or

(ii) is recommended/after.....years..... months, and therefore this certificate shall be valid till (DD/MM/YY) .....

@ e.g. Left/right/both arms/legs

e.g. Single eye/both eyes

£ e.g. Left/Right/both ears

4. Signature and seal of the Medical Authority.

Name and Seal of Member	Name and Seal of Member	Name and Seal of the Chairperson

Signature/thumb impression of the person in whose favour certificate of disability is issued

Countersigned by the Chief Medical Officer (with seal)

उत्तर प्रदेश लोक सेवा (शारीरिक रूप से विकलांग, स्वतंत्रता संग्राम सेनानियों के आश्रितों और भूतपूर्व सैनिकों के लिये आरक्षण), अधिनियम, 1993 (यथासंशोधित) के अनुसार स्वतंत्रता संग्राम सेनानी के आश्रित के प्रमाण–पत्र का प्रपत्र।

प्रमाण–पत्र

प्रमाणित किया जाता है कि श्री/श्रीमती ..... निवासी ग्राम– ..... नगर– ..... जिला– ..... उत्तर प्रदेश लोक सेवा (शारीरिक रूप से विकलांग, स्वतंत्रता संग्राम सेनानियों के आश्रितों और भूतपूर्व सैनिकों के लिये आरक्षण) अधिनियम, 1993 के अनुसार स्वतंत्रता संग्राम सेनानी हैं और श्री/श्रीमती/कुमारी (आश्रित) ..... पुत्र/पुत्री/पौत्र (पुत्र का पुत्र या पुत्री का पुत्र) तथा पौत्री (पुत्र की पुत्री या पुत्री की पुत्री) (विवाहित अथवा अविवाहित) उपरांकित अधिनियम, 1993 (यथासंशोधित) के प्राविधानों के अनुसार उक्त श्री/श्रीमती (स्वतंत्रता संग्राम सेनानी) .....के आश्रित हैं।

स्थानः
दिनांकः

हस्ताक्षर .....
पूरा नाम .....
पदनाम .....
मुहर .....
जिलाधिकारी (सील)

कुशल खिलाड़ियों के लिये प्रमाण–पत्र जो उ.प्र. के मूल निवासी हैं

शासनादेश संख्या–22/21/1983–कार्मिक–2 दिनांक 28 नवम्बर, 1985

प्रमाण–पत्र के फार्म – 1 से 4

प्रारूप –1

(मान्यता प्राप्त क्रीड़ा/खेल में अपने देश की ओर से अन्तरराष्ट्रीय प्रतियोगिता में भाग लेने वाले खिलाड़ी के लिये)

सम्बन्धित खेल की राष्ट्रीय फेडरेशन/राष्ट्रीय एसोसिएशन का नाम ..... राज्य सरकार की सेवाओं/पदों पर नियुक्ति के लिए कुशल खिलाड़ियों के लिए प्रमाण–पत्र

प्रमाणित किया जाता है कि श्री/श्रीमती/कुमारी ..... आत्मज/ पत्नी/ आत्मजा श्री ..... निवासी .... पूरा पता ..... ने दिनांक ..... से दिनांक ..... तक ..... (स्थान का नाम) में आयोजित..... (क्रीड़ा/खेल–कूद का नाम) की प्रतियोगिता/टूर्नामेन्ट में देश की ओर से भाग लिया।

उनके टीम के द्वारा उक्त प्रतियोगिता/टूर्नामेन्ट में ..... स्थान प्राप्त किया गया।

यह प्रमाण–पत्र राष्ट्रीय फेडरेशन/राष्ट्रीय एसोसिएशन/(यहाँ संस्था का नाम दिया जाये) ..... में उपलब्ध रिकार्ड के आधार पर दिया गया है।

स्थान .....
दिनांक .....

हस्ताक्षर .....
नाम .....
पद .....
संस्था का नाम .....
मुहर .....

नोटः यह प्रमाण–पत्र नेशनल फेडरेशन/नेशनल एसोसिएशन के सचिव द्वारा व्यक्तिगत रूप से किये गये हस्ताक्षर होने पर ही मान्य होगा।

प्रारूप – 2

(मान्यता प्राप्त क्रीड़ा/खेल में अपने प्रदेश की ओर से राष्ट्रीय प्रतियोगिता में भाग लेने वाले खिलाड़ी के लिये)

सम्बन्धित खेल की प्रदेशीय एसोसिएशन का नाम .....राज्य सरकार की सेवाओं/पदों पर नियुक्ति के लिए कुशल खिलाड़ियों के लिए प्रमाण–पत्र

प्रमाणित किया जाता है कि श्री/श्रीमती/कुमारी ..... आत्मज/ पत्नी/आत्मजा श्री ..... निवासी (पूरा पता) .....ने दिनांक.....से दिनांक..... तक..... में (क्रीड़ा/खेल–कूद का नाम) की प्रतियोगिता (टूर्नामेन्ट स्थान का नाम) ..... आयोजित राष्ट्रीय ..... में (क्रीड़ा/ खेल– कूद का नाम) की प्रतियोगिता/टूर्नामेन्ट में प्रदेश की ओर से भाग लिया।

उनके टीम के द्वारा उक्त प्रतियोगिता/टूर्नामेन्ट में ..... स्थान प्राप्त किया गया।

यह प्रमाण–पत्र ..... (प्रदेशीय संघ का नाम) में उपलब्ध रिकार्ड के आधार पर दिया गया है।

स्थान .....
दिनांक .....

हस्ताक्षर .....
नाम .....
पद .....
संस्था का नाम .....
मुहर .....

नोटः यह प्रमाण–पत्र प्रदेशीय खेल–कूद संघ के सचिव द्वारा व्यक्तिगत रूप से किये गये हस्ताक्षर होने पर ही मान्य होगा।

प्रारूप – 3

(मान्यता प्राप्त क्रीड़ा/खेल में अपने विश्वविद्यालय की ओर से अन्तर्विश्वविद्यालय प्रतियोगिता में भाग लेने वाले खिलाड़ी के लिये)

विश्वविद्यालय का नाम ..... राज्य स्तर की सेवाओं/पदों पर नियुक्ति के लिए कुशल खिलाड़ियों के लिए प्रमाण–पत्र

प्रमाणित किया जाता है कि श्री/श्रीमती/कुमारी ..... आत्मज/ पत्नी/आत्मजा श्री ..... निवास (पूरा नाम) ..... विश्वविद्यालय की कक्षा ..... के विद्यार्थी ने दिनांक ..... से दिनांक ..... तक ..... (स्थान का नाम) में आयोजित अन्तर्विश्वविद्यालय ..... (क्रीड़ा/खेल–कूद का नाम) प्रतियोगिता/टूर्नामेन्ट में ..... विश्वविद्यालय की ओर से भाग लिया। उनके टीम के द्वारा उक्त प्रतियोगिता/टूर्नामेन्ट में ..... स्थान प्राप्त किया गया। यह प्रमाण–पत्र डीन ऑफ स्पोर्ट्स अथवा इंचार्ज खेल कूद .....विश्वविद्यालय में उपलब्ध रिकार्ड के आधार पर दिया गया है।

स्थान .....
दिनांक .....

हस्ताक्षर .....
नाम .....
पद .....
संस्था का नाम .....
मुहर .....

नोटः यह प्रमाण–पत्र विश्वविद्यालय के डीन ऑफ स्पोर्ट्स या इंचार्ज खेल–कूद द्वारा व्यक्तिगत रूप से किये गये हस्ताक्षर होने पर ही मान्य होगा।

प्रारूप – 4

(मान्यता प्राप्त क्रीड़ा/खेल में अपने स्कूल की ओर से राष्ट्रीय खेल–कूद में भाग लेने वाले खिलाड़ी के लिये)

डाइरेक्ट्रेट ऑफ पब्लिक इन्सट्रक्शन्स/निदेशक, शिक्षा, उत्तर प्रदेश ..... राज्य स्तर की सेवाओं/पदों पर नियुक्ति के लिए कुशल खिलाड़ियों के लिए प्रमाण–पत्र

प्रमाणित किया जाता है कि श्री/श्रीमती/कुमारी ..... आत्मज/पत्नी/आत्मजा श्री .... निवासी (पूरा पता) ..... में ..... स्कूल में कक्षा ..... के विद्यार्थी ने दिनांक ..... से दिनांक ..... तक .....(स्थान का नाम) में आयोजित स्कूलों के नेशनल गेम्स की ..... (क्रीड़ा/खेल–कूद का नाम) प्रतियोगिता/टूर्नामेन्ट में अपने स्कूल की ओर से भाग लिया। उनके टीम के द्वारा उक्त प्रतियोगिता/ टूर्नामेन्ट में ..... स्थान प्राप्त किया गया।

यह प्रमाण–पत्र डाइरेक्ट्रेट ऑफ पब्लिक इन्सट्रक्शन्स/शिक्षा में उपलब्ध रिकार्ड के आधार पर दिया गया है।

स्थान .....
दिनांक .....

हस्ताक्षर .....
नाम .....
पद .....
संस्था का नाम .....
मुहर .....

नोट : यह प्रमाण–पत्र निदेशक/या अतिरिक्त/संयुक्त या उपनिदेशक डाइरेक्ट्रेट ऑफ पब्लिक इन्सट्रक्शन्स/ शिक्षा ..... द्वारा व्यक्तिगत रूप से हस्ताक्षर होने पर मान्य होगा।

APPENDIX - 2

परीक्षा योजना

प्राविधिक शिक्षा विभाग (डिप्लोमा सेक्टर) उ0प्र0 के अन्तर्गत व्याख्याता व कर्मशाला अधीक्षक परीक्षा हेतु निम्नवत दो प्रश्न–पत्र होंगेः–

प्रथम प्रश्न–पत्र (व्याख्याता व कर्मशाला अधीक्षक हेतु)

विषय	प्रश्नों की संख्या	अंक	कुल अंक	समय
1–सामान्य हिन्दी	25 (प्रत्येक प्रश्न 03 अंक)	75	375	2.30 (ढ़ाई) घण्टा
2–मुख्य विषय (यांत्रिक अभि0–I, विद्युत अभि0–I, सिविल अभि0–I, इलेक्ट्रानिक्स अभि0–I, केमिकल अभि0–I, कम्प्यूटर–I, पेंट टेक्नो0–I, टेक्सटाइल टेक्नो0–I, लेदर टेक्नो0–I, प्लास्टिक मोल्ड टेक्नो0–I, वास्तुकला (आर्कीटेक्चर)–I, टेक्सटाइल केमेस्ट्री–I, भौतिकी–I, रसायन–I, अंग्रेजी–I, गणित–I, इन्स्ट्रूमेन्टेशन एण्ड कन्ट्रोल–I, फुटवियर टेक्नो0–I, कर्मशाला अधीक्षक (यांत्रिक अभि0 में स्नातक/स्नातकोत्तर)–।	100 (प्रत्येक प्रश्न 03 अंक)	300		

द्वितीय प्रश्न–पत्र (व्याख्याता व कर्मशाला अधीक्षक हेतु)

विषय	प्रश्नों की संख्या	अंक	कुल अंक	समय
1–सामान्य अध्ययन	25 (प्रत्येक प्रश्न 03 अंक)	75	375	2.30 (ढ़ाई) घण्टा
2–मुख्य विषय (यांत्रिक अभि0।।, विद्युत अभि0–।।, सिविल अभि0–।।, इलेक्ट्रानिक्स अभि0–।।, केमिकल अभि0–।।, कम्प्यूटर–।।, पेंट टेक्नो0–।।, टेक्सटाइल टेक्नो0–।।, लेदर टेक्नो0–।।, प्लास्टिक मोल्ड टेक्नो0–।।, वास्तुकला (आर्कीटेक्चर)–।।, टेक्सटाइल केमेस्ट्री–।।, भौतिकी–।।, रसायन–।।, अंग्रेजी–।।, गणित–।।, इन्स्ट्रूमेन्टेशन एण्ड कन्ट्रोल–।।, फुटवियर टेक्नो0–।।, कर्मशाला अधीक्षक(यांत्रिक अभि0 में स्नातक/ स्नातकोत्तर)–।।	100 (प्रत्येक प्रश्न 03 अंक)	300		

व्यक्तित्व परीक्षा (साक्षात्कार) – 100 अंक

कुल योग – 375+375+100=850

APPENDIX - 3

SYLLABUS

सामान्य हिन्दी

(व्याख्याता/कर्मशाला अधीक्षक पद हेतु)

(इसका स्तर हाईस्कूल का होगा)

1–हिन्दी–वर्णविचार–स्वर एवं व्यंजन
2–पर्यायवाची शब्द
3–विलोम शब्द
4–अनेक शब्दों के लिए एक शब्द/वाक्यांश के लिए एक शब्द
5–अनेकार्थक शब्द
6–उपसर्ग एवं प्रत्यय
7–अशुद्धि–शोधन–वर्तनी–शुद्धि, वाक्य–शुद्धि
8–तत्सम–तद्भव शब्द
9–शब्द–युग्म, अर्थबोध (शब्दार्थ)
10–मुहावरे एवं लोकोक्तियाँ
11–सन्धि, समास
12–विरामचिह्न
13–कारकचिह्न
14–हिन्दी–व्याकरण–संज्ञा, सर्वनाम, विशेषण, क्रिया, अव्यय, लिंग, वचन।

GENERAL STUDIES

(for the post of Lecturer/Workshop Superintendent)

1.History of India.
2.Geography of India.
3.Indian Polity and Constitution.
4.Current events of National and International significance.

