

ENGINEERING MATHEMATICS – II

Theory Exam: 100 marks

Theory: 4 hours / week

1. **Reduction Formulae:** Reduction Formulas for $\int_0^{\frac{\pi}{2}} \sin^m x \cos^n x \, dx$; Beta, Gamma Functions, relation between Beta and Gamma functions
2. **Multiple Integrals and its Applications:** Double Integration in Cartesian and polar Co-ordinates, change of order of integration and triple integration. Application of integral Calculus to find area by double integration, surface area and volume of revolution, volume by triple integration, mean value of a function, Root mean Square value.
3. **Fourier series:** Dirichelets's conditions, Expansion of functions as a Fourier series, change of intervals, Even and odd functions, half range Fourier series.
4. **Matrices :** Rank of matrix, normal form, consistency of equations (Homogeneous and non-Homogeneous), Characteristic equations, Eigen values, Eigen Vectors, Inverse of a Matrix by Cayley- Hamilton theorem, Linear dependence and Linear independence of vectors, linear transformations, orthogonal transformation of a quadratic form.

Note:

More stress should be given on engineering Applications

Section (a): Chapter Nos. 1 and 2

Section (b): Chapter Nos. 3 and 4

1. A textbook of Applied Mathematics Volume I and II Author : P. N. Wartikar, J. N. Wartikar
2. Higher Engineering Mathematics Author : Dr. B. S. Grewal
3. Advanced Engineering Mathematics Author : H. K. Dass
4. A textbook of Engineering Mathematics Volume I and II Author : D. T. Deshmukh
5. Engineering Mathematics Volume I, II and III Author : M. L. Bhatiya
6. A text book on engineering Mathematics Author : Bali, Saxena, Lyengar

APPLIED SCIENCE – II

Theory Examination: 100 Marks

Term Work: 50 Marks

Theory: 2 hours / week

SECTION A- APPLIED PHYSICS

1. **Matter Waves:** Wave and particle duality of radiation, De- Broglie's concept of matter waves and properties of matter waves, G. P. Thomson experiment on matter waves, Heisenberg's uncertainty principle, experimental illustration of uncertainty principle. Schrodinger's time independent and time dependent wave equations, physical significance of wave function.
2. **Band Theory of solids:** Energy band formation in solids, classification of solids on the basis of band theory. Fermi-Dirac distribution functions, position of Fermi level in intrinsic & extrinsic semiconductor at various temperatures (with derivations). P. N. Junction diode-depletion region & potential barrier, V-I characteristics. Bipolar junction transistor –working of transistor, transistor characteristics in CE configuration. Hall Effect and Hall coefficient.
3. **Laser and Fiber Optics:** Interaction of radiation with matter, population inversion, pumping schemes and methods optical resonator, laser characteristics, applications of laser. Ruby Laser, He Ne Laser. Basic structure of optical fiber, propagation of light through fiber, acceptance angle and acceptance cone, numerical aperture (general), step index and graded index fibers, advantages.
4. **Nuclear Physics:** Nuclear fission in natural uranium, chain reaction, nuclear reactor, nuclear fusion P-P cycle, C-C cycle. Particle accelerators – Cyclotron, Betatron, Particle detector- G. M. Counter
5. **Theory of Relativity:** Introduction, frame of reference, Galilean coordinate transformations of space and time, length contraction, time dilation, relativity of mass.

Note: Weightage to every topic is proportionate to hours allotted to each topic.

Term Work shall consist of any five experiments of the following.

1. Semiconductor diode characteristics.
2. Transistor input and output characteristics in CE configuration.
3. Determination of band gap of a semiconductor.
4. Determination of wavelength of laser source.
5. Refractive index of liquid using laser.
6. Measurement of electrostatic and magnetic sensitivity of CRT or CRO
7. USE of CRO for measurement of electrical parameters.
8. Determination of Hall coefficient and study of Hall Effect.

Reference Books:

1. Engineering Physics : R.K. Gaur and Gupta
2. Engineering Physics : M. N. Avadharnulu and P.G. Kshirsagar
3. Optical fiber and fiber optics communication system subir Kumar and sarkar

