RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Mechanical Engineering, VII-Semester

ME- 701 Heat and Mass Transfer

Course Objectives:
After studying this course, students will be able to
1. Know about the basic concept of heat transfer and its modes.
2. Solve problems based on conduction, convection, and radiation.
3. Differentiate the modes of heat transfer i.e. conduction, convection, and radiation
4. Understand the working principle and types of heat exchangers.
5. Understand the concept of boiling and condensation, mass transfer.

Syllabus:
Unit-1 Basic Concepts: Modes of heat transfer, Fourier's law, Newton's law, Stefan Boltzman law; thermal resistance and conductance, analogy between flow of heat and electricity, combined heat transfer process; Conduction: Fourier heat conduction equation, its form in rectangular, cylindrical and spherical coordinates, thermal diffusivity, linear one dimensional steady state conduction through a slab, tubes, spherical shells and composite structures, electrical analogies, critical-insulation-thickness for pipes, effect of variable thermal conductivity.

Unit 2 Extended Surfaces (fins): Heat transfer from a straight and annular fin (plate) for a uniform cross section; error in measurement of temperature in a thermometer well, fin efficiency, fin effectiveness, applications; Unsteady heat conduction: Transient and periodic conduction, heating and cooling of bodies with known temperatures distribution, systems with infinite thermal conductivity, response of thermocouples.

Unit 3 Convection: Introduction, free and forced convection; principle of dimensional analysis, Buckingham 'pie' theorem, application of dimensional analysis of free and forced convection, empirical correlations for laminar and turbulent flow over flat plate and tubular geometry; calculation of convective heat transfer coefficient using data book.

Unit 4 Heat Exchangers: Types- parallel flow, counter flow; evaporator and condensers, overall heat transfers coefficient, fouling factors, log-mean temperature difference (LMTD), method of heat exchanger analysis, effectiveness of heat exchanger, NTU method;
Mass transfer: Fick's law, equi-molar diffusion, diffusion coefficient, analogy with heat transfer, diffusion of vapour in a stationary medium.

Unit 5 Thermal Radiation : Nature of radiation, emissive power, absorption, transmission, reflection and emission of radiation, Planck's distribution law, radiation from real surfaces; radiation heat exchange between black and gray surfaces, shape factor, analogical electrical network, radiation shields.
Boiling and condensation: Film wise and drop wise condensation; Nusselt theory for film wise condensation on a vertical plate and its modification for horizontal tubes; boiling heat transfer phenomenon, regimes of boiling, boiling correlations.

References:

1. Sukhatme SP; Heat and mass transfer; University Press Hyderabad
2. Holman JP; Heat transfer; TMH
3. Nag PK; heat and Mass Transfer; TMH
4. Domkudwar,Heat and Mass Transfer,Dhanpt Rai & Co.
5. Sachdeva R.C., Fundamentals of Engineering Heat and Mass Transfer, New Age Science
6. Dutta BK; Heat Transfer Principles And App; PHI Learning
7. Mills AF and Ganesan V; Heat transfer; Pearson
8. Cengel Yunus A; Heat and Mass transfer;TMH
9. Yadav R; Heat and Mass Transfer; Central India pub-Allahabad
10. Incropera FP and Dewitt DP; Heat and Mass transfer; Wiley

List of Experiments (Pl. expand it):

1 Conduction through a rod to determine thermal conductivity of material
2 Forced and free convection over circular cylinder
3 Free convection from extended surfaces
4. Parallel flow and counter flow heat exchanger effectiveness and heat transfer rate
5. Calibration of thermocouple
6 . Experimental determination of Stefen-Boltzman constant

Evaluation

Evaluation will be continuous an integral part of the class as well through external assessment.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Mechanical Engineering, VII-Semester

Departmental Elective ME- 702(A) Advance Machining Processes

Course Objectives:

- Understand the fundamentals and technologies used in different advance machining processes.
- Apply the characteristics and applications of the product obtained using advanced manufacturing processes.
- Compare different advance machining processes.

