

**परिशिष्ट- 2**

**'उत्तराखण्ड सम्मिलित राज्य कनिष्ठ अभियन्ता सेवा परीक्षा-2021' का पाठ्यक्रम/परीक्षा योजना  
लिखित प्रकृति (वस्तुनिष्ठ प्रकार)**

**(अ) सामान्य योग्यता परीक्षण (पाठ्यक्रम परिशिष्ट - I)**

क्र०सं०	विषय	कुल प्रश्नों की संख्या	पूर्णांक	समय अवधि
1	सामान्य हिन्दी	100	100 (प्रत्येक प्रश्न 01 अंक का)	02 घण्टा
2	सामान्य अंग्रेजी	100	100 (प्रत्येक प्रश्न 01 अंक का)	02 घण्टा

**(ब) अभियंत्रण विषय (पाठ्यक्रम परिशिष्ट - II)**

क्र०सं०	विषय	कुल प्रश्नों की संख्या	पूर्णांक	समय अवधि
1	सिविल इंजी० (प्रथम प्रश्न-पत्र/द्वितीय प्रश्न-पत्र)	180 / 180	360 / 360 (प्रत्येक प्रश्न 02 अंक का)	3 घण्टा
2	मैकेनिकल इंजी० (प्रथम प्रश्न-पत्र/द्वितीय प्रश्न-पत्र)	180 / 180	360 / 360 (प्रत्येक प्रश्न 02 अंक का)	3 घण्टा
3	इलैक्ट्रीकल इंजी० (प्रथम प्रश्न-पत्र/द्वितीय प्रश्न-पत्र)	180 / 180	360 / 360 (प्रत्येक प्रश्न 02 अंक का)	3 घण्टा
4	एग्रीकल्चर इंजी० (प्रथम प्रश्न-पत्र/द्वितीय प्रश्न-पत्र)	180 / 180	360 / 360 (प्रत्येक प्रश्न 02 अंक का)	3 घण्टा

**(स) साक्षात्कार (व्यक्तित्व परीक्षा) - 100 अंक**

1	लिखित परीक्षा	920 अंक
2	साक्षात्कार	100 अंक
<b>कुल योग - 1020 अंक</b>		

**पाठ्यक्रम :-**

1. सामान्य हिन्दी एवं सामान्य अंग्रेजी का पाठ्यक्रम परिशिष्ट-I में दिया गया है।

2. वैकल्पिक विषय का पाठ्यक्रम एवं साक्षात्कार (व्यक्तित्व परीक्षा) संबंधी प्राविधान परिशिष्ट-II में दिया गया है।

**नोट :-** सामान्य हिन्दी एवं सामान्य अंग्रेजी का पाठ्यक्रम सभी अभ्यर्थियों के लिए समान है। सिविल, यांत्रिक, विद्युत एवं कृषि अभियंत्रण में से अभ्यर्थियों को किसी एक शाखा का चयन करना है। सामान्य हिन्दी, सामान्य अंग्रेजी एवं सिविल, यांत्रिक, विद्युत एवं कृषि अभियंत्रण का विस्तृत पाठ्यक्रम निम्नवत् है :-

**परिशिष्ट – I**  
**उत्तराखण्ड सम्मिलित राज्य कनिष्ठ अभियन्ता सेवा (मुख्य) परीक्षा**  
**सामान्य हिन्दी**

**लिखित परीक्षा (वस्तुनिष्ठ प्रकार)**

**समय : 02 घण्टे**

**कुल प्रश्नों की संख्या : 100**

**पूर्णांक : 100**

- |   |        |
|---|--------|
| 1. वर्ण संरचना (स्वर और व्यंजन)               | 10 अंक |
| 2. वर्तनी शोधन/विश्लेषण                       | 10 अंक |
| 3. शब्द रचना – उपसर्ग, प्रत्यय, संधि और समास  | 20 अंक |
| 4. शब्द भेद – रचना, अर्थ, इतिहास, व्याकरण     | 20 अंक |
| 5. रिक्त स्थानों में उपयुक्त शब्दों का प्रयोग | 05 अंक |
| 6. वाक्य रचना                                 | 06 अंक |
| 7. वाक्य शोधन                                 | 05 अंक |
| 8. शब्द शुद्धिकरण                             | 05 अंक |
| 9. लोकोक्ति एवं मुहावरे                       | 10 अंक |
| 10. अपठित गद्यांश –                           |        |
| (क) आठ रेखांकित शब्दों/वाक्यों के अर्थ        | 08 अंक |
| (ख) उपयुक्त शीर्षक का चयन                     | 01 अंक |