1.History of India: Emphasis should be on general understanding of political, economic and social aspects of Indian History.

2.Geography of India: Candidates will be expected to have knowledge of the Physical and Human aspects of the Geography of India in general terms.

3.Indian Polity and Constitution: Candidates are expected to have a basic knowledge and preliminary understanding about Indian Political system as well as Indian Constitution.

4.Current events of National and International significance.

1.MECHANICAL ENGINEERING/WORKSHOP SUPERINTENDENT

PAPER–I

1. Engineering Mechanics:
Analysis of Force Systems, Friction, Centroid and Centre of Gravity, Trusses , Bending Moment and Shear Force diagrams, Kinematics and Kinetics of Rigid Bodies.

2. Mechanisms and Machines:
Velocity and Acceleration analysis, Cams and Followers, Gears and gear trains, Clutches, Brakes and Dynamometers, Flywheel and Governors, Braks and Dynamometers, Balancing of rotating and Reciprocating Masses, Balancing of Multi Cylinder Engines, Free and Forced Vibration, Gyroscopic Stabilization, Whirling of Shafts.

3. Mechanics of Solids: Stresses and Strains, Compound Stresses and Strains, Torsion of circular Shafts, Slope and Deflection, Unsymmetrical bending, Curved Beams, Thin and Thick Cylinders, thin Spheres, Helical and Leaf Springs, Buckling of Columns.

4.Design of Machine Elements: Design for Static and Dynamic Loading, Theories of failures, Fatigue, Design of Rivetted, Welded and Bolted Joints, Shafts, Gears, Bearings, Clutches and Brakes.

5. Engineering Materials: Crystal Systems and Crystallography, Crystal Imperfections, Phase Diagrams, Iron Carbon Equilibrium Diagram, Heat Treatment, Ferrous and Non Ferrous Metals and Alloys, Mechanical Properties and Testing.

6. Manufacturing: Metal Casting, Metal joining, Metal forming, Mechanics of Metal cutting,

Machining and Machine Tool Oprerations, Unconvenctional Machining, Limits, Fits and Tolerances, Inspection: Surface Roughness and its measurement; Comparators, Computer Integrated Manufacturing, Flexible Manufacturing Systems, Jigs and Fixtures.

7. **Industrial Engineering:** Production Planning and Control, Inventory Control, Operations Research, CPM and PERT.

8. **Mechatronics and Robotics:** Microprocessors and Micro Controllers, Architecture, Programming, Computer Interfacing, Programmable Logic Controllers, Sensors and Actuators, Piezoelectric Accelerometers, Hall Effect Sensors, Optical Encoder, Resolver, Inductosyn, Pneumsatic and Hydraulic Actuators, Stepper Motor, Control System, Mathematical Modelling of Physical Systems, Control Signals, Controllability and Observability. Robotics : Robot Classification, Robot Specification, Notation, Direct and Inverse Kinematics, Homogeneous Co-ordinates and Arm Equations of four Axis SCARA Robot.

PAPER–II

1. **Thermodynamics:** Thermodynamic Systems and Processes, Properties of Pure Substances, Concepts and Applications of Zeroth, First and Second Law of Thermodynamics, Entropy, Availability and Irreversibility, detailed Analysis of Thermodynamic Cycles, Ideal and Real gases, Fuels and Combustion.

2. **Fluid Mechanics:** Basic Concepts and Properties of Fluids, Manometry, Fluid Statics, Buoyancy, Equations of Motion, Bernoulli's Equation and Applications, Viscous Flow of incompressible fluids, Laminar and turbulent flows, Flow through pipes and head losses in Pipes, Isentropic and Adiabatic Flows, Normal Shock Waves.

3. **Heat Transfer:** Modes of Heat Transfer, Steady and unsteady heat Conduction, Themocouple time constant, critical thickness of insulation, Heat Transfer from Fins, Momentum and energy Equations for Boundary Layer flow on a Flat Plate. Free and Forced convection Radiative heat transfer, Stefan-Boltzmann law, Shape Factor, Black and Grey Body radiation, heat exchanger, Boiling and Condensation, Heat Exchanger Performance Analysis, LMTD and NTU-Effectiveness Methods.

4. **Energy Conversion:** SI and CI engines, Performance Characteristics and Testing of IC Engines, Fuels, Combustion Phenomena in SI and CI Engines, Carburetion and Fuel Injection Systems, Emission and Emission Control. Reciprocating and Rotary Pumps, Pelton wheels, Francis and Kaplan Turbines, velocity Diagrams, Impulse and Reaction Principles, Steam and Gas Turbines, Rankine and Brayton Cycles with regeneration and reheat, High Pressure Boilers Drafts, Condensers. Unconventional Power Systems Including Nuclear, MHD, Biomass, Wind and Tidal Systems. Utilization of Solar Energy, Reciprocaing and Rotary Compressor; Theory and applications, Theory of Propulsions, Pulsejet and Ramjet Engines.

5. **Environmental Control:** Vapour Compression, Vapour Absorption, Steam jet and Air Refrigeration Systems, Properties of Refrigerant and their Nomenclature, Psychrometric Properties and Proceses, Psychrometric Relations, Use of Psychrometric chart, Load Estimation, Supply Air Conditions, Sensible Heat Factor, Air Conditioning; System Layout, Comfort Chart, Comfort and Industrial Air Conditioning.

2. ELECTRICAL ENGINEERING

PAPER-I

Electrical Circuits and Networks: Circuit elements, KCL, KVL, Nodal and Mesh analysis, Thevenins's, Norton's, Superposition and Maximum power transfer theorems, Steady state and Transient Response of DC and AC networks, Two-part netwroks, Magnetically coupled circuits.

Electromagnetic Field Theory: Electrostatic fields; Gausees' Law, Maxwell's equations, Energy density in electrostatic fields, Properties of materials Magnetostatic Fields: Biot-Savart's Law, Ampere's circuit law, Maxwell's equations, Application of Ampere's law, Waves and applications.

Basic Electronics Engineering: Basics of Semiconductor diodes BJT, FET, MOSFETS characteristics, Different types amplifiers, equivalent circuit and frequency response, Oscillator and other circuits, feedback amplifiers.

Electrical and Electronics Measurements: Principles of measurement, Accuracy, Precision, Errors, Moving coil, Moving iron, Dynamometer and induction types of instruments, Measurement of voltage, Current, Power, Energy and Power factor, Instrument transformer, Bridges and Potentiometers, Electronic instruments, Digital voltmeters, Phase Frequency measurement, Q-meters, Basics fo sensors and transducers.

Electrical Machines: Electro Magnetic Energy concersion (EMEC), DC Machines-types, Generator and moter characteristics, Starting and control of motors; Synchronous machines- Principle and performance, Regulation, Paralled operation of generators, Motor starting, Characteristics and application, Single phase, Three phase transformers- Principle, Equivalent circuit efficiency, Regulation, Connections.

Power Systems: Basic power generation concepts- Steam, gas annd water turbines, Line parameters and calculations, Performance of transmission lines, Mechanical design of overhead lines and insulators, Corona and radion interference, Power factor correction, Symmetrical components, Fault analysis, Load flow equations and methos of solutions, Power system stability- Power system transients and travelling waves, EHV transmission, HVDC transmission, Concepts of FACTs, Voltage control and Economic operation, Concepts of distributed generations, Solar and wind power, Smart grid Concept.

Control System: Mathematical modelling of physical systems, Principles of feedback, Transfer function, Block Diagram and signal flow graphs, Time response specification, Routh-Hurcoitz criterion, Bode plots, root loci, Nyquist technique, Lag, Lead and lead-lag compensation, stability analysis, transient and frequency response analysis, State space model, State transition matrix, Controllability and observability, PID and industrial controllers.

PAPER-II

Analog and Digital Electronics:
Operational amplifies- Characterisitcs and applications, combinational and sequential circuits, Multiplexers, Multivibrators, Sample and hold circuits, A/D and D/A converters, Basics of filter circuits and applications, Active filters, Microprocessor basics- Interfaces and applications, Basics of integrated circuits, Analog communication basics, Modulation and Demodulation, Noise and bandwidthm Signal to noise ratio, Transmitters and recievers, Digital communication basics- sampling, quantizing, coding , frequency and time domain multiplexing, Power line carrier communication systems.

Systems and Signal Processing: Representation of continuous and discrete-time signals, Shifting and sealing operations, Linear, time-invariant and causal systems, Fourier series representation of continuous periodic signals, Sampling theorem, Fourier and Laplace transform, Z-transforms, Discrete fourier transform, FFT,Linear convolution, FIR and IIR filters, bilinear transformation.

Induction and Special Mechines: Three-Phase induction motors- rotating magnetic field theory, Equivalent circuit and determination of its parameters, Torque-slip characteristics, Starters, Speed control, induction generators, Single-phase induction motors- theory, Characteristics, Starting and applications, Servomotors, Stepper motors, brushless DC (BLDC) motors.

Power System Protection: Principles and need for protection schemes, Types of faults, Relay application and Characteristies- over current relays, Directional ralays, Distance relay, Differential relays, Methods of Arc extinction,
Restriking voltages and recovery voltage, testing of circuit breakers, Protective schemes for power system equipment, Surge in transmission line and protection.

Power Electronic and Drivers: Semiconductor power diodes, Transistors, Thyristors, Triacs, GTOs, MOSFETs, IGBTs- principles of operation and their static characteristics, Triggering circuits, Phase control rectifiers, Bridge convertors- fully controlled and half controlled, Principle of choppers and inverters, Basic concepts of adjustable speed DC and AC drives, DC-DC switched mode converters, DC-AC switched mode converters, Resonant convertors, Basics of electric drives- types, quadrant operation, Reversing and breaking of electric motors, Estimation of power ratings, Traction motors.

Electrical Material: Electrical enginerring materials, Crystal structures and defects, Ceramic materials, Insulating materials, Magnetic materials- basics, Properties and applications; Ferrites, Ferro-magnetic materials and components, Basics of solid state Physics, Conductors, Photo-conductivites, Basics of Nano materials and superconductors.