4. Fibere optics – Agrawal.
5. Perspective of modern physics – Arthur Besiser.

SECTION B – APPLIED CHEMISTRY

1. **Phase rule:** Gibbs's phase rule, terms involved one component systems, water system, sulphur system. Two component systems silver lead system, lead tin system, lever rule, iron carbon system. Use and limitations of phase rule.
2. **Polymers:** introduction, nomenclature of polymers, classification of polymers. Types of polymerization, mechanism of addition polymerization, plastic properties. Thermoplastics and thermosetting resins. Resins: Cellulose derivatives, polytechnic or vinyl resins polyamides. Thermosetting resins – phenolic resins, epoxy resins, acrylic polymers. Rubber: Natural rubber. Compounding of rubber, synthetic rubber.
3. **Lubricants:** Introduction, friction and Wear, classification of lubricants, mechanism of lubrication. Solid lubricants graphite. Molybdenum, Disulphide. Semi solid lubricants. Liquid lubricants. Properties like viscosity flash and fire point, acid value, cloud and pour point. Selection of lubricants.
4. **Ceramics:** General properties, structures, classification, Refractory, requirements of good refractory, classification, applications. Abrasives, properties of abrasives, classification and application. Portland cement, chemical composition, requirement of good cement, setting and hardening.
5. **Fuels and combustion:** Definition, classification, calorific value. Solid fuels, coal, proximate and ultimate analysis fuels. Liquid fuels petroleum origin, refining and fractional distillation. Gaseous fuel L.P.G., coal gas and biogas.

Term work shall consist of any five of the following experiments.

1. Study of micro structures of steel
2. Determination of viscosity of lubricant by Redwood viscometer.
3. Determination of acid value of lubricating oil.
4. Determination of percentage of iron in plain carbon steel.
5. Determination of acid value of plastic material.
6. Preparation of phenol formaldehyde resin
7. Determination of Molecular weight of a polymer.
8. Preparation of urea formaldehyde resin.

Reference Books:

1. A textbook of Engineering Chemistry by S. S. Das
2. Engineering Chemistry by Jain and Jain
3. A solid state chemistry and its application by R. West, John Wiley and sons
4. Applied chemistry by N. Krishnamurthy, P. vallimangaman, K. Jeya Subramanian (TMH Publication)

ENGINEERING MECHANICS

(One paper: 3 Hours, Theory: 100 Marks, Term work 50 Marks)

STATICS

1. Force System :

- a) Force, Rigid body, Principles of transmissibility. Moment Principles of Superposition, Varignon's theorem.
 - b) Coplanar Force System, Resultant by Analytical Method, Equivalent Force couple, free body diagram, Equilibrium (Analytical methods) Plane frames with joints.
 - c) Non Coplanar System: Resultant, Equivalent force couple, conditions of equilibrium of non coplanar forces.
2. **Friction:** Definition, Significance, Laws of Friction, Angle of friction, cone of friction wedge friction, rolling friction, Belt friction and their application.
3. **Virtual Work:** Principle, application to different situations, such as Beams, Bodies in equilibrium etc.
4. **Plane Trusses:** Analysis of plane determinate trusses, analytical methods.
5. **Properties of Plane Surfaces:** Central Second moment of area, transformation theorems, radius of Gyration.

DYNAMIC

1. Introduction to simple machines:

- a) Work and Worm wheel
- b) Differential axle and wheel
- c) Single and double purchase crab.
- d) Screw jack

2. Kinematics of Particles :

- a) Tangent and normal acceleration in Cartesian and cylindrical co-ordinates Projectiles: Study of motion of bodies thrown freely from any position. Linear motion: motion with constant and variable acceleration, Motion diagrams. Curvilinear motion. Relative motion on parallel paths in like direction, relative velocity and resultant velocity (only introduction)
- b) Kinematics of particles. Newton's laws of motion, linear motion of particles and connected bodies, principle of work and energy and its application, principle of impulse and momentum, conservation of momentum, impact: direct central and oblique.
- c) Kinetics of rigid bodies; plane motion of a rigid body D' Alembert's principle of work and energy, principle of impulse and momentum and their application.

Term work

A. Graphical solution for :

- a) System of non concurrent forces on problem with resultant as a force and one problem with resultant as a couple.
- b) Equilibrium of non concurrent force system: one problem.
- c) Friction: wedge and block; one problem.
- d) Analysis of trusses: two problems.

B. Any five experiments from below:

- a) Moment of inertia of fly wheel.
- b) Belt friction
- c) Member forces in trusses.

- d) Differential axle and wheel or differential pulley block.
- e) Single purchase crab or spur gear pulley block.
- f) Worm and worm wheel
- g) Screw jack.

C. Assignments:

- a) Three assignments of static's.
- b) Two assignments of Dynamics.

Text books.

- a) Mechanics for engineers: static's of dynamics by bear and bear and Johnston.
- b) Engineering mechanics by F. L. Singer.

Reference books.

- a) Engineering mechanics by Nelson (Schaum series)
- b) Engineering mechanics by V. S. Mokashi Vol. I and II
- c) Engineering mechanics by Tayal A. K.
- d) Applied Mechanics by I. B. Prasad.