**नोट – प्रत्येक प्रश्न 01 अंक का होगा। प्रश्न-पत्र का स्वरूप हाईस्कूल स्तर का होगा।**

**SYLLABUS FOR UTTARAKHAND COMBINED STATE JUNIOR ENGINEER SERVICE EXAM**

**WRITTEN EXAMINATION**

**Subject : General English  
(Objective Type)**

**Time : 02 Hours**

**M.M. - 100**

**No.of questions – 100**

**UNITS**

**M.M.**

**1. Comprehension**

**20**

A passage of appropriate length which is designed to test the ability of the candidate in the following areas:

**(a)** Familiarity with vocabulary

**(b)** Knowledge of English grammar

**(c)** Thematic understanding of the passage

**2. Use of Articles**

**05**

**3. Use of correct Prepositions**

**05**

**4. One- word substitution**

**05**

**5. Synonyms**

**05**

**6. Antonyms**

**05**

**7. Filling up of blanks with appropriate words**

**05**

**8. Verbs – Main, Auxiliary and Modals**

**05**

**9. Active/Passive voice**

**05**

**10. Direct/Indirect Narration**

**05**

**11. Correct spelling of words**

**05**

**12. Tenses**

**05**

**13. Re-ordering of given sentences into a meaningful paragraph.**

**05**

**14. Subject - Verb agreement**

**05**

**15. Idioms and Phrases**

**05**

**16. Conjunctions**

**05**

**17. Homonyms**

**05**

**Note :** Each Multiple choice question shall be of 01 Mark.

**परिशिष्ट – II**  
**CIVIL ENGINEERING (DIPLOMA COURSE)**  
**GENERAL CIVIL ENGINEERING**  
**PAPER-I**  
**SECTION - A**

**(a) Strength of materials and theory of structures.:** 1. Effect of a force, tension and compression, free body diagram, virtual work, force distribution system. 2. Principle of energy, conservation of energy and momentum, rotation of rigid bodies about fixed axis, mass moment of inertia. 3. Stresses and strains: Types of stresses and strains, Definition of tension, compression, shear, bending, torsion, volumetric and lateral strain, Poisson's ratio, Hooke's law. 4. Bending moment and shear force: Types of beam, simply supported, cantilever, fixed, overhanging and continuous beams. 5. Analysis of trusses, slope and deflection of beams. 6. Columns and struts: Long columns, short columns & struts, slenderness ratio. 7. Torsion: Circular shaft, combined bending, torsion and axial thrust, strength of hollow and solid shaft.

**(b) Design of reinforced concrete structures.:** 1. Design based on working stress method Flexural strength shear strength and bond strength of a singly reinforced RCC beam. 2. Design of lintels, Design of a Cantilever beam and slab. Design of doubly reinforced concrete beam. 3. Design of RCC slab, design of one way and two way slabs. 4. Design of Reinforced brick beams, slab & lintels, design of T-beams. 5. Design of columns and column footings, cantilever retaining walls. 6. Components of (i) overhead water tank and (ii) Multistoreyed framed structures. 7. Introduction to design based on limit state method. 8. Prestressed concrete.

**(c) Steel and Machinery structures.:** 1. Tension and Compression members in steel. 2. Design of steel of steel beams. 3. Design of simple column bases. 4. Design of simple trusses and purlins. 5. Design of masonry retaining walls. 6. Design of masonry wall foundation.

**(d) Building estimates & coating, construction management, account & entrepreneurship development.**

**SECTION-B**

**(a) Soil mechanics and foundation engineering.:** 1. Fundamental terms and their relationships. 2. Classification and identification of soils. 3. Phase relationship index property, laboratory determination. 4. Capillary phenomenon permeability, factors affecting permeability. 5. compaction, methods of compaction. 6. Consolidation, difference between compactions and consolidation. 7. Stresses in soil, shear strength, colomb's equation, unconfined compression test. 8. Earth pressure and retaining structures. 9. shallow and deep foundations, classifications of piles. 10. Stabilisation of soils by lime and cement. 11. Sub-surface exploration.