Syllabus:

Unit 1: Mechanical processes; Process selection, mechanics of cutting, metal removal rate, cutting tool system design, ultrasonic machining, abrasive jet machining, water jet machining, , effect of parameters and variables, applications and limitations, recent developments in mechanical processes.

Unit 2: Electrochemical and chemical metal removal processes; Electrochemical machining[ECM], elements of ECM, power source and control system, electrolytes, tool work system, chemistry of the process, tool design and metal removal rate, process faults, material removal and surface finish, electrochemical grinding, electrochemical deburring, electrochemical honing, chemical machining,

Unit 3: Thermal metal removal processes; Electric discharge machining[EDM], spark erosion, mechanism of metal removal, spark erosion generator, electrod feed control, vibrating electrode system, dielectric fluid, flushing, accuracy, plasma arc machining[PAM], non thermal generation of plasma, mechanisms and parameters, equipments, electron beam machining[EBM],generation and control of electron beam, theory and process capabilities, neutral particle etching, laser beam machining, hot machining, methods of local heating,tool lie and production rate.

Unit 4: Rapid prototyping fabrication methods; Fundamentals, technologies, applications, principles and working of 3D printing, subtractive v/s additive manufacturing process, VAT photo polymerization, material and binder jetting, continuous liquid inter phase production, direct metal laser sintering.

Unit 5: Technologies of micro fabrication; Types of micro system devices, indusrial applications, micro fabrication processes, LIGA process .Technologies of nano fabrication, importance of size, scanning probe microscope, carbon Buckyballs and nano tubes, nano fabrication processes,

References:

1. Mikell P. Groover, Fundamentals of Modern Manufacturing, Wiley India, ISBN 978 81 265 2301 6
2. Pandey P.C, Shan H.S., Modern Machining Processes, Tata McGraw Hill,ISBN 0 07 096518 8
3. Lal G.K,Gupta V, Reddy N.V., Narosa Publishing House,ISBN 81 7319 709 1
4. CMTI Handbook
5. Jain V.K. Introduction to Micro Machining Process Narosa Publication
6. Jain V.K. ,Micromanufacturing Processes , Crc Press.

Evaluation

Evaluation will be continuous an integral part of the class as well through external assessment.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Mechanical Engineering, VII-Semester

Departmental Elective ME- 702(B) Internet of Things

Course Objectives :

The explosive growth of the "Internet of Things" is changing our world and the rapid drop in price for typical IoT components is allowing people to innovate new designs and products at home. The Internet of Things (IoT) is a course about the new paradigm of objects interacting with people, with information systems, and with other objects. The course will focus on creative thinking and on hands-on project development.

After learning the course, the student will be able:

1. Understand the vision of IoT from a global context.
2. Understand the application of IoT.
3. Determine the Market perspective of IoT.
4. Use of Devices, Gateways and Data Management in IoT.
5. Building state of the art architecture in IoT.
6. Application of IoT in Industrial and Commercial Building Automation and Real World Design Constraints.

Unit I: Internet of Things (IoT)

Vision, Definition, Conceptual Framework, Architectural view, technology behind IoT, Sources of the IoT, M2M Communication, IoT Examples . Design Principles for Connected Devices: IoT/M2M systems layers and design standardization, communication technologies, data enrichment and consolidation, ease of designing and affordability .

Unit II: Hardware for IoT

Sensors, digital sensors, actuators, radio frequency identification (RFID) technology, wireless sensor networks, participatory sensing technology. Embedded Platforms for IoT: Embedded computing basics, Overview of IOT supported Hardware platforms such as Arduino, Raspberry pi, Beagle Bone, Intel Galileo .

Unit III: IoT PROTOCOLS

IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN – Network Layer: IP versions, Constrained Nodes and Constrained Networks, Zigbee – Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks – Application Transport Methods: Supervisory Control and Data Acquisition – Application Layer Protocols: CoAP and MQTT .

