RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA BHOPAL

Choice Based Credit System

Mechanical Engineering , III-Semester

Material Science

Objectives :
The course introduces several advanced concepts and topics in the rapidly evolving field of material science. Students are expected to develop comprehension of the subject and to gain scientific understanding regarding the choice and manipulation of materials for engineering applications.

Outcomes :
1. To acquire basic understanding of advanced materials, their functions and properties for technological applications.
2. To emphasize the significance of materials selection in the design process
3. To understand the principal classes of bio-materials and their functionalities in modern medical science
4. To get familiarize with the new concepts of Nano Science and Technology
5. To educate the students in the basics of instrumentation, measurement, data acquisition, interpretation and analysis

Crystal Atoms of Solid: Structure of atom binding in solids metallic, space lattice and crystal system arrangement of atoms in BCC, FCC and HCP crystal. Mechanical , Electrical , thermal , Magnetic & optical Properties of materials
Types of materials .

Plastic deformations of metals: Point and line defects in crystals, their relation to mechanical properties, deformation of metal by slip and twinning, stress strain curves of polycrystalline materials ,Cold and hot working of metals and their effect on mechanical properties .

Alloy Formation and Binary diagram: Phase in metal system solution and inter-metallic compounds. Hume-Rottery's rules, solidification of pure metals and alloy equilibrium diagrams of iso-morphous, eutectic, peritectic and eutectoid system Iron carbon equilibrium diagram.

Heat treatment of Alloys: Principles of heat treatment of steel TTT curves Heat treating processes, normalizing, annealing and spherodizing, hardening, tempering, Case hardening aus-tempering, mar-tempering, precipitation
hardening process with reference to AI, Cu alloys.

Engineering Materials & their applications : Ferrous & Non ferrous metals , base alloys, bronze brasses and Duralumin. Study of Advanced materials: Shape memory alloys, Carbon nano tubes, composite materials, Smart materials Powder Metallurgy: Property and application of powder metallurgy, various processes and methods of making products by powder metallurgy techniques. Polymers & Plastics ,their properties & applications in engineering .Refractory materials .

EVALUATION

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

References:

1. Narula GK, KS and Gupta VK; Material sciemce; Mc Graw Hill Education
2. Askeland , Essentials of Materisl Science & Engineering CENGAGE Learning .
3. R Balasubramaniam , Callister's Material Science ,Wiley Students edition
4. James F Shackelford ;Introduction to Material Science for Engineers PEARSON, Sixth edition.
5. Raghavan V; Material science and Engineering, PHI Publication.
6. Sriniwasan R; Engineering materials and Metallurgy;
7. Agarwal BK Introduction to Engineering Materials , Mc Graw Hills

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA BHOPAL

Choice Based Credit System

Mechanical Engineering , III-Semester

Strength of Materials

Objectives :
To familiarize the students with the fundamentals of deformation, stresses, strains in structural elements.

Outcomes :
At the completion of this course, students should be able to
1. Know the concepts of stress and strain.
2. Analyze the beam of different cross sections for shear force, bending moment, slope and deflection. 3. Understand the concepts necessary to design the structural elements and pressure vessels.

Stress and strain: stresses in members of a structure, axial loading, normal stress, shear stress, analysis of simple structures, stepped rods, members in series and parallel: stress strain diagram, Hooke's law, stress due to temperature, Poisson's ratio, Bulk modulus, shear strain, relation among elastic constants, residual stress, fiber reinforced composite materials, strain energy under axial loads and stresses due to impact of falling weights. Transformation of stress and strain, principal stresses, normal and shear stress, Mohr's circle and its application to two and three dimensional analysis .

Bending: pure bending, symmetric member, deformation and stress, bending of composite sections, eccentric axial loading, shear force and BM diagram, relationship among load, shear and BM, shear stresses in beams, strain energy in bending, deflection of beams, equation of elastic curve, Macaulay's method and Area moment method for deflection of beams.

Torsion in shafts: Tensional stresses in a shafts, deformation in circular shaft, angle of twist, stepped and hollow transmission shafts .