**(b) Surveying.:** 1. General principles. 2. Chain surveying. 3. Compass Traversing, bearings, local attractions, types of traversing, traverse computations, corrections and missing readings. 4. Leveling-Theory, Temporary & permanent adjustment of levels, types of levelling. Reciprocal levelling, L-section and cross section, Refraction and curvature corrections. 5. contouring - characteristics, uses and plotting of contours. 6. Plane table surveying- orientation, plotting methods, two & three point problems, Lehmann's ruler errors and precautions. 7. Theodolite: Adjustmen (Temporary & permanent) Measurement of angles, curves, horizontal and vertical curves, their design and layout transition curves. 8. Minor Instruments Abneys Level, Tangent Clinometer, ceylone Ghat tracer, pantograph and planimeter.

**(c) Building Materials and construction.:** 1. Building Materials: Bricks, their classification and characteristics, building stones, source, quarrying, classification and properties, lime, properties, Cement types, properties and tests, timber and wood products, types, properties and uses, paints, varnishes and distempers, glass and plaster etc., Lime concrete, uses in foundation and terracing, Cement concretes, ingredients, grading of aggregates, workability, water cement ratio, mixing, laying compaction, curing. 2. Building constructions- Detailing of walls, floors, roofs stair cases, doors and windows, finishing of building, plastering pointing, damp proofing etc., Ventilation and air conditioning fire fighting.

**(d) Water supply and sanitation for public building.:** 1. Sources of water, quality and quantity of water supply, water treatment, water distribution, laying of pipes, building water supply & maintenance. 2. Quantity of sewage, sewerage systems, sanitation and drainage, disposal of rainfall and domestic wastes. Including night soil, waste water and garbage, plumbing for public and residential buildings, septic tanks and soak pit, sewage treatment.

**CIVIL ENGINEERING (DIPLOMA COURSE)**  
**WATER RESOURCES ENGINEERING**

**PAPER-II**

1. Introduction: Definition of irrigation, necessity of irrigation, history of development of irrigation in india, types of irrigation in india. sources of irrigation water. 2. Rain fall & run-off: Definition of rainfall & run-off, catchment area, dicken's & ryve's formula, types of rain gauges-automatic & non-automatic, stream guaging. 3. Water requirement of crops: Definition of crop season, duty, delta and base period, their relationship, irrigation methods & efficiencies, gross command area, culturable command area, intensity of irrigation, irrigable area, water requirement of crops-kharif and rabi, preparation of water supply schedules for kharif and rabi. 4. Lift irrigation: Types of wells, shallow & deep well, aquifer, types, ground water flow, construction of open wells and tube wells yield of an open/tube well and problems, methods of lifting water, manual and mechanical devices, use of wind mills, lift canals their design, construction and water scheduling. 5. Flow irrigation: Irrigation canals, perennial irrigation, different parts of irrigation canals and their functions, sketches of different canal cross sections, classification of canals according to their alignment, design of irrigation canals, chezy's formula, mannings formula, kennedy's and lacey's silt theory and equations, comparison of above two silt theory, equations, critical velocity ratio, use of garrets and lacey's charts, various types of canal lining, advantage & disadvantages. 6. Canal head works: Definition, object, general layout functions of different parts, difference between weir and barrage. 7. Regulatory works: Functions and explanation of terms used cross and head regulators, falls, energy dissipates, outlets-different types, escapes. 8. Cross drainage works functions and necessity of the following types: Aqueduct, syphon, superpassage, level crossing, inlet outlet, constructional details of the above. 9. Dams: earthen dams-types, causes of failure, classification into masonry & concrete dams, labelled cross section of gravity dam, spillways. 10. Water logging and drainage: Definition, causes and effects, detection, prevention and remedies, surface and sub-surface drains and their layout, field drainage, salinity controlling measures, ground water recharging measures. 11. Flood protection: Estimation of flood discharges, systems of flood warning, river behaviour, training works and control, marginal embankments, their design, causes of failure, spurs & dykes, attracting & repelling types, nonstructural flood management, relief & rehabilitation measures. 12. Irrigation management: Checking of irrigated areas, raising water charges, bills, compensation for crop damages, penalties for unauthorised use of irrigation water, procedure for imposition of panel rates. Canal law and its application, formation of water users, associations and their participation in irrigation management, command area development. 13. Major irrigation projects in India. 14. Fluid mechanics: (a) Properties of fluids, hydrostatic pressure of various types of surfaces, measurement of pressure, kinematics of fluid flow. (b) Dynamics of fluid flow, bernouli's theorem, measurement of flow, pilot tube, piezometer, orifices venturimeter, current meter. (c) Flow through pipes-losses and pipe network, water hammer, reynold's number. (d) Flow through open channels-hydraulic gradients, equation for uniform flow, chezy's and manning formula most economical section. (e) Measurement of discharges by (i) weirs and (ii) notch. (f) Hydraulic machines-pumps (Reciprocating and Centrifugal), Turbines (Impulse & Reaction).