3. CIVIL ENGINEERING

PAPER-I

Part - A

Engineering Mechanics: Force Systems, Rigid Body equilibrium; Coplanar Concurrent forces, Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of coplanar Systems. Laws of Friction, Static and Dynamic Friction. Centroid and Centre of Gravity, Centroid of Simple figures, centroid of composite sections, Moment of inertia of plane sections, Moment of inertia of standard sections and composite sections, Mass moment inertia of circular plate, Cylinder, Cone, Sphere, Basic Structural Analysis, Equilibrium in three dimensions, analysis of simple trusses, Simple beams and support reactions. Rectilinear motion, Plane curvilinear motion, Work-kinetic energy, power, potential energy. Impulse-momentum, Impact, Kinetics of Rigid Bodies, D'Alembert's principle and its applications in plane motion, Work energy principle, Kinetics of rigid body rotation,Virtual Work and Energy Method.

Strength of Materials : Types of stresses and strains, Hook's law, stress and strain diagram for ductile and brittle metal. Lateral strain, Poission ratio, volumetric strain, elastic moduli and relation between them, composite bar, Mohr's stress circle, three dimensional state of stress & strain, Shear force (SF) and Bending moment (BM) diagrams for simply supported, cantilevers, overhanging and fixed beams. Flexural Stresses-Theory of simple bending, bending stresses, Design of simple beam sections, Derivation of torsion equation, Combined torsion and bending of circular shafts, Shear stress distribution across various beam sections rectangular, circular, triangular, Slope and deflection – Relationship between moment, slope and deflection, Moment area method, Macaulay's method, short Columns and Struts : Buckling and stability, slenderness ratio.

Structural Analysis : Static and Kinematic Indeterminacy for beams, trusses and building frames. Analysis of determinate plane trusses. Method of substitution, method of tension coefficient for analysis of plane trusses, Castigliano's theorems, Calculations of deflections: Strain Energy method and unit load method for statically determinate beams, frames and trusses. Deflection of determinate beams by Conjugate beam method. Rolling loads and influence line diagrams for determinate beams and trusses, Types of Arches, Analysis of three hinged parabolic and circular Arches. Moving load & influence lines for three hinged parabolic arch.

Part – B

Structural Steel Design : Stress-Strain Curve for Mild Steel, Rolled Steel Sections, Limit State Design, Limit States of Strength, Limit States of Serviceability, Actions, Probabilistic Basis for Design. Riveted, Bolted and Pinned Connections, Patterns of riveted Joints, Bolted Connection, Types of Bolted Joints, Failure of Bolted Joints, Tensile Strength of Plate, Efficiency of the Joint, Combined Shear and Tension, Welded Connections, types, Weld Defects, Failure of welds, Design of eccentric welded connections. Types of Tension Members, Sectional Area, Types of Failure, Slenderness Ratio, Design of Tension Member, Lug Angles, Splices, Gusset Plate. Compression Members, Types of Buckling, Classification of Cross Sections, column formula, Built-Up columns, Lacing, Batten, Splices, Types of Beam Sections, Lateral Stability of Beams, Bending Strength of Beams, Shear Strength of Beams, Web Buckling, Built-Up Beams (plated Beams), Purlins, Effect of Holes in Beam, Plate Girder, Gantry Girder.

Design of Concrete & Masonry Structure : Design of Rectangular singly and doubly reinforced Sections by working Stress Method. Assumptions in Limit State Design method, Design of Rectangular Singly and doubly Reinforced beams, T-Beams, L-beams by Limit State Design Method. Shear Strength of beams with and without shear reinforcement, development length, Anchorage bond, flexural bond. Limit State Design method, Failure of beam under shear. Design of one way, one way continuous and cantilever solid slabs by Limit State Design Method, Design of two way slabs by limit state method, Design of columns by Limit State Design Method, Short column under axial load and uni-axial bending, Design of isolated footings, combined rectangular and trapezoidal footings by Limit State Method, Design of strap footings. Structural behavior of retaining wall, stability of retaining wall against overturning and sliding, design of cantilever retaining wall by Limit State Method.

Part - C

Bulding Materials : Stones : Requirement of good building stone, Bricks : Properties of clay bricks, Different types of bricks. Gypsum, Cement, Types of cement, Testing of cement properties, Cement Concrete, Grades of concrete, Testing of concrete, Pozzolona, Chemical composition and requirements for uses, Timber, Properties of timber, Defects in timber, Methods of seasoning and preservation of timber, Asphalt : Bitumen and Tar. Plastics, Paints, varnishes and distempers, properties and uses of aluminum and lead, Insulating Materials, Thermal and sound insulating material, Building, construction Principle and Methods for layout, Damp proofing, anti termite treatment in buildings, stair cases and their types and planning, types of floors, Bricks and stone masonry construction, Wall, Doors and Windows, roof and roof treatments, Lintel Principles of building Planning, Natural Ventilation, Water Supply and Sanitary fittings, Methods of building maintenance.

Construction Management : Quantity Estimation for Buildings, Centreline method, Long and short wall method of estimates, Types of estimates, Rate Analysis, Specification and Tenders, Different types of contracts, process of tendering, management system in construction, Bar charts, preparation of networks, PERT & CPM in construction management, Project Cost Management, Basic principle of financial planning.

Part - D

Geotechnical Engineering and Foundation Engineering : Origin and classification of Soils, Weight volume relationships, Clay minerals, Index properties, sensitivity and thixotropy, Particle size analysis, Unified and Indian standar soil classification system. Soil Hydraulics, Soil Permeability – Darcy's Law, hydraulic conductivity, equivalent hydraulic conductivity in stratified soil, Seepage, flow nets, critical hydraulic gradient and quick sand condition, uplift pressure, piping, Phenomena , Soil compaction, field compaction control, consolidation, Primary and secondary consolidation, Terzaghi's one dimensional theory of consolidation, Normal and Over Consolidated soils, Over Consolidation Ratio, Stress Distribution in soil, Boussinesq equation for vertical stress, The Westergaard equation, Stress distribution under loaded areas, Concept of pressure bulb, contact pressure, Shear Strength : Mohr-Coulomb failure criterion, shear strength parameters, pore pressure, Soil liquefaction, Earth pressure, Coulomb and Rankine's approaches for fictional and c-ϕ soils, Stability of slopes – finite and infinite slopes, types of slope failure, coulomb's wedge theory, subsurface exploration. Shallow and Deep foundations, Bearing Capacity estimation, Pile foundations, Well foundations.

PAPER-II

Part – A

Fluid Mechanics : Physical properties of fluids, Pressure-density height relationship, manometers, pressure on plane and curved surfaces, buoyancy, stability of immersed and floating bodies. Steady and unsteady, uniform and non-uniform, laminar and turbulent flows, rotational and irrotational flows, compressible and incompressible flows, subsonic, sonic and supersonic flows, sub-critical, critical and supercritical flows, one, two and three dimensional flows, streamlines, path lines, streak lines, stream tube, continuity equation for 1-D, 2-D and 3-D flows, stream function and velocity potential function. Bernoulli's equation and its applications – Pitot tube, orifice meter, venturimeter and bend meter, notches and weirs, momentum equation, siphon, water hammer, laminar flow through pipes, Stokes' law, velocity distribution in turbulent flow over smooth and rough surfaces, Boundary layer thickness, boundary layer over a flat plate, displacement, momentum and energy thickness. Laminar boundary layer, turbulent boundary layer, laminar sub-layer, separation and its control. Vortex flow : Free & Forced. Drag and lift, Buckingham's Pi theorem, dimensionless numbers and their significance.

Open Channel Flow : Free surface flows, velocity and pressure distribution, Mass, energy and momentum principle for prismatic and non-prismatic channels, Uniform flow: Standard equations, Equation of gradually varied flow and its limitations, Transitions of subcritical and supercritical flow, Rapidly Varied flow (RVF), Hydraulic jump, flow measurement, critical depth flumes, sluice gate, Free over fall. Rapidly varied unsteady flow, “Celerity” of the gravity wave, Flow in channel of non-linear alignment and non-prismatic channel sections, Design considerations for sub critical and super critical flows, Design of culvert. Free surface flows, Specific energy and specific force. Chezy's and Manning's equations for uniform flow in open channel. Measurments of discharge & velocity – Venturi flume.

Hydraulic Machines : Reciprocating pumps, centrifugal pumps theory and Cavitation, Rotodynamic Machines, Pelton Turbine, reaction turbines, Francis and Kaplan type, Hydraulic turbines, Hydro Power development.

Part – B

Hydrology : Hydrologic cycle, Precipitation, Evaporation, Evapotranspiration, Infiltration process, Runoff characteristics of stream, mass curve. Hydrograph, Factors affecting flood hydrographs, hydrograph and its analysis, s-curve hydrograph, aquifers & its properties, confined and unconfined aquifers, rainwater harvesting and recharge.

Water Resources Engineering : Methods of Irrigation, Water requirement of crops, crop rotation. Canal irrigation, Parts of a canal system, Sediment Transportation, Irrigation channels and Design, silt theories: Kennedy's and Lacey's Design, Lining of Irrigation Canals, Economics of canal lining. Water Logging and Drainage Design, Regulation and control of canal system, Irrigation Outlets, river training works, Types of Head works, Failure of hydraulic structures, Principles of design, Bligh's theory, Khosla's theory for pressure and exit gradient. Design of Sarda type and straight glacis fall. Design of distributor head regulator and cross regulator, canal escape, Bed bars, Canal head works, Design of Weir, Barrage and Canal head Regulator, Cross drainage works: Necessity and types, design principles of cross drainage works, planning of dams and Reservoirs, Estimation of storage capacity, Earth Dams, Gravity dams, Spillways and their design.

Part – C

Transportation Engineering : History of road development, Geometric Design, Cross sectional elements, camber, shoulder, sight distance, horizontal curves, super elevation, extra widening, transition curves and gradient, vertical curves, summit and valley curves. Traffic studies on flow, speed, travel time – delay and O-D study, PCU, peak hour factor, accident study, traffic capacity, density, traffic control devices, Types of Pavements, Design of Flexible Pavement by CBR method, Design of rigid pavement, Westergaard theory, load and temperature stresses, joints, Wet mix macadam (WMM), Granular Sub Base (GSB), Tack Coat, Prime Coat, Seal Coat, Surface Dressing, Bituminous Macadam (BM), Cement Concrete (CC) raod construction.

Railways Engineering : Permanent Way and its Components, Type of rails, rail gauges, permanent way formation, coning of wheels, defect in rails, rail fastenings, fish plates, spikes, chairs, keys, bearing plates, sleepers, sleeper density, ballast, Track Geometrics, Turnouts and Crossings, Stations and Yards, Horizontal curves and super-elevation, transition curves, points and crossings, design of turnouts, types of crossings, stations and Yards, Signalling and Interlocking, Centralized train control system, ATS, principle types of interlocking, high speed track, airport planning & design, selection of site for an airport. Airports – layout and orientation, Runway and taxiway design consideration, geometric design, Zoning laws, traffic control, Runway lighting.

Part – D

Environmental Engineering : Population forecasting by various methods, Transmission of water, Storage and distribution of water, Physical, chemical and bacteriological examination of water and wastewater: Temperature, pH, colour and odour, solids, nitrogen and phosphorus, chlorides, toxic metals and compounds, BOD, COD etc. quality requirements, standards of water and waste water. Water treatment: screening, sedimentation, determination of settling velocity, efficiency of ideal sedimentation tank, design of settling tanks, grit chamber. Primary sedimentation and coagulation, filtration: theory of filtration; hydraulics of filtration; slow sand, rapid sand and pressure filters, backwashing; design of slow and rapid sand filters. Waste water treatment: unit operations, processes, Secondary and tertiary treatment, Anaerobic digestion of sludge, septic tank, up flow anaerobic sludge blanket (UASB).

