

SEMESTER-II

MATS UNIVERSITY, RAIPUR (C.G.)

SCHOOL OF ENGINEERING & I.T.

Semester : II B.Tech

Branch : All Streams of Engineering

Subject : Engineering Mathematics-II

Total Theory Periods : 60

Total Tutorial Periods : 00

Total Credits : 04

Code : BT 200

OBJECTIVES:

- To make the student acquire sound knowledge of techniques in solving ordinary differential equations that model engineering problems.
- To acquaint the student with the concepts of vector calculus needed for problems in all engineering disciplines.
- To develop an understanding of the standard techniques of complex variable theory so as to enable the student to apply them with confidence, in application areas such as heat conduction, elasticity, fluid dynamics and flow the of electric current.
- To make the student appreciate the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.

OUTCOMES:

- The subject helps the students to develop the fundamentals and basic concepts in vector calculus, ODE, Laplace transform and complex functions. Students will be able to solve problems related to engineering applications by using these techniques.

UNIT-1: MULTIPLE INTEGRALS Double and triple integrals, change of order of integration; Beta and Gamma functions; application to area and volume.

UNIT-2: VECTOR CALCULUS Scalar and vector fields, Line and surface integrals, gradient, divergence and curl, line integrals, Green's theorem, divergence theorem and Stock's theorem (without proofs) and their simple applications

UNIT-3: DIFFERENTIAL EQUATION OF HIGHER ORDER Linear differential equations of higher order with constant coefficients, method of variation of parameters, Cauchy's and Legendre's linear equations, simultaneous linear equations with constant coefficients.

UNIT-4 : LAPLACE TRANSFORMS Transforms of elementary functions, transforms of derivatives and derivatives of transforms, inverse transforms, transforms of periodic function, shifting a theorem, solutions of ODE's using Laplace transforms.

UNIT-5 : COMPLEX NUMBERS De Moivre's theorem, roots of complex numbers, separation into real and imaginary parts of circular, hyperbolic, logarithmic and exponential function, summation of trigonometric series by C+iS method. .

TEXT BOOKS:

1. Higher Engineering Mathematics by B.S.Grewal (40th edition)-Khanna Publisher.
2. Advanced Engineering Mathematics by Erwin Kreyszig (8th edition)-John Wiley & Sons.

REFERENCE BOOKS:

1. Differential Calculus by Gorakh Prasad-Pothisala Private Limited.
2. Advanced Engineering Mathematics by R.K.Jain and S.R.K. Iyengar-Narosa Publishing House.
3. Applied Mathematics by P.N.Wartikar & J.N.Wartikar Vol-II –Pune Vidyarthi Griha Prakasan, Pune.
4. Integral Calculus by Gorakh Prasad-Pothisala Private Limited.

MATS UNIVERSITY, RAIPUR (C.G.)
SCHOOL OF ENGINEERING & I.T.

Semester : II B.Tech

Branch : All Streams of Engineering

Subject : Fundamental of Mechanical Engineering

Total Theory Periods : 45

Total Tutorial Periods : 20

Total Credits : 04

Code : BT 201

OBJECTIVES:

- To develop capacity to predict the effect of force and motion in the course of carrying out the design functions of engineering.

OUTCOMES:

- ability to explain the differential principles applies to solve engineering problems dealing with force, displacement, velocity and acceleration.
- ability to analyse the forces in any structures.
- ability to solve rigid body subjected to dynamic forces.

UNIT – I :

RESULTANT AND EQUILIBRIUM ANALYSIS:

Basic concepts and laws of mechanics, system of forces, free body diagram, Resultant and equilibrium of concurrent, parallel and non-concurrent co-planar force system.
General numerical applications.

UNIT – II :

(a) ANALYSIS OF PLANE TRUSSES Perfect truss, basic assumptions for perfect truss, analysis of axial forces in the members by method of joint and method of sections. General numerical applications.