## MECHANICAL ENGINEERING (Diploma Level)

### Paper-I

#### SECTION - A

##### **Applied Mechanics**

**Forces:** Transmissibility, moments and couples, funicular polygon, lami's theorem, varignon theorem. **Friction:** Limiting and dynamical friction, coefficient of friction, bodies on inclined planes, simple screw jack. **Machines:** Basic terms-mechanical advantage, velocity ratio, mechanical efficiency. **Lifting machines:** System of pulleys-weston differential pulleys. **Stress and strain:** Volumetric and lateral strains hooke's law, poisson ratio, modulus of rigidity bulk modulus. Application to bars and composite sections. **Beams and trusses:** Determinate cases, bow's notation. Types of supports. **Graphical methods:** Analytical methods of joints and sections. **Thin cylinders and spherical shells:** Hoop stress, longitudinal stress. Changes in dimensions and volumes of thin shells subjected to internal pressure.

##### **Theory of Machines and Automobile Technology**

**Slider crank mechanism:** Turning moment in single cylinder engine: Fluctuation of speed and energy; crank effort diagrams, flywheel size. Gear drive: Gear trains; simple, compound, epicyclic and reverted. automobile gear box. Automobile differential. **Clutches:** Function of clutch in automobiles. Single plate and multiplate clutches. Friction torque for uniform wear and uniform pressure. **Cams:** Concept, classification of different cams and followers. Application to automobile engines, simple cam profiles for uniform velocity, SHM and uniform acceleration balancing. Static and dynamic balancing. balancing of masses rotating in same plane. Basic concept of several masses rotating in different planes, Application to automobile engines. Belt drive. Derivation of limiting ratios of driveing tensions, centrifugal tension V-belts. Ropes and chains. **Dynamometers:** Classification, functions, construction and working concepts. **Governor:** Functions, classification: Watt, porter, hartnell, hartung. Elementary numericals about height, maximum and minimum radil, controlling force etc.

##### **Mechanics of Solids**

**Mechanical properties of materials:** Concept of stress and strain, stress-strain curves of mild steel, aluminium, cast iron rubber etc., various modulli determination of stresses and strains in bolts, stepped bars, compound bars and columns oblique plane. Principal stresses, mohr circle. **Shear force/bending moments/deflection:** analysis of cases of concentrated and uniformly distributed load. **Shear force and bending moments diagrams:** Cantilever, simply supported, overhanging beams. **Strain energy:** resilience, derivation of formulae of strain energy for uniform bars in tension, shock load, shear stress. Modulus of resilience. **Torsion:** solid and hollw circular shafts-polar modulus, weights, power transmitted. **Springs:** close colled helical springs. Laminated springs. Maximum stress and central defiection, (simple numericals, no proof of formulae). **Columns and struts:** long and short columns, slenderness ratio. End conditions and equivalent lengths. Euler and rankine formulae (no derivation).

#### SECTION-B

##### **Material Science**

**Materials:** Ferrous-iron, steel, alloy steels. Nonferrous metals-aluminium, zinc, copper, tin, lead. Nonmetallic materials-timber, polymers. Basic knowledge of their production. **Structure of materials:** Crystalline, amorphous, arrangement of atoms. Crystal structure, imperfections. mechanical properties of common metals and alloys, deformation. **Heat treatment:** Iron-carbon equilibrium diagram, TTT curves; recovery recrystallisation and grain growth, elementary concepts of hardening, tempering, annealing normalizing and case hardening. **Alliy elements:** effects of alloying Cr,Co,Si,Mn etc., Tool steels, stainless steels, heat resisting alloys, spring steel. **Nonferrous materials:** Duralumin, solders, brass, bronze, gnmetal, inconel. **Non-metallic materials:** Timber-plywood, hard board, seasoning. Polymers, thermoplasts and thermosets. Heat insulating materials. Glass wool, thermocol, rubber. **Electric insulation materials:** Bakelite, mica refractory materials; composites.

