher-Content – Teacher-Teacher – Content-Content

Role of Teachers in e-learning – Blended Learning – Cooperative Learning – Collaborative Learning – Multi Channel learning – Virtual University – Virtual Library

Module 5 (12 hrs) – Development Issues
Assessment in e-learning – Quality in e-learning – Tools for Development – Costs for Developing and Using E-learning Environments – Challenges and Careers – Future of e-learning

References:

1. Michael W. Allen, “Michael Allen’s Guide to E-learning”, John Wiley & Sons, 2003.
2. Michael W. Allen, “Successful E-learning Interface: Making Learning Technology Polite, Effective and Fun”, Pfeffer & Company, 2011.
3. Michael W. Allen, “Michael Allen’s 2012: E-learning Annual”, Pfeffer & Company, 2011.

4. Gourishankar Patnaik, “E-learning”, Vdm Verlag, 2010.
5. Gaurav Chadha & Nafay Kumail S. M., “E-Learning: An Expression of the Knowledge Economy”, Tata McGraw-Hill Publication, 2002.
6. Singh P. P. & Sandhir Sharma, “E-Learning: New Trends and Innovations”, Deep & Deep Publications, 2005.

EC010 805 G03 MECHATRONICS

Teaching Schemes **Credits: 4**

2 hours lecture and 2 hours tutorial per week

Objective: Mechatronics is a synergistic combination of Mechanical, Electrical and Computer Engineering and Information Technology, which includes control systems as well as numerical methods to design products. This subject shall lay the foundations of this multidisciplinary field of engineering.

Module 1 (12 hrs)

Introduction to Mechatronics: Mechatronics key elements, Mechatronics design process, approaches in Mechatronics Modeling and Simulation of Physical System Simulation and Block Diagrams, Analogies and Impedance Diagrams, Electrical Systems, Mechanical Translation systems, Mechanical rotational system, Electromechanical coupling, Fluid systems

Module 2 (12 hrs)

Sensors and Transducers: Introduction to Sensors and transducers, Sensors for motion and position Measurement, force, torque, and Tactile sensors, flow sensors, Temperature – sensing devices, Ultrasonic sensors, range sensors, active vibration control Using agnetostrictive transducers, Fiber optic devices in mechatronics.

Module 3 (12 hrs)

Actuating Devices- Direct current motor, permanent magnet stepper motor, fluid power actuation, Fluid power design elements, Piezoelectric Actuators. Hardware components for Mechatronics. Transducer signal conditioning and devices for data conversion, programmable Controllers.

Module 4 (12 hrs)

Signals, systems and controls: Introduction to signals, systems, and controls, system representation, Linearization of Nonlinear systems, time delays, measures of system Performance, root locus and bode plots. Real- Time Interfacing. Introduction, Elements of a Data Acquisition and Control system, overview of the I/O process, Installation of the I/O card and software, installation of the Application software, examples of interfacing

Module 5 (12 hrs)

Closed Loop controllers Continuous and discrete processes, control modes, two step mode, proportional mode, derivative control, integral control, PID controller, digital controllers, control system performance, controller tuning, velocity control and Adaptive control Advanced applications in mechatronics -Sensors for condition monitoring, Mechatronic control in automated Manufacturing, artificial intelligence in mechatronics, Fuzzy logic applications in Mechatronics, Micro sensors in mechatronics.

References:

1. Devdas Shetty and Richard.A.Kolk, “Mechatronics system design”, Thomson Asia Pte. Ltd. Second reprint, 2001

2. W.Bolton, “Mechatronics”, Pearson Education Asia, Third Indian Reprint 2001.
3. David G Alciatore and Michael.B.Histand, “Introduction to Mechatronics and Measurement systems”, Tata McGraw Hill, Second Edition, 2003.

EC010 805 G04 BIO INFORMATICS

Teaching Schemes **Credits: 4**

2 hours lecture and 2 hours tutorial per week.

Objective: To cater the needs of students who want a comprehensive study of the principle and techniques of bioinformatics..

Module 1 (12 hrs)

Nature and scope of life science, Various branches of life sciences, Organization of life at various levels, Overview of molecular biology, The cell as basic unit of life- Prokaryotic cell and Eukaryotic cell - Central Dogma: DNA-RNA-Protein, Introduction to DNA and Protein sequencing, Human Genome Project, SNP, **Bioinformatics databases**, - Nucleotide sequence databases, Primary nucleotide sequence databases-EMBL, GeneBank, DDBJ; Secondary nucleotide sequence databases Protein sequence databases- SwissProt. Protein Data Bank

Module 2 (12 hrs)

Basic concepts of sequence similarity, identity and homology, definitions of homologues, orthologues, paralogues. Scoring matrices- PAM and BLOSUM matrices, Pairwise sequence alignments: Needleman & Wuncsh, Smith & Waterman algorithms for pairwise alignments. BLAST and FASTA. Multiple sequence alignments (MSA)- CLUSTALW.

Module 3 (12 hrs)

Phylogeny: Basic concepts of phylogeny; molecular evolution; Definition and description of phylogenetic trees. Phylogenetic analysis algorithms - Maximum Parsimony, UPGMA and Neighbour-Joining. Evaluation of phylogenetic trees- reliability and significance; Boot strapping; Jackknifing

Module 4 (12 hrs)

Computational approaches for bio-sequence analysis - Mapping bio-sequences to digital signals – various approaches – indicator sequences – distance signals – use of clustering to reduce symbols in amino acid sequences - analysis of bio-sequence signals – case study of spectral analysis for exon location.

Module 5 (12 hrs)

Systems Biology: System Concept- Properties of Biological systems, Self organization, emergence, chaos in dynamical systems, linear stability, bifurcation analysis, limit cycles, attractors, stochastic and deterministic processes, continuous and discrete systems, modularity and abstraction, feedback, control analysis, Mathematical modeling; Biological Networks- Signaling pathway, GRN, PPIN, Flux Balance Analysis, Systems biology v/s synthetic biology

References.

1. Claverie & Notredame, “Bioinformatics - A Beginners Guide”, Wiley-Dreamtech India Pvt.
2. Uri Alon, “An Introduction to Systems Biology Design Principles of Biological Circuits”, Chapman & Hall/CRC.
3. Marketa Zvelebil and Jeremy O. Baum, “Understanding Bioinformatics”, Garland Science.
4. Bryan Bergeron, “Bioinformatics Computing, Pearson Education”, Inc., Publication.
5. D. Mount, “Bioinformatics: Sequence & Genome Analysis”, Cold spring Harbor press.
6. Charles Semple, Richard A. Caplan and Mike Steel, “Phylogenetics”, Oxford University Press.
7. C. A. Orengo, D.T. Jones and J. M. Thornton, “Bioinformatics- Genes, Proteins and Computers”, Taylor & Francis Publishers.
8. Achuthsankar S. Nair et al. “Applying DSP to Genome Sequence Analysis: The State of the Art, CSI Communications”, vol. 30, no. 10, pp. 26-29, Jan. 2007.
9. Resources at web sites of NCBI, EBI, SANGER, PDB etc

EC 010 805 G05: Intellectual Property Rights

Teaching scheme **Credits:4**

2 hour lecture and 2 hour tutorial

Objectives

1. *To appreciate the concept of Intellectual Property and recognize different kinds of Intellectual Property*
2. *To appreciate the rationale behind IP and underlying premises*
3. *To know the position of IP under the constitution of India*

Module 1(12 Hours)

Concept of intellectual property – different types of IP-Rationale behind Intellectual property-Balancing the rights of the owner of the IP and the society – Enforcement of IPRs – IP and constitution of India.

Module 2 (12 Hours)

World intellectual Property Organization (WIPO) – WTO/TRIPS Agreement – India and the TRIPS Agreement – Patent law in India –Interpretation and implementations – Transitional period.

Module 3 (12 Hours)

Patent system – Patentable Invention – Procedure for obtaining patent – Rights of a patentee – Limitations on Particular's Rights – Revocation of patent for Non – working Transfer of patent – Infringement of patent.

Module 4 (12 Hours)

Indian Designs Law – Meaning of Design Registration and Prohibitions – Copyright in Designs – Piraiy of Design and Penalities – Steps for foling an Application – Copyright law in India –Owner of the copyright – Rights of Broad Casters and Performers – Registration of Copyright – Assignment, Licensing and Transmission – Infringement – International Copyright and Copyright Societies

Module 5 (12 Hours)

Trade Mark Law in India – Functions of a Trade Mark – Registration of Trade Mark Exploiting Trade Mark – Infringement –Offenses and Penalties – Indian Trade Mark Act 1999; salient features. Geographical Indications – Registration of Geographical Indication – Term and Implication of Registration – Reciprocity and Prohibition on Registration.

Text books

1. Jayasree Watal **-Intellectual Property Rights:** In the WTO and Developing Countries -Oxford University Press
2. V.Sarkar-Intellectual Property Rights and Copyright- ESS publications

References

1. R..Anita Rao and Bhanoji Rao - Intellectual Property Rights –Eastern Book Company

2. Arthur R Miller and Michael H Davis – Intellectual Property in a Nutshell: marks patents, Trade and Copy Right

3. Richard Stim - Intellectual Property marks patents, Trade and Copy Right – Cangage Learning

4. Christopher May and Susan K Sell - Intellectual Property Rights –A critical History - Viva Books

EC010 805G06 PROFESSIONAL ETHICS

Teaching Schemes **Credit: 4**
2 hours lecture and 2 hours tutorial per week.

Objectives:
- *To create awareness on professional ethics for engineers*
- *To instil human values and integrity*
- *To respect the rights of others and develop a global perspective*

Module 1 (12 hrs)
Understanding Professional Ethics and Human Values Current scenario – contradictions – dilemmas – need for value education and self esteem – Human values – morals – values – integrity – civic virtues - work ethics – respect for others – living peacefully – caring – honesty – courage – valuing time – co operation – commitment – empathy – self confidence - character

Module 2 (12 hrs)
Ethics for Engineers Ethics – its importance – code of ethics – person and virtues – habits and morals – 4 main virtues – ethical theories – Kohlberg's theory – Gilligan's theory – towards a comprehensive approach to moral behaviour – truth – approach to knowledge in technology

Module 3 (12 hrs)
Environmental Ethics and sustainability problems of environmental ethics in engineering - engineering as people serving profession – engineer's responsibility to environment – principles of sustainability - industrial, economic, environmental, agricultural and urban sustainability - Sustainable development.

Module 4 (12 hrs)
Social Experimentation, Responsibility and Rights Engineers as responsible experiments – safety and risk – confidentiality – knowledge gained confidentiality – experimental nature of engineering – Intellectual Property Rights – professional rights – employee rights – occupational crime

Module 5 (12 hrs)
Global Issues Globalisation – unethical behaviour – computer ethics – weapons development – engineers as expert witness and advisors – moral leadership

Reference

1. Mike W Martin, Roland Schinzinger, " Ethics in Engineering", Tata McGraw -Hill, 2003
2. Govindarajan M, Natarajan S, Senthil Kumar V S, "Engineering Ethics" PHI India, 2004
3. P Aarne Vesblind, Alastair S Gunn, " Engineering Ethics and the Enviornment"
4. Edmund G Seebauer, Robert L Barry, " Fundamentals of Ethics for scientists and engineers" Oxford University Press 2001

5. R RGaur, R Sangal, G P Bagaria, “ A foundation course in value education and professional ethics”

EC010 806 VLSI & EMBEDDED SYSTEM LAB

Teaching Schemes **Credits : 2**

3 hour practical per week

VLSI LAB

1. Verilog implementations of
    a) Multiplexer
    b) Demultiplexer
    c) Full adder & Full subtractor
    d) Decoder

    Using data flow style of modelling.
2. Using Structural modelling implement
    a) 4:1 multiplexer using 2:1 multiplexer.
    b) Four bit full adder using one bit full adder.
    c) 4 bit counters.
3. Using behavioural modelling implement
    a) D Flip Flop
    b) J K Flip Flop
4. Using switch level modelling implement
    a) One bit Full adder
    b) Multiplexer – 2 channel
    c) CMOS AND gate
    d) CMOS OR gate
5. Verilog implementation of Moore and Mealy FSM.

EMBEDDED LAB (PIC)

1. Four bit binary counter using LEDs.
2. Interfacing 7 segment LED and a character LCD.
3. Timers and counters.
4. Analog to digital convertor.
5. DC motor control using.
6. Understanding interrupts.
7. Asynchronous Serial Communication.

*Program the PIC microcontroller and realize the circuits in breadboard (Avoid use of readymade kits).

EC010 807 Project Work

Teaching scheme **credits: 4**

6 hours practical per week

The progress in the project work is to be presented by the middle of eighth semester before the evaluation committee. By this time, the students will be in a position to publish a paper in international/ national journals/conferences. The EC can accept, accept with modification, and request a resubmission.

The progress of project work is found unsatisfactory by the EC during the middle of the eighth semester presentation, such students has to present again to the EC at the end of the semester and if it is also found unsatisfactory an extension of the project work can be given to the students.

Project report: To be prepared in proper format decided by the concerned department. The report shall record all aspects of the work, highlighting all the problems faced and the approach/method employed to solve such problems. Members of a project group shall prepare and submit **separate** reports. Report of each member shall give details of the work carried out by him/her, and only summarise other members' work.

The student's sessional marks for project will be out of 100, in which 60 marks will be based on day to day performance assessed by the guide. Balance 40 marks will be awarded based on the presentation of the project by the students before an evaluation committee.

For Project, the minimum for a pass shall be 50% of the total marks assigned to the Project work.

EC010 808 Viva -Voce

Teaching scheme **credits: 2**

A comprehensive oral Viva-voce examination will be conducted to assess the student's intellectual achievement, depth of understanding in the specified field of engineering and papers published / accepted for publication etc. At the time of viva-voce, certified bound reports of seminar and project work are to be presented for evaluation. The certified bound report(s) of educational tour/industrial training/ industrial visit shall also be brought during the final Viva-Voce.

An internal and external examiner is appointed by the University for the Conduct of viva voce University examination.

For Viva-voce, the minimum for a pass shall be 50% of the total marks assigned to the Viva-voce.

Note: If a candidate has passed all examinations of B.Tech. course (at the time of publication of results of eighth semester) except Viva-Voce in the eighth semester, a re-examination for the Viva-Voce should be conducted within one month after the publication of results. Each candidate should apply for this 'Save a Semester examination' within one week after the publication of eighth semester results.

Mechanical Engineering (ME)

EN010501A ENGINEERING MATHEMATICS IV

(Common to all branches except CS & IT)

Teaching scheme **Credits: 4**

2 hours lecture and 2 hour tutorial per week

Objectives: *Use basic numerical techniques to solve problems and provide scientific techniques to decision making problems.*

MODULE 1 Function of Complex variable (12 hours)

Analytic functions – Derivation of C.R. equations in cartision co-ordinates – harmonic and orthogonal properties – construction of analytic function given real or imaginary parts – complex potential – conformal mapping of z^2 , $\frac{1}{z}$ - Bilinear transformation – cross ratio – invariant property (no proof) – simple problems

MODULE 2 Complex integration (12 hours)

Line integral – Cauchy's integral theorem – Cauchy's integral formula – Taylor's series- Laurent's series – Zeros and singularities – types of singularities – Residues – Residue theorem – evaluation of real integrals in unit circle – contour integral in semi circle when poles lie on imaginary axis.

MODULE 3 Numerical solution of algebraic and transcendental equations (10 hours)

Successive bisection method – Regula –falsi method – Newton –Raphson method - Secant method – solution of system of linear equation by Gauss – Seidel method

MODULE 4 Numerical solution of Ordinary differential equations (10 hours)

Taylor's series method – Euler's method – modified Euler's method – Runge – Kutta method (IV order) - Milnes predictor – corrector method

MODULE 5 Linear programming problem (16 hours)

Definition of L.P.P., solution, optimal solution, degenerate solution – graphical solution –solution using simplex method (non degenerate case only) Big -M method – Duality in L.P.P. – Transportation problem –Balanced T.P. – initial solution using Vogel's approximation method - modi method (non degenerate case only)

References

1. B.V. Ramana – Higher Engg. Mathematics – Mc Graw Hill
2. M.R.Spicgel , S.Lipschutz , John J. Schiller, D.Spellman – Complex variables, schanm's outline series - Mc Graw Hill
3. S.Bathul – text book of Engg.Mathematics – Special functions and complex variables –PHI
4. B.S. Grewal – Numerical methods in Engg. and science - Khanna Publishers
5. Dr.M.K Venkataraman- Numerical methods in science and Engg -National publishing co

6. S.S Sastry - Introductory methods of Numerical Analysis -PHI
7. P.K.Gupta and D.S. Hira – Operations Research – S.Chand
8. Panneer Selvam– Operations Research – PHI
9. H.C.Taneja – Advanced Engg. Mathematics Vol II – I.K.International

ME010 502 Computer Aided Design & Manufacturing

(Common with PE010 604 and AU010 502)

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

- *To provide a comprehensive concepts of the design aspects and its importance in computer assisted design and manufacture.*
- *To examine technologies those have been developed to automate manufacturing* operations.

Module 1 (12 hours)

Evolution of CAD/CAM and CIM, computers and workstation, elements of interactive graphics, input/ out put display, storage devices in CAD, – networking of CAD systems - 2D Graphics: line drawing algorithms, DDA line algorithm – circle drawing, bressnham`s circle drawing algorithm– 2D Transformation: translation, rotation, scaling, reflection – clipping -3D Graphics (basic only).

Module 2 (12 hours)

Geometric modeling: Wire frame, surface and solid modeling - Engineering analysis; design review and evaluation, automated drafting.

Numerical control: Need - advantages and disadvantages – classifications – Point to point, straight cut and contouring positioning - incremental and absolute systems – open loop and closed loop systems – DDA integrator and Interpolators – resolution – CNC and DNC.

Programmable Logic Controllers (PLC)**:** need – relays - logic ladder program – timers, simple problems only - Devices in N.C. systems: Driving devices - feed back devices: encoders, moire fringes, digitizer, resolver, inductosyn, and tachometer.

Module 3 (12 hours)

NC part programming: part programming fundamentals - manual programming – NC co-ordinate systems and axes – tape format – sequence number, preparatory functions, dimension words, speed word, feed world, tool world, miscellaneous functions – programming exercises.

Computer aided part programming: concept and need of CAP – CNC languages – APT language structure: geometry commands, motion commands, postprocessor commands, compilation control commands – programming exercises – programming with interactive graphics.

(At least one programming exercise should be included in the University examination)

Module 4 (12 hours)

Computer Aided Process Planning (CAPP): concepts; traditional and CAPP; automated process planning: process planning, general methodology of group technology, code structures of variant and generative process planning methods, AI in process planning, process planning software.

Flexible Manufacturing Systems (FMS): Introduction, types, concepts, need and advantages of FMS - cellular and FMS - JIT and GT applied to FMS.