Unit IV: Security

Understanding the risks, Modes of attack - Denial of Service Guessing the credentials , Getting access to stored credentials, Man in the middle , Sniffing network communication , Port scanning and web crawling ,Search features and wildcards ,Breaking ciphers , Tools for achieving security - Virtual Private Networks , X.509 certificates and encryption , Authentication of identities , Usernames and passwords , Using message brokers and provisioning servers ,Centralization versus decentralization .

Unit V: IoT Applications

Home Automation- Smart Appliances , Smoke/ Gas Detection, Cities – Smart Parking ,Smart Lighting , Smart Road , Health and Lifestyle- Health and fitness monitoring, Retail- Smart Payments. Case Studies: Smart city streetlights:- control and monitoring

References:

1.Raj Kamal "Internet of Things", McGraw-Hill, 1st Edition, 2016

2.Olivier Hersent,David Boswarthick, Omar Elloumi "The Internet of Things key applications and protocols", Wiley

3. Peter Waher, "Learning Internet of Things", Packt publishing

4.Arshdeep Bahga, Vijay Madisetti, "Internet of Things (A hands on approach)" University Press (India)

5.Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1 st Edition, Apress Publications, 2013

.6. Cuno Pfister, Getting Started with the Internet of Things, O"Reilly Media, 2011, ISBN: 978-1-4493-9357-1

Evaluation Evaluation will be continuous an integral part of the class as well through external assessment

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Mechanical Engineering, VII-Semester

Departmental Elective ME- 702(C) Power Plant Engineering

Course Objectives:

After studying this course, students will be able to

1. Understand the conversion of renewable energy system into electrical power.
2. Design & enhance the performance of fossil fuel based power plant.
3. Analyze the nuclear power plant and its safety.
4. Design & enhance the performance of hydro based power plant.
5. Determine economics of the power plant of renewable and non renewable / nuclear power system

Syllabus:

Unit I: Introduction:

Introduction to methods of converting various energy sources to electric power, direct conversion methods renewable energy sources, solar, wind, tidal, geothermal, bio-thermal, biogas and hybrid energy systems, fuel cells, thermoelectric modules, MHD-Converter

Unit II: Fossil fuel steam stations:

Basic principles of sitting and station design, effect of climatic factors on station and equipment design, choice of steam cycle and main equipment, recent trends in turbine and boiler sizes and steam conditions, plant design and layout, outdoor and indoor plant, system components, fuel handling, burning systems, element of feed water treatment plant, condensing plant and circulating water systems, cooling towers, turbine room and auxiliary plant equipment., instrumentation, testing and plant heat balance.

Unit III: **Nuclear Power Station**:

Importance of nuclear power development in the world and Indian context, Review of atomic structure and radio activity, binding energy concept, fission and fusion reaction, fissionable and fertile materials, thermal neutron fission, important nuclear fuels, moderators and coolants, their relative merits, thermal and fast breeder reactors, principles of reactor control, safety and reliability features.

Unit IV: Hydro-Power Station:

Elements of Hydrological computations, rainfall run off, flow and power duration curves, mass curves, storage capacity, salient features of various types of hydro stations, component such as dams, spillways, intake systems, head works, pressure tunnels, penstocks, reservoir, balancing reservoirs, Micro and pico hydro machines, selection of hydraulic turbines for power stations, selection of site.

Unit V: Power Station Economics:

Estimation and prediction of load. Maximum demand, load factor, diversity factor, plant factor and their influence on plant design, operation and economics; comparison of hydro and nuclear power plants typical cost structures, simple problems on cost analysis, economic performance and tariffs, interconnected system and their advantages, elements of load dispatch in interconnected systems.

References:

1- Nag PK; Power plant Engg; TMH
2- Al-Wakil MM; Power plant Technology; TMH
3- Sharma PC; Power plant Engg; Kataria and sons, Delhi
4- Domkundwar; Power Plant Engg; Dhanpatrai & sons.
5- Rajput RK; A text book of Power plant Engg.; Laxmi Publications.

Evaluation

Evaluation will be continuous an integral part of the class as well through external assessment.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Mechanical Engineering, VII-Semester

Departmental Elective ME- 702(D) Advance Machine Design

Course Objective

- Understand the design concepts of belt, rope and chain drives.
- Able to design different types of gears.
- Able to design I.C. Engine components, different types of couplings and power screw
- Inspect miscellaneous components such as flanged coupling, rigid coupling, and pressure vessels.