Part – E

Surveying : Classification, Principles, distance, direction and elevation. Ranging. Meridians and Bearings, Methods of leveling, Booking, Reciprocal leveling, distance of visible horizon, Profile leveling and cross sectioning, Errors in leveling, plane table surveying, Contouring, Theodolite survey, Methods of horizontal and vertical control, Triangulation, Signals, Satellite station, corrections, Trigonometric leveling, simple circular curves, Transition curves – types, Vertical curves. Electronic Distance Measurement systems, Total Station – its advantages and applications, Global Positioning Systems Segments, working principle, errors, Geographic information system, Photogrammetry; basic principles, scale of a vertical photograph, relief displacement, relief displacement, flight planning, stereoscope and stereoscopy, parallax equations, Remote Sensing, Electromagnetic spectrum, atmospheric effects, image characteristics, Remote sensing systems, spectral signatures and characteristics, spectral reflectance curves, image classification, Applications of remote sensing to civil engineering.

4. ELECTRONIC ENGINEERING

PAPER-I

1. **Electronic Devices:** Energy bands in semiconductor, band-gap in direct and indirect semiconductors, P-N junction, Zener diode, clipping, clamping and rectifiers. Small signal equivalent circuits of diods,working of BJT, JEFT, MOSFET devices.
2. **Analog Circuits:** Diode circuits, amplifier models: Voltage amplifier, current amplifier, trans-conductance amplifier and trans-resistance amplifier. biasing schemes for BJT and FET amplifiers, bias stability, various configurations. High frequency transistor models, frequency response of single stage and multistage amplifiers. Oscillators: Review of the basic concept, Barkhausen criterion, RC oscillators (phase shift, Wien bridge etc.), LC oscillators (Hartley, Colpitt, Clapp etc.), non-sinusoidal oscillators. Op-Amp applications: Review of inverting and non-inverting amplifiers, integrator and differentiator, summing amplifier, precision rectifier, Schmitt trigger and its applications, active filters: Low pass, high pass, band pass and band stop, design guidelines.
3. **Advanced Electronics:** VLSI technology: Processing, lithography, interconnects, packaging, testing; VLSI design principles, MUX/ROM/PLA-based design, Moore & Mealy circuit design; Pipeline concepts & functions; Design for testability, examples.
4. **Network Theory and Basic Machines:** DC Circuits-Ohm's & Kirchoff's laws, mesh and nodal analysis, circuit theorems; Single phase AC circuits; Network graphs & matrices; Wye-Delta transformation; Linear constant coefficient differential equations-time domain analysis of RLC circuits; Solution of network equations using Laplace transforms-frequency domain analysis of RLC circuits; 2-port network parameters-driving point & transfer functions; State equations for networks; Steady state sinusoidal analysis.
Basics-DC machines, induction machines, and synchronous machines. Transformers and its efficiency.
5. **Digital Electronics:** Number representations: binary, integer and floating-point-numbers. Combinatorial circuits, Boolean algebra, minimization of functions using identities and Karnaugh map, logic gates, arithmetic circuits, code converters, multiplexers, decoders. Sequential circuits: latches and flip-flops, counters, shift-registers. Data converters; sample and hold circuits, ADCs and DACs. Basics of multiplexers, counters/registers/memories/microprocessors, design & applications.
6. **Control Systems:** Basic control system components; Feedback principle; Transfer function; Block diagram representation, Transforms & their applications; Signal flow graph; Frequency response; Routh-Hurwitz criteria, root loci, Nyquist/Bode plots;
Feedback systems-open & close loop types, stability analysis, steady state, transient and frequency response analysis; compensation; Lag, lead and lag-lead. State variable model and solution of state equations of LTI systems. Transient and steady-state analysis of LTI systems.
7. **Instrumentation:** Principles of measurement, accuracy, precision and standards; Analog and Digital systems for measurement, measuring instruments for different applications; Static/dynamic characteristics of measurement systems, errors, statistical analysis and curve fitting.
8. **Computer Organization and Architecture:** Basic architecture, CPU, I/O organisation, memory organisation, peripheral devices, trends; Hardware/software issues; Date representation & Programming; Operating systems-basics, processes, characteristics, applications. Microprocessors & microcontrollers, basics, interrupts, DMA, instruction sets, interfacing; Controllers & uses; Embedded systems.

PAPER-II

1. **Electromagnetics:** Elements of vector calculus, Maxwell's equations-basic concepts-differential and integral forms and their interpretation; Gauss', Stokes' theorems; Poynting vector: Wave propagation through different media; Transmission lines: equations, characteristic impedance, impedance matching, impedance transformation, S-parameters, Smith chart. Waveguides-basics, rectangular types, modes, cut-off frequency, dispersion, dielectric types; Antennas-antenna types radiation pattern, gain and directivity, return loss, monopoles/dipoles, gain, antenna arrays.
2. **Analog communication Systems:** AM, FM, transmitters/receivers, amplitude modulation and demodulation, angle modulation and demodulation, spectra of AM and FM, superheterodyne receivers.
3. **Digital communication basics:** Sampling, quanizing, coding, PCM/ DPCM, multiplexing audio/video; Digital modulation: ASK, FSK, PSK; Multiple access: TDMA, FDMA, CDMA;
4. **Digital Signal Processing :** Discrete time signals/systems, uses; Digital filters: FIR/IIR types, design, speech/audio/radar signal processing uses;
5. **Communication networks:** Principles/practices/technologies/uses/OSI model/security; Basic packet multiplexed sreams/scheduling; Cellular networks, types, analysis, protocols (TCP/TCPIP).
6. **Random signals and processes :**
autocorrelation and power spectral density, properties of white noise, filtering of randon signals.
7. **Information theory :** entropy, mutual information and channel capacity theorem, Huffman coding algebraic and convolutional coding.
8. **Microwave & satellite communication:** Terrestrial/space type LOS systems, block schematics link calculations, system design; Communication satellites, orbits, characteristics, systems, uses; Fibre-optics-Light propagation in optical fibre, fibre optic communication:fibre optics, theory, practice/standards, systems, block schematics, link calculations, system design.

5. CHEMICAL ENGINEERING

PAPER–I

(a) Fluid and Particle Dynamics

Properties of fluids, concepts of compressible and incompressible flow, Laminar and turbulent flows, Equation of continuity and Nervier-Stokes equation, Bernoulli's theorem, flow meters, fluid drag and pressure drop due to friction, Reynold's Number, friction factor and pipe roughness, pumps, jet ejectors, compressors, blowers, fans. Agitation and mixing of liquids/solids/pastes, screening, crushing, grinding, principles and equipments. Rittinger's, Kick's and Bond's laws, filtration and equipments. Free and hindered settling, concept of fluidization, transport of solids.

(b) Mass Transfer
Molecular diffusion, Fick's law of diffusion, mass transfer coefflecients, film and penetration theories, distillation, relative volatility, fractional distillation, plate and packed columns of distillation, calculation of theoretical number of plates. Liquid-liquid extraction, absorption & stripping, drying, humidification, dehumidification, leaching, crystallization, adsorption isotherms.

(c) Heat Transfer
Conduction, thermal conductivity, extended surface heat transfer. Free and forced convection, heat transfer coefficients, Nusselt number, co-current and counter current flow, LMTD, fouling factor. Design of double pipe and shell & tube heat exchangers, analogy between heat and momentum transfer, boiling and condensation, single and multiple effect evaporators. Radiation, Stefan-Boltzmann Law, emissivity and absorptivity, calculation of heat load of a furnace, Solar heaters.

(d) Advance Separation Processes
Fundamentals of separation process, equilibrium separation processes, ion exchange, electro-dialysis, reverse osmosis, ultra-filtration, molecular distillation, super critical fluid extraction.

(e) Process Equipment design
Basic design Procedures and theory, factors affecting vessel design, cost considerations, design of storage and pressure vessels, design of flat and elliptical head, design of supports, characteristics and selection of materials of construction.

(f) Process Dynamics Instrumentation and Control
Measuring instruments for level, pressure, flow, temperature, pH and concentration. Control variables, manipulated variable and load variables. Laplace transforms, transfer functions of first and second order systems, Block diagram representation, controllers and their transfer functions, stability of closed loop system, Routh array test, transient and frequency response, Bode plots.

PAPER–II

(a) Material and Energy Balance
Gas law, material balance without chemical reactions, material balance with chemical reactions, recycle/bypass/purge calculations, combustion of solid/liquid/gaseous fuels, energy balance calculations, heat of reaction, adiabatic flame temperature.

(b) Chemical Engineering Thermodynamics
Laws of thermodynamics, PVT relationship for pure components and mixture, Maxwells relations, Fugacity, activity and chemical potential, vapor liquid equilibria for ideal/non-ideal, single and multicomponent systems. Criteria for chemical reaction equilibrium, equilibrium constant and equilibrium conversions, heat engines, heat pumps, refrigeration and related cycles.

(c) Chemical Reaction Engineering
Molecularity and order of reactions, theories of reaction mechanism, kinetics of homogeneous reactions and interpretation of kinetic data. Ideal flow reactors(batch, mixed, plug flow) and their performance equations, series and parallel reactions, multiple reactor system, temperature and pressure effects. Heterogeneous reactions, catalytic and non-catalytic reactions, gas-solid and gas-liquid reactions, effectiveness factor, non isothermal reactors and reactor stability.

(d) Chemical Technology
Wood based chemicals, pulp and paper, sugar industry, edible oils extraction, soaps and detergents, biogas, coal and coal chemical, petroleum refining, (Atmospheric distillation/cracking/reforming), polyethylene's (LDPE/HDPE/LLDPE), PVC, Polystyrene, ammonia manufacture, cement and lime industries, paints and varnishes, glass and ceramics, alcohol and antibiotics, nitrogenous and phosphatic fertilizers.

(e) Environmental Pollution Monitoring & Control
Safety, Ecology and Environment, Sources of pollutants in air water, Green house effect, Ozone layer depletion, Acid rain. Micrometeorology and dispersion of pollutants in environment, water quality index (WQI), air quality index (AQI), measurement techniques of pollutant levels and their control strategies. solid wastes, their hazards and disposal techniques, Design and performance analysis of pollution control equipment, fire and explosion hazards, HAZOP and HAZAN, disaster management, environment protection acts.

(f) Process Engineering Economics
Fixed and working capital, cost estimation and comparison of alternatives. Net present value, pay back analysis. IRR, depreciation, taxes and insurance, break even point, PERT and CPM, profit and loss account, balance sheet and financial statement. Plant location and plant layout including piping.

6. COMPUTER SCIENCE

PAPER–I

1. Computer Organization and Architecture: Functional units of digital system and their interconnections, buses, bus architecture, types of buses and bus arbitration. Register, bus and memory transfer. Processor organization, general registers organization, stack organization and addressing modes. Arithmetic and Logic Unit, Control Unit, Memory, Input/output devices, interfaces and ports, Interrupts and exceptions. Modes of Data Transfer, Synchronous & asynchronous communication, standard communication interfaces.

2. Data Structures: Elementary Data Organization, Built in Data Types in C / C++/JAVA. Algorithm, Efficiency of an Algorithm, Time and Space Complexity, Asymptotic notations: Big Oh, Big Theta and Big Omega, Time-Space trade-off. Abstract Data Types (ADT), Arrays and Application of arrays, parse Matrices and their representations. Linked lists, Stacks, Queues, Searching and sorting, Graphs, Tree, Binary Tree and its applications, Hashing, B+ tree.

3. Discrete Structures & Theory of Logic: Set Theory, Relations, Functions, Natural Numbers, Proof Methods, Proof by counter – example, Proof by contradiction. Algebraic Structures, Lattices, Propositional Logic, Trees, Graphs, Combinatorics.

