SPPU B.E./B.Tech CSE Sem 2 syllabus

Engineering Mechanics (2019 Pattern)

101011: ENGINEERING MECHANICS

Credits 04

Unit I Resolution and Composition of Forces (07Hrs)

Principle of statics, Force system, Resolution and composition of forces, Resultant of concurrent forces. Moment of a force, Varignon's theorem, resultant of parallel force system, Couple, Equivalent force couple system, Resultant of parallel general force system

Unit II Distributed Forces and Friction (06Hrs)

Moment of area, Centroid of plane lamina and wire bends, Moment of Inertia. Friction- Laws of friction, application of friction on inclined planes Wedges and ladders friction Application to flat belt.

Unit III Equilibrium (06Hrs)

Free body diagram Equilibrium of concurrent, parallel forces in a plane Equilibrium of general forces in a plane Equilibrium of three forces in a plane, Types of beams, simple and compound beams, Type of supports and reaction, Forces in space, Resultant of concurrent and parallel forces in a space, Equilibrium of concurrent and parallel forces in a space.

Unit IV Analysis of Structures (06 Hrs)

Two force member, Analysis of plane trusses by Method of joints Analysis of plane trusses by method of section, Analysis of plane frames, Cables subjected to point load multi force member.

Unit V Kinematics of Particle (06 Hrs)

Kinematics of linear motion- Basic concepts Equation of motion for constant acceleration Motion under gravity, Variable acceleration motion curves. Kinematics of curvilinear motion- Basic Concepts Equation of motion in Cartesian coordinates Equation of motion in path coordinates Equation of motion in polar coordinates Motion of projectile.

Unit VI Kinetics of Particle (06Hrs)

Kinetics- Newton's Second Law of motion Application of Newton's Second Law. Work, power, energy, conservative and non-conservative forces Conservation of energy for motion of particle, Impulse, Momentum, Direct central impact. Coefficient of restitution, Impulse Momentum principle of particle.

Books & Other Resources:

Text Books:

1. Vector Mechanics for Engineers, by F. P. Beer and E. R. Johnson, McGraw-Hill Publication

2. Engineering Mechanics by R. C. Hibbeler, Pearson Education

Reference Books:

1. Engineering Mechanics by S. P. Timoshenko and D. H. Young, McGraw- Hill publication

2. Engineering Mechanics by J. L. Meriam and Craige, John Willey

3. Engineering Mechanics by F L Singer, Harper and Rowe publication

4. Engineering Mechanics by A. P. Boresi and R. J. Schmidt, Brooks/Cole Publication

Engineering Physics (2019 Pattern)

107002: ENGINEERING PHYSICS

Unit I Wave Optics (08 Hrs)

Interference - Introduction to electromagnetic waves and electromagnetic spectrum - Interference in thin film of uniform

thickness (with derivation) - Interference in thin film wedge shape (qualitative) - Applications of interference: testing optical flatness, anti-reflection coating

Diffraction - Diffraction of light - Diffraction at a single slit, conditions for principal maxima and minima, diffraction pattern - Diffraction grating, conditions for principal maxima and minima starting from resultant amplitude equations, diffraction pattern - Rayleigh's criterion for resolution, resolving power of telescope and grating Polarization - Polarization of light, Malus law - Double refraction, Huygen's theory of double refraction Applications of polarization: LCD

Unit II Laser and Optic Fibre (08 Hrs)

Laser - Basics of laser and its mechanism, characteristics of laser - Semiconductor laser: Single Hetro-junction laser - Gas laser: CO_2 laser - Applications of lasers: Holography, IT, industrial, medical Optic Fiber - Introduction, parameters: Acceptance Angle, Acceptance Cone, Numerical Aperture - Types of optical fiber- step index and graded index - Attenuation and reasons for losses in optic fibers (qualitative) - Communication system: basic building blocks Advantages of optical fiber communication over conventional methods.