(b) FRICTION Static, dynamic and limiting friction, Law of limiting friction, Angle of friction, Angle of Repose, Cone of Friction, Wedge friction. General numerical applications

UNIT –III :

PROPERTIES OF SURFACES Centre of Gravity, Second moment of area, determination of second moment of area by integration, polar moment of inertia, radius of gyration of area, Parallel axis theorem, Moment of inertia of composite areas, and determination of Product of inertia by integration.

UNIT –IV :

KINETICS OF PARTICLES (a) D'Alembert's principle applied to bodies having rectilinear motion.

(b) Principle of work and Energy: General numerical applications (c) Principle of Impulse and momentum: General numerical applications

UNIT – V :

LAWS OF THERMODYNAMICS (a) Thermodynamic System, properties, process, cycle, thermodynamic equilibrium, Quasi-static Process, Zeroth Law of thermodynamics, Work and Heat transfer, flow work, general numerical application.

(b) First Law of thermodynamics, internal energy, proof of internal energy as a point function, general numerical application of first law to non-flow process and steady flow process.

Text Books:

1. Engineering Mechanics (Statics and Dynamics) ; A. K. Tayal ,Umesh Pub., Delhi .
2. Engineering Mechanics : S. Timoshenko and D.H. Young, TMH
3. Engineering Thermodynamics: P.K.Nag, TMH
4. Engineering Thermodynamics: C.P.Arora, TMH

Reference Books:

1. Engineering Mechanics (Statics and Dynamics): R.C.Hibbeler, Pearson
2. Engineering Mechanics:Meriam and Kreige ,John Wiley and sons
3. Thermodynamics: Cengel and Boles, TMH
4. Essentials of Engg Mechanics: S.Rajasekharan& G.Shankara Subramaniam, Vikas Publications
5. Engineering Mechanics: Basudeb Bhatyacharya , Oxford

MATS UNIVERSITY, RAIPUR (C.G.)
SCHOOL OF ENGINEERING & I.T.

Semester : II B.Tech

Branch : All Streams of Engineering

Subject : Basic Electronics Engineering

Total Theory Periods : 45

Total Tutorial Periods : 20

Total Credits : 04

Code : BT 202

OBJECTIVES:

- To explain the principles of digital electronics
- To impart knowledge of communication.

OUTCOMES:

- ability to identify electronics components and use of them to design circuits.

UNIT-I :

SEMICONDUCTOR & JUNCTION DIODE CHARACTERISTICS

Review of semi conductor Physics – n and p – type semiconductors, Mass Action Law, Opencircuited p-n junction, The p-n junction as a rectifier(forward bias and reverse bias) ,The current components, drift and diffusion in p-n diode, law of junction, diode equation, Energy band diagram of p-n diode, Volt- ampere characteristics of p-n diode, temperature dependence of V-I characteristics, transition and diffusion capacitances, p-n junction in the breakdown region, ideal diode, terminal characteristics of junction diode, load –line analysis of diode circuits ,breakdown mechanisms in semiconductor diodes, Zener diode characteristics, characteristics of tunnel diode, varactor diode.

UNIT-II :

(a) RECTIFIERS Half wave rectifier, ripple factor, full wave rectifier, Bridge rectifiers and Harmonic components in a rectifier circuit (b) FILTERS Inductor filter, Capacitor filter, L-section filter, π -Section filter and comparison of various filter circuits in terms of ripple factors © REGULATORS Regulators line regulation and load regulation, Block diagram of power supply, working of switched mode power Supply (SMPS)

UNIT-III:

BJT Introduction, NPN & PNP transistors, transistor action, biasing, current components, current amplification factor, relationship between α & β , ebers-moll model, transistor circuit configuration, CB,CE,CC, comparison of characteristics of transistors in different configuration, transistor as an amplifier, .

UNIT – IV :

TRANSISTOR BIASING Transistor Load line. Transistor Biasing and Thermal stabilization: The operating point, Bias stability, Stability factor, Emitter Bias, Collector – to – base bias, Voltage divider bias with emitter bias, Emitter bypass capacitor. Bias Compensation.