Module 5 (12 hours)

Robot Technology**:** overview, basic components - robot end effectors – sensors in robotics – control of actuators in robotic mechanisms (basic only) – control of robo joint, stepper motor, direct drive actuators – hydraulic and pneumatic systems (basic only) – robot arm kinematics, direct and inverse kinematics solution robot arm dynamics – robot applications: material transfer, machine loading and unloading, pre cutting operations, assembly, inspection and welding.

TEXT BOOKS:

1. Newman and Sproull - Principles of interactive Graphics, McGraw – Hill.
2. Yoram Koren - Numerical control of machine tools, McGraw-Hill.

REFERENCE BOOKS:

1. Craig John - Introduction to Robotics
2. Groover M.P. - CAD/CAM, PHI.
3. Hearn and Baker - Computer graphics (in C version), Prentice Hall.
4. Petruzella Frank.D. - Programmable logic controllers.
5. Jonn Craig - Introduction to Robotics

ME010 503: Advanced Mechanics of Materials

(Common with PE010 503)

Teaching scheme **Credits:** 4

2 hours lecture and 2 hour tutorial per week

Objectives

1. *To impart concepts of stress and strain analysis in a solid.*
2. *To study the methodologies in theory of elasticity at a basic level.*
3. *To acquaint with energy methods to solve structural problems.*

Module I (12 hours)

Basic equations of Elasticity, Stress at a point with respect to a plane - normal and tangential components of stress - stress tensor - Cauchy's equations - stress transformation - principal stresses and planes - strain at a point - strain tensor - analogy between stress and strain tensors - constitutive equations - generalized Hooke's law - relation among elastic constants – equations of equilibrium -strain-displacement relations –

Module II (12 hours)

Compatibility conditions - boundary conditions - Saint Venant's principle for end effects –uniqueness condition. 2-D problems in elasticity. Plane stress and plane strain problems – Airy's stress function – solutions by polynomial method – solutions for bending of a cantilever with an end load and bending of a beam under uniform load.

Module III (12 hours)

Equations in polar coordinates - Lame's problem - stress concentration problem of a small hole in a large plate. Axisymmetric problems - thick cylinders - interference fit - rotating discs. **S**pecial problems in bending: Unsymmetrical bending - shear center - curved beams with circular and rectangular cross-section

Module IV (12 hours)

Energy methods in elasticity: Strain energy of deformation - special cases of a body subjected to concentrated loads, due to axial force, shear force, bending moment and torque – reciprocal relation -Maxwell reciprocal theorem - Castigliano's first and second theorems - virtual work principle -minimum potential energy theorem - complementary energy

Module V (12 hours)

Torsion of non-circular bars: Saint Venant's theory - Prandtle's method - solutions for circular and elliptical cross-sections - membrane analogy - torsion of thin walled open and closed sections- shear flow

Text Books

1. L. S. Sreenath, Advanced Mechanics of Solids, McGraw Hill
2. S. M. A. Kazimi, Solid Mechanics, McGraw Hill
3. S. P. Timoshenko, J. N. Goodier, Theory of elasticity, McGraw Hill

Reference Books

1. J. P. Den Hartog, Advance Strength of Materials, McGraw Hill
2. C. K. Wang, Applied Elasticity, McGraw Hill

ME010 504: Kinematics of Machinery

(Common with AU010 504)

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

1. *To understand the basic components and layout of linkages in the assembly of a system/machine.*
2. *To understand the principles involved in assembly the displacement, velocity and acceleration at any point in a link of a mechanism.*
3. *To understand the motion resulting from a specified set of linkages.*
4. *To understand and to design few linkage mechanisms and cam mechanisms for specified output motions.*
5. *To understand the basic concepts of toothed gearing and kinematics of gear trains.*

Module I (14hours)

Classification of mechanisms – Basic kinematic concepts and definitions – Degree of freedom, Mobility – Kutzbach criterion, Gruebler's criterion – Grashof's Law –Kinematic inversions of four-bar chain, slider crank chains and double slider crank chains – Limit positions –Mechanical advantage – Transmission Angle -Coupler curves – Description of some common Mechanisms – Quick return mechanisms, Straight line generators, Dwell Mechanisms, Ratchets and Escapements, Universal Joint, steering mechanisms

Module II (12hours)

Displacement, velocity and acceleration analysis of simple mechanisms – Graphical method – Velocity and acceleration polygons – Velocity analysis using instantaneous centers – Kennedy's theorem, kinematic analysis by complex algebra methods – Vector approach – Computer applications in the kinematic analysis of simple mechanisms – Coincident points – Coriolis component of Acceleration.

Module III (10hours)

Kinematic synthesis (Planar Mechanisms) - Tasks of kinematic synthesis – Type, Number and dimensional synthesis – Precision points - Graphical synthesis for four link mechanism Function generator – 2 position and 3 position synthesis – Overlay Method - Analytical synthesis techniques

Module IV (12 hours)

Cams and Followers: - types-follower motion-SHM-uniform velocity and acceleration-Cycloidal - displacement, velocity and acceleration curves-Cam profile-Reciprocating and oscillating followers-Tangent cams-Convex and concave cams with footed followers. Introduction to Polynomial cams.

Module V (12 hours)

Law of toothed gearing – Involutes and cycloidal tooth profiles –Spur Gear terminology and definitions –Gear tooth action – contact ratio – Interference and undercutting – Non-standard gear teeth – Helical, Bevel, Worm, Rack and Pinion gears [Basics only] Gear trains – Speed ratio, train value – Parallel axis gear trains– Epicyclic Gear Trains – Differentials

Reference Books

1. R L Norton, Kinematics and Dynamics of Machinery, 1st ed., *Tata McGraw Hill Education Private Limited*, Delhi, 2009
2. J. E. Shigley, J. J. Uicker, *Theory of Machines and Mechanisms*, McGraw Hill
3. S .S Rattan Theory of Machines, 3rd ed., *Tata McGraw Hill Education Private Limited*, Delhi, 2009
4. A. Ghosh, A. K. Malik, *Theory of Mechanisms and Machines*, Affiliated East West Press
5. A. G. Erdman, G. N. Sandor, *Mechanism Design: Analysis and synthesis Vol I & II*, Prentice Hall of India

ME010 505 I. C. Engines & Combustion

(Common with AU010 505)

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

- *To impart the basic concepts of IC Engine and Combustion*

Module I (15 hours)

Working of two stroke and four stroke engines and valve timing diagrams of – Petrol and diesel engine. (Review only). Fuel air cycles. Ignition systems- Battery and magneto systems- ignition timing and spark advance. Fuels – Qualities, rating of fuels - Octane and Cetane numbers. Alternative fuels.

Types of engines - Wankel engine,- Stirling engine - Stratified charge engine - VCR engine - free piston engine.

Module II (15 hours)

Air fuel mixture requirements – Solex Carburettor. Stoichiometric and excess air calculations. Fuel injection systems in SI and CI engines - Fuel injection pumps.- nozzle- direct and indirect injections. MPFI systems and GDI engines. CRDI technology.

Lubrication systems- types – properties of lubricants. Flash point, fire point and viscosity index.

Module III (10 hours)

Thermodynamics of combustion. Combustion reaction of common fuels. Exhaust gas composition. Flue gas analysis. Air fuel ratio from exhaust gas composition. Variation of specific heats- heat losses- Dissociation.

Engine cooling systems- Air and liquid system- Super charging and turbo charging

Module IV (10 hours)

Combustion in SI engines- P-θ diagram- Stages of combustions- Ignition lag. Flame propagation – Abnormal combustion – detonation effects. Combustion in CI engines, P-θ diagram - Ignition delay, diesel knock- controlling methods.

Air motion- Squish, tumble, swirl motions. Different types combustion chamber for SI and CI engines.

Module V (10 hours)

Pollutants in SI and CI engines. NOx, CO, unburned hydrocarbons ,smoke and particulate. Measurement of exhaust emission. (HC, CO, NOx and smoke intensity) Exhaust gas treatment.- Catalytic converter – Thermal reaction -Particulate trap.

Testing of IC engines - Indicated power – Brake Power - Volumetric efficiency - Heat balance test - Morse test.

Text Books

V Ganesan, *Internal Combustion Engine* Tata Mc Graw Hill Publishing Company Ltd. New Delhi 2006. -

Reference Books

John B Heywood, Internal Combustion Engine Fundamentals, Mc Graw Hill Publishing Company Sigapur,1998.
Obert E F,Internal Combustion Engine and air Pollution Mc Graw Hill book company New York.

Mathur and Sharma,A course in Internal Combustion Engine - Dhanpat Rai Publications new Delhi, 2004.

Sharma S.P, Fuels and Combustion, Tata Mc Graw Hill Publishing Company Ltd.
New Delhi.1990.

Spalding D.B. Some Fundamentals of Combustion Better Worths Scientific Publications London, 1955.

ME010 506 Thermodynamics

(Common with PE 010 506 and AU010 506)

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

- *To impart the basic concepts of Thermodynamics*

Pre-requisites: *Knowledge required to study this subject (especially any subject previously studied)*

Module I (10 hours)

Fundamentals concepts – scope and limitations of thermodynamics. Thermodynamic systems – different types of systems – macroscopic and microscopic analysis – continuum – Properties – state – processes. Thermodynamics equilibrium – Equation of state of an ideal gas – PVT system – Real gas relations – Compressibility factor – Law of corresponding states.

Module II (15 hours)

Laws of thermodynamics- Zeroth law of thermodynamics – Thermal equilibrium – Concept of temperature – Temperature scales – Thermometry – Perfect gas temperature scales. – Thermometry – Perfect gas temperature scales. Work and heat – First law of thermodynamics – Concept of energy _ First law for closed and open systems – Specific heats – internal energy and enthalpy – Steady flow energy equations _ Jule Thompson effect.

Module III (15 hours)

Second law of thermodynamics- Various statements and their equivalence_ Reversible process and reversible cycles- Carnot cycles- Corollaries of the second law – thermodynamics temperature scales – Clausis inequality- Concept of entropy – Calculation of change in entropy in various thermodynamic processes – Reversibility and irreversibility – Available and unavailable energy – Third law of thermodynamics.

Module IV (10 hours)

Thermodynamic relations – Combined first and second law equations – Hemholtz and gibbs functions – Maxwell relations- Equations for specific heats, internal energy, enthalpy and entropy – Clausius Clapeyron equations _ applications of thermo dynamic relations.

Module V (10 hours)

Properties of pure substances – PVT, PT and TS diagrams, Mollier diagrams- Mixture of gases and vapours- mixture of ideal gases – Dalton's law – Gibbs law- Thermodynamic properties of mixtures

Text Books

1 P K Nag, *Engineering Thermodynamics*, Tata Mc Graw Hill Publishing Company Ltd. New Delhi 2008.

Reference Books

1. J. F. Lee and FW Sears, *Engineering Thermodynamics*, Addison-Wesleg Publishing Company, London, 1962.
2. Spalding and Cole, *Engineering Thermodynamics*, The English Language Book Society and Edward Arnold Ltd.,1976.
3. M. A.chuthan, *Engineering Thermodynamics*,Prentice Hall of India Private Ltd, New Delhi 2002.
4. J.H Keenan, *Thermodynamics*, John Wiley and Sons , New York, 1963.
5. Edward F Obert, *Concept of Thermodynamics*, McGraw Hill book company New York, 1988.
6. J.P. Holman, *Thermodynamics*, McGraw Hill book company New York, 1988.
7. Mark W. Zemansky, *Heat and Thermodynamic*, McGraw Hill, New Delhi, 2001.
8. Roy T, *Basic Engineering Thermodynamics*, Tata Mc Graw Hill Publishing Company Ltd. New Delhi 1989.

ME010 507: **CAD/CAM Lab**

(Common with PE010 708)

Teaching scheme **Credits:** 2
3 hours practical per week

Objectives

- *To train the students in solid modelling, surface modelling and drafting*
- *To gain experience in assembly modelling, mechanism design and systems routing*
- *To practise computer controlled manufacturing methods*
- *To expose students to rapid prototyping*

Solid Modeling (15 hours)

Creation of 3D models-Wireframe, Surface and Solid modeling techniques using CAD packages- Parametric modeling-Drafting-Generation of orthographic 2D views from models,Sectioning,Detailing –Exposure to Industrial components-Application of Geometrical Dimensioning &Tolerancing.

Assembly Design (15 hours)

Assembling of various machine parts and tolerance analysis, generation of 2D drawings and bill of materials from assembly
Mechanism Design - synthesis and design of mechanisms - animations - exercises on various mechanisms like four bar chain, slider crank mechanism and its inversions
System Design-Schematic and non schematic driven routing of pipes and tubes,

Computer aided manufacturing (15 hours)

Part programming fundamentals - manual part programming and computer aided part programming - hands on training in computer controlled turning and milling operations - tool path generation and simulation - exercises on CNC lathe and machining center/milling machines
Generation of STL files and rapid prototyping of CAD models

Exercises

1) Modeling of machine parts, brackets using 2D drawings
2) Modeling of surfaces using given master geometry
3) Parametric modeling of standard parts such as nuts, bolts, rivets, washers etc
4) Assembling of machine parts
5) Generation of manufacturing drawings from 3D models/assembly
6) Synthesis of four bar mechanism and its simulation using software packages
7) Synthesis of slider crank mechanism and its simulation using software packages
8) Schematic and non schematic routing of pipes/tubes
9) Manual/Computer aided part programming for turning and milling operations
10) Rapid prototyping of simple CAD models

Reference Books

1. CAD and Solid Modeling Software Packages CATIAV5, UNIGRAPHICS and PRO-E Manuals of Latest Version
2. Ibrahim Zeid, R Sivasubrahmanian CAD/CAM: Theory & Practice *Tata McGraw Hill Education Private Limited*, Delhi,
3. Yoram Koren, Computer Control of Manufacturing Systems *Tata McGraw Hill Education Private Limited*, Delhi,
4. Peter Smid, (2003), CNC programming Handbook a comprehensive guide to practical CNC programming, Industrial Press

Internal Continuous Assessment *(Maximum Marks-50)*

50%-Laboratory practical and record
30%- Test/s
20%- Regularity in the class

Note: Exercise in Rapid prototyping may be demonstrated for the entire batch

End Semester Examination *(Maximum Marks-100)*

70% - Procedure, modeling steps, results
30% - Viva voce

ME010 508 Electrical & Electronics Lab

(Common with PE010 508 and AU010 508)

Teaching scheme **Credits:** 2

3 hours practical per week

Objectives

- *To conduct various tests on Electrical Machines and to study their performance.*
- *To conduct various tests on practical electronic circuits*

PART A

1. Study of 3-point and 4-point starters for D.C machines

2. OCC of self excited D.C machines – critical resistances of various speeds. Voltage built-up with a given field circuit resistance. Critical speed for a given field circuit resistance

3. OCC of separately excited D.C machines

4. Load test on shunt generator – deduce external, internal and armature reaction characteristics.

5. Load test on compound generator

6. Swinburne's test on D.C machines

7. Brake test on D.C shunt motors and determination of characteristics.

8. Brake test on D.C series motors and determination of characteristics.

9. Brake test on D.C compound motors and determination of characteristics.

10. O.C and S.C tests on single phase transformers – calculation of performance using equivalent circuit – efficiency, regulation at unity, lagging and leading power factors.

11. Load test on single phase transformers.

12. Alternator regulation by emf and mmf methods

13. Study of starters for three phase induction motors

14. Load tests on three phase squirrel cage induction motors

15. Load tests on three phase slip ring induction motors

16. Load tests on single phase induction motors

PART B

1. Design and testing of clipping and clamping circuits

2. Design and testing of of RC integrator and differentiator circuits.

3. Design and testing of rectifier circuits – Half wave – Full wave (centre – tapped and bridge) circuits. Filter circuits.

4. Design and testing of RC coupled amplifier– frequency response.
   Sweep circuits

5. Design and Testing of RC phase-shift Oscillator

References

1. Dr. P S Bimbra, *Electrical Machinery*, Khanna Publishers
2. R K Rajput, *A text book of Electrical Machines,* Laxmi publishers
3. A.P. Malvino, *Electronic Principles*– TMH
4. Floyd, *Electronic Devices*, Pearson Education, LPE

Internal Continuous Assessment *(Maximum Marks-50)*

50%-Laboratory practical and record
30%- Test/s
20%- Regularity in the class

End Semester Examination *(Maximum Marks-100)*

70% - Procedure, conducting experiment, results, tabulation, and inference
30% - Viva voce

ME010 601 Mechanics of Machines

(Common with AU010 601)

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

- To understand the method of static force analysis and dynamic force analysis of mechanisms
- To understand the principles of governors and gyroscopes.
- To understand the design of flywheel
- To understand the working of different types of brakes and dynamometers

Module I (14 hours)

Force analysis of machinery - static and dynamic force analysis of plane motion mechanisms - graphical method - principle of superposition –matrix methods - method of virtual work.

Module II (12 hours)

Governors: - terminology; Watt, Porter, Proel, Hartnell, Hartung, Wilson-Hartnell, and Pickering governors-spring controlled governors of gravity type-effort and power-controlling force diagram-quality of governors-effect of friction-insensitiveness-stability-inertia governors- governor speed, torque characteristics of an engine-governor and flywheel.

Module III (12 hours)

Turning moment diagram and Flywheel: - coefficient of fluctuation of energy and speed- energy saved in a flywheel-punching press-dynamically equivalent two mass system-centre of percussion-kinetic equivalence-reversed effective force analysis-piston effort-crankpin effort- crank effort-turning moment diagrams for I.C. engines.

Module IV (10 hours)

Gyroscope: - Principle-Angular acceleration-Effect of gyroscopic couple on bearings, airplanes, and ships-stability of automobile and two wheel vehicles-Gyroscopic stabilization of sea vessels and grinding mills-Rigid disc at an angle fixed to a rotating shaft

Module V (12 hours)

Brakes and clutches: Shoe, double block, long shoe, internally expanding shoe, band, band & block, hydraulic, mechanical, air and power brakes-braking of a vehicle-cone, single plate, multiple, centrifugal clutches.

Dynamometers: Pony brake. rope brake, epicyclic train, belt transmission and torsion dynamometers-effort and power.