##### **Design and Estimating**

**General design considerations for machine parts:** Steps in machine design, factor of safety. Mechanical properties of materials, selection of materials. Machine parts subjected to the following loadings: **(i) Direct and shear loads:** Theaded connection, cotter and knucle joints **(ii) Bending moment:** Design for railway wagon axle and road vehicle axles. Proof load and proof stress. Semi elliptic laminated springs, maximum stress and deflection, **(iii) Twisting moment:** Solid and hollow shafts. Design of keys and coupling bolts in rigid flanged coupling. **Reveted and welded joints:** Types of reveted joints, strength, efficiency, safe load and pitch of revets, lap and butt joints. Common types of welded joints, leg length, throat thickness and size

of weld. Simple design for vee, butt, transverse fillet and parallel fillet welded joints. **Theories of failure:** Maximum principal stress theory, maximum shear stress theory, concept of equivalent bending moment and torque; **Rolling elements bearing:** Equivalent load, dynamic capacity, life of bearings. **Estimation of material requirements:** Estimation of weight of simple machine parts. Review of the area/volume of triangle, hexagon, octagon, cylinder, frustum of cone and pyramid etc. **Estimation of time for common operations:** Turning, facing, threading, drilling, shaping, chamfering. Simple problems pertaining to above. **Estimation of cost:** Concept of costing-direct materials, indirect materials, direct labour, indirect labour, overhead expenses. Break-even analysis. **Cost estimation of welding:** Cost of materials, fabrication, preparation, welding, finishing and overhead expenses.

### **Industrial Engineering**

**Plant Layout:** General plant location factors, selection of plant site. Product layout, process layout. **Standardization:** National and international standards, value of standardization. Standardization techniques and problems. **Quality Control:** Elements of quality control and objectives. Frequency distribution. X-R charts, P-charts, C-charts and acceptance sampling concept of production. Inspection and its objectives. Types of inspections. **Work Study:** Flow process chart, flow diagrams, work measurement, time study. Time and motion study. **Products, planning and control:** Sales forecasting and its uses. Planning-products, process, parts, materials. Optimum batch quantity for production and inventory. Routing, dispatching and follow-up activities. **Inventory control:** Elements of control procedures, types of controls. Inventory control system of bin and recorder cycle system. Safety stock concepts. **Material handling:** Factors in material handling problems. Reduction of cost and time through improved material handling. **Material handling equipment:** Lifting, lowering, transporting and combination devices. **Industrial safety:** Need for safety-legal, humanitarian, economic and social considerations. Safety at work place-unsafe conditions and hazards-electrical hazards, lighting, ventilation, heat control, noise and vibrations, fire and explosion, chemical hazards; hygiene. Brief knowledge of relevant acts like factory act, workman compensation act, Indian boiler act, Indian electricity act, explosive act.

## **MECHANICAL ENGINEERING (Diploma Level)**

### **Paper-II**

### **SECTION - A**

#### **Thermal Engineering**

**Boilers:** Fire tube, water tube, mountings and accessories. Equivalent evaporation, efficiencies. **Steam and gas turbines:** Impulse and reaction. Turbine components. Classification. Steam condensers, components and construction features. Internal combustion engines, classification. Two stroke and four stroke engines. Main components and their functions. Air standard cycles, otto, diesel, dual; efficiencies. Engine lubrication, cooling systems. **Air compressors:** Types reciprocating and rotary, single stage and two stage compressors. Simple numerical problems.

#### **Refrigeration and Air Conditioning**

**Refrigeration:** Various cycles. COP. Representation of cycles in p-V, T-S and P-H diagrams. **Vapour compression system:** Wet and dry compression. Domestic refrigerator. Vapour absorption system, cycles of operation. Simple numerical problems. **Refrigerants:** Classification, properties SO<sub>2</sub>, CO<sub>2</sub>, NH<sub>3</sub>, Freon-12 etc., **Air conditioning:** Psychrometry, basic ideas of salient terms-dry and wet bulb temperatures, dew point, enthalpy, sensible heating, humidification and dehumidification, sensible heat factor, basic knowledge of room air conditioning. Central air conditioning systems.