Theories of failures: maximum normal stress & shear stress theory; maximum normal and shear strain energy theory; maximum distortion energy theory; application of theories to different materials and loading conditions .

Columns & struts : stability of structures, Euler's formula for columns with different end conditions, Rankine's formula.

EVALUATION

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

References:

1. Beer FP, Johnson Mechanics of Materials ,Sixth Edition ;Mc Graw Hills
2 Debabrata Nag & Abhijet Chanda :Strength of Materials : Wiley
3 Rattan; Strength of materials;Second Edition , Mc Graw Hills
4. Nash William; Schaum's Outline Series; forth Edition Strength of Materials;Mc Graw Hills
5. Singh Arbind K; Mechanics of Solids; PHI
6. Sadhu Singh; Strength of Materials; Khanna Pub.
7 R Subramannian , Strength of materials OXFORD University Press ,Third Edition .
8 S Ramamurthum , Strength of materials , Dhanpat Rai

List of experiments :
1. Standard tensile test on MS and CI test specimen with the help of UTM
2. Direct/ cross Shear test on MS and CI specimen
3. Transverse bending test on wooden beams to obtain modulus of rupture

4. Fatigue test
5. Brinell Hardness tests
6. Vicker hardness test
7. Izod/Charpy test
8 Rockwell Hardness test

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA BHOPAL

Choice Based Credit System

Mechanical Engineering , III-Semester

Theory of Machines & Mechanisms

Objectives :
To expose the students to learn the fundamentals of various laws governing rigid bodies and its motions.
Outcomes : At the completion of this course, students should be able to know

1. Basic mechanisms, velocity and acceleration of simple mechanisms
2. Drawing the profile of cams and its analysis
3. Gear train calculations , Gyroscopes
4. Inertia force analysis and flywheels
5. Balancing of rotating and reciprocating masses

Mechanisms and Machines: Links, Pairs, Chains, Structure, Mechanism, Machine, Equivalent linkage, Degrees of freedom, Gruebler's & Kutzback's criterion, Inversions of four bar chain, Mechanism with lower pairs Pantograph, Straight line motion mechanisms, Davis and Ackermann's steering mechanisms, Hooke's joint, Numerical problems based on above topics..

Motion: Plane motion, Absolute & Relative motion, Displacement, Velocity and Acceleration of a point, Velocity and Acceleration Analysis by Graphical & Analytical methods, Velocity image, Velocity of rubbing, Kennedy's Theorem, Acceleration image, Acceleration polygon, Coriolis acceleration component, Klein's construction, Velocity and Acceleration Analysis using Complex Algebra (Raven's Approach), Numerical problems based on above topics

Gears: Classification of gears, Helical, Spiral, Bevel, Worm and Spur Gear, Spur Gear Terminology, Law of gearing, Tooth profiles, , velocity of sliding, Path of contact, Arc of contact, Contact Ratio, Interference and Undercutting, , Conjugate action, Numerical problems based on above topics
Gear Trains : Simple, compound, reverted and epi cyclic gear trains . Velocity ratio and torque calculation in gear trains

Cams: Classification of Cams and Followers, Radial Cam Terminology, Analysis of Follower motion (uniform, modified uniform, simple harmonic, parabolic, cycloidal), Pressure Angle, Radius of Curvature, Cam Profile for radial and offset followers Synthesis of Cam Profile by Graphical Approach, Cams with Specified Contours.

Gyroscope: Gyroscopic Action in Machines, Angular Velocity and Acceleration, Gyroscopic torque/ couple, Gyroscopic effect on Naval Ships, Stability of Two and Four Wheel Vehicles, Rigid disc at an angle fixed to a rotating shaft.

Belt Rope & Chain Drive : Types of Belts, Velocity ratio of a belt drive, Slip in belts, Length of open belt and crossed belt, Limiting ratio of belt-Tensions, Power transmitted by a belt,

Centrifugal tension, Maximum tension in a belt, Condition for maximum power transmitted, Initial tension in a belt, Creep in belt, Applications of V-Belt, Rope and Chain drives.