Course Contents:

Unit- I: Design of Belt, Rope and Chain Drives: Methods of power transmission, designof flat beltdrive and V-belt drive ; Design of chain drives, roller chain and its selection; Design of rope drives.

Unit- II: Spur and Helical Gears: Force analysis of gear tooth, AGMA Bending stress equation and AGMA Contact stress equation, modes of failure, beam strength, Lewisequation, form factor, formative gear and virtual number of teeth; Gear materials; Surface strength and wear of teeth; strength against wear; Design of straight tooth spur and Helical Gears.

Unit- III: Bevel Gears: Application of bevel, formative gear and virtual number of teeth; Force analysis; Lewisequation for bevel gears; Strength against wear; Design of bevel gear.

Unit- IV: Design of I.C. Engine Components: General design considerations in I C engines; design ofcylinder; design of piston and piston-rings; design of connecting rod; design of crankshaft.

Unit -V: Design of Miscellaneous Components: Design of Knuckle joint, Design of Cotter joint, Design of keys, Design of Flanged coupling; Rigid coupling and Flexible coupling ,Design of Pressure vessels subjected to internal pressure, Design of power screw.

References:

1. Shigley J.E.; Machine Design; TMH
2. Bhandari VB; Design of Machine Elments; TMH
3. Abdul Mubeen; Machine Design; Khanna Publishers
4. Sharma & Agrawal; Machine Design; Katson
4. Sharma CS and Purohit K; Design of Machine Elements; PHI Learning.
5. Dwivedi and Pandey; Machine Drawing and Design, Dhanpat Rai & Co.
6. Wentzell TH; Machine Design; Cegage Learning
7. Hall and Somani; Machine Design; Schaum Series; TMH
8. Kulkarni SG; Machine Design; TMH
9. Norton R; Design Of Machinery; TMH

Note: PSG Design data book and/ or Mahadevan and Reddy's Mechanical design data book are to be provided/ permitted in exam hall (duly verified by authority)

Evaluation: Evaluation will be continuous an integral part of the class as well through external assessment

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Mechanical Engineering, VII-Semester

Open Elective ME- 703(A) Operation Research & Supply Chain

Course Objective:

The student will be made .

1. To be familiar with all the OR Techniques and optimization methods.
2. To understand the role of logistics in the supply chain within a focal firm as well as between organisations linked within a given supply chain network. and ,
3. To be familiar with various inventory control techniques.
4. To clear idea of the decision making and meta-heuristic algorithm.

Course Content:

Unit 1 Linear system and distribution models: Mathematical formulation of linear systems by LP, solution of LP for two variables, Simplex method, special cases of LP- transportation and assignment model and their graphical solution, Vogels Approximation Method (VAM) or penalty method, cell evaluation degeneracy, basics of SW Lindo, Tora, Excell.

Unit II Supply chain (SCM): Definition, importance, expenditure and opportunities in SCM; integrationof inbound, outbound logistics and manufacturing to SCM, flow of material money and information,difficulties in SCM due to local v/s system wide (global) optimization and uncertainties in demand andtransportation; Bull-whip effect; customer value; IT, info-sharing and strategic partnerships; plant andwarehouse-network configuration; supply contracts and revenue sharing; outsourcing; transportation,cross docking and distribution, forecasting models in SCM; coordination and leadership issues; changeof purchasing role and vendor rating, variability from multiple suppliers.

Unit III Inventory models: Necessity of inventory in process and safety stock, problem of excess inventory and cycle time, JIT/ Lean Mfg; basics of inventory models with deterministic demand, Classical EOQ Model, ABC, VED and other analysis based on shelf life, movement, size, MRP technique and calculations, lot sizing in MRP, linking MRP with JIT; evolution of MRP to ERP to SCM and e-business.