Unit III Quantum Mechanics (08 Hrs)

- De-Broglie hypothesis - Concept of phase velocity and group velocity (qualitative) - Heisenberg Uncertainty Principle - Wave-function and its physical significance - Schrodinger's equations: time independent and time dependent - Application of Schrodinger's time independent wave equation - Particle enclosed in infinitely deep potential well (Particle in RigidBox) - Particle in Finite potential well (Particle in Non Rigid box) (qualitative) - Tunneling effect, Tunneling effect examples (principle only): Alpha Decay, Scanning Tunneling Microscope, Tunnel diode - Introduction to quantum computing

Unit IV Semiconductor Physics (08 Hrs)

- Free electron theory (Qualitative) - Opening of band gap due to internal electron diffraction due to lattice Band theory of solids -

Effective mass of electron Density of states - Fermi Dirac distribution function - Conductivity of conductors and semiconductors - Position of Fermi level in intrinsic and extrinsic semiconductors (with derivations based on carrier concentration) - Working of PN junction on the basis of band diagram - Expression for barrier potential (derivation) - Ideal diode equation - Applications of PN junction diode: Solar cell (basic principle with band diagram) IV Characteristics and Parameters, ways of improving efficiency of solar cell - Hall effect: Derivation for Hall voltage, Hall coefficient, applications of Hall effect

Unit V Magnetism and Superconductivity (8Hrs.)

Magnetism - Origin of magnetism - Classification of magnetism on the basis of permeability (qualitative) - Applications of magnetic devices: transformer cores, magnetic storage, magneto-optical recording Superconductivity - Introduction to superconductivity; Properties of superconductors: zero electrical - resistance, critical magnetic field, persistent current, Meissner effect - Type I and Type II superconductors - Low and high temperature superconductors (introduction and qualitative) - AC/DC Josephson effect; SQUID: basic construction and principle of working; Applications of SQUID - Applications of superconductors

Unit VI Non Destructive Testing and Nanotechnology (8 Hrs.)

Non Destructive Testing - Classification of Non-destructive testing methods - Principles of physics in Non-destructive Testing - Advantages of Non-destructive testing methods - Acoustic Emission Testing - Ultrasonic (thickness measurement, flaw detection) - Radiography testing Nanotechnology - Introduction to nanotechnology - Quantum confinement and surface to volume ratio - Properties of nanoparticles: optical, electrical, mechanical Applications of nanoparticles: Medical (targeted drug delivery), electronics, space and defense, automobile

Engineering Chemistry (2019 Pattern)

107009: ENGINEERING CHEMISTRY

Unit I Water Technology (08Hrs)

Impurities in water, hardness of water: Types, Units and Numericals.

Determination of hardness (by EDTA method using molarity concept) and alkalinity, numericals. Ill effects of hard water in boiler - priming and foaming, boiler corrosion, caustic embrittlement, scale and sludge. Water treatment: i) Zeolite method and numericalsii) Demineralization method. Purification of water: Reverse osmosis and Electrodialysis.

Unit II Instrumental Methods of Analysis (08Hrs)

Introduction: Types of reference electrode (calomel electrode), indicator electrode (glass electrode), ion selective electrode: ion selective membranes such as solid membrane, enzyme based membrane and gas sensing membrane.

[A] Conductometry: Introduction, conductivity cell, conductometric titrations of acid versus base with titration curve.

[B] pHmetry: Introduction, standardization of pH meter, pH metric titration of strong acid versus strong base with titration curve.

Unit III Engineering Materials (08Hrs)

A] Speciality polymers: Introduction, preparation, properties and applications of the following polymers:

1. Engineering Thermoplastic: Polycarbonate,

2. Bio-degradable polymers: Poly (hydroxybutyrate-hydroxyvalanate),

3. Conducting Polymer: Polyacetylene,

4. Electroluminescent polymer: Polyphenylenevinylene,

5. Polymer composites: Fiber reinforced plastic (FRP)- Glass reinforced and Carbon reinforced polymer composite

[B] Nanomaterials: Introduction, classification of nanomaterials based on dimensions (zero dimensional, one-dimensional, two-dimensional and three-dimensional), structure, properties and applications of graphene and carbon nanotubes, quantum dots (semiconductor nanoparticles).