#### **Hydraulics & Hydraulic Machines**

**Fluid Properties:** Pressure-depth relationship, total pressure on lamina, condition of equilibrium of floating bodies, meta center and meta centric height (simple numerical problems). **Fluid dynamics:** types of flow, equation of continuity. Bernoulli equation, orifices, coefficients of contraction, velocity and discharge. Minor losses in fluid flow. Venturimeter, orifice meter, pilot tube. **Notches and weirs:** Rectangular notch, V-notch Francis and Bazin formulae for rectangular weirs. Broad crested weirs. Flow through pipes, friction loss Darcy Weisbach equation. Simple numericals. **Channels:** uniform flow in rectangular and trapezoidal channels. Chezy and Manning equations. Most economical sections. **Hydraulic machines:** Impulse and reaction turbines, Pelton, Francis and Kaplan turbines-constructural and operational features. Velocity diagrams. **Pumps:** Centrifugal and reciprocating pumps. Basic knowledge of constructural and operational features.

### **SECTION-B**

#### **Manufacturing Processes**

**Metal forming processes:** Classification on the basis of properties of deformability, fusibility and divisibility such as rolling, forging, drawing, extruding, pressing, punching, blanking, spinning. **Welding:** Concept of various welding processes-electric arc, resistance, thermit, metal-inert-gas, tungsten-inert-gas, laser beam, electron beam, explosion and ultrasonic. **Welding of different materials in industries:** Plastics, aluminium, copper, brass, bronze, alloy steels, cast iron, stainless steel; oxyacetylene method. Welding arcs; arc initiation, structure, types, metal transfer characteristics. Different types of electrodes. Basic knowledge of testing of welds and relevant welding code. **Foundry practice:** Patterns and moulding-pattern types, materials, allowances, layout, colour scheme, defects cores. **Moulding process:** Mould materials, types of sands, parting powders, sand mixing and preparation. Moulding defects. Melting and pouring. Basic knowledge of refractory materials and fluxes. Furnaces-cupola, pit, tilting and electric types. **Special castings:** Shell mould casting, die casting, investment mould casting. Centrifugal and continuous casting, full mould casting. **Powder metallurgy:** Basic knowledge of the process, production of metal powders, blending, compaction, sintering etc. Self lubricated bearings. Advantages and limitations of the process.

### **Machine Tool Technology & Maintenance**

**Machine tools:** Basic common features, drive systems, sources of power, work and tool holding devices, speed varying systems, mechanical methods of providing automaticity in machine tools. **Lathe:** Various parts, their functions and kinematics, lathe accessories and attachments. Capstan and turret lathe tools operations carried out on lathes such as turning, taper turning, drilling, screw cutting, reaming, knurling. Common lathe tools and their uses. Simple knowledge of computer numerical control (CNC) lathes and automation. **Milling machines:** Types, components, general maintenance. Operations such as plane milling, angular milling, straddle milling, spur gear milling, endmilling. **Shaping, planing and slotting machines:** Components, working principle, quick return mechanism; types of tools used, their geometry. **Drilling and boring machines:** Constructional details and principle of working. Classification such as simple and radial types. Tools used. Maintenance; general and periodic. **Grinding machines:** Types common abrasive materials, grains, grits; speeds and feeds. Use of coolants. **Jigs and fixtures:** Difference between jigs and fixtures, types of jigs. **Cooling processes:** Coolants and cutting fluids their functions, selection for different materials and operations.

### **Workshop Practice & Production Technology**

**Workshop technology:** Scope in engineering. Brief survey of different shops generally contained in a standard engineering workshop viz. Carpentry, foundry, smithy, sheet metal, fitting, painting and machine shops. **Carpentry:** Common carpentry tools-their classification such as marking and measuring, holding and supporting, cutting and sawing, drilling and boring, striking and turning (name of parts, functions and specification only). **Joining of timber components:** Types of joints, common defects likely to occur in joints, their causes. **Foundry:** Basic knowledge of tools used in foundries. **Patterns-types, uses and allowances:** Green sand moulding; sand preparation and additives, parting powders, problems in moulding, uses of cores, risers, gates, chills etc. **Smithy:** Basic concepts of operations in smithy shop such as fullering, upsetting, swaging, forge welding drawing down. Tools used in smithy (names, functions and size specifications only) smithy forge, blower, shovel anvil, swage block, striking tools, punch, drift and hammers. **Sheet metal shop:** Basic knowledge of operations such as laying out, shearing, blanking, seaming, burning, stamping etc., tools in sheet metal shop used for marking, measuring, punching. **Fitting shop:** Fasteners like rivets, bolts, nuts, screws, keys, pins etc., (basic understanding only). Tools used in fitting shop such as threading tools, dies, taps, vices, wrench and spanners, hack saw, drills (names, function and specifications only). **Painting shop:** Surface preparation, sand and emery papers, varnishing and polishing. Common materials used such as red oxide, putty, yellow clay. Defects likely to occur in painting and their remedies. **Machine shop:** Elementary theory of metal cutting; chips-types, geometry of formation. Brief idea of newer machining processes such as abrasive jet machining, ultrasonic machining, chemical machining, electric discharge machining, laser beam machining, electron beam machining, plasma arc machining. **Metal finishing processes:** Such as diamond machining, honing, lapping buffing etc.

