

Soldering; Adhesive Bonding.

**Machining and Machine Tool Operations:** Mechanics of Machining; Basic Machine Tools; Single and Multi-Point Cutting Tools, Tool Geometry and Materials, Tool Life and Tool Wear; Economics of Machining; Principles of Non-Traditional Machining Processes; Principles of Work Holding Devices, Principles of Jigs and Fixtures.

**Metrology and Inspection:** Limits, Fits and Tolerances; Linear and Angular Measurements; Comparators; Gauge; Interferometry; Form and Surface Finish Measurement; Alignment and Testing Methods; Tolerance Analysis in Manufacturing and Assembly.

**Computer Integrated Manufacturing:** Basic concepts of CAD/CAM and their integration tools.

**Production Planning and Control:** Forecasting Models, Aggregate Production Planning, Scheduling, Materials Requirement Planning.

**Inventory Control:** Deterministic Models; Safety Stock Inventory Control Systems.

**Operations Research:** Linear Programming, Simplex Method Transportation, Assignment, Simple Queuing Models, PERT and CPM.

## **PAPER.II ELECTRICAL AND ELECTRONICS ENGINEERING (DEGREE LEVEL)**

**1. Electric Circuits and Fields:** Network graph, KCL, KVL, node and mesh analysis, transient response of dc and ac networks; sinusoidal steady-state analysis, resonance, basic filter concepts; ideal current and voltage sources, Thevenin's, Norton's, Superposition, Maximum Power Transfer and Reciprocity theorems; two-port networks, three phase circuits; Star, Delta connections, Measurement of power in 3-phase by two-wattmeter method; Fourier, Laplace and Z transforms; Gauss Theorem, electric field and potential due to point, line, plane and spherical charge distributions; Ampere's and Biot-Savart's laws; inductance; dielectrics; capacitance.

**2. Electrical Machines:** Single phase transformer - equivalent circuit, phasor diagram, tests, regulation and efficiency; three phase transformers - connections, parallel operation; auto-transformer; energy conversion principles; DC machines - types, windings, generator and motor characteristics, losses and efficiency, armature reaction and commutation, starting and speed control of motors, tests; three phase induction motors - principles, types, performance characteristics, starting and speed control; single phase induction motors; synchronous machines - performance, regulation and parallel operation of alternators, motor starting, characteristics and applications; servo motors.

**3. Power Systems:** Basic power generation concepts, Economic aspects, Types of Tariffs; transmission line models and performance; cable performance, insulators, Sag and Tension; corona and radio interference; distribution systems; per-unit quantities; bus impedance and admittance matrices; load flow study; voltage control; power factor correction; economic operation; Load Frequency Control; symmetrical components; symmetrical & unsymmetrical fault analysis; principles of over-current, differential and distance protection; Generator protection, Transformer protection, Feeder protection, static relays; circuit breakers; Power system stability concepts, swing equation, power angle curve, solution of swing equation, equal area criterion.

**4. Control Systems:** Principles of feedback; transfer function; block diagrams; steady-state errors; Routh and Nyquist techniques; Bode plots; root loci; lag, lead and lead-lag compensation; state space model; state transition matrix, controllability and observability.

**5. Electrical and Electronic Measurements:** DC, AC Bridges, potentiometers; PMMC, moving iron, dynamometer and induction type instruments; measurement of voltage, current, power, energy and power factor; shunts, multipliers; instrument transformers; digital voltmeters, CRO; phase, time and frequency measurements using lissajous patterns; error analysis.

**6. Analog and Digital Electronics:** Characteristics of p-n junction diode, Zener diode, BJT, FET; amplifiers - biasing, equivalent circuit and frequency response; oscillators and feedback amplifiers; operational amplifiers - characteristics and applications; simple active filters; VCOs and timers; Boolean Algebra, minimization of switching functions combinational and sequential logic circuits; schmitt trigger, multi vibrators Flip flops, counters and registers, sample and hold circuits; A/D and D/A converters; microprocessor basics.(8085 & 8086), architecture, programming and interfacing, 8051 mc BASICS (Architectures. Addressing modes and instruction set).

**7. Power Electronics :** Semiconductor power diodes, transistors, thyristors, triacs, GTOs, MOSFETs and IGBTs - static characteristics and principles of operation; triggering circuits

commutation circuits; phase control rectifiers; bridge converters - fully controlled and half controlled; dual converters, principles of choppers, inverters, cyclo-converters and ac voltage controllers.