EVALUATION

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

Reference :

1. Thomas Bevan; Theory of Machines; Pearson Education
2. Rattan SS; Theory of machines; MC Graw Hills

3. Ambekar AG; Mechanism and Machine Theory; PHI. Eastern Economy Edition 2015

4 Uicker & Shigley, Theory of machines & Mechanism Second Edition Oxford University Press

4 Dr.Jagdish Lal; Theory of Machines; Metropolitan Book Co; Delhi
5 Rao J S and Dukkipati; Mechanism and Machine Theory; New Age Delhi.
6 .Abdulla Shariff , Theory of Machines .

List of Experiments:

1 To finds out gyroscopic couple .

2 To Find out velocity & acceleration of slider crank mechanism by Klin"s Construction

3 To find out velocity ratio of various gear trains

4 To study various types of belt drives & find out the velocity ratio of the drive .

5 To Draw the cam profile .

6 Study of working models of various popular mechanisms like quick return mechanism etc .

7 .To draw Involute profile of a gear by generating method .

8.Study of the mechanisms like Pantograph mechanism , Davis & Ackerman's steering mechanisms etc .

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA BHOPAL

Choice Based Credit System

Mechanical Engineering , III-Semester

Thermodynamics

Objectives : To develop ability and gain insight into the process of problem-solving, with emphasis on thermodynamics .Specially in following manner:
· apply conservation principles (mass and energy) to evaluate the performance of simple engineering systems and cycles, · evaluate thermodynamic properties of simple homogeneous substances, · analyze processes and cycles using the second law of thermodynamics to determine maximum efficiency and performance, · discuss the physical relevance of the numerical values for the solutions to specific engineering problems and the physical relevance of the problems in general, and · critically evaluate the validity of the numerical solutions for specific engineering problems.

Outcomes : At the completion of this course, students should be able to
1. find values of thermodynamic properties in tables;
2. draw thermodynamic processes on pressure-temperature, pressure-volume, or temperature-volume diagrams;
3. use compressibility charts;
4. calculate expansion or compression work in a closed system;
5. use conservation of mass to determine the change in mass of a system

Basic Concepts & Laws of Thermodynamics : Basic concepts: Property, Equilibrium, State, Process, Cycle, Zeroth law of thermodynamics, Heat and work transfer. First law of thermodynamics- first law applied to various systems steady flow process, limitations of first law of thermodynamics.
Second law of thermodynamics, heat engine, heat reservoir, Refrigerator, heat pump, Carnot's cycle, statements of second law Reversible and irreversible processes, consequence of second law, Clausious
Inequality , Entropy, T-S diagrams, Available & Unavailable energy Availability Concept .

Properties of Steam : Pure Substance, Phase, Phase-transformations, formation of steam, properties of steam, PVT surface, HS,TS,PV,PH,TV diagram, processes of vapor measurement of dryness fraction, Use of steam tables and Mollier chart.

Air standard cycles: Carnot, Otto, Diesel, Dual cycles and their comparison, Brayton cycle, Non reactive gas mixture, PVT relationship, mixture of ideal gases, properties of mixture of ideal gases, internal energy, Enthalpy and specific heat of gas mixtures.

Fuels & combustion : Actual & theoretical Combustion processes , Enthalpy of formation & enthalpy of reaction, first law analysis of reacting systems, Adiabatic flame temperature , Basic concept of Third Law of thermodynamics .
Steam Tables Mollier Charts & tables connected to reactive systems are allowed in Examination hall .

EVALUATION

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

References:

1. P.K.Nag; Engineering Thermodynamics; Mc Graw Hills Fifth Edition
2 Cengel Y; Thermodynamics; MC Graw Hills ,Eight Edition
3 Kross & Potter Thermodynamics for Engineers CENGAGE Learning
4 Moran, Shapiro ,Boettner Principles of Engineering Thermodynamics Wiley student edition
5 P Chattopadhya , Engineering Thermodynamics Second Edition,OXFORD University Press
5 Zemansky Heat & Thermodynamics , Eight Edition , Mc Graw Hills India Education
6. Achuthan M; Engineering Thermodynamics by, PHI India.
7 R Yadav Applied Thermodynamics , Central Publishing house Allahabad

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA BHOPAL

Choice Based Credit System

Mechanical Engineering , III-Semester

Manufacturing Process

Objectives :
To make the students aware of different manufacturing processes like casting, metal forming, metal cutting and gear manufacturing.
Outcomes :
1. Concepts of casting Technology.
2. Mechanical working of metals.
3 Concepts of welding process
4 Concept of forging methods
5 Understanding press working .