Reference Books

1. R L Norton, Kinematics and Dynamics of Machinery, 1st ed., *Tata McGraw Hill Education Private Limited*, Delhi, 2009
2. J. E. Shigley, J. J. Uicker, *Theory of Machines and Mechanisms*, McGraw Hill
3 S .S Rattan Theory of Machines, 3rd ed., *Tata McGraw Hill Education Private Limited*, Delhi, 2009
4 A. Ghosh, A. K. Malik, *Theory of Mechanisms and Machines*, Affiliated East West Press
5. C. E. Wilson, P. Sadler, *Kinematics and Dynamics of Machinery*, 3rd edition, Pearson Education.
6. Holowenko, Dynamics of Machinery, John Wiley

ME010602: Heat and Mass Transfer

(Common with AU010 602)

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

- *To provide a useful foundation and basic knowledge of the subject required for innovative work and advanced studies.*
- *To motivate the students and to develop interest in the subject by providing information along with practical application of different formulae from an engineering point of view.*

Module I (12 hours)

Scope and application of heat transfer principles in engineering practice. Introduction to basic modes of heat transfer

Conduction: Fourier law-thermal conductivity of solids, liquids and gasses-factors affecting thermal conductivity-common conducting and insulating materials. General heat conduction equation in Cartesian, cylindrical and spherical co-ordinates- one dimensional steady state conduction with and without heat generation-conduction through homogeneous and composite surfaces-plane wall, cylinders and spheres-concept of thermal resistance-contact resistance-variable thermal conductivity-critical thickness of insulation-overall heat transfer coefficient-heat transfer through corners and edges-conduction shape factor.

Module II (12 hours)

Convection: Elementary ideas of hydrodynamic and thermal boundary layers-Newton's law of cooling-factors affecting heat transfer coefficient in forced and natural (free) convection heat transfer-application of dimensional analysis to free and forced convection-significance of Prandtil number, Reynold's number, Grashof number and Nusselt number. Forced convection: Laminar and turbulent flow heat transfer in a circular pipe- Laminar and turbulent flow heat transfer in flow over a flat plate-flow across a cylinder. Natural convection: Natural convection heat transfer from a plate kept vertical and horizontal- cylinder kept vertical and horizontal-description of natural convection heat transfer from enclosed spaces. (Problems limited to using important empirical relations available in data book)

Module III (12 hours)

Heat transfer from extended surfaces: Governing equation and boundary conditions-straight rectangular fin-pin fin of uniform cross sectional area-circumferential fin-fin effectiveness-fin efficiency-solving problems using data book.

Heat exchangers: General classification of heat exchangers according to type of energy transfer, according to flow arrangement and according to area to volume ratio-Log Mean Temperature Difference (LMTD) for parallel flow, counter flow and cross flow arrangements-calculation of heat exchanger size and flow rates from known temperatures. Effectiveness_NTU method of evaluation-solving problems using data book.

Module IV (12 hours)

Radiation: Nature of thermal radiation-definitions and concepts-monochromatic and total emissive power-absorptivity, reflectivity and transmissivity-definition of black, grey and real surfaces-concept of a black body-Plank's law, Kirchoff's law, Wein's displacement law and Stefan-Boltzmann law-geometric factor (shape factor or configuration factor) of simple geometries. Heat exchange by radiation between black surfaces of equal, parallel and opposite black squares and discs-black rectangles perpendicular to each other having a common edge-heat exchange between infinite parallel planes of different emissivity-radiation shield (no derivation)-simple derivations and simple problems using data book.

Module V (12 hours)
Mass Transfer: Introduction to mass transfer-Fick's law of diffusion-steady state mass diffusion of gasses and liquids through solids-convective mass transfer (elementary concepts and definitions)-analogy between heat and mass transfer-elementary problems.
Condensation and boiling: Laminar film condensation on a vertical plate and horizontal tubes. Pool boiling-different regimes of pool boiling-flow patterns in flow boiling in a vertical tube.
Two dimensional steady state heat conduction-governing equation and boundary conditions-application of finite difference method in solving two dimensional steady state heat conduction through a rectangular slab (method of discretisation of nodal equations only)
Data Book:

1. C. P. Kothandaraman, S. Subramanyan, *Heat and Mass Transfer Data Book*, 5th ed., New Age International Publishers.
2. A. V. Domkundwar, Dr. V. M. Domkundwar, *Heat and Mass Transfer Data Book*, 3rd ed., Danapat Rai & Co.

References:

Text Books

1. S. P. Sukhatme, *A Text Book on Heat Transfer*, 4th ed.,Universities Press, Hydrabad, 2005
2. S. K. Som, *Introduction to Heat Transfer*, PHI Learning pvt.ltd,New Delhi, 2008
3. P. K. Nag, *Heat Transfer*, 1st ed., Tata McGraw-Hill

Reference Books

1. Frank P. Incropera, David P. Dewitt, *Fundementals of Heat and Mass Transfer,* 5th ed., John Wiley & Sons
2. J. P. Holman, *Heat Transfer*, 9th ed., Tata McGraw Hill Education pvt.ltd., New Delhi, 2010
3. M. Necati Ozisick, *Heat Transfer A Basic Approach*, McGraw Hill Book Company
4. Frank Kreith, Mark S. Bohn, *Principles of Heat Transfer,* 5th ed , PWS Publishing Company
5. S. P. Venkateshan, *A First Course in Heat Transfer*, Ane Books, Chennai

ME010 603 Thermal Systems and Applications

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objectives

- *To impart the basic concepts of different types of engines*
- *To develop an idea about various thermal systems..*

Module I (12 hours) Steam Engineering: Properties of steam - wet, dry and superheated steam - dryness fraction - enthalpy and internal energy - entropy of steam - temperature entropy diagram - process - Mollier chart - Rankine cycle for wet, dry and superheated steam. Steam Generators - classification - modern steam generators - boiler mountings and accessories.

Module II (12 hours) Steam nozzles - Mass flow rate - throat pressure for maximum discharge - throat area - effect of friction - super saturated flow.
Steam turbines: velocity triangles, work done, governing, and efficiencies.

Module III (12 hours) Gas turbine Plants - Open and closed cycles - thermodynamics cycles - regeneration, re heating - inter cooling - efficiency and performance of gas turbines. Rotary Compressors - Analysis of rotary compressors - centrifugal and axial compressors and reciprocating compressors. Combustion - combustion chambers of gas turbines - cylindrical, annular and industrial type combustion chamber - combustion intensity - combustion chambers efficiency - pressure loss combustion process and stability loop.

Module IV (12 hours) Introduction to solar energy - solar collectors - Liquid flat plate collectors - principle - thermal losses and efficiency - characteristics - overall loss coefficient - thermal analysis - useful heat gained by fluid - mean plate temperature - performance - focussing type solar collectors - solar concentrators and receivers - sun tracking system - characteristics - optical losses - thermal performance - solar pond - solar water heating - solar thermal power generation (Description Only)

Module V (12 hours) Thermal power plants: layout and operation of steam and diesel power plants - coal burners - stockers - cooling ponds & towers - chimneys - draught - dust collectors - precipitators - feed water heaters - evaporators - steam condensers - coal handling - ash handling.

Text Books

1. E. L. Wahid , *Power plant technology*
2. Mathur and Mehta, *Thermodynamic and heat power engineering*, Jain Brothers.
3. P. L. Ballaney , *Thermal Engineering*, Khanna publishers

Reference Books

1. Cohen & Rogers, *Gas Turbine Theory*
2. G. D. Rai, *Solar Energy Utilization*
3. R.K. Rajput, *Thermal engineering*, Lakshmi publications

ME010 604: Metrology and Machine Tools

(Common with AU010 604)

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

- *Understand and appreciate the importance of basic principles of traditional material removal processes.*
- *Understand the application of those principles in practice.*
- *To understand the principles of metrology and measurements, methods of measurement and its application in manufacturing industries.*

Module I (12 hours)

Conventional Machining Processes Turning machines:- Types - method of holding work and tool, accessories, attachments-operations and types of tools for each operation - tool room lathe - duplicating lathe - Capstan and Turret lathe – knurling - Drilling:- types of drilling machines - types of drills - nomenclature of drill point - drill wear - types of chip breakers - cutting forces in drilling - Boring:- types of boring machines, tool geometry - counterboring, spot facing, countersinking, trepanning – Reaming:- types of reamers - tool nomenclature - cutting forces - tool materials and surface roughness obtainable in each operations.
Shaping, planing and slotting machines:- Types and specifications - quick return motion - hydraulic feed and its advantages - automatic feed-speed, feed and depth of cut -work holding devices - types of operation and examples of work done - shaping of V-blocks, planing of guide gibs, slotting of keyways – Broaching:- - basic process - different cutting elements – force required for broaching and strength of broach – tool materials and surface roughness obtainable in each operations.

Module II (12 hours)

Milling operations:- different types milling machines - Different methods of milling - nomenclature of milling cutters – cutting forces in milling – different types of milling cutters – attachments for milling:-vertical milling and universal milling attachment, high speed milling attachment, rack milling and slot attachments, parking bracket, rotary table, universal dividing head, vices, arbors, adaptors and collet chucks – tool materials and surface roughness obtainable in milling – machining centers: applications and advantages - Grinding: - types of machines - Grinding mechanisms:- grinding debris, grinding force power, specific energy - Grinding wheels:- different types of abrasives, grain size, different types of bond, grade, structure – marking system of grinding wheels - Grinding fluids – Truing and dressing of grinding wheels - Grinding temperature, thermal damage and surface roughness obtainable. Horning: Types of machines, methods of honing – types honing stones – honing conditions - cutting fluids - surface roughness obtainable - Lapping: - types of hand lapping - types of lapping machines - surface roughness obtainable – Burnishing:- processes and surface roughness obtainable.

Module III (12 hours)

Gear cutting process: - Gear milling: - gear milling machines and different gear milling operations - Gear hobbing: - principle of the hobbing process and hobbing machines, basic types of hobbing machines, different hobbing techniques, nomenclature of hob, hob wear, spur gear hobbing, helical gear hobbing - gear shaping: - principle of gear shaping process - gear finishing - gear errors - Thread production process: - different thread production processes: screw cutting on lathe, thread milling, thread whirling, die threading, tapping, thread rolling, and thread grinding.

Module IV (12 hours)
Engineering Metrology
General measurements concepts:- Principles for achieving accuracy; methods for estimating accuracy and precision, precision Vs accuracy, systematic and constant errors; progressive, random, erratic, drunken errors - Fits and tolerances:- types of fits: hole and shaft basis system – limit gauges:- gauge tolerance, presentation of gauge tolerances – Taylor's theory of gauging – limit gauges for screw threads - Design and operation of linear measurements:- Principle of alignment (Abbe's), accuracy and precision etc. – Principle of kinematics: complete constraints, one degree of freedom – Gauge blocks:- gauge materials, accuracy and standards, effect of temperature, surface roughness and manufacturing of gauge blocks – Comparators:- mechanical, mechanical-optical, pneumatic and horizontal length comparator – Angle measurements:- three disc, sine bar and dial gauge – measurement of taper plug ring gauges and taper bores – Precision levels, clinometer – Optical instruments for angle measurements:- optical principles of projector, microscope, telescope, collimator, auto collimator - optical flat and optical parallel applications – auto collimator, angle dekkor, combination of angle gauges, optical flat.

Module V (12 hours)
Tool makers microscope – profile projector – optical microscope, SEM and TEM - straight edge – surface plate – measurement of squareness:- squareness testing with dial gauge, tilting bar, optical square, checking an internal right angle - Measurement of surface roughness: meaning of surface texture and causes – stylus probe instrument, RMS, CLA, peak to valley, R_a, R_t, R_z etc. – stylus, skid, effect of sampling length, magnification, cut-off, evaluation length etc. – comparison of surface roughness of different machining process – concept of apparent to real area of contact of mating surfaces, applications in clutch plate surface, brake liner, inner race of a bearing, cylinder liner, machine tool guide way, significance of surface roughness in crack initiation – assessment of roundness errors:- least square reference circle, minimum circumscribed circle, minimum zone reference circle and maximum inscribed circle – roundness parameters:- eccentricity, concentricity and runout – three wire system of thread pitch diameter measurement - gear tooth measurement by vernier caliper, pin method of measuring gear teeth – Alignment tests for machine tools:- test for level installation of a lathe bed – spindle tests of concentricity and alignment with guide ways – tests for straightness and flatness of a lathe bed guide ways – test for squreness of a drilling machine spindle with table – CMM, laser interferomerty and applications.

Text Books

1. S. Haykin and B. V. Veen, *Signals and Systems*, John Wiley & Sons, N. Y., 2002
2. A. V. Oppenheim, A. S. Willsky and S. H. Nawab, *Signals & Systems*, 2nd ed., Prentice Hall of India, New Delhi, 1997

Reference Books

1. C. L. Philips, J. M. Parr, E. A Riskin, *Signals, Systems and Transforms*, 3rd ed., Pearson Education, Delhi, 2002
2. R. E. Zeimer, W. H. Tranter, and D. R. Fannin, *Signals and Systems: Continuous and Discrete*, 4th ed., Pearson Education, Delhi, 1998
3. M. J. Roberts, *Signals and Systems: Analysis using Transform methods and MATLAB*, Tata McGraw Hill, New Delhi, 2003

ME010 605 Mechatronics and Control systems

(Common with AU010 605)

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

- *To impart basic concepts of mechatronics and control systems.*

Module 1 [12 Hours]

Introduction:-Scope of Mechatronics-Systems-Microprocessor based controllers-mechatronic approach-sensors-transducers-force-velocity-displacement-temperature-inputting data by switches-signal conditioning-operational amplifiers-filtering-multiplexers-data acquisition-modulation. Data presentation systems:- Displays-measurement systems-calibration-pneumatic and hydraulic systems-control valves-actuators-mechanical and electrical activation systems-relays and solenoid switches-proximity pickups.

Module 2 [12 Hours]

Input/output Systems:-Ports, interface requirements, adaptors-programmable logic controllers-data handling digital communications-system, networks, protocols, interfaces, fault finding- design and mechatronic design solutions. Electromechanical systems:-CD, DVD Rom, OCR, Printers.

Module 3 [12 Hours]

Introduction to Control Systems Engineering:-Concept of automatic control-open loop and closed loop systems-servomechanisms-Block diagrams-transfer functions-Representation of control components and systems-Translational and rotational mechanical components –series and parallel combinations-comparators ,integrating devices, hydraulic servomotors, temperature control systems, speed control systems.

Module 4 [12 Hours]

System Response:-First and second order system-Response to step, pulse, ramp and sinusoidal input-systems with distance, velocity lag. Control System Analysis:-Transient Response of simple control systems –Stability of control systems –Routh Stability criteria –Error Analysis.

Module 5 [12 Hours]

Frequency Response Analysis :- Polar ,Rectangular and Logarithmic plots – Experimental determination of frequency response -Bode and Nyquist stability criteria – Gain and phase margin. Root locus of simple transfer function.

Text Books

1. Mechatronics-W.Bolton-Pearson
2. Control Systems- A. Nagoor Kani

References

1. Mechatronics-A.Smaili&F.Mrad-Oxford
2. Control Systems Engg –T .J. Nagrath & M .Gopal.
3. Automatic Control Theory-Ravan.
4. Modern Control Engg.-K. Ogatta
5. Control Systems Engg -Benjamin C Kuo

ME010 606L01 Computational Fluid Dynamics

Teaching scheme **Credits:** 4
2 hours lecture and 2 hour tutorial per week

Objectives

- *To introduce the primary components of learning and practicing CFD*
- *To develop an understanding of solution methods for fluid motion and energy transfer equations*

Module 1 (15 hours)
Basic concepts: conservation principles – derivation of transport equations: control volume – Langangian and Eulerian approach- mass conservation equation-momentum conservation equations-stress laws-mass transfer equation-energy equation-rate change-convection and conduction-volumetric generation-work done by surface and body forces- dimensionless form of Navier-Stokes equations- introduction to numerical methods, advantages and limitations.
Module 2 (10 hours)
One dimenensional conduction: The governing equation- grid layout-discretisation-stability and convergence-explicit, implicit and semi-implicit procedures-methods to handle non-linearities- Solution methods-Gauss-Siedel method and TDMA-Simple problems.
Module 3 (10 hours)
One dimensional conduction-convection: exact solution-discretisation- central difference scheme-upwind difference schemes- numerical false diffusion-stability of unsteady equation-exact solution-explicit finite difference form-implicit finite difference form.
Module 4 (10 hours)
Two dimensional boundary layers: governing equations- descretisation method- symmetry, wall and free stream boundary conditions- dealing with source terms –defining initial conditions-choice of grid size and iterations-applications (excluding turbulence)
Module 5 (15 hours)
Two dimensional Convection-Cartesian Grids: simple mathematical models for incompressible, in viscid, potential and creeping flows-approximations of hyperbolic, parabolic, elliptic, and mixed flows. Solution strategies for 2D convection problems- SIMPLE algorithm-descretisation- pressure correction equation- solution procedure- Solution methods: iterative solvers-evaluation of residuals-under relaxation-boundary conditions - simple description on treatment of turbulent flows - applications (laminar flows only).

Text Books

1. Anderson J.D., *Computational Fluid Dynamics*, McGraw- Hill Co.
2. Joel H. Ferzigerand Peric M., *Computational methods for Fluid Dynamics*, Springer Werlag Publishers

Reference Books

1. Patankar S.V., *Numerical Fluid Flow and Heat Transfer* , Hemisphere, New York
2. Anil W. Date, *Introduction to Computational Fluid Dynamics*, Cambridge University Press
3. Hiderbrand F.B., *Introduction to Numerical Analysis* , Tata McGraw- Hill

ME010 606 L02: Composite Materials Technology

Teaching scheme **Credits:** 4

2 hours lecture and 2 hour tutorial per week

Objectives: To understand the concept of composite materials

Module I (12 hours)

Fibers**:** introduction – glass fibers: fabrication, structure, properties and applications – Boron fibers: fabrication, structure, morphology, properties and application – Carbon fibers: Different preparation methods, structural change during preparation, properties and application – Aramid fibers: fabrication, structure, properties and applications – Ceramic fibers: Alumina and silicon carbide fibers – metallic fibers.

Module II (12 hours)

Matrix materials: Polymers and its characteristics – Metals: fiber reinforcement of metals **-** Ceramic matrix materials: bonding and structure, effect of flaws on strength and common ceramic matrix materials.

Interfaces**:** wettability and bonding interface in composites – types of bonding at interface – tests for interfacial strength.

Module III (12 hours)

Metal Matrix Composites (MMC)**:-** Different fabrication methods of MMC – interface in MMC – discontinues reinforcement of MMC – detailed discussion on mechanical properties – applications.

Module IV (12 hours)

Ceramic Matrix Composites (CMC)**:-** Different fabrication methods of CMC – interface in CMC – detailed discussion on properties – toughness of CMC **-** applications.

Carbon fiber composites: fabrication – properties – interface.

Module V (12 hours)

Micromechanics of composites: Maximum stress and strain criterion, Tsai-Hill and Tsai-Wu failure criterion (derivations) **-** mechanics of load transfer from matrix to fiber (description only).

Polymer matrix composites**:** properties and engineering applications **–** processing of PMC: hand lay-up, spray up, compression molding, reinforced reaction injection molding, resin transfer molding, pultrusion, filament winding, injection, vacuum bag molding process.