Unit IV Fuels (08Hrs)

Introduction (definition, classification of fuel based on chemical

reactions and characteristics of an ideal fuel),

Calorific value (CV): Higher calorific value (HCV) and Lower calorific value (LCV), Determination of Calorific value: Principle, construction and working of Bomb calorimeter and Boy's gas calorimeter and numericals,

Solid fuel: Coal: Analysis of Coal-Proximate and Ultimate analysis, numericals,

Liquid fuel: Petroleum: Refining of petroleum /crude oil and composition, boiling range and uses of various fractions,

Gaseous fuel: Composition, properties and applications of CNG. Hydrogen gas as a future fuel Alternative fuels: Power alcohol and biodiesel.

Unit V Spectroscopic Techniques (08Hrs)

[A]UV-Visible Spectroscopy: Introduction, interaction of electromagnetic radiation with matter, statement of Beer's law and Lambert's law, absorption of UV radiation by organic molecule leading to different electronic transitions, terms involved in UV-visible Spectroscopy- chromophore, auxochrome, bathochromic shift, hypsochromic shift, hyperchromic shift and hypochromic shift, Instrumentation and basic principle of single beam spectrophotometer, applications of UV-visible spectroscopy.

[B] Infra red Spectroscopy: Introduction, Principle of IR Spectroscopy, types of vibrations: Stretching (symmetric and asymmetric) and bending (scissoring, rocking, wagging and twisting), conditions of absorption of IR radiations, vibration of diatomic and polyatomic molecules. Instrumentation with block diagram. Parts of IR spectrum, fundamental group region, fingerprint region, applications of IR spectroscopy.

Unit VI Corrosion Science (08Hrs)

Introduction, Types of corrosion – Dry and Wet corrosion, mechanism of dry corrosion, nature of oxide films and Pilling-Bedworth's rule, wet corrosion – mechanism: hydrogen evolution and oxygen absorption, galvanic cell corrosion, concentration cell corrosion, Factors influencing rate of corrosion. Methods of corrosion control and prevention: cathodic and anodic protection, metallic coatings and its types, surface preparation, methods to apply metallic coatings-hot

dipping, cladding, electroplating, cementation.

Basic Electrical Engineering (2019 Pattern)

103004: BASIC ELECTRICAL ENGINEERING

Unit I Electromagnetism: (6Hrs)

Review: resistance, emf, current, potential, potential difference and Ohm's law Electromagnetism: Magnetic effect of an electric current, cross and dot conventions, right hand thumb rule, nature of magnetic field of long straight conductor, solenoid and toroid. Concept of mmf, flux, flux density, reluctance, permeability and field strength, their units and relationships. Simple series magnetic circuit, Introduction to parallel magnetic circuit(Only theoretical treatment), comparison of electric and magnetic circuit, force on current carrying conductor placed in magnetic field, Fleming's left hand rule. Faradays laws of electromagnetic induction, Fleming's right hand rule, statically and dynamically induced e.m.f., self and mutual inductance, coefficient of couplings. Energy stored in magnetic field.

Unit II Electrostatics and AC Fundamentals (6 Hrs)

A) Electrostatics: Electrostatic field, electric flux density, electric field strength, absolute permittivity, relative permittivity and capacitance. Capacitor, capacitors in series and parallel, energy stored in capacitors, charging and discharging of capacitors (no derivation) and time constant. (2Hrs)

B) AC Fundamentals: Sinusoidal voltages and currents, their mathematical and graphical representation, Concept of cycle, Period, frequency, instantaneous, peak(maximum), average and r.m.s. values, peak factor and form factor. Phase difference, lagging, leading and in phase quantities and phasor representation. Rectangular and polar representation of phasor. (4Hrs)

Unit III Single Phase AC Circuits (06 Hrs)

Study of AC circuits consisting of pure resistance, pure inductance, pure capacitance, series R-L, R-C and R-L-C circuits, phasor diagrams, voltage, current and power waveforms, resonance in series RLC circuits, concept of impedance, concept of active, reactive,

apparent, complex power and power factor, Parallel AC circuits (No numericals), concept of admittance