4. Database Management Systems: Database System vs File System, Database System Concept and Architecture, Data Model Schema and Instances, Data Independence and Database Language and Interfaces, Data Definitions Language, DML, Overall Database Structure. Data Modeling Using the Entity Relationship and enhanced E-R, Relational data Model and Language, Relational Algebra, Relational Calculus, Tuple and Domain Calculus. SQL, Data Base Design & Normalization, NoSQL, Transaction Processing, Concurrency Control Techniques, Web Interface to DBMS, OO database, Case Studies of commercial DBMS.

5. Design and Analysis of Algorithm: Algorithms and its analysis, Complexity of Algorithms, Growth of Functions, Performance Measurements, Sorting and Order Statistics, Red-Black Trees, B – Trees, Binomial Heaps, Fibonacci Heaps, Tries, Skip List, Divide and Conquer with Examples Such as Sorting, Matrix Multiplication, Convex Hull and Searching. Greedy Methods: Optimal Reliability Allocation, Knapsack, Minimum Spanning Trees – Prim's and Kruskal's Algorithms, Single Source Shortest Paths - Dijkstra's and Bellman Ford Algorithms, Dynamic Programming such as Knapsack. All Pair Shortest Paths – Warshal's and Floyd's Algorithms, Resource Allocation Problem. Backtracking, Branch and Bound techniques such as Travelling Salesman Problem, Graph Coloring, n-Queen Problem, Hamiltonian Cycles and Sum of Subsets. Algebraic Computation, Fast Fourier Transform, String Matching, Theory of NP-Completeness, Approximation Algorithms and Randomized Algorithms.

6. COMPUTER NETWORKS: Goals and Applications of Networks, Network structure and architecture, The OSI reference model, services, Network Topology Design, Physical Layer Transmission Media, Switching methods, ISDN, Terminal Handling, Medium Access sub layer - Channel Allocations, LAN protocols - ALOHA protocols - Overview of IEEE standards - FDDI. Data Link Layer - Elementary Data Link Protocols, Sliding Window protocols, Error Handling. Network Layer - Point - to Pont Networks, routing, Congestion control Internetworking -TCP / IP, IP packet, IP address, IPv6. Transport Layer - Design issues, connection management, Session Layer-Design issues, remote procedure call. Presentation Layer-Design issues, Data compression techniques, cryptography - TCP - Window Management. Application Layer: File Transfer, Access and Management, Electronic mail, Virtual Terminals, Other application. Internet and Public Networks, Peer to Peer Network.

7. Principles of Programming Languages, Role of Programming Languages, Programming Paradigms, Programming Environments, Language Description: Syntactic Structure, Language Translation Issues: Programming Language Syntax, Stages in Translation, Formal Translation Models, Data Types, and Basic Statements, Binding, Type Checking, Scope, Scope Rules , Lifetime and Garbage Collection, Primitive Data Types, Strings, Array Types, Associative Arrays ,Record Types, Union Types, Pointers and References , Arithmetic Expressions , Overloaded Operators, Type Conversions , Relational and Boolean Expressions, Assignment Statements, Mixed Mode Assignments, Control Structures, Selection ,Iterations, Branching, Guarded Statements, Subprograms and Implementations, Design Issues for Functions , Semantics of Call and Return, Implementing Simple Subprograms, Stack and Dynamic Local Variables, Nested Subprograms, Dynamic Scoping. Object-Orientation, Concurrency and Event Handling, Object Oriented Programming using C++ and Java, Functional and Logic Programming Languages.

8. SOFTWARE PROJECT MANAGEMENT: Fundamentals of Software Project Management (SPM), Software Project Planning, Software Project Estimation, Project Organization and Scheduling Project Elements, Project Life Cycle and Product Life Cycle, Ways to Organize Personnel, Project Schedule, Scheduling Objectives, Building the Project Schedule, Scheduling Terminology and Techniques, Network Diagrams: PERT, CPM, Bar Charts: Milestone Charts, Gantt Charts, Dimensions of Project Monitoring & Control, Earned Value Analysis, Earned Value Indicators: Budgeted Cost for Work Scheduled (BCWS), Cost Variance (CV), Schedule Variance (SV), Cost Performance Index (CPI), Schedule Performance Index (SPI), Interpretation of Earned Value Indicators, Error Tracking, Software Reviews, Software Quality Assurance and Testing, Project Management and Project Management Tools, Software Configuration Management, Risk Management, Cost Benefit Analysis, SPM Tools: CASE Tools, Planning and Scheduling Tools, MS-Project.

9. CYBER SECURITY: Information Systems, its types and development, Information Security and its Need, Threats to Information Systems, Information Assurance, Cyber Security, and Security Risk Analysis. Application Security: Database, E-mail and Internet, Data Security Considerations: Backups, Archival Storage and Disposal of Data, Security Technology:, Firewall and VPNs, Intrusion Detection, Access Control. Security Threats -Viruses, Worms, Trojan Horse, Bombs, Trapdoors, Spoofs, E-mail Viruses, Macro Viruses, Malicious Software, Network and Denial of Services Attack, Security Threats to E-Commerce- Electronic Payment System, e- Cash, Credit/Debit Cards. Digital Signature, Public Key Cryptography, Developing Secure Information Systems, Information Security Governance & Risk Management, Security Architecture & Design Security Issues in Hardware, Data Storage & Downloadable Devices, Physical Security of IT Assets, Access Control, CCTV and Intrusion Detection Systems, Backup Security Measures. Security Policies: Development of Policies, WWW Policies, Email Security Policies, Policy Review Process-Corporate Policies-Sample Security Policies, Publishing and Notification Requirement of the Policies. Evolving Technology Security – Mobile, Cloud, Outsourcing, SCM, Information Security Standards: ISO, IT Act, Copyright Act, Patent Law, IPR. Cyber Laws in India, IT Act 2000 Provisions, Intellectual Property Law, Software License, Semiconductor Law and Patent Law. Corporate Security

PAPER–II

1. OPERATING SYSTEMS: Operating System definition, function and services, Types and features, Operating System Structure- Layered structure, System Components, Reentrant Kernels, Monolithic and Microkernel Systems, System Calls types, System Programs, Process and Thread: process states, process control block, Inter process communication; Process Synchronization: Classical problems of synchronization, Concurrent Processes CPU Scheduling Criteria and Algorithms, Memory Management, File management, Device Management and Disk scheduling, File Management, UNIX Commands and utilities, Linux: System components, Process management, scheduling, memory management, Networking software layers, Security, various editors, I/O devices, IPC.

2. COMPUTER GRAPHICS: Types of computer graphics, Graphic Displays, Random scan displays, Raster scan displays, Frame buffer and video controller, Points and lines drawing algorithms, Circle generating algorithms and parallel version of these algorithms, Basic and Composite Transformations, Reflections and shearing. Windowing and Clipping, 3-D Geometric Primitives, representation, Transformation, projections and Clipping, Curves and Surfaces, Hidden Lines and Surfaces

3. ARTIFICIAL INTELLIGENCE: Introduction, Foundations and History of Artificial Intelligence, Applications of Artificial Intelligence, Intelligent Agents, Structure of Intelligent Agents. Computer vision, Natural Language Possessing, strategies, Informed search strategies and algorithms, Knowledge Representation & Reasoning, Machine Learning , Pattern Recognition.

4. COMPILER DESIGN: Phases and passes, Bootstrapping, Finite state machines and regular expressions and their applications to lexical analysis, Optimization of DFA-Based Pattern Matchers implementation of lexical analysis, Formal grammars and their application to syntax analysis, BNF notation, ambiguity, YACC. The syntactic specification of programming languages: Context free grammars, derivation and parse trees, capabilities of CFG, Parsing Techniques, Syntax-directed Translation, Symbol Tables, Run-Time Administration, Error Detection & Recovery, Code Generation and Code optimization .

5. SOFTWARE ENGINEERING: Introduction, Software life-cycle models, Software requirements, Requirements Specification, Software design and Software user interface design, Coding Issues, Software integration and testing, Software support processes and Quality Assurance, IEEE Software Engineering Standards , Software maintenance, Software reuse, SOFTWARE TESTING & AUDIT.

6. DISTRIBUTED SYSTEM: Characterization of Distributed Systems, Theoretical

Foundation for Distributed System, Distributed Mutual Exclusion, Distributed Deadlock Detection, Agreement Protocols, Distributed Resource Management, Failure Recovery in Distributed Systems, Transactions and Concurrency.

7. WEB TECHNOLOGIES: Introduction and Web Development Strategies, Protocols Governing Web, Writing Web Projects, Internet services and tools, Client-server computing. Core Java, Web Page Designing, XML, DOM and SAX, Dynamic HTML, Scripting, Networking, Enterprise Java Bean, Java Database Connectivity (JDBC), Merging Data from Multiple Tables, Servlets, Handling HTTP get and post Requests, Redirecting Requests to Other Resources, Session Tracking, Cookies, Session Tracking with Http Session, Java Server Pages (JSP)

8. IMAGE PROCESSING: DIGITAL IMAGE FUNDAMENTALS: Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels – Color image fundamentals – RGB, HSI models, Two-dimensional mathematical preliminaries, 2D transforms – DFT, DCT. IMAGE ENHANCEMENT: Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering– Smoothing and Sharpening Spatial Filtering, Frequency Domain: Introduction to Fourier Transform– Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters, Homomorphic filtering, Color image enhancement. IMAGE RESTORATION: Image Restoration – degradation model, Properties, Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering, IMAGE SEGMENTATION: Edge detection, Edge linking via Hough transform – Thresholding – Region based segmentation – Region growing – Region splitting and merging – Morphological processing- erosion and dilation, Segmentation by morphological watersheds – basic concepts – Dam construction – Watershed segmentation algorithm. IMAGE COMPRESSION AND RECOGNITION: Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, JPEG standard, MPEG. Boundary representation, Boundary description, Fourier Descriptor, Regional Descriptors – Topological feature, Texture – Patterns and Pattern classes – Recognition based on matching.

9. SOFT COMPUTING: Neural Networks, Fuzzy Logic and Genetic Algorithm(GA)

10. HIGH PERFORMANCE COMPUTING: Grid Computing, Cluster Computing, Beowulf Cluster, Cloud Computing.

7. PAINT TECHNOLOGY

PAPER–I

(a) Introduction to Surface Coatings and their Components

Surface coatings , Essential mineral and fixed oils, Modification of oils, Coating driers, Volatile solvents and other components, Safety, Health and environmental aspects.

(b) Material and Energy Balance in Paint technology

Gas law, Material balance without chemical reactions, Material balance with chemical reactions, recycle/bypass/purge calculations, Energy balance calculations, Heat of reaction.

(c) Fluid Flow Solid handling, Instrumentation and Control in Paint technology

Properties of fluids, Newtonian and Non-Newtonian fluids , Laminar and turbulent flows, Equation of continuity, Bernoulli's theorem, Free and hindered settling Flow meters, Pressure drop due to friction, Reynold's Number, Friction factor and pipe roughness, Pumps, Agitation and mixing, Free and hindered settling, Measuring instruments for level, pressure, flow, temperature, concentration. Laplace transforms, Transfer functions of first and second order systems, Block diagram representation, Controllers and their transfer functions.

(d) Technology of Inorganic Pigments and Extenders

Pigmentary properties, Inorganic prime pigments, Extender pigments, White and black pigments, Colour pigments.

(e) Technology of natural resins, alkyds and polyesters

Natural resins and their modification, Natural polymers and their modification, Introduction to synthetic polymers, Alkyd resins, Hydrocarbon and other resins.

(f) Technology of synthetic resins and polymers

Formaldehyde resins, Epoxy resins, Polyurethane resins, Silicone resins, Ethylene resins.

(g) Technology of organic functional and effect pigments

Colour phenomena, Industrial organic pigments, Classical AZO pigments , Metallic, functional and effect pigments, High performance and composite effect pigments.

PAPER–II

(a) Heat and Mass transfer in Paint Technology

Fundamental laws of conduction, convection and radiation , Co-current and counter current operations, Log mean temperature difference (LMTD), Different heat exchangers and their calculations, Molecular diffusion, Fick's law of diffusion, Mass transfer coefficients, Basics of distillation and extraction, Humidification and dehumidification.