## ELECTRICAL ENGINEERING (Diploma Level)

### Paper-I

#### SECTION - A

(Brief study of following subjects)

**1. Basic Electrical Engg.:** Basic terminology and their concept, D.C. circuits, batteries, capacitors, electromagnetism, electromagnetic induction, A.C. circuits, polyphase circuits. **2. Electrical and electronic engg. materials:** Classification, conducting materials, insulating materials, magnetic materials, semiconductor materials, special purpose materials. **3. Electronics-I:** Semiconductor diode, bipolar junction transistor, basic transistor amplifier, single stage transistor amplifier, transistor power amplifier, feedback in amplifiers, regulated power supply. **4. Electrical machine-I:** Generalized treatment, D.C. machines, transformer, A.C. generator (Alternator). Voltage regulators.

#### SECTION-B

(Brief study of following subjects)

**5. Electrical instruments and measurements:** Introduction to electrical measuring instruments, measurement and errors, ammeters and voltmeters (moving coil and moving iron) wattmeters (dynamometer type) and max. demand indicator, energy meter (induction type), miscellaneous measuring instruments, electronic instruments, measurement of resistance, inductance and capacitance. Elements of process instruments. **6. Power plant engg.:** Thermal stations, hydro electric plants, nuclear power plants, diesel power plants, gasturbine plants. Combined working of power plants, major electrical equipment in power stations, recent development. **7. Transmission and distribution of electrical powers:** Electrical design of lines. Constructional features of transmission lines, economic principles of transmission, mechanical design of distribution system lines/power factor improvement, underground cables, carrier communication. **8. Electronics-II:** Digital electronics, microprocessors, oscillators, integrated electronics, operational amplifiers, communication engg.

## ELECTRICAL ENGINEERING (Diploma Level)

### Paper-II

#### Section – A

(Brief study of following subjects)

- 1. Network Theorems:** KCL, KVL, Thevenin's theorem, Norton's theorem, Superposition theorem and Maximum power transfer theorem.
- 2. Electrical Machines-II :** Synchronous motor, Induction motor, FHP motors, Stepper motor, Servomotor, Submersible pumps.
- 3. Switchgear and Protection:** Distribution system, Causes of low power factor, Fuses, Switchgears, Circuit breakers, Isolators, protective schemes, overvoltage protection, over current protection, different types of substations.
- 4. Non-conventional sources of energy :** Importance and it's present scenario, Future prospects and it's Economics, Solar Energy, Bio Energy, Wind Energy, Geothermal and Tidal Energy.
- 5. Estimation and costing in Electrical Engineering :** Introduction and types of wiring, Estimation and costing of overhead and underground distribution. Introduction to Energy Management.
- 6. Utilization of Electrical Energy:** Illumination, Electrical welding, Electric-heating, Electrolytic process, Electric circuits in refrigeration, Air conditioner and water cooler, Electric drives and Electric traction.

#### Section – B

(Brief study of following subjects)

- 7. Installation and Maintenance of Electrical equipment:** Brief study of Electrical maintenance, installation and commissioning, Preventive maintenance of electrical equipments, Electrical safety, Insulation testing and electrical earthing.
- 8. Industrial Electronics:** Semiconductor, Introduction to SCR, Controlled Rectifiers, Choppers, Dual Convertors, Cycloconverters, Thyristor control of electric drives and UPS.
- 9. Instrumentation and control:** CRO and it's application, open loop and closed control system, Components and circuits of control system, Introduction, working and application of programmable logic controllers (PLC).

**10. Miscellaneous measurements and Transducers:** Meggar and it's application, Transducers, Measurement of displacement, strain, force, torque, pressure flow and temperature, signal conditioning, recording and display systems.