Unit IV (a) **Waiting Line Models:** Introduction, Input process, service mechanism, Queue discipline,
single server (M/M/1), average length and average time calculations, optimum service rate; basic multipleserver models (M/M/s)
(b) **Competitive strategy:** concept and terminology, assumptions, pure and mixed strategies, two-person zero sumgames, saddle point, dominance, graphical, algebraic and LP methods for solving game theory
problems.

Unit V: (a) **Network Analysis:** Project Planning, Scheduling and Controlling; Project management; Network Techniques and its role in project management, Network logics, Fulkerson's Law, Merits and Demerits of AON Diagrams; Programme Evaluation and Review Technique (PERT), Critical Path Method (CPM), Determination of critical path, Float/Slack.
(b**) Meta-heuristics:** Definition of heuristic and meta-heuristic algorithms; introduction to Tabu search,Simulated Annealing and Genetic algorithms and solution of traveling salesman, non linearoptimization problems.

References:

1. Hillier FS and Liberman GJ; Introduction to Operations Research concept and cases; TMH
2. Simchi-Levi, Keminsky; Designing and managing the supply chain; TMH.
3. Heera and Gupta,Operation Research, S Chand Pub.
4. Sharma JK; Operations Research; Macmillan
5. Taha H; Operations research; PHI
6. Jain, pandey & shrivastava; Quantitative techniques for management, New Age publishers.
7. Srinivasan G; Quantitative Models In Operations and SCM; PHI Learning
8. Mohanty RP and deshmukh SG; Supply Chain Management; Wiley India
9. Sen RP; Operations Research-Algorithms and Applications; PHI Learning
10. Bowersox DJ, Closs DJ, Cooper MB; Supply Chain LogistiMgt; TMH
11. Bronson R ;Theory and problems of OR; Schaum Series; TMH
12. Kantiswaroop,Operation Research, Sultan Chand

Course Out Comes:

Evaluation:

Evaluation will be continuous and integral part of the class as well as through external assessment.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Mechanical Engineering, VII-Semester

Open Elective ME- 703(B) Artificial Intelligence Techniques

Course Objectives

After studing this course, students will be able to

1. learn about importance of AI techniques. Adoption of Artificial Intelligence (AI) technologies is widely expanding in our society. Applications of AI include: self-driving cars, personal assistants, surveillance systems, robotic manufacturing, machine translation, financial services, cyber security, web search, video games, code analysis and product recommendations.

2. Know the exact application of AI Techniques. Such applications use AI techniques to interpret information from a wide variety of sources and use it to enable intelligent, goal-directed behavior.

3. understand the working of Modern AI based systems. It often involves self-learning systems that are trained on massive amounts of data, and/or interacting intelligent agents that perform distributed reasoning and computation.

4. Know about sensors used in AI based systems.AI connects sensors with algorithms and human-computer interfaces, and extends itself into large networks of smart devices.

5. know the opportunities after having knowledge of AI techniques. The knowledge of Artificial Intelligence opens career opportunities in companies that are building the next generation of intelligence and language understanding for their products: for example intelligent personal assistants, opinion mining systems, customer support system, biomedical applications, computer games, smart adaptive devices, robots, smart planning systems.

Syllabus

Unit 1: Introduction to Artificial Intelligence

Main components and characteristics of AI (Feature Engineering,ANN,Deep Learning),Applications of AI, Advantages and disadvantages of AI, Goals of AI, Comparision of Programming of a System with AI and without AI,Challenges in AI, Programming languges preferably used in AI,Techniques/Algorithms used in AI,AI Software plaforms,Future of AI

Unit 2: Various types of production systems and search techniques: Types of production systems,Characteristics of production systems, Study and comparison of breadth first search and depth first search. Techniques, other Search Techniques like hill Climbing, Best first Search. A* algorithm, AO* algorithms etc, and various types of control strategies.

Unit 3: Knowledge Representation and Probabilistic Reasoning: Problems in representing knowledge, knowledge representation using propositional and predicate logic, comparison of propositional and predicate logic, Resolution, refutation, deduction, theorem proving, inferencing, monotonic and nonmonotonic reasoning. Probabilistic reasoning, Baye's theorem, semantic networks, scripts, schemas, frames, conceptual dependency, fuzzy logic, forward and backward reasoning.