(b) Characterization, Analysis and Evaluation of Coatings

Analysis of coatings and classification of their properties, Optical properties of coatings and complete application in colour development, Quality control, Physical, chemical and mechanical properties of coatings, Weather resistance and ageing properties of coatings.

(c)Technology of Formulation and Manufacture of Coatings

Coating additives and principles of coating formulation, Principles of coating manufacture, Heavy duty machines and ball mills, Attritors and high speed machines , Production planning, Factory lay-out, Safety health & environment , Computers and modeling in paint resin formulation.

(d) Technology of Surface Preparation, Treatments and Coating Application

Methods and equipments of surface preparation, Pretreatment and conversion coating, Coating application and electro-deposition, Curing of film, Effluent treatment, Waste management, Paint shop services, Paint defect and paint remover, Different paint additives and their role in paint technology, Packaging in paint technology.

(e) Technology of Printing inks

Printing process and nature of printing inks, Raw materials for printing inks , Testing and evaluation, Different types of inks for diverse industrial applications, Mixing and milling equipments, handling and storage.

(f) Technology of Industrial , automotive and specialty coatings

Clear finishes, primers and marine coatings, Appliance and heavy duty coatings, Novelty finishes, fire retardant coating, Automotive protection products Finishing and refinishing, Electro-deposition coatings, UV curable coatings, Powder and specialty coating.

(g) Technology of Architectural and Eco friendly coatings

Introduction to eco system, Architectural aspect of eco-friendly coatings, Architectural coating systems, Eco-friendly coating. Corrosion and its control in paint technology.

8. PLASTIC MOULD TECHNOLOGY

PAPER–I

(a) Fundamentals of Polymer Science

Classification of polymers, types of polymerization, degree of polymerization, glass transition temperature, morphology of polymers.

(b) Chemistry and Thermodynamics of Polymers

Monomers, monomer reactivity ratio and its significance, kinetics of polymerization, stereochemistry of polymers, block and graft co-polymers, laws of thermodynamics, open and close systems, thermodynamics of melting and polymers, thermodynamics of glass transition, thermodynamics of polymer solutions.

(c) Plastic Materials and Processing

Sources and manufacture of plastic raw materials, oefin polymers, vinyl chloride polymers, PMMA, polystyrene, cellulose polymers, epoxy plastics, polyurethane, silicones, extrusion, types of extruders, compression and transfer molding and its applications, calendaring and milling.

(d) Polymerization Engineering

Industrial methods of polymerization, types of polymer production processes and reactors, utility of catalysts in polymerization.

(e) Mould and Die Manufacturing

Types and applications of mould making, electrical discharge machining (EDM), Electroforming for mould manufacturing, heat treatment processes, various types of furnaces, hobbing for mould making, polishing technology in mould making, advantages and disadvantages of automation.

(f) Plastic Packaging Technology

Selection criteria for packaging materials, conversion process for packaging materials, process for flexible/rigid packaging, testing of plastic packaging.

PAPER–II

(a)Additives and Compounding

Evaluation and functions of additives, selection criteria, fillers, stabilizers, pigments, antioxidants, metal deactivators, thermal stabilizers, UV stabilizers, impact modifiers, colourants, fire retardants, coupling and blowing agents, plasticizers, applications of additives, estimation of additives.

(b)Polymer Composites

Introduction to composite materials, theory of composite materials, compounding of thermo plastics, fiber reinforced plastic (FRP) processing.

(c) Characterization of Polymeric Materials

Molecular characterization of polymers, thermal analysis techniques, x-ray diffractometry, principles of microscopy, UV-visible spectroscopy, FTIR spectroscopy, Gas chromatograph (GC), mass spectrometer, nuclear magnetic resonance spectroscopy (NMR).

(d) Polymer degradation and plastic waste management

Thermal degradation, mechanical and ultrasonic degradation, photo degradation, degradation by high energy radiation, biodegradation, plastic waste generation and separation techniques, processing of plastic waste, recycling of thermoplastics and thermosets.

(e)Rheology of Polymers

Properties of fluids, Newtonian and Non-newtonian fluids, shear stress and strain, viscoelasticity, rheometers and viscometers, rheology of polymeric liquids, rheology in polymer processing operations.

(f) Diverse Applications of Polymers

Structural and semi structural applications, biomedical application, specialty polymers, conducting polymers, polymer nanomaterials.

9. TEXTILE TECHNOLOGY

PAPER-I

1. Textile Fibre-I: Textiles fibres & their classification, general properties of fibres, cultivation/production, structure & properties of cotton, jute, linen, wool, silk, & other natural fibres, identification of fibres by different methods, molecular weight & its determination, concept of orientation & crystallinity, concept of Tg & Tm & its determination. high performance fibres, high strength high modulus fibre, aramid fibres, carbon fibres, thermal & chemical resistant fibres, elastomeric fibres, biodegradable fibres, their manufacture, properties & application.

2. Yarn manufacture-I: Sequence of cotton & its blends, ginning of cotton, objects of opening & cleaning, role of blow room machines & their principle of operation, carding: Objects, functions & working principle & process parameters of cotton card, woolen & worsted cards, Objects, principles & process parameters of draw frame for cotton & its blends, process sequence of combing, principle of combing, calculations related to blow room, card, draw frame, & comber, objectives, functions & working of gill boxes, calculations pertaining to blow room, card, draw frame, comber & gill box. Role & function of autoleveller in card & draw frame, types of defects & remedies during blow room, carding & draw frame.

3. Fabric Manufacture-I: Objects of preparatory process, different types of winding machines & their working principles, objects of warping, different types of warping machines & their principles of operation, objects of sizing, sizing ingredient, different types of sizing machines & their working, defects in winding, warping & sizing & their remedies, calculations pertaining to winding, warping, sizing & beaming, weft knitting machines, different types of weft knitted structures & machines, basic warp knitted structure, underlap & overlap, principles of Tricot, & Rachel machines, calculation pertaining to weft & warp knitting, process control in knitting.

4. Chemical processing-I: Objective, singeing techniques, their merits and demerits, Desizing: objectives & mechanism of desizing, desizing evaluation, scouring of natural, manmade and blended textiles, Evaluation of scouring efficiency, carbonisation of wool. degumming of silk, bleaching of cotton, silk, wool, man-made fibres and blended textiles, estimation of bleaching, objectives, concepts of mercerization, concept of color, additive, Application of direct, reactive, vat, solubilized vat and sulphur dyes on cellulose fibres, application of acid, basic and metal complex dyes on wool and silk. auxiliaries used in dyeing.

5. Textile Testing-I: Objective of testing & sample size, methods & principles involved in testing of fibre properties, like moisture, length, fineness, tensile strength, maturity, yarn testing : count, strength, tenacity, unevenness, hairiness, principle involved in testing of various fibre &yarn properties.

6. Technical textiles: Types of technical textiles, textiles for filtration, protective textiles, medical textiles, smart textiles, geo textiles building material etc.

PAPER-II

1. Textile Fibre-II: Textile Fibre-II: Regenerated & synthetic fibres, concept of polymerization & manufacturing process of regenerated & synthetic fibres by melt, dry, wet & dry-jet wet spinning methods, structure & properties of regenerated & synthetic fibres & their uses, concept of as spun, POY & FOY, objectives & principles of different methods of texturing & process parameters involved in texturing, concept of drawing & heat setting & process parameter of drawing & heat setting.

2. Yarn manufacture-II: Principles & process parameters of speed frame & rubbing frame, objectives & working of ring frame, & mechanism involved in drafting, twisting &

winding at speed frame & ring frame, Spinning of long staple fibres like jute, wool, & silk etc, Objects of doubling, types of doubling systems, Calculations pertaining to speed frame, ring frame & doubling & TFO. & new spinning systems, principle involved in rotor spinning, principle of operation of DREF-II & DREF-III machines, principle & mechanism of air-jet, air vortex, ply-fil, wrap, electrostatic spinning, textured yarn manufacture. Idealized helical geometry, packing of fibres in a yarn, fibre migration.

3. Fabric Manufacture-II: Different methods of fabric manufacturing- woven, knitted & non-woven, Types of shuttle loom & their mechanism, role & working of tappet, dobby & jacquard & their developments, picking, beat-up, let off & take up mechanism in loom, role & working of various stop motions, features of automatic shuttle looms, different types of shulleless loom viz; air-jet, water-jet, rapier, projectile & their principle & mechanism, elements of fabric geometry, Classification of non-woven fabrics, principles of web formation, web characteristics and their influence on properties, bonding techniques, needle punching, spun bonding techniques, application of different types of non woven structures.

4. Fabric Structure & design: Basic elements of fabric design, plain, twill, sateen, huck-a-back, weaves their derivatives construction, objectives of extra warp & weft design, warp backed & weft backed design, different types of double cloth construction, geometrical & floral design, damask & brocade design, tapestry structure, basis of carpet & textile design, Indian Motif, Historical, aesthetical, traditional textile, Jamdani, Bandhani, Batik prints, digital printing, screen printing, block printing, colour forecasting of carpet & textile Design, computer aided design & its importance.Fabric geometry, square & jammed structure, fabric deformation under stress.

5. Chemical processing-II: Dyeing of polyester with disperse dye, nylon with acid dye, acrylic with cationic dyes, methods of dyeing blends, characteristics of printing paste ingredients, classification and mechanism of thickeners, printing methods, styles of printing, printing after treatments, objects & types of finishing, mechanical finishing, chemical & functional finish, mechanism, flame retardant finishes, water repellent finishes etc.

6. Textile Testing-II: Fabric testing: gsm, thickness, cover, air permeability, moisture & water transmission, wetting & wicking properties, compressibility, tensile, tear & bursting strength, abrasion & pilling resistance, FAST & KESF properties etc.

10. FOOTWEAR TECHNOLOGY

PAPER-I

UNIT-I

INTRODUCTION TO LEATHER TECHNOLOGY

Various fibrous and non fibrous proteins, Non proteinous skin components. General physical and chemistry of proteins. Chemical constitution of hides and skins. Reaction of proteins with acids, bases and salts.

Primary structure of collagen, effect of enzymes on collagen.

Keratin, Reticulin, Elastin, histology of hides and skins-cell, tissue, fibers, muscles, glands, epidermics, pretanning process-soaking, liming, deliming, bating, degreasing, pickling & depickling.

Concept of tanning and leather, leather properties dependent on tanning, Vegetable tannins and vegetable tanning, classification of vegetable tannins, vegetable tanning materials and their properties, hydrolysable and condensed tannins, Mechanism of vegetable tanning, process of vegetable tanning, synthetic tannins, chrome complexes and their structures, method of chrome tanning, preparation of chrome liquors & Powders, mechanism of chrome tannage. Study of Aluminum, Zirconium, Iron, Titanium, Sodium silicate & Polyphosphates. Theory of neutralization, Combination tannages.

Principle of color chemistry, classification of leather dyes, color matching, theory and mechanism of dyeing, oils, fats, classification and types of leather finishes, pigments, binders, intro cellulose lacquers, wax emulsions, silicon emulsion.

Tannery effluents, effluent disposal, leather machinery-different machine used in leather processing. Anatomy of human foot, closing, making of footwear, classification of leather goods, method and material for construction.

UNIT-II

TESTING AND QUALITY CONTROL

Chemical analysis of pelts and Leathers: Principles and methods of analysis of limed and pickled pelt, chemical testing of vegetable tanned/chrome tanned/aluminum tanned/zirconium tanned/ formaldehyde tanned, combination tanned leathers.

Physical Testing of Leather: Sampling position for physical testing of leather. Different methods employ for physical testing of leather.

Principle involved in Static and Dynamic methods of non destructive testing of leathers. Different methods in testing of colour fastness of leathers.