UNIT V :

FET & MOSFET Field Effect Transistor (FET): Introduction, Construction, Operation, V-I Characteristics, Transfer Characteristics, Drain Characteristics, Small-Signal Model. Metal Oxide

Semiconductor Field Effect Transistor (MOSFET): Introduction, Construction, Operation and characteristics, Depletion MOSFET, Enhancement MOSFET

Breakdown devices Introduction, unijunction transistor (UJT), programmable UJT (PUT), silicon controlled rectifier (SCR),

TEXT BOOKS:

1. Electronic Devices and Circuits-J Millman and C.C. Halkias, Tata McGraw Hill, 1998
2. Electronic Devices and Circuits –A.P. Godse & U.A. Bakshi..
3. Electronic Devices and Circuits –R.S.Sedha.

REFERENCES:

1. Electronic Devices and Circuits-Prof GS N Raju, I K International Publishing House Ltd 2006.
2. Electronic Devices and Circuits-T F Bogart Jr., J.S.Beasley and G.Rico, Pearson Education,6th edition,2004
3. Principles of electronic circuits- S G Burns and P R Bond, Galgotia publications, 2nd Edn1998

**MATS UNIVERSITY, RAIPUR (C.G.)
SCHOOL OF ENGINEERING & I.T.**

Semester : II B.Tech
Branch : All Streams of Engineering
Subject : Environmental Sciences
Total Theory Periods : 45
Total Tutorial Periods : 00
Total Credits : 03
Code : BT 203

UNIT-I:

CONCEPTS OF ENVIRONMENTAL SCIENCES AND NATURAL RESOURCES

Environment, Levels of organizations in environment, Structure and functions in an ecosystem; Biosphere, its Origin and distribution on land, in water and in air, Broad nature of chemical composition of plants and animals. Renewable and Non-renewable Resources, Forests, water, minerals, Food and land (with example of one case study); Energy, Growing energy needs, energy sources (conventional and alternative).

UNIT-II:

BIODIVERSITY AND ITS CONSERVATION

Biodiversity at global, national and local levels; India as a mega-diversity nation; Threats to biodiversity (biotic, abiotic stresses), and strategies for conservation.

UNIT-III:

ENVIRONMENTAL POLLUTION

Types of pollution- Air, water (including urban, rural, marine), soil, noise, thermal, nuclear; Pollution prevention; Management of pollution- Rural/Urban/Industrial waste management [with case study of any one type, e.g., power (thermal/nuclear), fertilizer, tannin, leather, chemical, sugar], Solid/Liquid waste management, disaster management.

UNIT-IV:

ENVIRONMENTAL BIOTECHNOLOGY AND ENVIRONMENTAL MONITORING

Biotechnology for environmental protection- Biological indicators, bio-sensors; Remedial measures- Bio-remediation, phyto-remediation, bio-pesticides, bio-fertilizers; Bio-reactors- Design and application. Monitoring- Identification of environmental problem, tools for monitoring (remote sensing, GIS); Sampling strategies- Air, water, soil sampling techniques.

SOCIAL ISSUES AND ENVIRONMENT

Problems relating to urban environment- Population pressure, water scarcity, industrialization; remedial measures; Climate change- Reasons, effects (global warming, ozone layer depletion, acid

rain) with one case study; Legal issues- Environmental legislation (Acts and issues involved), Environmental ethics

TEXTBOOKS :

1. Gilbert M. Masters, "Introduction to Environmental Engineering and Science", 2nd Edition, Pearson Education, 2004.
2. Benny Joseph, "Environmental Science and Engineering", Tata McGraw-Hill, New Delhi, 2006.

REFERENCE BOOKS :

1. A. K. Chatterji, "Introduction to Environmental Biotechnology", Prentice Hall of India, New Delhi, 2006.
2. R.K. Trivedi, "Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards", Vol. I and II, Enviro Media.
3. Nebel B. J., "Environmental Science", Prentice Hall of India, New Delhi, 1987.