Unit 4: Game playing techniques: Minimax procedure, alpha-beta cut-offs etc, planning, Study of the block world problem in robotics, Introduction to understanding and natural languages processing.

Unit 5: Introduction to learning ,ANN: Various techniques used in learning, introduction to Artificial neural networks, common sense, reasoning, Convolution Neural Network,Feedforward Neural Network, Recurrent Neural Network, Multilayer perceptron, Architecture / Three Layers in Artificial Neural Networks, Implementation of ANN, Applications of ANN in images,signals and languagesome example of expert systems.

References:-

1.Rich E and Knight K, "Artificial Intelligence", TMH, New Delhi.
2.Nelsson N.J., "Principles of Artificial Intelligence", Springer Verlag, Berlin.
3. Stuart Russell , Artificial Intelligence: A Modern Approach , 3rd Edition), Peter Norvig, PHI, ISBN-13: 978-0136042594, ISBN-10: 0136042597
4. B. Yegnanarayana , Artificial Neural Networks ,PHI
5.Schalkoff, Artificial Neural Networks . Mc Graw HILL Education

Evaluation:

Evaluation will be continuous and integral part of the class as well as through external assessment

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Mechanical Engineering, VII-Semester

Open Elective ME-703(C) Systems Engineering

This course in systems engineering examines the principles and process of creating effective systems to meet application demands.
The course is organized as a progression through the systems engineering processes of analysis, design, implementation, and deployment with consideration of verification and validation throughout.
COURSE OUTCOME: After successful completion of the course, students would be able to

* Plan and manage the systems engineering process
* Examine systems from many perspectives (such as software, hardware, product, etc.)
* Distinguish critical functions, diagnose problems, and apply descoping strategies and judge the complexity of production and deployment issues.
* Know about the complexity in modern systems such as in missiles, rocket engines, modern automobiles etc.
* Solve real complex problems

Syllabus:

Unit 1: Overview of Systems Engineering:
Introduction, Origin, Examples of Systems requiring systems engineering,Systems Engineer Career Development Model, Perspectives of Systems Engineering, Systems Domains, Systems Engineering Fields, System Engineering Approaches.

Unit 2: Structure of Complex Systems:
System Building Blocks and Interfaces, Hierarchy of Complex Systems, System Building Blocks, The System Environment, Interfaces and Interactions, Complexity in Modern Systems.

Unit 3 Concept Development and Exploration:
Originating a New System, Operational Analysis, Functional Analysis, Feasibility, System Operational Requirements, Implementation of Concept Exploration.Exploration in system life cycle, Concept definition phase, Activities involved in concept definition phase.

Unit 4: Engineering Development:
Reducing Program Risks, Requirements Analysis, Functional Analysis and Design, Prototype Development as a Risk Mitigation Technique, Development Testing, Risk Reduction. Place of engineering design phase in system life cycle, Various activities involved in engineering design phase.

Unit 5: Integration and Evaluation:
Integrating, Testing, And Evaluating The Total System, Test Planning And Preparation, System Integration, Developmental System Testing, Operational Test And Evaluation, Engineering For Production, Transition From Development To Production, Production Operations.operation and support phase.

Books:

1.Alexander Kossiakoff, William N Sweet, "System Engineering Principles and Practice, Wiley India
2.Blanchard Fabrycky, Systems engineering and analysis, Pearson
3. Dwivedi Krishna K, Pandey M., Fundamentals of Systems Engineering , Wiley Precise Text book Series, Wiley India. ISBN: 978-265-6654-9
4. Dennis M. Buede, William D.Miller, "The Engineering Design of Systems: Models & Methods" Wiley India
5.JeffreyL Whitten, Lonnie D Bentley, "System Analysis and Design Methods" 6.Richard Stevens, Peter Brook," System Engineering – Coping with complexity, Prentice Hall of India.
7.Eisner, H. Essentials of Projects and Systems Engineering Management, 2nd edition. John Wiley & Sons, New Jersey, USA.
8. Buede, D. M.. The Engineering Design of Systems, Models and Methods. John Wiley & Sons, New Jersey, USA.