Unit IV Polyphase A.C. Circuits and Single phase Transformers (06 Hrs)

A) Polyphase A.C. Circuits: Concept of three-phase supply and phase sequence. Balanced and unbalanced load, Voltages, currents and power relations in three phase balanced star-connected loads and delta-connected loads along with phasor diagrams. (3Hrs)

B) Single phase transformers: principle of working, construction and types, emf equation, voltage and current ratios. Losses, definition of regulation and efficiency, determination of these by direct loading method. Descriptive treatment of autotransformers. (3Hrs)

Unit V DC Circuits: (06 Hrs)

Classification of electrical networks, Energy sources – ideal and practical voltage and current sources, Simplifications of networks using series and parallel combinations and star-delta conversions, Kirchhoff's laws and their applications for network solutions using loop analysis, Superposition theorem, Thevenin's theorem.

Unit VI Work, Power, Energy and Batteries (06 Hrs)

A) Work, Power, Energy: Effect of temperature on resistance, resistance temperature coefficient, insulation resistance, conversion of energy from one form to another in electrical, mechanical and thermal systems. (4Hrs)

B) Batteries :Different types of batteries (Lead Acid and Lithium Ion), construction, working principle, applications, ratings, charging and discharging, concept of depth of charging, maintenance of batteries, series -parallel connection of batteries (2Hrs)

Basic Electronics Engineering (2019 Pattern)

104010:BASIC ELECTRONICS ENGINEERING

Unit I Introduction to Electronics (08Hrs)

Evolution of Electronics, Impact of Electronics in industry and in

society. Introduction to active and passive components, P-type Semiconductor, N-type Semiconductor. Current in semiconductors(Diffusion and Drift Current) P-N Junction Diode: P-N Junction diode construction and its working in forward and reverse bias condition, V-I characteristics of P-N junction Diode, Diode as a switch, Half Wave Rectifier, Full wave and Bridge Rectifier. Special purpose diodes: Zener diode, Light Emitting Diode (LED) and photo diode along with V-I characteristics and their applications.

Unit II Transistor and OPAMP (07Hrs)

Bipolar Junction Transistor : Construction, type, Operation, V-I Characteristics, region of operation, BJT as switch and CE amplifier Metal Oxide Semiconductor Field Effect Transistors (MOSFET): Construction, Types, Operation, V-I characteristics, Regions of operation, MOSFET as switch & amplifier. Operational amplifier: Functional block diagram of operational amplifier, ideal operational amplifier, Op-amp as Inverting and Non inverting amplifier

Unit III Number System and Logic Gates (07Hrs)

Number System:- Binary, BCD, Octal, Decimal, Hexadecimal their conversion and arithmetic, De-Morgan's theorem. Basic Gates:- AND, OR, NOT, Universal Gate- XOR, XNOR, Half adder, Full adder Flip Flop's SR, JK, T and D Introduction to Microprocessor and Microcontroller (Only block diagram and explanation)

Unit IV Electronic Instrumentation (06Hrs)

Electronic Instruments: Principles and block diagram of digital multimeter, Function Generator, Digital Storage Oscilloscope (DSO) Power scope, AC/DC power supply, Auto transformer, Analog ammeter and voltmeter.

Unit V Sensors (07Hrs)

Classification of a sensors, Active /Passive Sensors, Analog/Digital Sensors, Motion Sensors (LVDT, Accelerometer), Temperature Sensors (Thermocouple, Thermistor, RTD), Semiconductor Sensors(Gas Sensors), Optical Sensors (LDR), Mechanical Sensors (Strain Guage, Load Cell, Pressure sensors), Biosensors. (Working Principle and one application).

Unit VI Communication Systems (07Hrs)

Basic Communication System: Block Diagram, Modes of Transmission, Communication Media: Wired and Wireless, Electromagnetic Spectrum, Allotment of frequency band for different applications, Block Diagram of AM and FM Transmitter and receiver, Mobile Communication System: Cellular concept, Simple block diagram of GSM system.