## AGRICULTURAL ENGINEERING (Diploma Level)

### Paper-I

#### SECTION - A

**1- Farm Power Engineering & Non Conventional sources of Energy:** Introductions : Sources of power on farms, comparative study and uses. Limitation and brief description of animal, fossil fuel (Diesel/petrol) wind, solar, Biogas and electric power. **I.C. Engines :** Principles Heat engine, principle of operation, classification of I.C. Engines, Principles of operation two stroke and four stroke engine. Diesel and petrol engine, stationary, reciprocating and rotary parts, their material of construction and functions. Concept of terms related with I.C. engine, Numerical problems related with different terms. Performance of engine. **Tractor:** Introduction Classification of tractor and adoptability. Factors affecting selection of tractor. General idea about different makes, models, in different H.P. ranges of tractors. **Hourly Cost of Operation :** Hourly Cost of operation of small petrol engine, diesel engine and tractor.

**2- Non Conventional Energy ; Bio-gas Technology :** Introduction of Biogas, Production of Biogas, Bio-digestion of plants and animals waste, reaction taking place during bio-digestion, gases produced during the process, elimination of unwanted gases such as CO<sub>2</sub> and H<sub>2</sub> s. Factors affecting production of gas, efficiency of Bio-gas plants in winter, uses of biogas. **Wind Energy Technology:** Types of wind mills-Vertical axis and Horizontal axis. Various uses of wind mills. Site selection for a wind mill construction, working and maintenance of wind mills. **Solar Energy Technology :** Solar radiation and potentiality of solar radiation in India. Application of solar energy. solar collector.

#### Section-B

**3- Post Harvest Technology & Agro Based Industries :** Introduction: Importance of grain and seed processing principles of agricultural processing, sequence of operation, Flow digestion services offered by processor of farmers: Wheat, Maize, paddy and Soyabean, **Agro-Based Industries:** Sugercane crushing, khandsari and Gur making process and equipment, vegetable and animal waste utilization, by products of Soyabean and potato, dehydration of vegetables.

**4- Farm & Land Development Machinery : Farm Mechanization:** Definition, Status of farm mechanization in India, Scope, Limitation, Advantages. Primary and Secondary tillage equipment, Sowing and Planting equipment, Harvesting and threshing equipment, Land Development equipment: construction, operation and output of the following Dozen Scraper, Draghoe and Dragline.

## AGRICULTURAL ENGINEERING (Diploma Level)

### Paper-II

#### SECTION - A

**1- Irrigation and Drainage Engineering:** Introduction: Definition of Irrigation, History of Irrigation, Necessity and scope of Irrigation. **Water Requirement of Plants:** Types of soils, soil properties in relation of Irrigation and drainage, classes and availability of soil water, Evaporation, transpiration, evapotranspiration, consumptive use, estimating crop water requirements, duty of water, delta. Assessment irrigation water requirements of different crops, estimation of depth and time of irrigation, different criteria for irrigation scheduling depending upon soil plant- atmospheric factor. **Irrigation Methods:** Surface and subsurface methods, sprinkler and drip system of irrigation and conjunctive use. Measurement of irrigation efficiencies, water conveyance, storage, application, distribution and water use efficiency.

**Drainage Engineering:** Definition, necessity, water logging salinity, its control interrelationship of irrigation, drainage, drainage coefficient. Different types of surface and subsurface drainage system.

**2- Minor Irrigation :** Importance, necessity and advantages of minor irrigation, land survey, method of levelling, determination of cuts and fill. Importance and necessity of levelling. Sources of minor irrigation. Definition of tubewell, need, advantage & disadvantage, characteristics of tubewell site, factor affecting site selection.

#### Section - B

**3- SOIL & WATER CONSTRUCTION AND LAND RECLAMATION ENGINEERING:** Mechanics, types and causes of soil erosion, factors affecting erosion, damages caused by soil erosion. Agronomical measures for soil & water conservation : Contour tarming, matching, grip cropping, cover cropping, mixed cropping, role of grasses in soil conservation. **Mechanical method of erosion control:** Field bunding, contour bunding, graded bunding, ridge and channel terraces. **Gully erosion control:** classification of gullies, control of gullies by temporary and permanent structures: earthen check dams, brush dams, loose rock dams, straight drop

spiliway. **Land Reclamation:** Classification of user soils, salty resistant crops, reclamation of user soils. Reclamation of waste lands forest lands and sandy soils, sanddunes stabilization. **Ravine Reclamation:** Classification of ravines and various measures for ravine reclamation.

---