Evaluation:

Evaluation will be continuous and integral part of the class as well as through external assessment

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Mechanical Engineering, VII-Semester

Open Elective ME-703(D) Reliability Engineering

Course Objectives:

1. To introduce the basic concepts of reliability, various models of reliability.
2. To analyze reliability of various systems.
3. To introduce techniques of frequency and duration for reliability evaluation of repairable systems.

Unit 1. Reliability :

Definition, Importance, History, Reliabilty Vs. Quality,Failure pattern of complex product, Factor of safety and reliability, Reliability analysis procedure, Reliability management , Some examples of system failures., Reliability function-MTTF, Hazard rate function, Bathtubcurve

Unit 2. Basic probability theory:

Set theory, Laws of probability, Probability theorem Random variables and probability distributions, Bay's Theorem, Central limit theorem,

Unit 3. Functions of random variables:

Single , two and several random variables, Probability distribution functions, density functions for different types of discrete and continuous variables, mean, mode and median, Numerical solutions, Extremal distributions, derivation of the reliability function-constant failure rate model – time dependent failure models. Weibull distribution – normal distribution – the lognormal distribution.

Unit 4. Modeling of geometry, strength and loads:

Fatigue strength, Time dependent reliability of components, Failure rate versus time, reliability and hazard functions and different distributions, Estimation of failure rate, Expected residual life, Series, parallel and mixed systems, complex systems, Reliability enhancement,

Unit 5. Reliability based design:

Optimization problems, Failure modes and effect analysis, Event tree and fault tree analysis, Reliability testing, Reliability data and analysis, measurement of reliability, Monte Carlo Simulation, Computation of reliability, Optimization techniques for system reliability with redundancy – heuristic methods applied to optimal system reliability- redundancy allocation by dynamic programming – reliability optimization by non linear programming.

References:

1. Singiresu S. Rao, Reliability Engineering, Pearson
2. Grant E. L. & Leave Worth, Statistical Q. C., T.M.H.
3. Balagurusamy, Reliability Engg., T.M.H.
4. Mahajan , Statistical Q.C.
5. Juran and Grayan, Quality Planning Analysis, T.M.H
6. Charles E. Ebling, "An introduction to Reliability and Maintainability Engg", Tata McGraw-Hill, 2000
7. Atrick D T o'connor, "Practical Reliability Engineringt", John-Wiley and Sons inc, 2002
8. David J Smith, "Reliability, Maintainability and Risk: Practical Methods for Engineers", Butterworth, 2002.

9. Srinath I.S, Engineering Design and Reliability, ISTE, 1999.

Evaluation:

Evaluation will be continuous and integral part of the class as well as through external assessment

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Mechanical Engineering, VII-Semester

ME- 704 CAD/CAM /CIM

The purpose of this laboratory is to provide the complete practical exposure of Computer aided design software tools such as Solid works,CATIA,Unigraphics etc., Computer assisted manufacturing processes such as CNC Turning, CNC Milling, CNC Drilling etc as well Computer integrated manufacturing (i.e. demonstrating remotely over the internet the operations of actual CIM cell established in the dept of Institute /industry) to the students so that they will become industry ready just after completing their graduation.

Suggested list Experiments; (Pl expand it)

1. 2D and 3D modeling on CAD software
2. Use of CAM software for writing CNC programs
3. Study of automatic and semi automatic control system and writing the electrical analogy.
4. Production & layout for GT for group of jobs to be manufactured
5. A case study / tutorial using CAPP Software
6. Writing M & G codes for given operations.
7. Robot and AGV programming
8. Modelling and simulation of computer integrated manufacturing system'
9. Modelling,offline manual part programming and simulation of the operation of 3 axis CNC milling machine
10. Programming and operation of a 5 axis robot Manipulator
11. Remote monitoring and operation of Computer integrated manufacturing system
12. To write the part program for any component (stepped cylindrical rod) . Assuming the work piece is Aluminum and the speed is 1200 rpm, feed 20 mm/min and maximum depth of cut is 1 mm.
    a. With Canned cycle
    b. Without Canned cycle.