Books & Other Resources:

Text Books:

1. “Electronics Devices” by Thomas. L. Floyd, 9th Edition, Pearson (Unit I, II)

2. “Modern Digital Electronics” by R.P. Jain, 4th Edition, Tata McGraw Hill (Unit III)

3. “Electronic Instrumentation” by H.S. Kalsi, 3rd Edition, Tata McGraw Hill (Unit IV)

4. “Sensors and Transducers” by D. Patrnabis, 2nd Edition, PHI (Unit V)

5. “Electronic Communication Systems” by Kennedy & Davis, 4th Edition, Tata McGraw Hill (Unit VI)

6. “Mobile Wireless communication” by M. Schwartz, Cambridge University Press (Unit VI)

Reference Books:

1. “Digital Fundamentals” by Thomas. L. Floyd, 11th Edition, Pearson

2. “Mobile Communication” by J. Schiller, 2nd Edition, Pearson

3. “Sensors Handbook”, by S. Soloman, 2nd Edition.

Programming and Problem Solving (2019 Pattern)

110005: PROGRAMMING AND PROBLEM SOLVING

Unit I Problem Solving, Programming and Python Programming (07 Hrs)

General Problem Solving Concepts- Problem solving in everyday life,

types of problems, problem solving with computers, difficulties with problem solving, problem solving aspects, top down design. Problem Solving Strategies, Program Design Tools: Algorithms, Flowcharts and Pseudo-codes, implementation of algorithms. Basics of Python Programming: Features of Python, History and Future of Python, Writing and executing Python program, Literal constants, variables and identifiers, Data Types, Input operation, Comments, Reserved words, Indentation, Operators and expressions, Expressions in Python.

Unit II Decision Control Statements (08 Hrs)

Decision Control Statements: Decision control statements, Selection/conditional branching Statements: if, if-else, nested if, if-elif-else statements. Basic loop Structures/Iterative statements: while loop, for loop, selecting appropriate loop. Nested loops, The break, continue, pass, else statement used with loops. Other data types- Tuples, Lists and Dictionary.

Unit III Functions and Modules (08 Hrs)

Need for functions, Function: definition, call, variable scope and lifetime, the return statement. Defining functions, Lambda or anonymous function, documentation string, good programming practices. Introduction to modules, Introduction to packages in Python, Introduction to standard library modules.

Unit IV Strings (07 Hrs)

Strings and Operations- concatenation, appending, multiplication and slicing. Strings are immutable, strings formatting operator, built in string methods and functions. Slice operation, ord() and chr() functions, in and not in operators, comparing strings, Iterating strings, the string module.

Unit V Object Oriented Programming (08 Hrs)

Programming Paradigms-monolithic, procedural, structured and object oriented, Features of Object oriented programming-classes, objects, methods and message passing, inheritance, polymorphism, containership, reusability, delegation, data abstraction and

encapsulation. Classes and Objects: classes and objects, class method and self object, class variables and object variables, public and private members, class methods.

Unit VI File Handling and Dictionaries (07 Hrs)

Files: Introduction, File path, Types of files, Opening and Closing files, Reading and Writing files. Dictionary method. Dictionaries-creating, assessing, adding and updating values. Case Study: Study design, features, and use of any recent, popular and efficient system developed using Python. (This topic is to be excluded for theory examination).

Engineering Graphics (2019 Pattern)

102012: ENGINEERING GRAPHICS

Unit I Fundamentals of Engineering Drawing (01 Hrs)

Need of Engineering Drawing and design, Sheet layout, Line types and dimensioning and simple geometrical constructions

Unit II Introduction to 2D and 3D computer aided drafting packages (02 Hrs)

Evolution of CAD, Importance of CAD, Basic Commands - Edit, View, Insert, Modify, Dimensioning Commands, setting and tools etc. and its applications to construct the 2D and 3D drawings

Unit III Engineering Curves (01 Hr)