Text Books

1. S. Haykin and B. V. Veen, *Signals and Systems*, John Wiley & Sons, N. Y., 2002
2. A. V. Oppenheim, A. S. Willsky and S. H. Nawab, *Signals & Systems*, 2nd ed., Prentice Hall of India, New Delhi, 1997

Reference Books

1. C. L. Philips, J. M. Parr, E. A Riskin, *Signals, Systems and Transforms,* 3rd ed., Pearson Education, Delhi, 2002
2. R. E. Zeimer, W. H. Tranter, and D. R. Fannin, *Signals and Systems: Continuous and Discrete,* 4th ed., Pearson Education, Delhi, 1998
3. M. J. Roberts, *Signals and Systems: Analysis using Transform methods and MATLAB,* Tata McGraw Hill, New Delhi, 2003

ME010 606L03: AUTOMOBILE ENGINEERING

Teaching scheme **Credits:** 4
2 hours lecture and 2 hour tutorial per week

Objectives

- *To impart the basic concepts of Automobile parts and its working*
- *To develop an idea about the fundamentals on modern vehicle technologies.*

Module 1 (12 hours)

Engines: Types of engines in automobiles-classifications-engine components-working of various systems-present and future vehicles, engine construction- intake and exhaust systems. Different combustion chambers, carburetors, diesel fuel pumps, injectors, single point and multi point fuel injection-MPFI and CRDI systems - lubricating and cooling systems.

Vehicle performance-resistance to the motion of vehicle-air, rolling, and radiant resistance-power requirement-acceleration and gradeability-selection of gear ratios.

Module 2 (12 hours)

Transmission: prime movers- clutch-principle of friction and cone clutches – centrifugal clutches, diaphragm clutches and fluid couplings-Gear box-necessity and principle. Constant mesh, sliding mesh, synchromesh gear boxes and epicyclic gearbox –overdrives. Hydraulic torque converters-semi and automatic transmission systems - constant velocity and universal joints. Final drive-front wheel, rear wheel and four wheel drives-transfer case-Hotchkiss and torque tube drives-differential-non-slip differential-rear axles-types of rear axles.

Module 3 (12 hours)

Steering and Suspension: Different steering mechanisms- Ackermann Steering mechanism. Steering gear boxes- power steering –types. Suspension systems-front axle, rigid axle and independent suspensions-anti-roll bar-coil spring and leaf spring - torsion bar -Macpherson strut- sliding pillar- wish bone- trailing arm suspensions-Shock absorbers -hydraulic and gas charged shock absorbers-air suspensions

Front axle types-front wheel geometry-castor, camber, king pin inclination, toe-in toe-out , wheel balancing- wheel alignment.

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Module 4 (12 hours)

Chassis, Brakes and Tyres: Types of chassis and body constructions-crumble zones, air bags and impact beams. Braking mechanism and convectional brakes- Drum brakes and Disc brakes. Vacuum booster, hydraulic and power brakes, components and attachments of mechanical, hydraulic and pneumatic brakes-Master cylinder-Tandem cylinder- working. Anti-lock braking systems-Wheels and Tyres- tubeless tyres-ply ratings- radial tyres. Different tyre wears- causes

Module 5 (12 hours)

Electrical systems - Battery ignition system circuit- electronic ignition system alternators - voltage regulators starting system- bendix and follow through drives – automotive lighting, accessories and dashboard instruments- head light and horn with relays-circuit diagrams. Automotive air conditioning Preventive and breakdown maintenance- engine testing, servicing-engine overhaul- engine tuning.

Text Books

1. Kripal Singh , *Automobile Engineering (Vol. 1 & 2)*
2. V.A.W Hillier & Peter Coombes, *Hillier's Fundamentals of Motor Vehicle Technology*. New Age International.

Reference Books

1. K.M.Guptha , *Automobile Engineering (Vol. 1 & 2)*
2. Joseph Heitner, *Automotive Mechanics*
3. Harbans Singh Reyd, *Automobile Engineering*
4. William H. Course, *Automotive Mechanics*

ME010 606L04:Advanced Strength of Materials

(Common with PE 010 606L05)

Teaching scheme **Credits:** 4

2 hours lecture and 2 hour tutorial per week

Objectives

- *To analyse the stresses and deformations through advanced mathematical models.*
- *To estimate the design strength of various industrial equipments.*

Module 1 (12 -hours)

ANALYSIS OF PLATES Mathematical modeling of plates with normal loads – Point and Distributed Loads – Support conditions – Rectangular plates - Stresses along coordinate axes – Plate deformations – Axi-symmetric plates – Radial and tangential stresses – plate deflections.

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Module II (14-hours)

THICK CYLINDERS AND SPHERES Equilibrium and compatibility conditions - Lame's Theorem – Boundary conditions – distribution of radial and tangential stresses – compound cylinders – Interference fits - Stresses due to temperature distributions. piston, oscillating motor-characteristics.

Module III (12 -hours)

ROTATING DISCS Lame-Clayperon Theorem – radial and tangential stresses in discs due to centrifugal effects – boundary conditions – solid and hollow discs – Interference fit on shafts –Strengthening of the hub – residual stresses – Autofrettege – Discs of variable thickness – Disc profile for uniform strength.

Module IV (12 - hours)

BEAMS ON ELASTIC FOUNDATION Infinite beam subjected to concentrated load – Boundary Conditions – Infinite beam subjected to a distributed load segment – Triangular load – Semi infinite beam subjected to loads at the ends and concentrated load near the ends – Short beams.

Module V (10 - hours)

CURVED BEAMS AND CONTACT STRESSES Analysis of stresses in beams with large curvature – Stress distribution in curved beams – Stresses in crane hooks and C clamps – Contact Stresses – Hertz equation for contact stresses – applications to rolling contact elements.

Text Books

1. Boresi A.P., Schmidt R.J., "Advanced Mechanics of Materials", John Wiley and Sons, Sixth edition, 2003.
2. Dally J.W. and Riley W.F, "Experimental Stress Analysis", John Wiley and Sons 2003

Reference Books

1. Burr A. H., CheathAm J.B., "Mechanical Analysis and Design", Prentice Hall of India, Second edition, 2001.
2. Den-Hartog J.P., "Strength of Materials", John Wiley and Sons..

ME010 606L05: Industrial Hydraulics

(Common with PE 010 606L05)

Teaching scheme **Credits:** 4

2 hours lecture and 2 hour tutorial per week

Objectives

- *To impart the basic concepts of Fluid properties, hydraulic machines and pumping machinery*
- *To develop an idea about pressure measurements working and properties of hydraulic machines and various types of pumping machineries.*

Module 1 (14 -hours) Introduction to hydraulic / pneumatic devices. Symbols and nomenclature. Power transmission, Hydraulic pumps-classifications, characteristic **C**omparison of electric, hydraulic and pneumatic devices. Hydraulic accumulators.

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Module II (14-hours) Pumps and motors: Principle of working. Hand pumps-single acting, double acting, multi- displacement. Gear pumps- internal, external and gear ring. Screw, vane, piston pumps – axial piston pump, swash pump, bent axis pump radial and series pumps. Types of hydraulic motors, gear motors, vane motors, piston motors- radial piston, rolling vane, ball piston, oscillating motor-characteristics. Telescopic cylinder, cylinder cushion**.**

Module III (12 -hours) Hydraulic valves: Directional control valve, shuttle valve, pressure control valve Stop valve- non return valve-relief valve-sequence valve-counter balance valve- pressure reducing valve – flow control valve –direction control valves- throttling, non throttling- open centre and closed centre and tandem centre valves- their principle of operation.

Module IV (12 - hours) Hydraulic Circuits and Circuit fundamentals. Flow divider and combiner. Piping terminology, control terminology, flow control of hydraulic pump, velocity control- characteristics. Different types of switching and its merits Meter in and meter out. Applications of unloading valve. Application of pressure reducing and pressure sequence valve.

Module V (8 - hours) Properties of commonly used hydraulic fluids-Typical hydraulic circuits used in machine tools –Rivetter- pneumatic Hammer, hydraulic press, and power steering

Text Books

1. S.R.Majumdar, *Oil Hydraulics and Systems-Principles and maintenance*, TMH
2. John Pippenger & Tyler Hicks - *Industrial Hydraulics*

Reference Books

1. Daniel Bonteille -*Fluid Logic and Industrial automation*.
2. Pneumatic Systems –*Principles and Maintanance by S.R Majumdar*, TMH
3. Esposito- *Fluid power with applications*.

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ME010606 L06 Project Management

Teaching scheme **Credits:** 4

2 hours lecture and 2 hour tutorial per week

Objectives

- *To impart the basic concepts of Project selection.*
- *To develop an understanding of tools, techniques and software available for Project Management.*

Module 1 (10 hours)

Introduction, Capital Investments, Phases of Capital Budgeting, Project Characteristics, Taxonomy of Projects, Project Identification and Formulation. 7-S of Project Management. Project feasibility Analysis- Market and Demand Analysis, Technical Analysis, Financial Analysis, Ecological Analysis, Social Cost Benefit Analysis.

Module 2 (15 hours)

Cost of the Project, Means of Finance, Financial Evaluation of projects- Pay back period method, Accounting Rate of Return method, Net Present Value method, Internal Rate of Return method, Benefit Cost Ratio method, etc., Simple Problems.

Module 3 (10 hours)

Risk Analysis-risk in economic analysis-measuring risk in investment; Sources, Measures and Perspectives on Risk, Techniques used for risk analysis – Decision trees, Simulation, Break-even Analysis etc., Techniques for Managing Risk.

Module 4 (15 hours)

Project Scheduling- PERT and CPM techniques, Estimates -time, cost, resources (man, material, tool), Crashing of Projects, Project scheduling with constrained resources, resource leveling, resource Allocation.

Module 5 (10hours)

Computer Aided Project management, Essential Requirement of Project Management Software, MS Project 2010 software, Features and Facilities in Project 2010, Types of Reports available in Project 2010 etc. Project Management Information Systems (PMIS), PMIS sotware, Web- Enabled Project Management.

Text Books

1. Prasanna Chandra, *Projects*, Tata McGraw Hill.
2. Nagarajan K, *Project Management 4th edition*, New Age International (P) Ltd.

Reference Books

1. Nicholas J. M. & Steyn H., *Project Management*, Elsevier.
2. Brian Kennemer and Sonia Atchison, *Using Microsoft Project 2010*, Que Publishing.
3. Harvey Maylor, *Project Management*, Pearson Education.
4. Panneerselvam & Senthilkumar, *Project Management*, PHI

ME010 607: HEAT ENGINES LABORATORY

(Common with AU010 607 and AN010 607)

Teaching scheme **Credits:** 2
3 hours practical per week

Objectives

- *To provide experience on testing of IC engines performance.*

Study of systems and components of IC Engines and automobiles - study of dynamometers used in engine testing - study of IC Engine repairs and maintenance.

Study of boilers, boiler mountings and accessories - study of steam engine parts and systems.

Testing of IC engines • Performance analysis of IC engine using computerized test rig-
Load test on petrol and diesel engines- determination of indicated and brake thermal efficiencies - mechanical efficiency - relative efficiency - volumetric efficiency - air-fuel ratio and compression ratio - valve timing diagram - retardation test - Morse test - heat balance - effect of varying the rate of cooling water and varying the speed on the performance characteristics of engines.

Testing of steam boiler - boiler trial - steam calorimeters and steam nozzles - performance test on steam engines - performance test on steam turbines.

Testing of fuels and lubricants - determination of flash and fire points of petroleum products - determination of kinematics and absolute viscosity of lubricating oils - determination of calorific values

Internal Continuous Assessment *(Maximum Marks-50)*

50%-Laboratory practical and record
30%- Test/s
20%- Regularity in the class

End Semester Examination *(Maximum Marks-100)*

70% - Procedure, conducting experiment, results, tabulation, and inference
30% - Viva voce

ME010 608 Machine Tool Laboratory

(Common with AU010 608)

Teaching scheme **Credits:** 2

3 hours practical per week

List of Experiments

1. Study of precision tools used in machine tool laboratory: – Vernier caliper, micrometers, surface plates, surface gauges, gauge block, straight edges, dial gauge, plug and ring gauges, slip gauges, sine bar, care of tools and gauges. **– 2 practices**.
2. Study of lathe tools and accessories: - Selection of tool for different operations - tool materials: high carbon steel, HSS, cemented carbides, coated WC, indexable inserts, alumina, cBN, diamond etc. - tool nomenclature and attributes of each tool angles on cutting processes – effect of nose radius, side cutting edge angle, end cutting edge angle and feed on surface roughness – tool grinding and safe working practices. - 1 **practice.**
3. Selection of speeds, feeds and depth of cut – selection of cutting fluids – different methods of holding work. **- 1 practice.**
4. Experiment on arc and gas welding: - butt welding and lap welding of M.S. sheets. **- 1 practice.**
5. (a) Measurement of cutting forces in turning process using dynamometers. (b) Experiment on lathe:- Facing, plain turning, step turning and parting - groove cutting, knurling and chamfering - form turning and taper turning - eccentric turning.
   (c) Measurement of flank wear in turning process using tool makers microscope. **- 3 practices.**
6. Experiment on thread cutting: - single and multistart external and internal threads, square and V-threads. **- 1 practice.**
7. Disassembly and assembly of small assemblies such as tail stock, bench vice, screw jack etc. **- 1 practice.**
8. Experiment on drilling machine: - drilling, boring, reaming and counter sinking – taping – study of reamers and taping. **- 1 practice**.
9. Study and demonstration of N.C. machines:- CNC machines components - Point to point, straight cut and contouring positioning - incremental and absolute systems – open loop and closed loop systems – DDA integrator and interpolators - part programming fundamentals - manual programming – tape format – sequence number, preparatory functions, dimension words, speed word, feed world, tool world, miscellaneous functions – Computer aided part programming:- APT language structure: geometry commands, motion commands, postprocessor commands, compilation control commands – programming, simulation and demonstration exercises involving plane taper and form turning etc. **- 3 practices.**

Besides to the skill development in performing the work, prepare the control charts and oral examination should also be carried out. Observation and record books are to be maintained.

The student's assessment, continuous evaluation, awarding of sessional marks, record bonafides, oral examination etc and University examination shall be carried out by the faculty members (lecturer and above).

TEXT BOOKS:

1. Acharkan. N., Machine Tool Design Vol. 1 to 4, MIR Publication.

REFERENCE BOOKS:

1. Chapman, Workshop Technology, Vol II, ELBS.
2. HMT, Production Technology, Tata McGraw Hill.
3. Yoram Koren, Numerical Control of Machine Tools, McGraw-Hill.

ME 010 701 Design of Machine Elements

(Common with AU010 701)

Teaching scheme **Credits:** 4

2 hours lecture, 1 hour tutorial and 1 hour drawing per week

Objectives

To provide basic knowledge on the design considerations and methodology of various machine elements.

Module I (15 Hrs)

System design cycle - Different phases in design process - design factors and considerations - tolerances and fits - Hole basis & Shaft basis system - standardization - selection of materials - stress concentration - Methods to reduce stress concentration - theoretical stress concentration factor - theories of failure - Guest's theory - Rankine's theory - St. Venant's theory - Haigh's theory - Von Mises & Hencky theory - shock and impact loads - fatigue loading - endurance limit stress- Factors affecting endurance limit - Factor of safety - creep and thermal stresses.

Module II (15 Hrs)

Design of riveted joints- Failure of riveted joints and efficiency of joint -boiler and tank joints- structural joints, Cotter and Knuckle joints

Threaded joints - thread standards- thread nomenclature - stresses in screw threads- bolted joints preloading of bolts- eccentric loading- fatigue loading of bolts - Power screws.

Module III (15 Hrs)

Design of welded joints- Representation of welds - stresses in fillet and butt welds- design for static loads - bending and torsion in welded joints- eccentrically loaded welds - design of welds for variable loads.

Springs- stresses and deflection of helical springs with axial loading - curvature effect - resilience - design of spring for static and fatigue loading- surging- critical frequency- stress analysis and design of leaf springs..

Module IV (15 Hrs)

Shafts and axles design- stresses- causes of failure in shafts - design based on strength, rigidity and critical speed- design for static and fatigue loads- repeated loading- reversed bending-

Design of couplings - Rigid and flexible couplings - design of keys and pins.

Note: Any one of the following data book is only permitted for reference in the University examination

1. Machine Design Data hand book by K. Lingaiah, Suma Publishers, Bangalore/ Tata Mc Graw Hill
2. PSG Design Data, DPV Printers, Coimbatore.

Text Books

1. C.S, Sarma, Kamlesh Purohit, Design of Machine Elements, Prentice Hall of India Ltd , New Delhi
2. M. F. Spotts, T. E. Shoup, Design of Machine Elements, Pearson Education.
3. V.B. Bhandari, Design of Machine Elements, McGraw Hill Book Company

Reference Books

1. J. E. Shigley, Mechanical Engineering Design, McGraw Hill Book Company

ME 010 702: Dynamics of Machines

Teaching scheme **Credits:** 4

2 hours lecture and 2 hour tutorial per week

Objectives

- *To understand the basic principles involved in the balancing of rotating and reciprocating masses*
- *To understand the basic concepts of vibration of single degree of freedom systems*
- *To understand the methods of analysis of two degree and multi degree of freedom systems.*
- *To understand the concepts in transient and non linear vibration*
- *To understand the methods of noise control*

Module I (14 hours)

Balancing: - Balancing of rotating masses, static balancing and dynamic balancing, Balancing of several masses rotates in same plane, balancing of several masses rotating in several planes, Balancing machines.
Balancing of reciprocating masses: - The effect of inertia force of the reciprocating mass on the engine. Partial primary balance. Balancing of multi cylinder inline engines, v-engines, Radial engines, Direct and Reverse cranks

Module II (16 hours)
Vibrations: - Definitions, simple harmonic motion. Single degree freedom systems: -
Undamped free vibrations: - Equations of motion Natural frequency, Energy method, Equilibrium methods, Rayleigh's methods, Equivalent stiffness of spring combinations.
Damped free vibrations: - Viscous damping, Free vibrations with viscous damping, Over damped system, Critically damped system, Under-damped system, Logarithmic decrement, viscous dampers, Energy dissipated by damping,
Forced Vibrations: - Forced harmonic excitation, Base Excitation, Vibration isolation and Transmissibility. Vibration measuring instruments.

Module III (14 hours)
Two degree freedom systems: - Principal modes of vibration, Rectilinear and angular modes, systems with damping, vibration absorbers, Centrifugal pendulum damper, Dry friction damper, untuned viscous damper.
Multi-degree of freedom system: - Free vibrations, equations of motion, Influence
Coefficients method, lumped mass systems, distributed mass systems (basics only), Stodola method, Dunkerly's method.
Torsional Vibrations: - Torsionally equivalent shaft, torsional vibration of two rotor, three-rotor, and geared systems

Module IV (14 hours)

Critical speeds of shafts: - Critical speed of a light shaft is having a single disc without damping.

Transient vibration: - Laplace transformation, response to an impulsive input, response to a step input, phase plane method, shock spectrum.