Evaluation:

Evaluation will be continuous and integral part of the class as well as through external assessment (Viva/voce)

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Mechanical Engineering, VII-Semester

ME- 705 MATLAB and R Programming

The purpose of this laboratory is to provide the knowledge of latest research tools/techniques such as MATLAB and R Programming which is being used in finding out the solution of most of the engineering problems. **MATLAB** is a multi-paradigm numerical computing environment and proprietary programming language developed by MathWorks. MATLAB allows matrix manipulations, plotting of functions and data, implementation of algorithms, creation of user interfaces, and interfacing with programs written in other languages.

Following are the suggested list of experiments related to MATLAB (Pl expand)

1. Introduction to MATLAB
2. Working with matrices
3. Rational and logical operation of MATLAB
4. Creating a plot using Plot function
5. Complex and stastical functions (e,g.: Produce ten elements vector of random complex numbers and find the summation of this vector)
6. Numbers and strings (1.Write a program in M-File to read 3 x 3 Matrix, then display the diagonal of matrix as shown below: The Diagonal of This Matrix = [ ]
2. Write a program to read a string, then replace each character in the string with its following character in ASCII code*.)

R Programming is a **programming** language and free software environment for statistical computing and graphics supported by the **R** Foundation for Statistical Computing. The **R** language is widely used among statisticians and data miners for developing statistical software and data analysis.

In this lab, students are supposed to learn how to program in R and how to use R for effective data analysis. Students need to learn how to install and configure software necessary for a statistical programming environment and describe generic programming language concepts as they are implemented in a high-level statistical language.

The lab should cover practical issues in statistical computing which includes programming in R, reading data into R, accessing R packages, writing R functions, debugging, profiling R code, and organizing and commenting R code.

Following are the suggested tutorials to be covered:

1. What is R Programming Language?
2. How to Download & Install R, RStudio, Anaconda on Mac or Windows
3. Weite R Data Types, Arithmetic & Logical Operators with Example
4. Write about R Matrix : Create, Print, add Column, Slice
5. Explain Factor in R: Categorical & Continuous Variables
6. Explain about R Data Frame: Create, Append, Select, Subset.

Evaluation:

Evaluation will be continuous and integral part of the class as well as through external assessment (Viva/voce)

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Mechanical Engineering, VII-Semester

ME- 706 Major Project -I

Objectives of the course Major Project I :

- To provide students with a comprehensive experience for applying the knowledge gained so far by studying various courses.
- To develop an inquiring aptitude and build confidence among students by working on solutions of small industrial problems.
- To give students an opportunity to do some thing creative and to assimilate real life work situation in institution.
- To adapt students for latest development and to handle independently new situations.
- To develop good expressions power and presentation abilities in students. The focus of the Major Project I is on preparing a working system or some design or understanding of a complex system using system analysis tools and submit it the same in the form of a write up i.e. detail project report.

  The student should select some real life problems for their project and maintain proper documentation of different stages of project such as need analysis market analysis, concept evaluation, requirement specification, objectives, work plan, analysis, design, implementation and test plan. Each student is required to prepare a project report and present the same at the final examination with a demonstration of the working system (if any)

Working schedule:

The faculty and students should work according to following schedule:

Each student undertakes substantial and individual project in an approved area of the subject and supervised by a faculty of the department. In special case, if project is huge, then maximum 03 students may be permitted to work together as a team to do the same. The student must submit outline and action plan for the project execution (time schedule) and the same be approved by the concerned faculty and Head of department.

Project guide should motivate students to develop some Innovative working models in the area of Advanced Automotives, Aero modelling, Renewable Energy based systems, Mechatronics,Robotic systems, Advanced Manufacturing Technology based systems etc. which can contribute to the society.

Evaluation:

There will be both external and internal evaluation of project carried out by each student.