Introduction to conic sections and its significance, various methods to construct the conic sections. Helix for cone and cylinder , rolling curves (Involutes , Cycloid) and Spiral

Unit IV Orthographic Projection (02 Hrs)

Principle of projections, Introduction to First and Third angle Projection methods, Orthographic projection of point, line, plane, solid and machine elements/parts

Unit V Isometric Projection (03 Hrs)

Introduction to isometric projection, oblique projection and

perspective projection. Draw the isometric projection from the given orthographic views

Unit VI Development of Lateral Surfaces (03 Hrs)

Introduction to development of lateral surfaces and its industrial applications. Draw the development of lateral surfaces for cut section of cone, pyramid, prism etc.

Books & Other Resources

Text Books

1. Bhatt, N. D. and Panchal, V. M., (2016), “Engineering Drawing”, Charotar Publication, Anand, India

2. K. Venugopal, K, (2015), “Engineering and Graphics”, New Age International, New Delhi

3. Jolhe, D. A., (2015), “Engineering Drawing with introduction to AutoCAD”, Tata McGraw Hill, New Delhi

4. Rathnam, K., (2018), “ A First Course in Engineering Drawing”, Springer Nature Singapore Pte. Ltd., Singapore

Reference Books

1. Madsen, D. P. and Madsen, D. A., (2016), “Engineering Drawing and design”, Delmar Publishers Inc., USA

2. Bhatt, N. D., (2018), “Machine Drawing”, Chartor Publishing house, Anand, India

3. Dhawan, R. K., (2000), “A Textbook Of Engineering Drawing”, S. Chand, New Delhi

4. Luzadder, W. J. and Duff, J. M., (1992), “The Fundamentals of Engineering Drawing: With an Introduction to Interactive Computer Graphics for Design and Production”, Peachpit Press, USA

5. Giesecke, F. E., Mitchell, A., Spencer, H. C., Hill, I. L., Loving, R. O., Dygon, J. T., (1990), “Principles of engineering graphics”, McMillan Publishing, USA

Engineering Mathematics – II

107008 – Engineering Mathematics – II

Credits 05

Unit I: First Order Ordinary differential Equations (09 Hrs.)

Exact differential equations, Equations reducible to exact form. Linear differential equations, Equations reducible to linear form, Bernoulli's equation.

Unit II: Applications of Differential Equations (09 Hrs.)

Applications of Differential Equations to Orthogonal Trajectories, Newton's Law of Cooling, Kirchhoff's Law of Electrical Circuits, Rectilinear Motion, Simple Harmonic Motion, One dimensional Conduction of Heat.

Unit III: Integral Calculus (09 Hrs.)

Reduction Formulae, Beta and Gamma functions, Differentiation Under Integral Sign and Error functions.

Unit IV: Curve Tracing (09 Hrs.)

Tracing of Curves – Cartesian, Polar and Parametric curves, Rectification of curves.

Unit V: Solid Geometry (09 Hrs.)

Cartesian, Spherical polar and Cylindrical coordinate systems, Sphere, Cone and Cylinder.

Unit VI: Multiple Integrals and their Applications (09 Hrs.)

Double and Triple integrations, Change of order of integration, Applications to find Area, Volume, Mass, Centre of Gravity and Moment of Inertia.

Text Books:

1. Higher Engineering Mathematics by B. V. Ramana (Tata McGraw Hill)

2. Higher Engineering Mathematics by B. S. Grewal (Khanna Publication, Delhi)

Reference Books:

1. Advanced Engineering Mathematics by Erwin Kreyszig (Wiley Eastern Ltd.)

2. Advanced Engineering Mathematics by M. D. Greenberg (Pearson Education)

3. Advanced Engineering Mathematics by Peter V. O'Neil (Thomson Learning)

4. Thomas' Calculus by George B. Thomas, (Addison-Wesley, Pearson)

5. Applied Mathematics (Vol. I and II) by P.N. Wartikar and J.N.Wartikar Vidyarthi Griha Prakashan, Pune.

6. Differential Equations by S. L. Ross (John Wiley and Sons)