**MATS UNIVERSITY, RAIPUR (C.G.)
SCHOOL OF ENGINEERING & I.T.**

Semester : II B.Tech

Branch : All Streams of Engineering

Subject : Engineering Chemistry

Total Theory Periods : 45

Total Tutorial Periods : 00

Total Credits : 03

Code : BT 204

OBJECTIVES:

- To make the students conversant with boiler feed water requirements, related problems and water treatment techniques.
- Principles of electrochemical reactions, redox reactions in corrosion of materials and methods for corrosion prevention and protection of materials.
- Principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells.
- Preparation, properties and applications of engineering materials. □ Types of fuels, calorific value calculations, manufacture of solid, liquid and gaseous fuels

OUTCOMES:

- The knowledge gained on engineering materials, fuels, energy sources and water treatment techniques will facilitate better understanding of engineering processes and applications for further learning.

UNIT-I:

ELECTROCHEMISTRY AND BATTERY TECHNOLOGY ELECTROCHEMISTRY: Introduction, Derivation of Nernst equation for electrode potential. Reference electrodes: Introduction, construction, working and applications of calomel and Ag / AgCl electrodes. Measurement of electrode potential using calomel electrode. Ion selective electrode: Introduction; Construction and working of glass electrode, determination of pH using glass electrode. Concentration cells: Electrolyte concentration cells, numerical problems.

BATTERY TECHNOLOGY: Introduction, classification - primary, secondary and reserve batteries. Characteristics - cell potential, current, capacity, electricity storage density, energy efficiency, cycle 10 hours life and shelf life. Construction, working and applications of Zinc Air, Nickel- metal hydride batteries. Lithium batteries: Introduction, construction, working and applications of Li-MnO₂ and Li-ion batteries.

FUEL CELLS: Introduction, difference between conventional cell and fuel cell, limitations & advantages. Construction, working & applications of methanol-oxygen fuel cell with H₂SO₄ electrolyte.

UNIT-II:

CORROSION AND METAL FINISHING CORROSION: Introduction, electrochemical theory of corrosion, galvanic series. Factors affecting the rate of corrosion: ratio of anodic to cathodic areas, nature of metal, nature of corrosion product, nature of medium – pH, conductivity, and temperature. Types of corrosion- Differential metal, differential aeration (Pitting and water line) and stress. Corrosion control: Inorganic coatings Anodizing of Al and phosphating; Metal coatings-Galvanization and Tinning. Cathodic protection (sacrificial anodic and impressed current methods).

METAL FINISHING: Introduction, Technological importance. Electroplating: Introduction, principles governing-Polarization, decomposition potential and overvoltage. Factors influencing the nature of electro deposit-current density, concentration of metal ion & electrolyte; pH, temperature & throwing power of plating bath; additives- brighteners, levellers, structure modifiers & wetting agents. Electroplating of Nickel (Watt's Bath) and Chromium(decorative and hard). Electro less plating: Introduction, distinction between electroplating and electro less plating, electro less plating of copper & manufacture of double sided Printed Circuit Board with copper.

UNIT-III:

FUELS AND SOLAR ENERGY FUELS: Introduction, classification, calorific value- gross and net calorific values, determination of calorific value of fuel using bomb calorimeter, numerical problems. Cracking: Introduction, fluidized catalytic cracking, synthesis of petrol by Fishcher-Tropsch process, reformation of petrol, octane and cetane numbers. Gasoline and diesel knocking and their mechanism, anti knocking agents, power alcohol & biodiesel.

SOLAR ENERGY: Introduction, utilization and conversion, photovoltaic cells- construction and working. Design of PV cells: modules, panels & arrays. Advantages & disadvantages of PV cells. Production of solar grade silicon: Union carbide process, purification of silicon (zone refining), doping of silicon-diffusion technique (n&p types).

UNIT-IV:

POLYMERS: Introduction, types of polymerization: addition and condensation, mechanism of polymerization- free radical mechanism taking vinyl chloride as an example. Molecular weight of polymers: number average and weight average, numerical problems. Glass transition temperature (T_g): Factors influencing T_g-Flexibility, inter molecular forces, molecular mass, branching & cross linking and stereo regularity. Significance of T_g. Structure property relationship: crystallinity, tensile strength, elasticity & chemical resistivity. Synthesis, properties and applications of PMMA (plexi glass), Polyurethane and polycarbonate. Elastomers: Introduction, synthesis, properties and applications of Silicone rubber. Adhesives: Introduction, synthesis, properties and applications of epoxy resin. Polymer Composites: Introduction, synthesis, properties and applications of Kevlar. Conducting polymers: Introduction, mechanism of conduction in Poly aniline and applications of conducting poly aniline.