Non-linear vibrations: - Phase plane, undamped free vibration with non-linear spring forces, hard spring, soft spring, Forced vibration with nonlinear forces, Duffings equation, self excited vibrations - problems.

Module V (12 hours)

Acoustics: - Sound propagation, decibels, acceptance noise levels, Air columns, acoustical measurements, Doppler Effect, microphones and loud Speakers. Recording and reproduction of sound, Fourier's theorem and musical scale, Acoustic impedence filters.

Environmental noise control: Industrial noise control strategies Noise ratings, human ear. human tolerance levels, equivalent sound level and loudness contours - Noise control through barriers and enclosures and absorbent linings - problems.

References

1. Theory of Machines - Thomas Bevan
2. Theory of Machines - P.L. Ballaney
3. Mechanical Vibrations, V edition - G.K. Groover
4. Theory of Vibrations with applications, III Edn - W.T. Thomson
5. Mechanical Vibrations - S. Graham Kelly, Schaum's outlines
6. Fundamentals of Vibrations - Leonard Meirovitch, Mac Graw Hill
7. A text book of sound - L.P. Sharma & H.C. Saxena
8. Engineering Noise Control - D.A. Bies & C.H. Hausen.
9. Noise & Vibration Control - Leo N. Beraneck

ME 010 703: Gas Dynamics and Jet Propulsion

Teaching scheme **Credits:** 3

2 hours lecture and 1 hour tutorial per week

Objectives

- *To impart the basic concepts of dynamics and thermodynamics of gas flow.*

Module I (7 hours)

Introduction: Continuum- Control Volume and System approaches- Continuity and Momentum equations for control volume- Mach number- Velocity of sound- Classification of flow based on Mach number- Physical difference between incompressible, subsonic and supersonic flow- Mach angle- Karman's rule of supersonic flow- Effect of Mach number on compressibility- General features of one dimensional flow of compressible fluid.

Module II (10 hours)

Isentropic flow of an ideal gas: General features and governing equations- stagnation properties and state- Reference velocities- Dimensionless velocity- Crocco number- Bernoulli equation- Isentropic flow through variable area- Comparison of isentropic and adiabatic flow- Mach number variations- Area ratio- Impulse function- Mass flow rate, Chocking in Isentropic flow- Variation of flow parameters in isentropic flow- Performance of convergent and De lavel nozzle- Performance of real nozzles- Applications of Isentropic flow.

Module III (10 hours)

Simple frictional flow: Governing equations- Fanno curves- Limiting conditions- Fanno flow equations- Variation of flow properties- Variation of Mach number with duct length- Choking due to friction. Isothermal flow with friction: Basic equations- Limiting conditions- Variation of flow properties. Flow with heat transfer: Governing equations- Rayleigh curves- Limiting condition- Rayleigh flow relations- Variation of flow properties- Maximum heat transfer- Thermal choking.

Module IV (9 hours)

Normal shock: Development of a shock wave- Governing equations- Intersection of Fanno and Rayleigh lines- Prandtl-Meyer relation- Properties of flow across normal shock- Thickness of shock waves- Shock strength- Determination of Mach number of supersonic flow- Variation of flow parameters through normal shock.

Module V (9 hours)

Air craft propulsion: Types of gas turbine engines- Components of a gas turbine engine- Energy flow through jet engines- Propeller and jet Thrust- propulsive and overall efficiency- Ramjet, Pulsejet and Scramjet engine. Rocket Propulsion: Types of rocket engines- Liquid propellant rockets and propellant feed system- Solid propellant rocket motors- Restricted and unrestricted burning- Rocket propulsion theory- Applications.

Text Books

1. S M Yahya, *Fundamentals of compressible flow with aircraft and rocket propulsion*, New Age International.
2. P Balachandran, *Fundamentals of compressible fluid dynamics*, Prentice Hall of India.
3. V Babu, *Fundamentals of gas dynamics,* Ane Books India.

Reference Books

1. A. H. Shapiro, *Dynamics and thermodynamics of compressible fluid flow (Vol-1)*, The Ronald Press Company.
2. Anderson, *Modern compressible flow with historical perspective*, Mc Graw Hill
3. James John & Theo Keith, *Gas Dynamics*, Pearson International.
4. Liepmann and Roshko*, Elements of gas dynamics*, Dover publications.
5. Zucrow M. J. & Jeo D Holfman ,*Gas dynamics (Vol 1)*, John Wiley

ME010 704: Refrigeration and Air Conditioning

(Common with AU010 704)

Teaching scheme **Credits:** 3

2 hours lecture and 1 hour tutorial per week

Objectives

- *To impart the basic concepts of Refrigeration and Air Conditioning*
- *To develop a sound physical understanding of the subject so that the learner will demonstrate the ability to design a refrigeration or air-conditioning equipment that meets the required specifications*

Module 1 (8 hours)

Principles of refrigeration: Thermodynamics of refrigeration – Carnot, reversed carrot cycle, heat pump, and refrigerating machine- coefficient of performance -unit of refrigeration-refrigeration methods - conventional refrigeration systems. Air refrigeration system -Bell Coleman cycle -C.O.P –capacity, work and refrigerant flow requirements in Bell Coleman cycle.

Module 2 (10 hours)

Vapor compression system: simple cycle -comparison with Carnot cycle, theoretical and actual cycles- COP- effect of operating parameters on COP- wet, dry and superheated compression- sub cooling - actual cycle representation on TS and PH diagrams- simple problems. Advanced vapor compression systems – multistage vapor compression systems- flash chamber- multiple compression and evaporation systems- cascading -simple problems.

Module 3 (10 hours)

Vapor absorption systems: simple cycles-actual cycle- ammonia water and lithium bromide water systems – COP -Electrolux system. Refrigerant and their properties: Nomenclature-suitability of refrigerants for various applications -unconventional refrigeration methods- vortex tube, steam jet, magnetic (Cryogenics) refrigeration and thermoelectric refrigeration- applied refrigeration: house hold refrigerator –unit air conditioners and water coolers- ice plant -cold storage

Module 4 (7 hours)

Refrigeration system components (Theory Only): water and air cooled condensers- evaporative condensers- expansion devises -capillary tube -constant pressure expansion valve- thermostatic expansion valve- float valve and solenoid valve. Evaporators: natural convection coils -flooded evaporators -direct expansion coils. Reciprocating compressors: single stage and multistage compressors- work done -optimum pressure ratio -effect of intercooling- volumetric efficiency -

effect of clearance- isothermal and adiabatic efficiency. Rotodynamic compresors: Screw and vane type compressors- principle of operation- hermetic, semi hermetic and open type refrigeration compressors.

Module 5 (10 hours)

Principles of air conditioning: Psychrometry and psychrometric chart - human comfort- effective temperature- comfort chart. Applied psychrometry: sensible heat factor- psychometric process – problems. Winter air conditioning- heating load calculations- humidifiers and humidistat. Summer air conditioning- cooling load calculations- year round air conditioning -unitary and central systems -principles of air distribution -design of air duct systems.

Text Books

1. Stoecker W.F. and Jones J.W, *Refrigeration and Air-Conditioning*, McGraw- Hill
2. Jordan and Prister, *Refrigeration and Air-Conditioning*, Prentice Hall of India.

Reference Books

1. Dossat., *Principles of Refrigeration*, John Wiley and Sons
2. Robert H. Enerick, *Basic Refrigeration and Air-Conditioning*, Prentice Hall.
3. Arora C.P., *Refrigeration and Air-Conditioning*, Tata McGraw- Hill

ME 010 705: Industrial Engineering
(Common with AU010 705)

Teaching scheme **Credits:** 4

2 hours lecture and 1 hour tutorial per week

Objectives

- *To provide an exposure to the fundamental tools and techniques in Industrial Engineering for integration and improvement of inter related work activities and productivity management.*

Module I (9 hours)

Introduction: Evolution of industrial Engineering, Branches and Fields of application of Industrial Engineering, Functions of Industrial Engineer. Types of production- Productivity- Productivity index- factors affecting productivity-techniques for productivity improvement.

Product development and design: Requirements of a good product design- product development process- product analysis. Value Engineering: Fundamental Concepts- reasons for poor values- types of values- Applications and benefits of Value Engineering.

Module II (9 hours)

Facility planning: Plant location-Procedure for site selection- Plant layout-Objectives and principles of plant layout- types of layout- Factors influencing layout- introduction to layouts based on group technology, just-in-time and cellular manufacturing systems.

Material Handling: Functions and Principles of material handling, Selection of material handling equipments-types of material handling equipments.

Module III (9 hours)

Materials Management: Objectives, functions and scope of materials management. **Purchasing** - Objectives and functions-purchasing procedure- buying techniques- Vendor development and rating system- Stores management.

Inventory Control: Objectives of inventory control-inventory costs-Determining inventory level- EOQ model-Models with shortages-Continuous and Periodic Review systems-ABC analysis- Make or buy decision-Vendor Managed Inventory.

Module IV (9 hours)

Methods engineering: Work study-Procedure for motion study- Recording Techniques- Micro motion study- Work measurement techniques- Time study.

Industrial Ergonomics: Introduction to Ergonomics-Objectives of Human Engineering- Aspects of Man- Machine System- Workplace design.

Job Evaluation and Merit Rating: Objectives of Job evaluation, methods of job evaluation, merit rating, Types of merit rating.

Module V (9 hours)

Inspection and Quality Control: Objectives and kinds of inspection-methods of inspection-Objectives of quality control- Statistical quality control-control charts, problems- Acceptance sampling-Total quality management- ISO systems-QFD- Benchmarking.

Text Books

1. Verma A.P., *Industrial Engineering*, S. K. Kataria & Sons.
2. Sharma S. C. & Banga T. R., *Industrial Organization and Engineering Economics,* Khanna Publishers.

Reference Books

1. Tompkins J.A and White J.A. *, Facilities Planning,* John Wiley, N.Y.,1984.
2. Tony Arnold, J.R, *Introduction to materials management,* Prentice hall inc, N.J,1998.
3. Tayyari and Smith J.L., *Occupational Ergonomics; principles and Applications,* Chapman and Hall publication, U.K., 1997

ME 010 706 L01: PLANT ENGINEERING AND MAINTENANCE

Teaching scheme **Credits:** 4

2 hours lecture and 2 hour tutorial per week

Objectives

- *The course is designed to develop an understanding of maintenance tools and techniques in the new industrial world.*

Module 1 (12 hours)

Fundamentals of plant engineering - Plant facilities - Layout of facilities, basic amenities etc. Types of maintenance- breakdown, preventive, periodic or predictive, condition based maintenance- deterioration and failure analysis- planning, scheduling, and controlling of maintenance work- organization for maintenance.

Module 2 (12 hours)

Wear: Sliding wear tests – Archard wear equation – unlubricated wear of metals - wear regime maps for metals – mechanism of sliding wear of metals : plasticity dominated wear, Oxidative wear – lubricated wear of metals – fretting wear of metals – wear of ceramics and polymers.

Module 3 (12 hours)

Reliability: concept and definition-chance failure and wear out failure -application of stochastic model for reliability studies- reliability of series, parallel and stand by systems- estimation of parameters of failure distribution- maintainability and availability.

Replacement: causes of deterioration and obsolescence- sudden and gradual obsolescence and deterioration- economic analysis- MAPI method- simple problems.

Module 4 (12 hours)

Condition based maintenance using Vibration Signature, SOAP, ferrography, hot ferrography, Infra Red Camera, fluorescent dye, Particle Analyzers and other diagnostic techniques.

Reliability Centered Maintenance- Total Productive Maintenance- Tero-technology and its influence on plant engineering and maintenance. Overall equipment effectiveness (OEE) – Reliability Availability and Maintainability analysis (RAM).

Module 5 (12 hours)

Safety management: fire protection and prevention - safety against mechanical hazards, chemical hazards- accident prevention program- Industrial noise - Pollution control- Waste disposal - Recycling of waste - Energy conservation, management and audit - legal provisions for safety in industry.

Text Books

1. Collacott R.A., *Mechanical fault Diagnosis and Condition Monitoring*, Chapman and Hall Ltd.
2. Sushikumar Srivastava, *Industrial Maintenance Management*, S. Chand and Co. Ltd., New Delhi.

Reference Books

1. Rosaler R., *Handbook of Plant Engineering*, McGraw Hill.
2. Mobley K., Higgins L.R., *Handbook of Maintenance Engineering*, McGraw Hill.
3. Hutchings I. M., *Trobology: friction and wear of engineering materials,* Edward Arnold
4. Robinowicz Ernest, *Friction and wear of materials,* John Wiley

ME010 706L02: Turbo Machines

Teaching scheme **Credits:** 4

2 hours lecture and 2 hour tutorial per week

Objectives

- *To impart the basic concepts of various turbo machines like blowers, fans, compressors and turbines.*

Module I (12 hours)

Principles: Energy transfer between fluid and rotor, classification of fluid machinery, dimensionless parameters, specific speed, applications, stage velocity triangles, work and efficiency for compressors and turbines.

Module II (12 hours)

Centrifugal Fans and Blowers: Types, stage and design parameters, flow analysis in impeller blades, volute and diffusers, losses, characteristics curves and selection, fan drives and fan noise.

Module III (12 hours)

Centrifugal Compressor: Construction details, types, impeller flow losses, slip factor, diffuser analysis, losses and performance curves.

Module IV (12 hours)

Axial Flow Compressor: Stage velocity triangles, enthalpy-entropy diagrams, stage losses and efficiency, work done factor, simple stage design problems and performance characteristics.

Module V (12 hours)

Axial and Radial Flow Turbines: Stage velocity diagrams, reaction stages, losses and coefficients blade design principles, and testing and performance characteristics.

Text Books

1) Yahya, S.H., *Turbines, Compressor and Fans*, Tata Mc Graw Hill Publishing Company, 1996.
2) B K Venkanna, *Fundamentals of Turbomachinery*, Prentice Hall of India, 2009

Reference Books

1. Bruneck, *Fans*, Pergamom Press, 1973.
2. Earl Logan, Jr., *Hand book of Turbomachinery*, Marcel Dekker Inc., 1992.
3. Dixon, S.I., *Fluid Mechanics and Thermodynamics of Turbomachinery*, Pergamom Press, 1990.
4. Shepherd, D.G., *Principles of Turbomachinery*, Macmillan, 1969.
5. Stepanff, A.J., *Blowers and Pumps*, John Wiley and Sons Inc., 1965
6. Ganesan .V. *Gas Turbines*, Tata Mcgraw Hill Pub.Co., New Delhi, 1999.

Mahatma Gandhi University, Kottayam

ME010 706 L03 Theory of vibration

Teaching scheme **Credits:** 4

2 hours lecture and 2 hour tutorial per week

Objectives

- *To understand the basic concepts and issues related to vibration*

Module I (12 hours)

Fundamentals of vibration

Introduction, Definitions, Vector method of representing harmonic motions, Additions of two Simple Harmonic Motions of the same Frequency, Beats Phenomenon.

Undamped free vibrations of single degree of freedom

Introduction, Derivation of differential equation, Solution of differential equation, Torsional Vibrations, equivalent stiffness of Spring Combinations, Energy Method.

Module II (12 hours)

Damped free vibrations of single degree of freedom system

Introduction, Different types of Damping, Free Vibrations with viscous damping, Logarithmic decrement, Viscous dampers, Dry Friction or Coulomb damping, Solid or Structural damping.

Module III (12 hours)

Forced vibrations with constant harmonic excitation

Introduction, Forced Vibrations with constant harmonic excitation, Forced Vibrations due to excitation of the Support, Energy dissipated by damping, Forced vibrations with Coulomb damping, Forced vibrations with Structural damping, Determination of Equivalent viscous damping from frequency-response curve, Vibration isolation and transmissibility, Vibration measuring instruments, Critical speed of shafts

Module IV (12 hours)

Two degree of freedom systems

Introduction, Principal modes of Vibration, Other cases of simple two degrees of freedom systems, Combined rectilinear and angular modes, Systems with damping, Undamped forced vibrations with Harmonic excitation, Vibration absorbers, Vibration Isolation Natural frequencies and mode shapes (eigenvalues and eigenvectors), orthogonal properties of normal modes, Introduction to Model analysis,

Module V (12 hours)

Continuous systems – vibrating strings - axial vibration of rod – transverse vibration of beams – torsional vibration of shafts.

Text Books

1. Leonard Meirovitch, "Fundamentals of Vibrations", International Edition, McGraw-Hill, 2001.
2. Singiresu S Rao, “Mechanical Vibrations", Fourth Edition, Pearson.
3. V. P. Singh, “Mechanical Vibrations", Dhanpat Rai & sons
4. William T Thomson, “Theory of Vibration with applications", Prentice Hall, 1993.

ME010 706 L04 Sales and Marketing Management

Teaching scheme **Credits:** 4

2 hours lecture and 2 hour tutorial per week

Module 1 (12 hours)

Marketing: Definition- Marketing concepts- Market segmentation- Market demand- Product- Value and satisfaction- Exchange and transactions- Marketing channels- Competition- Marketing environment- Marketing mix.
Marketing Management: Functions-Sales forecasting-Pricing-Distribution- Advertising- Sales promotion- Marketing research.

Module 2 (12 hours)

Strategic Planning: Strategic business unit (SBU)- Business strategic planning- SWOT analysis. Marketing decision support system.

Module 3 (12 hours)

Product life cycle: Marketing strategies in the different stages of product life cycle.
New product development: Idea generation- Concept development and testing conjoint analysis.
Introduction to Relationship marketing, International marketing and on line marketing.

Module 4 (12 hours)

Consumer behaviour: Major factors affecting consumer buying behavior- Consumer decision making process.
Organizational buying behavior: Buying situations- the buying center-Purchasing process.

Module 5 (12 hours)

Sales management: Evolution of Sales management- Objectives of Sales management- Personal selling situations- Theories of selling- Basic selling styles- Recruitment, selection and training of sales personnel-Sales territory-Sales quotas.

References
1. Marketing Management - Philip Khotler
2. Sales Management - Richard, Edward & Norman
3. Industrial Engg & Management - O.P.Khanna
4. Industrial Organisation & Management - Banga & Sarma
5. Organisational Behaviour - Fred Luthans

6. Consumer Behaviour - Schifman & Kanuk
7. Basic marketing - Gundiff
8. Marketing Management for small units - Jain
9. Sales Engg - Lester
10. Salesmanship concept - Thomson

ME010 706 L05 Failure Analysis and Design

Teaching scheme **Credits:** 4

2 hours lecture and 2 hours tutorial per week

Objectives:

- *To introduce basic concepts of reliability in analysis and design*
- *To study fracture, fatigue and other modes of failure*

Module1 (12 hours)

Reliability: Reliability concept and hazard function, life prediction, condition monitoring, application of Poisson, exponential and Weibull distribution for reliability - bath tub curve - parallel and series system - mean time between failures and life testing.