ELEMENTS OF MECHANICAL ENGINEERING

Theory Marks: 100;

Term work: 50;

Hours: 4/week;

1. **Introduction to engineering materials:** Introduction properties and Application of Materials, Steels, Alloy Steels, Stainless steel, Non Ferrous Metals Copper, Aluminum, Nickel, Zinc, composite materials.
2. **Manufacturing processes:** working principle and applications of casting, forging, welding, brazing, soldering and rolling, machining processes- turning, shaping, milling, drilling, planning, boring, grinding, broaching.
3. **Machine tools:** working principle, operation and application of simple lathe machine, shaping machine, milling machine, drilling machine, planning machine, broaching machine, boring machine and grinding machine.
4. **Power transmitting elements:** working principle and application of Axle, and spindles couplings. Friction clutches types of clutches. Bearings, Brakes, types of brakes. Drives, Belt drives, construction, geometrical relationship, chain drives, gears classification of gears, terminology of spur gear, velocity ratio.
5. **Fundamentals of thermodynamics:** thermodynamic system types of systems. Thermodynamic properties, state, state function, path function, process and cycles, thermodynamic equilibrium, quasistatic process. Pressure and pressure measurement (Analytical Treatment). Temperature, Zeroth law of thermodynamics, measurement of temperature, thermometer, forms of energy, work transfer, Pdv work, other forms of work transfer, heat transfer, concept of specific heat, latent heat, Entropy.
6. **First law of thermodynamics :** Law of conservation of Energy, Joule's experiment, PMM-1 first law for cyclic and non cyclic processes (non-flow processes) concept of internal energy, enthalpy. Ideal Gases – Concept of constant pressure, constant volume, constant temperature, Adiabatic, Polytrophic, Throttling Processes and their representation on P-v and T-s diagrams (fundamental numerical treatment)
7. **Introduction to thermal machines:** working principle and application internal combustion (2 stroke and 4 stroke engines) steam Turbines, Compressor, Refrigerator and Air Conditioner. (Description with block diagrams).
8. **Sources of energy:** renewable and non renewable energy, principle and working of steam power plant, nuclear power plant, (Description with block diagrams).

Term work

Term work shall consist of eight experiments and Assignments based on chapter 3, 4 and 8.

1. Study and demonstration of simple lathe machine,
2. Study and demonstration of Drilling Machine,
3. Study and demonstration of I. C. Engine.
4. Study and demonstration of Refrigerator.
5. Study and demonstration of Compressor.
6. Study and demonstration of Different types of Gears.
7. Study and demonstration of Clutch
8. Study and demonstration of types of Brakes,

9. Study and demonstration of simple lathe machine
10. Study and demonstration of shaping machine.
11. Assignments shall be based on Units 3, 4 and 8

Recommended Books.

1. Engineering Thermodynamics by P.K. Nag Published by Tata Mc Graw Hill Publication.
2. Engineering thermodynamics by R. K. Rajput Published by Laxmi Publication.
3. Engineering thermodynamics by V. M. Domkundwar.
4. Thermal Engineering by P. L. Ballaney published by kanna publishers.
5. Machine design by R. S. Khurmi published by Eurasia publishing House.
6. Machine design by V. B. Bhandari published by Tata Mc Graw Hill Publication.
7. Work shop Technology (Vol I and II) By Hajra Choudhary, Bose
8. Manufacturing Technology P. N. Rao.
9. Production Technology by R. K. Jain, Published by Khanna Publishers.

ELEMENTS OF ELECTRONIC AND COMPUTER ENGINEERING

Section –a (electronics engineering)

Max. Marks: 50

Teaching Hours: 20

1. **Electronics Components** : Review of semiconductor devices like Diode, Transistor, Optoelectronics Devices, LED, LCD, Photodiode, 7 segment displays, Zener Diode, MOSFET, UJT, JFET, and SCR
2. **Power conversion**: Rectifiers, Rectifier types, Filter Types Regulated Power supply.
3. Introduction to Amplifier: Ideal Amplifier and its Characteristics, performance measures like gain. Frequency response, distortion and stability, CE, CB and their uses. Introduction to power amplifiers and oscillators.
4. **Operational Amplifier** : Properties and Characteristics of Ideal and practical operational amplifiers basic parameters and elementary applications
5. **Logic gates and Number system**: Decimal, Binary, Octal Hexadecimal and their conversion, binary addition, Binary Subtraction using Complement, Basic Logic Gates, Universal Gates, Boolean Algebra and their implementations, Introduction to logic families.
6. **Transducer and measuring system**: measurement system and their characteristics, Digital MultiMate Cathode Ray Oscilloscope, introduction to transducer for temperature, Measurement flow and level measurement, thermocouple, thermistor, orifice plate and capacitive type.