UNIT-V:

WATER TECHNOLOGY AND NANOMATERIALS Water Technology: Introduction, boiler troubles with disadvantages & prevention methods-scale and sludge formation, priming and foaming, boiler corrosion(due to dissolved O₂, CO₂ and MgCl₂). Determination of DO, BOD and COD, numerical problems on COD. Sewage treatment: Primary, secondary (activated sludge method) and tertiary methods. Softening of water by ion exchange process. Desalination of sea water by reverse osmosis & electro dialysis (ion selective).

NANO MATERIALS: Introduction, properties (size dependent). Synthesis-bottom up approach (sol-gel, precipitation, gas condensation & chemical vapour condensation processes). Nano scale materials- carbon nano tubes, nano wires, fullerenes, dendrimers, nano rods, & nano composites.

Textbooks :

1. B.S.Jai Prakash, R.Venugopal, Sivakumaraiah & Pushpa Iyengar., "Chemistry for Engineering Students", Subhash Publications, Bangalore.

2. R.V.Gadag & A.Nityananda Shetty., “Engineering Chemistry”, I K International Publishing House Private Ltd. New Delhi.

3. P.C.Jain & Monica Jain., “Engineering Chemistry”, Dhanpat Rai Publications, New Delhi.

Reference Books:

1. O.G.Palanna, “Engineering Chemistry”, Tata McGraw Hill Education Pvt. Ltd. New Delhi, Fourth Reprint.

2. G.A.Ozin & A.C. Arsenault, “Nanochemistry A Chemical Approach to Nanomaterials”, RSC publishing, 2005.

3. “Wiley Engineering Chemistry”, Wiley India Pvt. Ltd. New Delhi. Second Edition.

4. V.R.Gowariker, N.V.Viswanathan & J.Sreedhar., “Polymer Science”, Wiley-Eastern Ltd.

5. M.G.Fontana., “Corrosion Engineering”, Tata McGraw Hill Publishing Pvt. Ltd. New Delhi.

**MATS UNIVERSITY, RAIPUR (C.G.)
SCHOOL OF ENGINEERING & I.T.**

Semester : II B.Tech

Branch : All Streams of Engineering

Subject : Constitution of India, Professional Ethics and Human Rights

Total Theory Periods : 15

Total Tutorial Periods : 00

Total Credits : 01

Code : BT 205

UNIT-I:

CONSTITUTION OF INDIA Introduction to the Constitution of India, The Making of the Constitution and Salient features of the Constitution, Preamble to the Indian Constitution Fundamental Rights & its limitations.

UNIT-II:

FUNDAMENTAL DUTIES AND UNION EXECUTIVES Directive Principles of State Policy & Relevance of Directive Principles State Policy Fundamental Duties. Union Executives – President, Prime Minister Parliament Supreme Court of India

UNIT-III: STATE LEGISLATURE AND ELECTORAL PROCESS State Executives – Governor Chief Minister, State Legislature High Court of State, Electoral Process in India, Amendment Procedures, 42nd, 44th, 74th, 76th, 86th & 91st Amendments.

UNIT-IV: HUMAN RIGHTS Special Provision for SC & ST Special Provision for Women, Children & Backward Classes Emergency Provisions. Human Rights –Meaning and Definitions, Legislation Specific Themes in Human Rights- Working of National Human Rights Commission in India ,Powers and functions of Municipalities, Panchyats and Co - Operative Societies..

UNIT-V: PROFESIONAL ETHICS Scope & Aims of Engineering Ethics, Responsibility of Engineers Impediments to Responsibility. Risks, Safety and liability of Engineers, Honesty, Integrity & Reliability in Engineering.