Stresses in a body: Two dimensional and three dimensional state of stress, Mohr's circle two and three dimensions, hydrostatic stress, Von-mises, maximum shear stress (Tresca), octahedral shear stress, torsional stresses for large plastic strain.

Module 2 (12 hours)

Fracture: Types of fracture, Griffith crack theory, stress analysis of cracks, metallographic aspects of fracture. Brittle, ductile fractures, notch effects, fracture curve, R curve, fracture under combined stresses, effect of hydrostatic pressure on fracture, probabilistic aspects of fracture mechanics, toughness of materials.

Module 3 (12 hours)

Fatigue: Statistical nature of fatigue, S-N curve, low cycle fatigue, strain life equations, structural feature of fatigue, fatigue crack propagation, effect of stress concentration, size, surface properties, metallurgical variables on fatigue, case studies, designing against fatigue, detail design, improvements after failure and service, fatigue of bolts, welded and adhesive joints.

Fatigue tests: Purpose, specimen, fatigue test procedures, evaluation of fatigue test results, crack growth measurement.

Module 4 (12 hours)

Wear failures: Type of wear, role of friction in wear, lubricated and non-lubricated wear, analysing wear failures, wear tests SOAP, ferrography.

Corrosion failures: Factors influencing corrosion failures, analysis of corrosion failures, overview of various types of corrosion, stress corrosion cracking - sources, characteristics of stress corrosion cracking, procedure of analysing stress corrosion cracking, various types of hydrogen damage failures, corrective and preventive action.

Module 5 (12 hours)

Elevated temperature failures: Creep, stress rupture, elevated temperature fatigue, metallurgical instabilities, environmental induced failure, elevated temperature effects on certain gas turbine components and petroleum refinery components, tests for analysis of failure at elevated temperatures.

References

1. Jaap Schijve, “Fatigue of Structures and Materials”, Kluwer Academic Publishers, 2001.
2. ASM Metals Handbook, "Failure Analysis and Prevention", ASM Metals Park, USA, Vol. 10, 10th Edition, 1995.
3. Richard W Hertzberg,“Deformation and Fracture Mechanism of Engineering Materials”,John Wiley & Sons,Inc.,1995.
4. George E Dieter, “Mechanical Metallurgy”, McGraw Hill Book Company, 1988.

ME 010 706 L06 Foundary and Welding Technology

Teaching scheme **Credits:** 4

2 hours lecture and 2 hour tutorial per week

Foundary Technology

Module 1 (12 hours)

Degassing: Gas Porosity – **Molten Metal Filtration**: sources of inclusions, methods for removal of inclusions – **Castability**: factors influencing fluidity, hot tearing - **Semisolid Metal Processing** - viscosity evolution during continuous cooling - **Rapid Solidification**: microstructural modification, heat flow - **Solidification during Casting of Metal-Matrix Composites**:- incorporation of reinforcements, reinforcement-metal wettability, solidification, distribution of reinforcements.

Module 2 (12 hours)

Hot Isostatic Pressing of Castings:- Reasons for using HIP, effect of HIP on mechanical properties, effect of HIP on the shape and structure of castings, problems encountered in HIP, economics of HIP – **Low Pressure Metal Casting**:- conventional methods, low-pressure furnace and tooling, cores, vacuum riserless/pressure riserless casting – **High Pressure Die Casting**:- die casting alloys and processes, hot and cold chamber, advantages, disadvantages - **Hot and Cold Chamber Die Casting**:- melting process, injection components, distinctions between hot and cold chamber processes, gate and runner design, temperature control.

Module 3 (12 hours)

Vacuum High-Pressure Die Casting:- vacuum riserless casting, high-vacuum die casting – **Semisolid Casting** (SSM):introduction, fundamentals: advantages of SSM processing, SSM processing - **Aluminum and Aluminum Alloy Castings**: effects of alloying and impurity elements, structure control, secondary dendrite arm spacing, nondendritic microstructures, grain structure, grain-refinement, welding, molten metal fluidity, hot cracking - **Titanium and Titanium Alloy Castings**: effects of alloying elements, microstructures of titanium castings, cast microstructure of Ti - 6Al - 4V, melting and pouring, molding methods, postcasting practice, welding, heat treatment **- Nickel and Nickel Alloy Castings**: structure and property correlations, melting practice and metal treatments, foundry practice, pouring practice, gating systems, risers, welding, heat treatment and applications.

Welding Technology

Module 4 (12 hours)

Heat Flow in Fusion Welding - Fluid flow phenomena during Welding: mass transport in the arc in gas tungsten arc welding, deep-penetration electron beam and laser welds, in gas metal arc welding, in submerged arc welding.

Module 5 (12 hours)

Transfer of Heat and Mass to the base metal in gas metal arc welding - Arc Physics of Gas - Tungsten Arc Welding: electrode regions and arc column - Introduction to **Special Welding processes**: **Underwater** Welding: underwater welding pyrometallurgy, micro structural development of underwater welds, heat sources, applications - welding for **cryogenic** service - welding in **space** and low - gravity environments: metallurgy of low-gravity welds.

TEXT BOOKS:

1. ASM Handbook, Volume 15, Casting, ASM International, Metals Park, Ohio, USA.
2. ASM Metals Handbook. Volume 6, Welding Brazing and Soldering, ASM International, Metals Park, Ohio, USA, 1993.

REFERENCE BOOKS:

1. Amstead B.H., Phillip E Ostwald and Myron L.Begeman, "Manufacturing Processes" John Wiley & Co., New York.
2. American Welding Society, Welding handbook, Vol. 1 and 2, 7th edition.
3. AWS Welding Handbooks, AWS, New York, 1995.
4. Flimm, Fundamentals of Metals Casting, Addison Wesley.
5. Gourd L.M., Principles of Welding Technology, ELBS/ Edward Arnold.
6. Howard B Cary., Modern Welding Technology, 4th edition, Prentice Hall, New Jersey, USA, 1997.
7. Koenigsberger and Adaer, Welding Technology, Macmillan.
8. Lancaster, The Physics of Welding; Pergaman Press.
9. Lancster and George Allen, The Metallurgy of Welding, Unwin Ltd. U.K.
10. Lincoln Electric Co, Procedure Handbook of ARC Welding; Lincoln Electric Co. USA.
11. Richard W.Heine, Carl R.Loper and Phlip C.Rosenthal, "Principles of Metal Casting", Tata McGraw Hill, New Delhi.
12. Rossi, Welding Technology, McGraw Hill.
13. Salman and Simans, Foundry Practice, Issac Pitman.
14. Tylecote, The Solid Phase Welding of Metals, Edward Arnold Pvt. Ltd.

ME 010 707 Mechanical Measurements Laboratory

Teaching scheme **Credits:** 2

3 hours practical per week

Objectives

- *To provide an exposure to the fundamentals of metrology*
- *To understand the need of precision measurement and measuring instruments*

1. Study and use of laser interferometer for calibration of linear measurements.
2. Study of slip gauges – wringing – surface roughness - standards.
3. Study of surface plates, straight edges, angle plate, V-block etc and applications.
4. Measurement of out of roundness using roundness measuring instrument, V block and dial indicator etc. - reasons for out of roundness etc.
5. Measurements of straightness using sprit level and auto collimator.
6. Measurement of thread parameters using three wire method.
7. Measurement of tool angles of single point tool using tool maker's microscope.
8. Measurement of gear parameters using profile projector.
9. Evaluation of straightness error using autocollimator, sprit level, straight edge etc.
10. Calibration and determination of uncertainties of the following;
    a. Strain gauge load cells
    b. Bourdon tube pressure gauge
    c. LVDT
    d. Thermocouples
    e. Tachometers and stroboscopes, etc.
11. Study and measurement of surface roughness using surface roughness instrument.
12. Study and measurements with coordinate measuring machines.
13. Experiments on limits and fits.
14. Study and use of ultrasonic flaw detector.
15. Study of different types of dial indicators - stands and holders for dial gauges.
16. Study and use of different types of comparators.
17. Exercises on measurement system analysis
18. Study and making measurements with precision vernier calipers, dial calipers, spline micrometer, point micrometer, wire groove micrometer, depth micrometer, V- anvil micrometers, depth gear tooth micrometer, thread micrometer, disc micrometer, thread pitch gauge, vernier height gauge, slip gauges, optical flat, three pin micrometer,

pyrometer, RTD, bore dial gauge, depth gauge, pitch gauge, thickness gauge, radius gauge, hole test, bench center etc.

19. Angular measurements using bevel protractor, sine bar, clinometers etc.
20. Measurement of vibration.
21. Analysis of automobile exhaust gas and flue gas.
22. Study and determination of area using planimeter.
23. Polishing, etching and determination of grain size and microstructure studies using optical microscope.

TEXT BOOKS:

1. Sharp K.W.B., Practical Engineering Metrology, Sir Isaac Pitman and sons Ltd, London, 1958.
2. Shotbolt C.R. and Gayler J.F.W, Metrology for Engineers, 5th edition, ELBS, London.

REFERENCE BOOKS:

1. Figliola, Richard S, and Beasley, Donald E, “Theory and Design for Mechanical Measurements”, Third edition, John Wiley and Sons Inc.
2. Collett, C.V. and Hope, A.D, “Engineering Measurements”, Second edition, ELBS/Longman.
3. Tarasevigh Y. and Yavosih E., Fits, Tolerances and Engineering Measurements, Foreign language publishing house, Moscow.

ME 010 708 Advanced Machine Tools Laboratory

Teaching scheme **Credits:** 2

3 hours practical per week

Objectives

- *To understand the different process parameters involved in shaping, slotting, milling, grinding machines.*
- *To analysis the causes for the variation on surface roughness obtainable in different machining process.*

PART – A

1. Experiment on shaping machine: - flat surfaces, dovetail cutting – grooving, keyway cutting etc. **- 2 practices.**

2. Experiment on slotting machine: - flat surfaces, dovetail cutting – grooving, keyway cutting etc. - making hexagonal hole using slotting machine. **- 2 practices.**

3. Study of milling machines – nomenclature of milling cutters – different types of milling cutters – attachments for milling:- vertical milling and universal milling attachment, high speed milling attachment, rack milling and slot attachments, parking bracket, rotary table, universal dividing head, vices, arbors, adaptors and collet chucks. **- 1 practice.**

4. Experiment on milling machine: - 1 - plane milling, keyway cutting, cutting of splines. **- 1 practice.**

5. Experiment on milling machine: - 2 – cutting of spur, helical and bevel gears – study of different methods of indexing - multi slot cutting on milling machine by indexing. **- 3 practices.**

6. Study of surface grinding machine and demonstration of grinding of plane surface - study of cylindrical grinding machine and demonstration of plane cylindrical grinding – study and demonstration of planing machine – study and demonstration of broaching machine. **- 2 practices.**

PART – B

Preparation of control charts - preparation of laboratory layout - facilities layout analysis– materials requirement planning – inventory analysis –preparation of process plan and cost estimation for the manufacture of various products – study of a jig and a fixture for drilling and milling operation - fabrication of simple bending dies – Preparation of process plans using CAPP software. **- 3 practices.**

Besides to the skill development in performing the work, oral examination should be conducted.

A detailed report on the work carried out on part – B is also to be prepared. Observation and record books are to be maintained for both part A and B.

The student's assessment, continuous evaluation, awarding of sessional marks, record bonafides, oral examination etc and University examination shall be carried out by the faculty members (Assistant professor and above).

TEXT BOOKS:

1. Acharkan. N., Machine Tool Design Vol. 1 to 4, MIR Publication.

REFERENCE BOOKS:

1. Chapman, Workshop Technology, Vol II, ELBS.
2. HMT, Production Technology, Tata McGraw Hill.
3. Yoram Koren, Numerical Control of Machine Tools, McGraw-Hill.

ME 010 709 Seminar

Teaching scheme **credits: 2**

2 hours practical per week

The seminar power point presentation shall be fundamentals oriented and advanced topics in the appropriate branch of engineering with references of minimum seven latest international journal papers having high impact factor.

Each presentation is to be planned for duration of 25 minutes including a question answer session of five to ten minutes.

The student's internal marks for seminar will be out of 50. The marks will be awarded based on the presentation of the seminar by the students before an evaluation committee consists of a minimum of 4 faculty members. Apportioning of the marks towards various aspects of seminar (extent of literature survey, presentation skill, communication skill, etc.) may be decided by the seminar evaluation committee.

A bona fide report on seminar shall be submitted at the end of the semester. This report shall include, in addition to the presentation materials, all relevant supplementary materials along with detailed answers to all the questions asked/clarifications sought during presentation. All references must be given toward the end of the report. The seminar report should also be submitted for the viva-voce examination at the end of eighth semester.

For Seminar, the minimum for a pass shall be 50% of the total marks assigned to the seminar.

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ME 010 710 Project Work

Teaching scheme **credits: 1**

1 hour practical per week

Project work, in general, means design and development of a system with clearly specified objectives. The project is intended to be a challenge to intellectual and innovative abilities and to give students the opportunity to synthesize and apply the knowledge and analytical skills learned in the different disciplines.

The project shall be a prototype; backed by analysis and simulation etc. No project can be deemed to be complete without having an assessment of the extent to which the objectives are met. This is to be done through proper test and evaluation, in the case of developmental work, or through proper reviews in the case of experimental investigations.

- The project work has to be started in the seventh semester and to be continued on to eighth semester.
- Project work is to be done by student groups. Maximum of four students only are permitted in any one group.
- Projects are expected to be proposed by the students. They may also be proposed by faculty member (Guide) or jointly by student and faculty member.
- Students are expected to finalise project themes/titles with the assistance of an identified faculty member as project guide during the first week of the seventh semester.

The progress from concept to final implementation and testing, through problem definition and the selection of alternative solutions is monitored. Students build self confidence, demonstrate independence, and develop professionalism by successfully completing the project.

Each student shall maintain a project work book. At the beginning of the project, students are required to submit a project plan in the project book. The plan should not exceed 600 words but should cover the following matters.

❖ Relevance of the project proposed
❖ Literature survey
❖ Objectives
❖ Statement of how the objectives are to be tackled

- Time schedule
- Cost estimate

These proposals are to be screened by the evaluation committee (EC- minimum of 3 faculty members including the guide) constituted by the head of department, which will include a Chairman and the EC will evaluates the suitability and feasibility of the project proposal. The EC can accept, accept with modification, request a resubmission, or reject a project proposal.

Every activity done as part of project work is to be recorded in the project book, as and when it is done. Project guide shall go through these records periodically, and give suggestions/comments in writing in the same book.

The students have to submit an interim report, along with project work book showing details of the work carried out by him/her and a power point presentation at the end of the 7^{th} semester to EC. The EC can accept, accept with modification, request a resubmission, or extension of the project.

The student's internal marks for project will be out of 50, in which 30 marks will be based on day to day performance assessed by the guide. Balance 20 marks will be awarded based on the presentation of the project by the students before an evaluation committee consists of a minimum of 3 faculty members including the guide.

For Project, the minimum for a pass shall be 50% of the total marks assigned to the Project work.

ME010 801 Design of Transmission Elements
(Common with AU010 801)

Teaching scheme **Credits:** 4

2 hours lecture, 2 hour tutorial and 1 hour drawing per week

Objectives

To provide basic design skill with regard to various transmission elements like clutches, brakes, bearings and gears.

Module I (20 Hrs)

Clutches - friction clutches- design considerations-multiple disc clutches-cone clutch- centrifugal clutch - Brakes- Block brake- band brake- band and block brake-internal expanding shoe brake.

Module II (17 Hrs)

Design of bearings - Types - Selection of a bearing type - bearing life - Rolling contact bearings - static and dynamic load capacity - axial and radial loads - selection of bearings - dynamic equivalent load - lubrication and lubricants - viscosity - Journal bearings - hydrodynamic theory - design considerations - heat balance - bearing characteristic number - hydrostatic bearings.

Module III (19 Hrs)

Gears- classification- Gear nomenclature - Tooth profiles - Materials of gears - design of spur, helical, bevel gears and worm & worm wheel - Law of gearing - virtual or formative number of teeth- gear tooth failures- Beam strength - Lewis equation- Buckingham's equation for dynamic load- wear load- endurance strength of tooth- surface durability- heat dissipation - lubrication of gears - Merits and demerits of each type of gears.

Module IV (16 Hrs)

Design of Internal Combustion Engine parts- Piston, Cylinder, Connecting rod, Flywheel

Design recommendations for Forgings- castings and welded products- rolled sections- turned parts, screw machined products- Parts produced on milling machines. Design for manufacturing - preparation of working drawings - working drawings for manufacture of parts with complete specifications including manufacturing details.

Note: Any one of the following data book is permitted for reference in the final University examination:

1. Machine Design Data hand book by K. Lingaiah, Suma Publishers, Bangalore/ Tata Mc Graw Hill
2. PSG Design Data, DPV Printers, Coimbatore.

Text Books

1. C.S,Sarma, Kamlesh Purohit, Design of Machine Elements Prentice Hall of India Ltd NewDelhi
2. V.B.Bhandari, Design of Machine Elements McGraw Hill Book Company
3. M. F. Spotts, T. E. Shoup, Design of Machine Elements, Pearson Education.

Reference Books

1. J. E. Shigley, Mechanical Engineering Design, McGraw Hill Book Company.
2. Juvinall R.C & Marshek K.M., Fundamentals of Machine Component Design, John Wiley
3. Doughtie V.L., & Vallance A.V., Design of Machine Elements, McGraw Hill Book Company.
4. Siegel, Maleev & Hartman, Mechanical Design of Machines, International Book Company.

ME010 802 Operations Management

(Common with AU010 802)

Teaching scheme **Credits:** 4

2 hours lecture and 2 hour tutorial per week

Objectives

- *To familiarize the main decision making scenarios (strategic, tactical and operative) an Operations Manager may come across.*
- *To develop an understanding of the main OM principles, techniques and tools to analyze, diagnose and then to improve processes.*

Module I (12 hours)

Introduction to Operations Management- Functions of Operations Management, Strategic, Tactical and Operational decisions. Forecasting in decision making: Factors affecting forecasting, Sources of data, Time series analysis, Demand patterns, Forecasting methods-Moving average, Regression, Exponential smoothing-problems, Qualitative methods- Measures of forecast accuracy.

Module II (12 hours)

Aggregate Planning: Aggregate planning strategies and methods, Transportation model for aggregate planning. Master Production Schedule- Materials Requirement Planning, Bill of materials, Lot sizing in MRP, MRP-II, CRP, DRP.

Module III (12 hours)

Introduction to Scheduling: Single machine scheduling, Flow shop scheduling, Job shop scheduling. Sequencing: Johnson's algorithm, Processing n jobs through two machines, processing n jobs through three machines, processing n jobs through m machines, processing two Jobs through m machines-problems.