Casting : Types of casting process **.**Molding and Foundry core sands and their properties, gating, runners, risers, solidification, defects and elimination, molding machines, centrifugal casting, dye casting, shell molding; Lost wax molding; continuous casting; cupola description and operation.
Welding: Types of welding ,Gas welding method, flames, gas cutting, Electric arc welding, AC and DC welding machines and their characteristics, flux, electrodes, submerged arc welding, TIG & MIG welding; pressure welding; electric resistance welding spot, seam and butt welding; Thermit chemical welding; brazing and soldering, welding defects & remedies .safety precautions .
Pattern Making: Types of patters, Pattern and pattern making, pattern allowances; pattern design considerations, core, core boxes .
Forging: types of forging operations Theory and application of forging processes description; , drop and horizontal forging machines .
Press working: Description and operation of processes, process of shearing, punching, piercing, blanking, trimming, perfecting, notching, lancing, embossing, coining, bending, forging and drawing; press, tool dies, auxiliary equipment, safety devices, stock feeders, scrap cutters, forces, pressure and power requirements .
Rolling: Types of Rolling operations ,General description of machines and process; rolling of structural section plates and sheets; hot and cold rolling techniques
Metal Machining : Basics of Lathe machines , operations & components ,working principle of Shaper & planner ,Introduction to milling ,grinding and drilling machines .

List of Experiments :
1. Study of tools used for various manufacturing processes , study includes application & live demonstration of hand and machine tools .
2. Hands on Exercise on Pattern Making
3. Performance on Metal Casting of Simple component
4. Performance on Welding of simple work piece (Example Arc and Resistance Welding)
5. Exercise Problems on Welding
6. Exercise problems on Casting
7 Study of forging machine & demonstration of various operations of forging .
8 Study of Hydraulic ,Pneumatic presses & demonstration of piercing, slitting, deep drawing operations on press machine .

EVALUATION

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

References:

1. Anderson and Tetro; Shop Theory; Mc Graw Hills
2. Kaushish JP; Manufacturing Processes; PHI Learning.
3 Kalpakjian Producting Engineering PEARSON Education
4. Chapman; Workshop Technology
5. Philip F Ostwald ; Manufacturing Process & systems : John Wiley
6. Raghuvanshi; Workshop Technology ; Dhanpat Rai.
7 Hajra Choudhary; Workshop Technology:, Vol I

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA BHOPAL

Choice Based Credit System

Mechanical Engineering, III-Semester

Communication Skills

Introduction: Communication, definition and role of communication, Process of communication, Importance of professional communication, Levels of communication, Types of communication, Challenges in communication. Non –verbal communication – Body language, personal appearance, posture, gesture and hand movement, eye contact, facial expressions, paralinguistic features - proxemics, haptics, chronemics. Oral presentations. Case studies.

Books recommended:

1. Business Communication, Mc Graw Hill Education, Matthukutty M. Monippally.
2. Effective Business Communication , Mc Graw Hill Education, Neera Jain, Shoma Mukherji.
3. Technical Communication , Cengage , P. Subba Rao, B. Anita Kumar, C. Hima Bindu.
4. Business Correspondence & Report Writing , Mc graw Hills. , R.C. Sharma & Krishna Mohan .
5. Technical Communication – Principles & Practice , Oxford , Meenakshi Raman.
6. Business Communication- Mc graw Hills , Peter Cordom.
7. Communication Skills , Oxford , Sanjay Kumar & Pushpa TMH.
8. Effective Technical Communication , M. Ashraf Rizvi ,Mc Graw Hill Education.

Language Lab II

Module 1 : Reading comprehension
Module 2 : Role plays
Module 3 : Debate
Module 4 : Group discussion
Module 5 : Resume writing
Module 6 : Interview skills
Module 7 : Body language
Module 8 : Oral presentations