Textbooks :

1. Durga Das Basu: “Introduction to the Constitution on India”, (Students Edn.) Prentice –Hall EEE, 19th / 20th Edn., 2001 2. Charles E. Haries, Michael S Pritchard and Michael J. Robins “Engineering Ethics” Thompson Asia, 2003-08-05.

Reference Books:

1. M.V.Pylee, “An Introduction to Constitution of India”, Vikas Publishing, 2002.
2. M.Govindarajan, S.Natarajan, V.S.Senthilkumar, “Engineering Ethics”, Prentice –Hall of India Pvt. Ltd. New Delhi, 2004
3. Brij Kishore Sharma, “Introduction to the Brij Constitution of India”, PHI Learning Pvt. Ltd., New Delhi, 2011.

**MATS UNIVERSITY, RAIPUR (C.G.)
SCHOOL OF ENGINEERING & I.T.**

Semester : II B.Tech

Branch : All Streams of Engineering

Lab : Fundamental of Mechanical Engineering Lab

Total Practical Periods : 30

Total Credits : 01

Code : BT 206

Note: MINIMUM TEN NUMBERS OF EXPERIMENTS IS TO BE PERFORMED

LIST OF EXPERIMENTS

1. To verify law of triangle of forces.
2. To verify the Lami's theorem.
3. To verify the law of polygon of forces.
4. To verify the law of lever. 5. To determine the support reactions of a simply supported beam subjected to point loads.
6. To draw the variation of bending moment at a given section in a simply supported beam under a moving point load.
7. To find the coefficient of friction between surfaces of wooden plane and following blocks: i) Aluminum ii) Tin iii) Glass iv) Asbestos v) Teak ply vi) Sand paper vii) card board .
8. To determine the coefficient of friction between (i) Belt and pulley (ii) Rope and pulley.
9. To study simple jib crane and to determine the internal forces in members of jib crane.
10. To determine the stiffness of helical compression spring.
11. To study lifting machine.
12. To study the lifting machine "second order pulley system" and to draw the following characteristic diagram: (i) Load-effort diagram (ii) Load- ideal effort diagram (iii) Load-efficiency diagram Also to determine the law of machine and the maximum efficiency of machine.
- 13 To study the lifting machine "Wheel and Differential axle" and to draw the following characteristic diagram: (i). Load-effort diagram (ii) Load- ideal effort diagram (iii). Load-efficiency diagram Also to determine the law of machine and the maximum efficiency of machine.
14. To study the lifting machine "Worm and worm wheel" and to draw the following characteristic diagram: (i). Load-effort diagram (ii). Load- ideal effort diagram (iii). Load-efficiency diagram Also to determine the law of machine and the maximum efficiency of machine.
15. To study the lifting machine "Simple screw jack" and to draw the following characteristic diagrams of the machine: (i) Load-effort diagram (ii). Load- ideal effort diagram (iii) Load-efficiency diagram Also to determine the law of machine and the maximum efficiency of machine.
16. To study the lifting machine "Modified screw jack" and to draw the following characteristic diagrams of the machine: (i) Load-effort diagram (ii) Load- ideal effort diagram (iii) Load-efficiency diagram Also to determine the law of machine and the maximum efficiency of machine.
17. To study the lifting machine "Geared Jib crane" and to draw the following characteristic diagrams of the machine: (i) Load-effort diagram (ii) Load- ideal effort diagram (iii) Load-efficiency diagram Also to determine the law of machine and the maximum efficiency of machine.

18. To study the lifting machine “Single Purchase Winch crab” and to draw the following characteristic diagrams of the machine: (i) Load-effort diagram (ii) Load- ideal effort diagram (iii) Load-efficiency diagram Also to determine the law of machine and the maximum efficiency of machine.

19. To study the lifting machine “Double Purchase Winch crab” and to draw the following characteristic diagrams of the machine: (i) Load-effort diagram (ii) Load- ideal effort diagram (iii) Load-efficiency diagram Also to determine the law of machine and the maximum efficiency of machine. LIST OF EQUIPMENTS