Module IV (12 hours)

Maintenance Planning and Control: Types of maintenance, Need for replacement, Replacement problems, Individual replacement policy, Group replacement policy, TPM. Reliability – Bath tub curve- reliability improvement, Measures for maintenance performance, reliability calculations, FMECA, information system for maintenance management.

Module V (12 hours)

Modern concepts/ techniques in operations management: Just in time manufacturing, Lean manufacturing, Push Pull Production, Kanban systems, Flexible manufacturing systems, ERP.

Supply Chain management: Supply chain, objective of Supply Chain, Supply chain macro processes, Process view of a supply chain, Drivers of Supply Chain.

Text Books

1. Mahadevan B., *Operations Management*, Pearson Education.
2. Panneerselvam R., *Production and operations Management*, Prentice Hall of India.

Reference Books

3. Krajewski and Ritzman, *Operations Management*, Pearson Education.
4. Verma A.P., *Industrial Engineering*, S. K. Kataria & Sons.
5. Adam and Ebert, *Production and Operations Management*, Prentice Hall of India.
6. Chopra and Meindl, *Supply Chain Management*, Prentice Hall of India.

ME 010 803 Production Engineering

Teaching scheme **Credits:** 4

2 hours lecture and 2 hour tutorial per week

Module 1 (12 hours)

Theory of metal cutting: Scenario of manufacturing process – Deformation of metals, Schmid’s law (review only) – Performance and process parameters – single point cutting tool nomenclature - attributes of each tool nomenclature - attributes of feed and tool signature on surface roughness obtainable, role of surface roughness on crack initiation - Oblique and orthogonal cutting – Mechanism of metal removal - Primary and secondary deformation shear zones - Mechanism of chip formation, card model, types of chip, curling of chips**,** flow lines in a chip, BUE, chip breakers, chip thickness ratio – Mechanism of orthogonal cutting: Thin zone and thick zone, Merchant’s analysis – shear angle relationship, Lee and Shaffer`s relationship, simple problems – Friction process in metal cutting: nature of sliding friction, columb`s law, adhesion theory, ploughing, sub-layer flow – Empirical determination of force component.

Module 2 (12 hours)

Thermal aspects of machining: Source of heat, temperature distribution pattern in chip, shear plane and work piece, effect of speed, feed and depth of cut – tool temperature measurement - **Tool materials**: properties of tool material, Carbon steel, HSS (classification, structure, composition, properties) - cemented Carbides (structure, properties), indexable inserts, coated WC, cermets – alumina (ceramic), sialon, cubic Boron Nitride (cBN), diamond, diamond coated tools – **Tool wear**: flank and crater wear – Tool **wear mechanisms**: adhesion, abrasion, diffusion and fatigue – **Tool life**, Taylor’s equation, applications - effect of rake angle, clearance angle, chip temperature and cutting time on tool life, simple problems - Tool **wear criterion**: allowable wear land etc - **Economics** of machining – **machineability** of Ti, Al, Cu alloys and machineability index – cutting force (quartz crystal dynamometer) - **Cutting fluids**: effect of specific heat on selection of fluids, functions, classifications, specific applications.

Module 3 (12 hours)

Powder Metallurgy: **Need** of P/M - **Powder Production** methods:- Atomization, electrolysıs, Reduction of oxides, Carbonyls (Process parameters, characteristics of powder produced in each method) – **Powder characteristics**: properties of fine powder, size, size distribution, shape, compressibility, purity etc.- **Mixing** – **Compaction**:- techniques, pressure distribution, HIP & CIP, – Mechanism of **sintering,** driving force, solid and liquid phase sintering - Impregnation and Infiltration Advantages, disadvantages and specific applications of P/M.

Micromachining: Diamond turn mechanism, material removal mechanism-Magnetorheological nano-finishing process: - polishing fluid, characteristics of MRP fluid, MRF and MRAFF process.

Module 4 (12 hours)

Ceramic Structures and properties**: -** coordination number and radius rations **-** AX, A_mX_p, $A_mB_mX_p$ type crystal structures – imperfections in ceramics- phase diagrams of Al_2O_3 – Cr_2O_3 and MgO- Al_2O_3 only – mechanical properties – mechanisms of plastic deformation – ceramic application in heat engine, ceramic armor and electronic packaging.

Fundamentals of **Composites: -** particle reinforced composites **–** large particle composites - fiber reinforced composites: influence of fiber length, orientation and concentration-fiber phase – matrix phase.

Module 5 (12 hours)

Advanced production methods: **Nontraditional machining**: EDM, ECM, USM, EBM, LBM, IBM, Abrasive water jet machining (principle, process parameters, material removal mechanism, MRR, surface roughness, HAZ and applications) – **Material addition process**:- stereo-lithography, selective laser sintering, fused deposition modeling, laminated object manufacturing, laser engineered net-shaping, laser welding, LIGA process.

TEXT BOOKS:

1. Armarego and Brown, The Machining of Metals, Prentice – Hall.
2. Bhattacharyya, Metal Cutting Theory and Practice**,** Central Publishers. Wiley
3. Paul. H. Black, Theory of Metal Cutting, McGraw Hill.

REFERENCES BOOKS:

1. ASM hand book Volume 16, Machining, ASM international, 1989
2. Boothroyd Geoffrey, Fundaments of Machining and Machine Tools, Marcel Dekker, 1990.
3. Brophy, Rose and Wulf, the Structure and Properties of Metals Vol.2, Wiley Eastern.
4. Dixon and Clayton, Powder Metallurgy for Engineers, Machinery Publishing Co. London.
5. Jain V.K., Introduction to Micromachining, Narosa publishers.
6. Juneja B.L. Fundamentals of metal cutting and machine tools, Wiley, 1987.
7. Komanduri R, Tool materials in Kirk Othmer Encyclopedia of chemical technology, 4th edition, volume 24, 390, Wiley, 1997.
8. Lal G.K., Introduction to Machining Science, New Age Publishers.
9. Machining date hand book, Volume 1 and 2, Machinability date center, Cincinnati, 1990.
10. Shaw Milton C, Metal Cutting Principles, CBS Publishers.
11. Trent M. Edward, Metal Cutting, Butterworth.
12. Venkatesh V.C. and H.Chandrasekaran, Experimental techniques in metal cutting, Prentice Hall, 1987.

Electives - III

ME010 804 L01 Aerospace Engineering

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Module 1 (12 hours)

The atmosphere: Characteristics of Troposphere, Stratosphere, Mesosphere and Ionosphere - International Standard Atmosphere – Pressure, Temperature and Density variations in the International Standard Atmosphere – Review of basic fluid dynamics – continuity, momentum and energy for incompressible and compressible flows – static, dynamic and stagnation pressures – phenomena in supersonic flows

Module 2 (12 hours)

Application of dimensional analysis to 2D viscous flow over bodies – Reynolds number – Mach number similarity – Aerofoil characteristics – Pressure distribution – Centre of Pressure and Aerodynamic Center – Horse shoe vortex

Module 3 (12 hours)

Momentum and Blade Element Theories – Propeller co-efficients and charts – Aircraft engines – Turbo jet, Turbo fan and Ram Jet engines – Bypass and After Burners

Module 4 (12 hours)

Straight and Level Flight – Stalling Speed – Minimum Drag and Minimum Power conditions – Performance Curves – Gliding – Gliding angle and speed of flattest glide – Climbing – Rate of Climb – Service and Absolute Ceilings – Take off and Landing Performance – Length of Runway Required – Circling Flight – Banked Flight – High Lift Devices – Range and Endurance of Air planes.

Module 5 (12 hours)

Air speed indicators – Calculation of True Air Speed – Altimeters – Rate of Climb meter – Gyro Compass – Principles of Wind Tunnel Testing – Open and Closed type Wind Tunnels – Pressure and Velocity Measurements – Supersonic Wind Tunnels (description only) – Rocket Motors – Solid and Liquid Propellant Rockets – Calculation of Earth Orbiting and Escape Velocities Ignoring Air Resistance and assuming Circular Orbit.

References

1. Mechanics of Flight - Kermode A. C.

2. Aerodynamics for Engineering Students - Houghton and Brock
3. Airplane Aerodynamic – Dommasch
4. Anderson J.D. Jr., (2007), Fundamentals of Aerodynamics, Tata McGraw-Hill, New Delhi.
5. Karamcheti K., (1966), Principles of Ideal-Fluid Aerodynamics, John Wiley & Sons Inc.
6. Bertin J.J., (2002), Aerodynamics for Engineers, 4th Ed. Prentice-Hall Inc.
7. Kuethe A. M. and Chow C.-Y., (1986), Foundations of Aerodynamics, John Wiley & Sons Inc.
8. Kundu P.K. & Cohen I.M., (2008), Fluid Mechanics, Elsevier Inc.

ME010 804L02 Advanced Machining Process

Teaching scheme **Credits:** 4

2 hours lecture and 2 hour tutorial per week

Objective: - To understand the need of smaller high quality parts and components.

Module 1 (12 hours)

Diamond turn machining (DTM):-Types of DTM - component of machine - components of DTM: spindle system, workpiece tool positioning system, machine support system, tool measurement system, machine control system – material removal mechanism in DTM – ductile regime machining – tools for DTM – tool geometries for single crystal diamond tools – tool setting – applications.

Abrasive jet micro machining (AJMM):- machining system – masking technology – erosion mechanism – metal, photo-resist and elastomer mask – erosion behavior – surface properties: hardness and roughness – pressurized power feed system – fluidized bed powder spray system – factors affecting in constant feeding – nozzle configuration – applications.

Module 2 (12 hours)

Magnetorheological nanofinishing processes: - Magnetorheological polishing fluid – rheological characteristics of fluid **-** Magnetorheological finishing (MRF) processes - Magnetorheological abrasive flow finishing processes (MRAFF) – performance analysis of MRAFF process - Magnetorheological jet finishing processes:- working principle, MR jet finishing machine, polishing performance.

Micro/nano finishing with flexible flow of abrasives:- process principle and description – process technology – selection of media – effect of process parameters of performance – mechanism of material removal – process capabilities - applications.

Module 3 (12 hours)

Ultrasonic micromachining (USMM):- machine tool – elements of USMM –abrasive slurry – workpiece – mechanism of material removal – process parameters: machine based parameters – performance characteristics: machining rate, surface roughness, accuracy and tool wear – effect of process parameters on quality characteristics – effect of process parameters on accuracy – process capabilities.

Module 4 (12 hours)

Electron beam micromachining: - mechanism of material removal in EB drilling – importance of vacuum – process parameters – effect of cutting speed, pulsed beam operation, heat affected zone, cross sectional area of a beam – theoretical aspects of electron beam – energy transfer to the work material – applications.

Focused Ion beam machining:- equipment – imaging with FIB system – interaction of ion with substrate – FIB milling – gas assisted FIB processing – applications.

Module 5 (12 hours)

Micro-electric discharge micromachining:-principle of micro –EDM **–** influence of pulse characteristics – high aspect ratio holes – heat affected zone.

Laser micromachining:-laser beam characteristics – laser material interaction – micromachining system – nanosecond, picoseconds, femtosecond pulse micromachining.

Text Book:

Jain V.K. Introduction to micromachining, Narosa publishers.

References

1. M. Madou, “Fundamentals of Microfabrication”
2. D. Dornfeld, S. Min and Y. Takeuchi, Recent Advances in Mechanical Micromachining, CIRP Annals - Manufacturing Technology, Volume 55, Issue 2, 2006, Pages 745-768.

ME010 804L03 Cryogenics

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

- *To impart the basic concepts of Cryogenic Engineering*
- *To provide the learner with the fundamental knowledge about the properties of cryogenic materials, its storage and transfer systems*
- *To develop an understanding of various cryogenic liquefaction and refrigeration systems and their performances*

Module 1 (8 hours)

Introduction: Historical development- application of cryogenics -present areas involving cryogenic engineering-cryogenics in space technology- cryogenics in biology and medicine-superconductivity applications.

Module 2 (12 hours)

Basic thermodynamics applied to liquefaction and refrigeration process – isothermal, adiabatic and Joule Thomson expansion process -efficiency to liquefaction and coefficient of performances- irreversibility and losses. Low temperature properties of engineering materials: mechanical properties – thermal properties -electrical and magnetic properties. Properties of cryogenic fluids- superconductivity and super fluidity - materials of constructions for cryogenic applications.

Module 3 (15 hours)

Gas liquefaction systems: Production of low temperatures – general liquefaction systems-liquefaction systems for neon, hydrogen and helium.

Module 4 (15hours)

Cryogenic refrigeration systems: ideal refrigeration systems- refrigerators using liquids and gases as refrigerants- refrigerators using solids as working media - adiabatic demagnetization method.

Module 5 (10 hours)

Cryogenic storage and transfer systems: Cryogenic fluid storage vessels- cryogenic fluid transfer systems-cryo pumping.

Text Books

1. Barron R., *Cryogenic Systems*, Oxford Science Publications
2. Scott R.B., *Cryogenic Engineering*, Van Nostrand Co.

Reference Books

1. Mamata Mukhopadyay., *Fundamentals of Cryogenic Engineering*, PHI Learning
2. Haseldon G.G., *Cryogenic Fundamentals*, Academic Press
3. Flynn T.M., *Cryogenic Engineering*, Marcel Dekker.

ME010 804 L04 Acoustics and Noise Control

Teaching scheme **Credits:** 4

2 hours lecture and 2 hours tutorial per week

Objectives:

- *Elementary physical acoustics in 1D and its extension to simple 3D situations*
- *The significance of human factors in acoustics*
- *Fundamentals of architectural acoustics and noise control*

Module1 (12 hours)

Longitudinal wave propagation in a rod-Derivation of wave equation-Physical interpretation of the wave equation solution-One Dimensional Waves in a Gas-Acoustic Energy and Acoustic Intensity-Energy in a plane progressive wave-Acoustic Impedance

Module 2 (12 hours)

Sound Perception and the Decibel Scale-The ear-The decibel Scale-Combining Sound Levels in Decibels-Octave Bands-Loudness-The “A” Weighting-Legal requirements for noise control

Module 3 (12 hours)

Acoustic Resonance-Resonance of a pipe closed at both ends-Resonance of a pipe closed at one end, open at the other-Reflection & Transmission of Plane Acoustic Waves-Sound Transmission through layers and partitions-Transmission through a layer-Transmission through solid partitions

Module 4 (12 hours)

Room Acoustics-Acoustic Absorption-Reverberation Time-Sound Transmission between Rooms

The wave equation in 3 dimensions-Acoustic impedance of a spherical wave - near and far field effects-Source efficiency

Module 5 (12 hours)

Directionality of acoustic sources and receivers-Directivity index-Screens-Silencers

Helmholtz resonator design-Expansion chamber silencer design-Dissipative silencers

Active control of noise

References

1. Turner and Pretlove, Acoustics for Engineers, Macmillan, 1991
2. Kinsler, Frey, Coppens & Sanders. Fundamentals of Acoustics. 3rd Edition. John Wiley, 1982
3. Smith, Peters and Owen, Acoustics and Noise Control, Addison-Wesley-Longman, 2nd edition 1996
4. Bies and Hanson, Engineering Noise Control, theory and practice E&FN Spon, 2nd edition, 1996

ME010 804L05 Non Destructive Testing

Teaching scheme **Credits:** 4

2 hours lecture and 2 hour tutorial per week

Module 1 (12 hours)

What is NDT,Comparison between destructive and NDT, Importance of NDT, Scope of NDT, difficulties of NDT, future progress in NDT, economics aspects of NDT.

Visual Inspection - tools, applications and limitations - Fundamentals of visual testing: vision, lighting, material attributes, environmental factors, visual perception, direct and indirect methods - mirrors, magnifiers, boroscopes, fibroscopes, closed circuit television, light sources and special lighting, a systems, computer enhanced system.

Liquid Penetrant Inspection: principles, properties required for a good penetrants and developers - Types of penetrants and developers, and advantages and limitations of various methods of LPI - **Magnetic Particle Inspection** - LPI technique/ test procedure, interpretation and evaluation of penetrant test indications, false indication, and safety precaution required in LPI, applications, advantages and limitations.

Module 2 (12 hours)

Magnetic Particle Inspection (MPI)- Principles of MPI, basic physics of magnetism, permeability, flux density, cohersiveforce, magnetizing force, rentivity, residual magnetis - Methods of magnetization, magnetization techniques such as head shot tecnique, cold shot technique, central conductor testing, magnetization using products using yokes, direct and indirect metod of magnetization, continous testing of MPI, residual tecnique of MPI, system sensitivity, checking devices in MPI, interpretation of MPI, indications, advantage and limitation of MPI - **Acoustical Holography**: Principles, types, applications, advantages and limitations.

Module 3 (12 hours)

Ultrasonic Testing (UT): principle, types of waves, frequency, velocity, wavelength, reflection, divergence, attenuation, mode conversion in ultrasonic UT testing methods - contact testing and immersion testing, normal beam and straight beam testing, angle beam testing, dual crystal probe, ultrasonic testing techniques - resonance testing, through transmission technique, pulse echo testing technique, instruments used UT, accessories such as transducers, types, frequencies, and sizes commonly used, reference blocks wit artificially created defects, calibration of equipment, applications, advantages, limitations, A, B and C scan - Time of Flight Diffraction (TOFD).

Module 4 (12 hours)

Radiography Testing (RT): Principle, electromagnetic radiation sources: X-ray source, production of X-rays, high energy X-ray source, gamma ray source - Properties of X-rays and gamma rays - Inspection techniques like SWSI, DWSI, DWDI, panoramic exposure, real time radiography, films used in industrial radiography, types of film, speed of films, qualities of film, screens used in radiography, quality of a good radiograph, film processing, interpretation, evaluation of test results, safety aspects required in radiography, applications, advantages and limitations of RT.

Module 5 (12 hours)

Eddy Current Testing (ECT) - Principle, physics aspects of ECT like conductivity, permeability, resistivity, inductance, inductive reactance, impedance - Field factor and lift of effect, edge effect, end effect, impedance plane diagram in brief, depth of penetration of ECT, relation between frequency and depth of penetration in ECT, equipments and accessories, various application of ECT such as conductivity measurement, hardness measurement, defect detection, coating thickness measurement, advantages and limitations of eddy current testing.

Thermography: Principles, contact and non contact inspection methods - heat sensitive paints - heat sensitive papers - thermally quenched phosphors liquid crystals - techniques for applying liquid crystals - calibration and sensitivity - other temperature sensitive coatings - non contact thermographic inspection - advantages and limitation - infrared radiation and infra-red detectors, instrumentations and methods, applications.

TEXT BOOKS:

1. Baldev Raj, Practical Non – Destructive Testing, Narosa Publishing House (1997).

REFERENCE BOOKS:

1. Hull B. and V.John, Non-Destructive Testing, Macmillan (1988).
2. Krautkramer, Josef and Hebert Krautkramer, Ultrasonic Testing of Materials, Springer-Verlag.
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ME010 804 L06 Advance Operations Research

Teaching scheme **Credits:** 4

2 hours lecture and 2 hour tutorial per week

Objectives

- *The course is designed to develop an understanding of advanced operation research and related techniques.*

Module I (12 hours)

Linear Programming: Problem Formulation, Simplex Method, Duality Theory, Dual Simplex Method, Revised Simplex Method, Sensitivity Analysis.