Standards and quality Control: Quality control in leather processing, Rectification of defects in hides, Skin and Leathers, control of yield, color and finish of leather etc. Physical and chemical characteristics (standard specifications) of various types of leathers.

Analysis of Footwear and Leather Product.

UNIT-III

LEATHER PRODUCTS TECHNOLOGY

Overview: Classification of leather Goods & Garments. Selection of materials Grading and assorting of Leathers for Leather Goods & Garments. Property Requirement for Leather and Lining materials, Accessories for leather Goods and garments.

Cutting: Hand and Machine Cutting, Pattern interlocking, various types of assembly Techniques, skiving, splitting, folding, Sewing Quality Control measures in Leather products manufacture.

Machinery needs for Leather Goods Manufacture, Various types of Sewing machines-Flat Bed, Post Bed, Clicking, Splitting, Skiving, folding, embossing.

General information about Sports Goods, Harness & Saddlery Industry. Classification of Leather Based Sports Goods like Football, Hockey Ball, Cricket Ball, Sports Gloves, Wicket keeping Gloves, Sports Goods Bags.

Harness and Saddlery such as jumping, riding, racing, reins, Halters, Bridles Stirrups, Noseband, Martingales. Special types of leathers manufactured for sports goods, Harness and Saddlery and their Characteristics.

Organisation & Management: Project feasibility Reports, costing and pricing for leather goods& garments. Total Quality management. Analysis of International market trends.

UNIT-IV

MATERIAL OF FOOTWEAR MANUFACTURE

1. LEATHER: Upper material (Natural and Man made) Different types of leather, used in shoe manufacturing, their characteristics and properties.

2. FABRIC: Classification, fabrics used for upper lining, side lining, backer, taping, Socking, toe puff and their characteristics, use of elastic in footwear.

3. RUBBER: (Soling Material/Sole) Utility of rubber in shoe industry and types of rubber used in footwear and their identification, characteristics, rubber sole, crepe sole, moulded rubber sole microcelluor, rubber sole, synthetic and resin rubber soles, Rubber compounding, mixing and vulcanization. Polymers.

4. FIBRE BOARD: Different types of fiber board, Classification of leather board, characteristics of different types of leather boards for insole, stiffener toe puff and heel. Utility and use of paperboard; different types of paper board. Insole and types of materials.

5. SYNTHETIC MATERIAL: PVC,PU,TPR poromerics, EVA and Filon materials, their properties and uses.

6. WOOD AND METAL: Wooden and metallic heels, platform logs and shanks : Types of wood and metal used and their characteristics.

7. ADHESIVES: Types of adhesives, basic materials used in formulation of adhesives like starch glue, latex, rubber solution, chloroprene based adhesive polyurethane, reoprere etc. Bonding strength of adhesives, time of setting comparative study of adhesives available in the market. Selection of adhesives for cemented construction.

8. GRINDERIES, SOLE AND SOLING MATERIALS: Eyelets, rivets, hob nails of different heads, pinel pins, tingles made of different metals like iron, brass and their suitability and longevity. Special type of rivets used in selective type of footwear, brass screw, brass and steel staple and their use in footwear spikes used in sport shoes, shank, stll toe cap and their use in special type of footwear, bottom - filling, materials like cement, elastics laces, EVA, Cork sheet, Saw Dust leather waste. Padding materials decorative fittings for footwear, different types of threads used in footwear manufacturing, Types of Niddles.

9. FINISHING MATERIALS: Creams and waxes of different varieties and their use in formulation of finishing materials like sole polish, heel hand ball, upper dressings, polishes and creams of different colours. Glazing materials, lacquers, binders, resines, plasticizers etc. Material used in the formulation of glazing material such as rosin, sundras, shellac and the solvents required for their preparation.

UNIT-V

FUNDAMENTAL OF FOOTWEAR TECHNOLOGY AND FOOTWEAR DESGN

FOOTWEAR MATERIALS AND COMPONENTS: Different types of upper and lining leathers; Different types of soling materials; Different types of adhesives used in footwear industry; Kinds of insole boards, Grinderies; Fasteners; Shoe dressing materials etc.

DESIGN AND PATTERN DEVELOPMENT: History of shoe; Purposes and styles; Fashion & designs; Preparation of standards and section for men, ladies & children; Classic and other types of shoes and boots.

CUTTING, PRE-CLOSING AND CLOSING: Principles of cutting – Hand, machine; Clicking room design and management. Checking incoming work, stitch making, skiving, punching and gimping, heat embossing, flow moulding, toe puff attachment, attaching linings and scrims, trimming linings, finishing off closed seams. Top line and other edge treatments, local reinforcements, attaching fasteners and trims

PRELASTING AND LASTING: Principles and methods of pre-lasting and lasting for different types of construction; Sole attaching; Lasted margin; Upper preparation; Sole preparation; Sole cementing; Upper 76 cementing; Bottom fillers and shanks; Adhesive drying, Heat activation, Spotting, Pressing, Last slipping, Health and safety, Quality control and fault finding problems- solving.

METHODS OF SHOE CONSTRUCTION: Various methods of shoe construction; shoe room techniques.

ANATOMY OF HUMAN FOOT: Bones, Joints, Arches, Ligaments, Skin.

FOOT DISEASES AND ABNORMALITIES.

FOOT MEASUREMENT AND INTERNATIONAL SIZE SYSTEM.

LAST.

PAPER-II

UNIT-I

SELECTION OF SITE, FOOTWEAR AND LEATHER GOODS MACHINERY

1. Selection of Site: Location of footwear and leather goods manufacturing units. Factors influencing site selection such as availity of power, transport, market, labour, raw materials.

2. Footwear and Leather Goods Machinery: General construction, descriptive idea of various footwear and leather goods machinery such as

(a) Pattern making machine
(b) Hand press
(c) Upper and bottom clicking press(Hydraulic/Pneumatic)
(d) Belt cutting machine
(e) Upper and bottom splitting machine
(f) Skiving machine
(g) Folding machine
(h) Industrial sewing machine (flat bed, cylinder bed, post bed, heavy duty, zigzag)
(i) Punching and eyeleting machine
(j) Trade mark embossing machine
(k) Fore part lasting m/c
(l) Side lasting machine
(m) Seat lasting veldschoen
(n) Upper roughing machine
(o) Bottom roughing machine
(p) Cementing press
(q) Pounding machine
(r) Sole screwing machine
(s) Sole & heel trimming machine
(t) Combined finishing machine
(u) Spray booth with compressor
(v) Heel attaching machine
(w) Double operating Press (D.O.P. machine)
(x) Double needle stitching machine
(y) Lasting machine (To & side lasting machine)
(z) Sole Press M/c (Hydraulic/Pneumatic), Heat Setter and Chiller

3. Footwear Plant Maintenance:

(a) Functions of maintenance department
(b) Maintenance procedures - preventive maintenance, Routine maintenance and breakdown maintenance of footwear and Leather goods machineries and accessories.
(c) Lubrication and oiling procedures in routine maintenance and development lubrication charts.
(d) Fabrication and repair of components for breakdown maintenance.
(e) Estimating the repair and maintenance cost.
(f) Safety - Definition, importance, causes of accident, accident prevention rules, general safety devices.

4. Selection of machinery for different capacities of production, conveyor system of working in upper making and assembly.

UNIT-II

CONCEPT OF FOOTWEAR TECHNOLOGY

1. A historical review of the footwear industry and its impact and importance in modern life particularly in relation to all type of gents, ladies and children shoes of every day use. Modern trends and development in foreign countries. Purpose of shoes in every day life.

2. Machines and tools employed in the upper and bottom clicking departments.

3.Various stages of footwear manufacture as: Upper clicking : Principles of clicking, marking and cutting of paper patterns and leather components of shapes, design tightness strength, uniformity, economy and control of material consumption. Condition of knife, way of cutting, planning of cutting arrangements, inter-locking locking continuity when cutting, over cutting, identification, marking and correct pairing. Cutting of fabrics by different system i.e. wrap system, welt system and bias system of cutting and lining marking. Advantages and disadvantages of Hand and press clicking. Qualities of a good clicker.

4. Introduction to constructions such as Good year welted, silhou welt Lock stitch through sewn welt, fair-stitched, moccasion machine sewn (Black or Mekay) cemented riveted screwd and stitched, turnshoe, veldschoen, sliplasted, direct moulded construction, injection moulding; DVP, DMS. Strobel construction, Machine strobel construction, Stitch down constant.

5. Bottom cutting and preparation of bottom stock Correct placing of cutting knives in accordance with their requirements, quality and thickness of the components for maximum economy, characteristics of different bottom components used.

Important point to be considered while cutting the bottom components, systematic cutting of different components from the appropriate portions of sole leather sides.

Preparation of bottom stock and the importance of correct preparation of bottom components. Sorting, splitting, insole preparation for welted shoes. Preparation of the toe puffs/stiffeners, tampering of bottom components and its effect on manufacturing processes. Leather unit soles (PVC coated)

6. Stamping and marking of cut components.

7. Economical methods of clicking and reduction in wastage.

8. Methods of estimating quantity of raw material required for upper lining and bottom component and calculation of upper cost.

UNIT-III

UPPER CLOSING AND FINISHING OPERATIONS

Upper closing: Checking of pairs and identification marks before commencing major operation in closing department.

Punching: To start the closing of components, decoration and punching.

Skiving: Close seam skive, under lay skive and turning in skive. Purpose and importance of skiving by hand and machine, their merits and demerits.

Edge treatment: Purpose and affects of edge treatment. Types of edge treatment. Raw-edge, burnished edge, folded edge, bound edge, gimped edge, slipbeaded edge and bagged edge.

Ornamentation and its purpose: Kinds of ornamentation - Fancy seam, multi seam, Braiding, corded seam. Ornamental lacing, stitching along edges. Embroidering and performing.

Reinforcements: Taping, backing, staying and stay stitching. Their purpose, importance and effects.

Jointing of upper and lining section for upper closing :

Different kinds of seam plain close seam, silked or open stirched seam, lapped seam use and importance in shoe upper closing. Types of stitches-lock, chain, and zigzag stitch. Difference in seam and stitch. Threads used in closing room.

Finishing operations: Cleaning, Edge beating, trimming, eyeleting and checking the quality of closed uppers, description and sequence of operations of upper closing of court shoe, Mocassion shoe.

Durby shoe and Oxford shoe. Machines and tools and devices employed in the upper closing department.

UNIT-IV

LASTING, MAKING AND FINISHING OF LEATHER PRODUCT

Lasting and Making: Preparation of awl. Types of stitches required for various purposes. Relation of awl stitches and threads to material and size of stitches. Principles of drafting and its importance in lasting of shoes of different constructions (Welted, veldt shoes) welt attaching by hand and machine (staples shank fitting, bottom filling, sole attaching by hand and machine, bottom leveling, sole nailing.)

Modern methods of footwear construction including direct moulded, injection moulded and cemented unit sole: Purpose and relative merits of the various methods of footwear construction in relation to their use. Importance of conditioning, damping, mulling, heat setting and drying. Detailed study of cemented shoe construction. Adhesives and machines used in cemented construction.

Finishing: Upper leather dressing, cleaning and shoe lacing, Heel attaching and top piece attaching by hand and machine. Different types of edge trimming, fore part and waste trimming, heel scouring, heel front buffing, inking, edge setting by hand and machine, bottom buffing, bottom finishing, upper leather cleaning and dressing, fitting and sock, shoe lacing, checking and packing for different types of footwear.

The aims and objects of finishing, their utility. The relation between heel pairing and heel scouring, edge trimming and setting, common faults in finishing.

Inspection recognition and elimination of faults. The use of heat and heat effects in shoe processes. Various tools, equipments and machinery employed for finishing. There use and general maintenance. The vital parts of machines and their minor adjustments.