**8. Electric Drives:** Four quadrant operation, Types of loads, Energy loss during starting and braking of dc and ac motors, Types of braking in dc & ac motors, Basis concepts of converter and chopper fed dc drives; V/f control, static rotor resistance control and slip power recovery scheme of 3-phase induction motor drives.

**9. Utilization:** High frequency eddy current heating, dielectric heating, Arc furnace, electric arc welding & electric resistance welding, Illumination: Laws of illumination, MSCP, SV & MV lamps, Factory, street & flood lighting, Electric traction and track electrification, Speed-time curves, Tractive effort, Specific energy consumption, Mechanism of train movement, adhesive weight and coefficient of adhesion. DC motor series parallel control, energy saving.

### **PAPER-II AGRICULTURAL ENGINEERING (DEGREE LEVEL)**

1. **Surveying and Levelling:** Classification and basic principles of surveying, Linear measurements. Chain surveying. Cross staff survey, Compass survey. Planimeter, Errors in measurements, their elimination and correction. Plane table surveying. Levelling, Levelling difficulties and error in levelling, Contouring, Computation of area and volume. Theodolite traversing. Introduction to setting of curves. Total station, Electronic Theodolite. Introduction to GPS survey
2. **Fluid mechanics and Open Channel Hydraulics:** Properties of fluids: Ideal and real fluid. Pressure and its measurement, Pascal's law, pressure forces on plane and curved surfaces, centre of pressure, buoyancy, meta centre and meta centric height, condition of floatation and stability of submerged and floating bodies; Kinematics of fluid flow: Lagrangian and Eulerian description of fluid motion, continuity equation, path lines, streak lines and stream lines, stream function, velocity potential and flow net. Types of fluid flow, translation, rotation, circulation and vorticity, Dynamics of fluid flow, Bernoulli's theorem, venturimeter, orifice meter and nozzle, siphon; Laminar flow: Stress strain relationships, flow between infinite parallel plates both plates fixed, one plate moving, discharge, average velocity; Laminar and turbulent flow in pipes, general equation for head loss Darcy, Equation, Moody's diagram, Minor and major hydraulic losses through pipes and fittings, flow through network of pipes, hydraulic gradient and energy gradient; Flow through orifices (Measurement of Discharge, Measurement of Time), Flow through Mouthpieces, Flow over Notches, Flow over weirs, Chezy's formula for loss of head in pipes, Flow through simple and compound pipes, Open channel design and hydraulics: Chezy's formula, Bazin's formula, Kutter's Manning's formula, Velocity and Pressure profiles in open channels, Hydraulic jump; Dimensional analysis and similitude: Rayleigh's method and Buckingham's 'Pi' theorem, types of similarities, dimensional analysis, dimensionless numbers. Introduction to fluid machinery.
3. **Soil Mechanics:** Introduction of soil mechanics, field of soil mechanics, phase diagram, physical and index properties of soil, classification of soils, effective and neutral stress, elementary concept of Boussinesq and Westergaard's analysis, newmark influence chart. Seepage Analysis; Quick condition-two dimensional flow-Laplace equation, Velocity potential and stream function, Flow net construction. Shear strength, Mohr stress circle, theoretical relationship between principal stress circle, theoretical relationship between principal stress, Mohr coulomb failure theory, effective stress principle. Determination of shear parameters by direct shear test, triangle test & vane shear test. Numerical exercise based on various types of tests. Compaction, composition of soils standard and modified proctor test, abbot compaction and Jodhpur mini compaction test field compaction method and control. Consolidation of soil: Consolidation of soils, one dimensional consolidation spring analogy, Terzaghi's theory, Laboratory consolidation test, calculation of void ratio and coefficient of volume change, Taylor's and Casagrande's method, determination of coefficient of consolidation. Earth pressure: plastic equilibrium in soils, active and passive states, Rankine's theory of earth pressure, active and passive earth pressure for cohesive soils, simple numerical exercises. Stability of slopes: introduction to stability analysis of infinite and finite slopes friction circle method, Taylor's stability number.
4. **Strength of materials:** Slope and deflection of beams using integration techniques, moment area theorems and conjugate beam method. Columns and Struts. Riveted and welded connections. Stability of masonry dams. Analysis of statically indeterminate beams. Propped beams. Fixed and continuous beam analysis using superposition, three moment equation and moment distribution methods.