Module II (12 hours)
Network Techniques: Examples of Network Flow Problems, Transportation Problems Assignment Problems, Shortest Path Model, Dijkstra's Algorithm.

Module III (12 hours)
Integer Programming: Introduction, Basic Concepts and Simple Problems: Gomory's Cutting Plane Algorithm, Branch and Bound Method.

Module IV (12 hours)
Goal Programming: Introduction, Basic Concepts, Weights Method, Preemptive Method.
Dynamic Programming: Basic Concepts, Forward and Backward Computational Procedures, Application of Dynamic Programming - Stage coach problem, Cargo loading problem.

Module V (12 hours)
Simulation: Basic Concepts, Discrete and Continuous systems, Generation of Random Numbers, Monte-Carlo Simulation, Simulation software.

Text Books

1. Verma A.P., *Operation Research*, S. K. Kataria & Sons.
2. Pannerselvam R., *Operation Research*, Prentice–Hall of India.

Reference Books

1. Hamdy A Taha, *Operations Research, – An Introduction,* Pearson Education.
2. Ravindran A., *Operations Research – Principles and Practice,* Wiley India (P) Ltd.
3. Srinivasan G., *Operations Research- Principles and Applications,* Prentice–Hall of India.
4. Hillier & Lieberman, *Introduction to Operations Research-Concepts and Cases*, Tata Mcgraw Hill.

Electives IV

ME010 805G01 Industrial Safety

Teaching scheme **Credits:** 4

2 hours lecture and 2 hours tutorial per week

Objectives

- *To develop an understanding of the principles of safety,terminolgies in accident prevention and its theories..*
- *To understand the theory and practice of occupational health,ergonomics and hygiene,principle of fire engineering and fire fighting.*

Module-I (12 Hours)

Development of safety movement: - Need for safety-safety and productivity-planning for safety-planning procedure-safety policy-formulation of safety policy-safety budget-role and qualification of safety professional-safety committees-need, types and functions of committees-safety organizations.

Module II (12 Hours)

Accident prevention: - Basic philosophy of accident prevention-nature and causes of accidents-accident proneness-cost of accidents-accident prevention methods-Domino theory-safety education and training-training methods-motivation and communicating safety-personal protective equipments.

Module III (12 Hours)

Safety management techniques: - Safety inspection-Safety sampling technique-Safety audit-Safety survey-Incident recall technique-Job safety analysis-Damage control-Risk management.

*Involvement in safety***: -** Role of management-role of supervisors-role of workmen- role of unions-role of government

Module IV (12 Hours)

Occupational health and hygiene: - Functional units and activities of occupational health and hygiene-types of industrial hazards-physical, chemical, mechanical, electrical, social, biological, ergonomic and environmental hazards-factors impeding safety-house keeping-hearing conservation programme

Module V (12 Hours)

*Industrial fire protection***: -** Fire chemistry-classification of fires-fire prevention activities-fire risks-fire load -contributing factors to industrial fires-fire detection-industrial fire protection systems.

Text Books:-

1. Heinrich H.W, ‘Industrial accident prevention’, McGraw Hill Company, New York, 1980.

2. Frank P Lees, 'Loss prevention in process industries', Vol I, II, III, Butterworth, London, 1980.
3. R.P.Blake, "Industrial Safety", Prentice Hall of India, New Delhi

Reference books:-

1. "Accident prevention manual for Industrial Operations", National Safety Council, Chicago, 1989.
2. Brown D.B, "System Analysis and Design for safety", Prentice Hall, New Jercy.

ME010 805G02 Disaster Management

Teaching scheme **Credits:** 4

2 hours lecture and 2 hours tutorial per week

MODULE 1 (12 hours)

Importance of disaster management - Types of emergencies – major industrial disasters – Components of a major hazard control system – identification of major hazard control installations – purpose and procedures – safe operation of major hazard installations – mitigation of consequences – reporting to authorities. Implementation of major hazard control systems – group of experts – training – checklists – inspection – evaluation of major hazards – information to the public – manpower requirements – sources of Information

MODULE 2 (12 hours)

Emergency planning – On-site emergency planning – formulation of the plan and emergency services – Identification of resources – actions and duties – emergency procedure – mock drills. Off-site emergency planning – objectives and elements of off-site plan – role of administrative machinery – role of major hazard works management – role of the local authority. Emergency preparedness at local level – Awareness and preparedness for emergencies at local level (APELL) – The process and its partners.

MODULE 3 (12 hours)

Requirements of emergency plan as per Indian legislations like Factories Act, Manufacture, Storage and Import of Hazardous Chemicals Rules, Chemical Accidents (Emergency planning, Preparedness and Response) Rules-Applications of remote sensing and GIS in disaster management

MODULE 4 (12 hours)

Emergency planning and preparedness in international standards like ISO 14001, OHSAS 18001 and OSHA's Process Safety Management System, Emergency Planning in Seveso II directive – elements of emergency planning in IS : 18001 – Hazardous Materials / Spills Emergencies – contingency plans for road transportation of hazardous chemicals – contingency plans for oil spills in marine environment.

MODULE 5 (12 hours)

Natural Hazards – potentially hazardous natural phenomena – earthquakes – landslides – flooding – cyclones – hazards in arid and semi-arid areas – nature of the hazard – hazard management activities – disaster mitigation – natural hazard prediction – emergency preparedness – disaster, rescue and relief – post disaster rehabilitation and reconstruction – education and training activities – vulnerable elements to be considered in the development planning for natural hazard management .

TEXT BOOKS:

1. Petak, W.J and Atkisson, A.A.: *Natural Hazard Risk Assessment and Public Policy: Anticipating the Unexpected*

2. Frank P Lees, '*Loss prevention in process industries*', Vol I, II, III, Butterworth, London, 1980

REFERENCES:

1. ILO, Geneva: *Major Hazard Control – a Practical Manual.*
2. UNEP, Paris : *APELL - A Process for responding to technological accidents , A Handbook*, Industry & Environment Office., 1998
3. *Accident Prevention Manual for Business and Industry, Vol. I* – National Safety Council, USA.
4. *Oil spill Response : The National Contingency Plan* - Institute of Petroleum, London
5. U.R. Rao : *Space Technology for Sustainable Development*

ME010 805G03 Nano Technology

Teaching scheme **Credits:** 4
2 hours lecture and 2 hours tutorial per week

MODULE 1 (12 hours)

Introduction to nano technology – definition – why nano – application in different fields - nano materials, solid state devices – carbon nano tubes: - structure, sythesis, growth mechanisms, properties, carbon nano tubes based nano objects, applications.

MODULE 2 (12 hours)

Nano tribology characterization studies – friction and wear on the atomic scale – nano mechanical properties of solid surface and thin films.

MODULE 3 (12 hours)

Mechanical properties of nano structures: - experimental techniques, indentation and scratch tests, bending tests; experimental results and discussion – nano tribology of ultra thin and hard amorphous carbon films.

MODULE 4 (12 hours)

Nano boundary lubrication – kinetics and energetic in nano lubrication - Nano tribology for data storage application

MODULE 5 (12 hours)

Industrial applications: - micro actuators for dual storage servo systems – MEMS/NEMS materials and applications – mechanical properties of micro machined structures.

TEXT BOOKS:

1. Bhushan – Springer Handbook of Nano technology.

REFERENCE BOOKS:

1. Nano manufacturing Handbook Busnaina CRC press.
2. Pradeep T., IIT Madras - NANO: The Essentials, Tata McGraw Hill

ME010 805 G04 Finite Element Analysis

Teaching scheme **Credits:** 4

2 hours lecture and 2 hours tutorial per week

Objectives

- *To learn the mathematical background of finite element analysis*
- *To solve structural mechanics problems using finite element approach*

Module I (12 hours)

Introduction to FEA:- Brief History, Applications of FEA in various fields, Advantages and disadvantages of FEA.

Review of Theory of Elasticity: - Degrees of freedom, rigid body motion, principle of minimum potential energy, stress and strain at a point, principal stresses, Von-Mises stress.

Basic equations of elasticity: - Stress-strain and, strain displacement relationships, 2D and 3D cases.

Basic steps in finite element problem formulation, importance of discretization, different types of elements, shape functions and stiffness matrices of 1D bar and beam elements.

Module II (12 hours)

Assembly of elements and matrices:- Concept of element assembly, 1D bar element assembly, boundary conditions, 1D problems. Analogous (1-D) problems of torsion and heat conduction.

Co-ordinate systems: - Global and local co-ordinate systems, transformation matrix

Module III (12 hours)

Structural analysis: - Plane truss problems, beam problems

2D finite element formulations: - Three nodded triangular element, four nodded rectangular element, compatibility, four nodded quadrilateral element, eight nodded quadrilateral element.

Variational methods : - Functionals - weak and strong form - essential and non- essential boundary conditions - Principle of stationary potential energy - Rayleigh-Ritz method -simple examples.

Module IV (12 hours)

Higher order Elements:- Quadratic and cubic elements, shape functions, Pascal's triangle, Pascal's pyramid, convergence criterion, Constant Strain triangle element and Linear Strain triangle element- stiffness matrices. Isoparametric elements, natural co-ordinates, area co-ordinates, linear triangle and quadratic triangle elements, Quadrilateral elements.

Module V (12 hours)

Modal analysis: - Eigen vectors and Eigen values, Consistent and lumped mass matrices. Mass matrices for bar element, truss element, beam element, frame element.

Finite element formulation of free vibration problems:- Natural frequencies and mode shapes of longitudinal vibration of bar element, flexural vibrations of beam element.

Structure of a FEA software package: - Pre-processor-solver-Post-processor.

Text Books

1. Hutton David V “Fundamentals of Finite Element Analysis”, TMH 2005
2. Daryl L.Logan, “A first course in the Finite Element Method”, Cengage Learning, Fourth edition, 2007.
3. Robert D.Cook, “Concepts and applications of Finite Element Analysis”, Wiley India, Fourth Edition, 2003.

Reference Books

1. Reddy J.N. “An Introduction to Finite Element Method”, McGraw-Hill, 2000.
2. Krishnamurthy, C.S., “Finite Element Analysis”, Tata McGraw-Hill, 2000.
3. Seshu P “A text book of Finite Element Analysis” PHI,2005

ME010 805 G05 Optimization Methods in Design

Teaching scheme **Credits:** 4

2 hours lecture and 2 hours tutorial per week

Module 1 (12 hours)

Nonlinear optimization: Introduction - one-dimensional optimization - elimination methods - unrestricted search, exhaustive scare Fibonacci and Golden section methods - Interpolation methods - quadratic and cubic interpolations, direct root methods.

Module 2 (12 hours)

Unconstrained nonlinear optimization: Direct search methods - random search methods - pattern search methods – method of rotating coordinates - descent methods - steepest descent, conjugate gradient, Quasi-Newton, and variable metric methods.

Module 3 (12 hours)

Constrained nonlinear optimization: Direct methods - the complex method, cutting plane method, methods of feasible directions - indirect methods - transformation techniques, interior and exterior penalty function methods.

Module 4 (12 hours)

Non-traditional optimization: Introduction to genetic algorithms, simulated annealing, particle swam optimization and ant colony optimization.

Module 5 (12 hours)

Static Applications: - Structural applications – Design of simple truss members - Design applications – Design of simple axial, transverse loaded members for minimum cost, weight – Design of shafts and torsionally loaded members – Design of springs.
Dynamic Applications:-Dynamic Applications – Optimum design of single, two degree of freedom systems.
Application in Mechanisms – Optimum design of simple linkage mechanisms.

Text Books

1 Singiresu S. Rao, *Engineering optimization: theory and practice*, 3rd Edition, Wiley Interscience, 1996
2. Kalyanmoy Deb, *Optimization for engineering design*, PHI, New Delhi, 2000
3. David E. Goldberg, *Genetic algorithms in search, optimization and machine learning*, Addison Wesley Pub. Co., 1989
4. Harvey M. Salkin, *Integer programming*, Addison-Wesley Pub. Co., 1975
5. Stephen C. Nash and Ariela Sofer, *Linear and nonlinear programming*, McGraw Hill College Div., 1995

Reference Books

1. Fred Glover, Manuel Laguna, and Fred Laguna, *Tabu search*, Kluwer Academic Publishers, 1997
2. Johnson Ray, C., “Optimum design of mechanical elements”, Wiley, John & Sons, 1990.
3. Goldberg, D.E., “Genetic algorithms in search, optimization and machine”, Barnen, Addison-Wesley, New York, 1989.

ME010 805 G06 Petrochemical Engineering

Teaching scheme **Credits:** 4

2 hours lecture and 2 hour tutorial per week

Objectives

• *To impart the basic concepts of science of petroleum drilling and transportation of oil.*

EXPLORATION AND DRILLING

Module 1 (12 Hours)

Methods of petroleum prospecting and exploration such as geophysical, seismic, etc. - drilling equipments such as rigs, platforms etc - techniques for offshore and onshore operation.

Directional Drilling: Objectives, Types of deflection tools, tool orientation, Directional well profiles, Well path deflection & correction.

Down Hole Motors: Positive displacement motors and Turbo-drills, motor description, Power calculation and applications - Auto-track and verti-track system - Rotary Steerable motors, Geo-steering tools.

Horizontal Well Drilling: Horizontal well objectives and selection, Different profiles, drilling techniques, Mud requirements & characteristics, casing and drill string requirements and completion programs. Problems.

Module 2 (12 Hours)

Slant Hole Drilling: Objectives and selections, Well profiles and applications.

Down the Hole Well Surveying: Well surveying objectives, surveying methods, Surveying Analysis methods and calculations for well coordinates.

Measurements While Drilling: Objectives of MWD/ LWD, MWD tools, Telemetry system and data interpretation.

Directional Drilling Problems and Their Remedies.

Special Methods of Drilling : Aerated drilling, Under-balanced drilling, Overbalanced drilling, HPHT Drilling, Variable pressure regime, Plasma drilling, Electrical Drilling, Top drive drilling, Re-entry drilling, Jet Drilling, Extended reach drilling, Multilateral drilling, Slim hole drilling, coil tubing drilling. Problems.

Drilling economics. Computer Application in Drilling.

DESIGN AND CONSTRUCTION OF PIPELINE

Module 3 (12 Hours)

Objective and scope of pipeline as a means of fluid transportation with special reference to crude oil/gas/refined products, Economics of Pipeline transportation.

Design of Pipeline: Factors influencing oil, gas and refined products as pipeline design; Hydraulic surge and water hammer; specific heat of liquids; river crossing; pipe size and station spacing etc.

Theory and different formulae of the flow of fluids in oil/gas pipelines; basic equations for the flow of fluids through pipes; different flow equations for laminar and turbulent flow of compressible and incompressible fluids (Newtonian); Introduction to the flow of Non-Newtonian fluids through pipes; multiphase flow and loop pipelines.

Module 4 (12 Hours)
Construction of pipelines; materials; project specifications; general equipment specifications (Pipes, valves and fittings); Installation of expansion loops and thermodymetric tapping plant. Pigging, Pigging Technology: pig launcher and receiver, intelligent pigging, types of pigs - Corrosion protection and control; Design of cathodic protection system, Pipeline automation. Problems.

Module 5 (12 Hours)
Offshore Pipeline: Design and control of Sag and Over bend; Description of stinger; and Riser, articulated stinger, construction of offshore pipeline, Method of underwater welding.
Hydrates, wax & scale - formation and prevention. Crude conditioning and use of additives to improve flow conditions. City distribution network of oil/gas. Lease and custody transfer.

References:

1. Berger B D, Anderson K E, “Modern Petroleum” Pennwell books
2. Bradley H B, “Petroleum Engineering Handbook”, SPE
3. Cole F W, Reservoir Engineering manual
4. Carl Gatlin, “Petroleum Engineering Drilling and Well Completions” Prentice Hall .
5. Mc Cray and Cole, “Oil Well Drilling Technology” Oklahoma Press

ME010 806 Mechanical Systems Laboratory

List of experiments

1. Test on reciprocating air compressor
2. Tests on blowers and rotary compressors
3. Free vibration analysis
4. Forced vibration analysis
5. Balancing of reciprocating and revolving masses
6. Assembling of mechanical systems
7. Test on refrigeration equipment
8. Test on air conditioning unit
9. Determination of thermal conductivity of conducting and insulating materials
10. Determination of emissivity of surfaces
11. Heat flow through lagged pipes
12. Heat flow through composite walls
13. Determination of overall heat transfer coefficient of heat exchangers
14. Free convection
15. Forced convection
16. Stefan-Boltzmann apparatus
17. Universal governor apparatus
18. Whirling of shafts
19. Gyroscope
20. Friction in hydrodynamic bearings
21. Heat pipe
22. Vortex tube
23. Critical heat flux

ME010 807 Project Work

Teaching scheme **credits: 4**

6 hours practical per week

The progress in the project work is to be presented by the middle of eighth semester before the evaluation committee. By this time, the students will be in a position to publish a paper in international/ national journals/conferences. The EC can accept, accept with modification, and request a resubmission.

The progress of project work is found unsatisfactory by the EC during the middle of the eighth semester presentation, such students has to present again to the EC at the end of the semester and if it is also found unsatisfactory an extension of the project work can be given to the students.

Project report: To be prepared in proper format decided by the concerned department. The report shall record all aspects of the work, highlighting all the problems faced and the approach/method employed to solve such problems. Members of a project group shall prepare and submit **separate** reports. Report of each member shall give details of the work carried out by him/her, and only summarise other members' work.

The student's sessional marks for project will be out of 100, in which 60 marks will be based on day to day performance assessed by the guide. Balance 40 marks will be awarded based on the presentation of the project by the students before an evaluation committee.

For Project, the minimum for a pass shall be 50% of the total marks assigned to the Project work.

ME010 808 Viva -Voce

Teaching scheme **credits: 2**

A comprehensive oral Viva-voce examination will be conducted to assess the student's intellectual achievement, depth of understanding in the specified field of engineering and papers published / accepted for publication etc. At the time of viva-voce, certified bound reports of seminar and project work are to be presented for evaluation. The certified bound report(s) of educational tour/industrial training/ industrial visit shall also be brought during the final Viva-Voce.

An internal and external examiner is appointed by the University for the Conduct of viva voce University examination.

For Viva-voce, the minimum for a pass shall be 50% of the total marks assigned to the Viva-voce.

Note: If a candidate has passed all examinations of B.Tech. course (at the time of publication of results of eighth semester) except Viva-Voce in the eighth semester, a re-examination for the Viva-Voce should be conducted within one month after the publication of results. Each candidate should apply for this 'Save a Semester examination' within one week after the publication of eighth semester results.