Note: the subject should be treated in descriptive manner only

Experiment list:

1. Testing of Active and passive electronic components.
2. Regulation Characteristics of Rectifier with filters.
3. Study of Op-Amp and their different circuit like adder, inverter, differentiator integrator.
4. Study of logic gates, verification of logic circuits using truth table.
5. Study of transducer like temperature, flow and level (any two).
6. Study of CRO and measurement of voltage, frequency etc. using CRO.

References books:

1. Millman and Halkies: Integrated Electronics.
2. Ramakant Gaikwad: Linear Integrated circuits and Op-Amp.
3. S. K. Khedkar: Electronics Instrumentation.
4. P. k. Jain: modern Digital Electronics.
5. Nakara and Choudhari: Instrumentation measurement and analysis.
6. Millman and Taub : pulse, Digital and Switching wave form (TMH)
7. B. L. Theraja: Basic Electronics (S Chand)

SECTION B- COMPUTER PROGRAMMING

Theory hours: 2/ week

Marks: 50

Programming in C language:

1. **Introduction to C:** importance to C, to write algorithm, Drawing flowchart, Basic structure of C program, creates a simple C program, executing a C program, why to include header files? Data types, Operators and Expressions: Character set, keywords and identifiers, constants and variables, data types, declaration of variables, defining symbolic constants. Arithmetic operators, relational operators, logical operators, assignment operator, increment and decrement operators, conditional operator, library functions, arithmetic expression evolution of expression, precedence of arithmetic operators, operators, operator precedence and associativity
2. **Data Input output:** Branching and Loops: Reading a character, writing a character, formatted input and formatted output. Decision making and if...else statement, nesting of if...else statement, the switch statement the? : Operator, the goto statement the while statement, the do statement, the for statement.
3. **Arrays and functions:** One dimensional arrays, two dimensional arrays, sorting algorithm bubble sort and insertion sort. Defining a function, function prototype, return type, passing arguments, call by value, call by reference, recursive function, passing array to function, scope ruled.
4. **Introduction to open source internet Technology:** What is open source? Advantages of open source. Internet terminology: e-mail, website, web page, web browser, web server etc., introduction to web server "Apache" basic syntax of PHP simple web pages using PHP, introduction to Database My Sql, simple table creation in MySql.

Term work:

The term work consists of record of minimum of 10 programs based on above syllabus. The term work will be evaluated on the basis of continuous assessment, performing the practical during the semester and an internal oral conducted by the subject teacher.

Reference Books:

1. Yashwant Kanetkar, "Let us C", BPB publications.
2. Vikram Vaswani, "How to do everything with PHP and MySQL" TMH Publications.
3. Dennis Ritchie, Brian W Kernighan, "The "C" Programming Language", PHI publications

Suggestive list of programs: Computer Programming (in "C")

1. Program to find the sum of individual digits in an integer.
2. Program to find largest of tree numbers.
3. Program for sorting the numbers in ascending / descending order.
4. Program to find the roots of Quadratic equation.
5. Program to convert decimal number to binary and vice-versa.
6. Program to construct pyramid of digits.
7. Program to reverse the given string.
8. Program to find factorial of given number using function.
9. Program to generate the specified mathematical series.
10. Creation of simple web pages using PHP
11. Creation of website of 2/3 pages using My Sql.

WORKSHOP PRACTICE – II

Marks: 50

Practical: 2 hours / week

1. **Plumbing:** study of various tools used in plumbing like pipe die wrench etc. study of various pipe joints. Preparation of a job amongst a group of students (not more than four), involving thread cutting on G. I. pipe and construction of a plumbing pipe line from a source to the outlet point involving at least 4 pipe accessories and a cork.
2. **Carpentry:** study of different carpentry tools and the process. Study of different types of wood, laminations, adhesives, polish and wood furniture material. Importance of trees in environment with their contribution to human life is to be told to the students. Preparation of one composite job involving three different joints. One job involving wood turning operation on wood Turing lathe.
3. **Sheet metal working:** Study of different tools, hand fly press, simple die. Gauges and materials. Study of different joints, folds and bending. Preparation of one job involving development of surfaces, marking, cutting bending, joint preparation by folding and soldering.

Term work:

1. Submission of jobs as specified above.
2. Submission of workshop diary having details of the jobs completed.
3. Submission of a journal consisting of information about various tools used and processes studied.

Reference books:

1. A course in work shop technology by B. S.I Raghuwanshi
2. Elements of work shop technology by S. K. Hazra Choudhary.
3. Work shop technology part 01 by W. A. J. Chanpman
4. Gerlin skip series No. 1.