Material used for packing, individual and trend ship packing. Export packing, use of fungicides for export packing. Defect removing methods- such as wrinkles on lining twisted back strap, High and low quarters, Soft toe and back, soft stiffener etc.

UNIT-V

COMPUTER AIDED LEATHER PRODUCT DESIGN

Anatomy of human foot, Function of the foot, Foot comfort and Common foot abnormalities, Foot and Last measurement, Shoe sizing system and fittings. Designing and pattern making, Different types of footwear, Various components of footwear, Basics concepts of design and pattern cutting, Grading methods, Various allowances, Applications of computer aid designing, Materials of leather products- Selection of leather and non-leather materials for different components of footwear and garments. Basic methods of cutting different components, Tools and equipment for clicking, marking, skiving, edge Treatments, fitting, stitching and types of stitches, closing of simple uppers.

Different method of footwear construction, Cemented, Direct vulcanized, Injection-moulded, Veldschoen, Machine welted, Slip and sting Lasted, Finishing and Trimming operation, Classification of Leather goods, Type and selection of materials, Methods of construction, Tools and Machinery. Classification of leather, Material selection criteria for leather garments. Lining materials, Factors such as light weight, Porosity, Water absorption, Accessories metal fittings for garments, Designing methods, Various components, Preparation of Standards & pattern of Garment/Material.

Computer aided design, CAD, CPU, Data storage, Input/output devices, Function of CPU, Main memory and backup storage devices, Selection of Input/output devices, Operating system, Application of software for Footwear.

11. TEXTILE CHEMISTRY

PAPER-I

1. Fibres-I: Textiles fibres & their classification, general properties of fibres, cultivation/production, structure & properties of cotton, jute, linen, wool, silk, & other natural fibres, identification of fibres by different methods, molecular weight & its determination, concept of orientation & crystallinity, concept of Tg & Tm & its determination.

2. Principal of Yarn and Fabric Manufacture:- Objectives of ginning, mixing & carding process, drafts (actual & mechanical) and draft constant, quality of web and neps etc., Objectives of Draw frame, passage of material on modern draw frame machine, Concept of draft, Comber, speed frame, ring frame, drafting twisting and winding on ring frame, double apron drafting system on ring frame, warping process, winding process, brief description of modern sizing machine, Passage of material on handloom and power loom, Comparison between shuttle and shuttleless looms.

3. Testing: Objective of testing & sample size, methods & principles involved in testing of fibre properties, like moisture, length, fineness, tensile strength, maturity, yarn testing : count, strength, tenacity, unevenness, hairiness, principle involved in testing of various fibre &yarn properties.

4. Preparatory process of Textiles:- Natural and added impurities in grey fabric, singeing-its object and various types of singeing, introduction to various preparatory processes for cotton, wool, silk, nylon, polyester, acrylic and their blends. wool: scouring, decatizing, desizing- its objects, various desizing methods with its advantages &disadvantages, scouring of cotton fabric: conventional and bio-scouring, Kiers –various types of kiers and their working. Objectives of bleaching, various types of bleaching agent such as NaOCl, CaOCl2 and H2O2, NaClO2. Bleaching chemistry and mechanism, batch wise, semi continuous and continuous bleaching processes: J-box, Continuous bleaching range (CBR). methods used for determination of degradation of cotton during scouring and bleaching such as copper no., methylene blue absorption method, cuprammonium fluidity etc. optical whitening agent and their applications. objectives of mercerization, physical and chemical changes in cotton due to mercerization, various methods of determination of efficiency of mercerization.

5. Technology of Dyeing:- Classification of dyes according to the methods of application, general theory of dyeing, various method of dyeing- Batch, Semi continuous, Continuous dyeing. dyeing of cellulosic fibres with direct dyes, reactive dyes., vat dyes, solublised vat dyes, sulphur dye, dyeing of protein fibres – silk and wool with different types of acid dyes –its advantages and limitations, metal complex dyes- 1:1, 1:2, metal complex, chrome dyes-pre, post & simultaneous mordanting, basic dyes., dyeing of synthetic fibres: polyester-carrier, HTHP& thermosol method, acrylic dyeing with basic dye, dyeing of nylon and their blends, problems associated with dyeing, common fault and their remedies, mechanism of dyeing, role of fibre structure in dyeing, heat of dyeing, entropy of dyeing, kinetics of dyeing –diffusion coefficient, diffusion in steady state and non steady state, rate of dyeing.

Mass coloration of man made fibres viz, polyester, nylon, acrylics, viscose, Dyeing machinery- Jet dyeing m/cs, Beam dyeing, Soft flow m/cs, Infra colour dyeing m/cs, closed jiggers and continuous dyeing ranges, Control and rectification of various problems in High temperature dyeing, thermo fixation process – pad liquor preparation, dyeing theory of nylon, leveling agents, swelling agents, faults and remedies in nylon dyeing.

6. Textile Chemicals and Quality Testing:- Quantitative chemical analysis of textile fibres and their blends, quantitative estimation of bleaching agents and dyes. colour fastness of dyes on textiles (wash, light, rubbing, hot press, perspiration) using National and International standards (BIS, AATCC, ISO), evaluation of wet treatments. evaluation of various chemicals, auxiliaries used in wet processing plants, analysis of fresh water and effluent, measurement of viscosity of chemical ingredients, printing paste, instruments used in chemical analysis. process and quality control in wet processing.

PAPER-II

1-Fibre:- Regenerated & synthetic fibres, concept of polymerization & manufacturing process of regenerated & synthetic fibres by melt, dry, wet & dry-jet wet spinning methods, structure & properties of regenerated & synthetic fibres & their uses, High performance fibres, their manufacture, properties & application.

2- Fabric testing: gsm, thickness, cover, air permeability, moisture & water transmission, wetting & wicking properties, compressibility, tensile, tear & bursting strength, abrasion & pilling resistance.

3-Chemistry of Dyes and Colour Chemistry:- Colour and chemical constitution, Classification of dyes based on constitution, Different types of chromophores., unit organic process/operation- sulphonation, nitration, amination and halogination, synthesis of major dye intermediates, azo dyes: Diazotisation and coupling reactions, azoic colours, acid dyes, mono azo dye; diasazo, nitro, diphenylamine and anthraquinone dyes; acid mordant dyes, azo metal complex dyes, direct dyes. vat dyes: indigoid, anthraquinonoid and polycyclic quinonoid dyes; solubilised vat dyes. sulphur dyes and sulphurised vat dyes, reactive dyes: chlorotriazine and other halo heterocyclic compounds, vinyl sulphone based dyes, high fixation, highly substantive dyes, neutral fixing reactive colours, pigments- phthalocyanine pigments, other organic and inorganic pigments, optical brightening agents- fluorescence and phosphorescence, fluorescent brighteners for different fibres.

4-Theory of dyeing and Colour Measurement:- Evolution of theories of dyeing. fundamentals of kinetics and thermodynamics of dyeing, diffusion of dyes, methods for measurement of diffusion coefficient, effect of fibre structure on dyeability and diffusion of dyes, thermodynamic parameters like affinity and heat of dyeing, thermodynamics of dyeing cotton with direct dye, glass transition temperature and its influence on dyeing. source of natural light, sources of artificial light, CIE illuminants, absorption & scattering of light. Beer-Lambert law, Kubelka-Munk's Equation. Computer aided Colour matching and recipe prediction.

5-Technology of Printing:- Introduction to printing, methods and styles of printing, classification of printing thickeners and methods of thickeners paste preparation, emulsion thickeners, synthetic thickeners, and mechanism of viscosity build up in emulsion and synthetic thickeners, Rheological behavior of thickeners., preparation of cloth for print paste preparation, wetting agents, hygroscopic chemicals dispersing agents, oxidative and reducing agents etc., precautions. methods of printing - block printing, roller printing, roller engraving and chroming, Screen printing- preparation of screens, rotary screen printing, rotary screen preparation-manual and photosensitive, its

method of application, merits and demerits. Faults and prevention in printing methods, General methods of print fixation, and machines used for after treatment of printing goods steaming, ageing, curing etc., Pigment printing of cotton, binder emulsion, print paste recipe and steps involved., Various styles of printing- direct, resist & discharge style of printing of cotton using direct, reactive, vat and indigosol colours.

Printing of wool and silk with different dye classes such as reactive, acid, metal complex dyes using the above styles. Printing of synthetic and blends- Printing in different styles on polyester, nylon, acrylic and their blends such as P/V, P/C, wool/acrylic, wool/nylon and different types of union fabricscotton/wool, cotton/silk etc with different dye classes., Other techniques of printing like raised, metal and flock printing, Poly chromatic dyeing, foam printing, bubble printing etc. Spray printing, Tie and dye, Batik printing, Brasso printing. Transfer printing- fundamental principles of transfer printing, Sublimation transfer printing of polyester, machines used. Digital printing - Inkjet printing, concept and practice. , Printing of non wovens -carpets, hosiery goods and bonded goods, camouflage printing.

6-Technology of Finishing:- Objective of textile finishing, principle of finishing of cotton, wool, silk and linen. Classification of finishing – (a) Mechanical, Chemical, finishes. Finishing machines – mangle & their function, drying machines, mechanical finishes- Stentering, calendaring, Sanforising, decatising, embossing, seuding, compacting, raising., Beetling of linen, crimping of cilk & rayon, finishing of woollen fabrics- dry wet decatising, crabbing, felting, milling, permanent setting, shrink proofing, and special finishing of silk. Heat setting -objects, types of setting, mechanism of temporary set and permanent set, structural changes brought about by heat setting, heat Setting conditions of various yarns and fabrics, industrial practices of heat setting of polyester and its blends, various methods to determine the degree of heat setting, softeners and hand builders - desirable properties and various classes of softeners, properties, comparison of various softeners, classification of stiffeners, examples and their application, energy efficient technology-low liquor application, spraying, powder coating and foam technology, blow ratio, foam generator, stabilizer, applicator.

Mechanism of creasing and theory of anticrease finish, wash-n-wear, low and no formaldehyde cross linking agents, application of BTCA and CA, Evaluation of wrinkle resistance, concept and mechanism of flame retardandcy, flammability of textile fibres. concept of LOI. flame retardant and flame proof finishes on natural fibres, synthetics and blends, phosphorylation and phosphonylation, use of halogen derivatives, evaluation of flame retardancy, soil release finish – mechanism of soiling, steps of soil release and theory, different soil release finishes, soil repellency, fluorocarbons and teflon finish, standard test methods for the finish effect, water proofing and water repelling, mechanism of water repellency, chemistry and application of silicones, testing of water repellence Antimicrobial finishing, chemistry of various antimicrobial finishes, application and evaluation., Nano Finishes:- Concept of nano phase materials, various types of nano finishes, caracterization and their application in textiles: e.g. self cleaning, anti bacterial, UV protection nano finishes.

12. LEATHER TECHNOLOGY
PAPER-I

UNIT-I

Microscopy and Becteriology

History: Histology of hides and skins-cells,, tissues, fibers, muscles, glands, epidermis, dermis etc. histological characteristics of buffalo and cow hides, goat and sheep skins, reptiles skins.

Compound Microscope: Mechanical and optical part of compound microscope, image formed, defects in eye pieces and their rectification etc. different types of microscopes.

Microscopical slides: Preparation of microscopical slides, finishing and hardening, embedding, sectioning, staining and counting the photomicrography.

Fiber Structure and Assessment: Orientation of fiber, structure in curing, soaking, limping, picking tanning and optimal conditioning of fiber structure in various types of leather assessment of leather.

The Bacterial Cell and its Internal Structure: Nutrition of bacteria and the preparation of culture media. Metabolism and respiration of bacteria-sterilization-effect of environment upon bacteria-isolation and identification of bacteria classification of bacteria usually found ion hides and skins-bacterial proteolysis disinfections and disinfectants-bacteriology of curing soaking, liming and bating.

Mycology: Isolation, identification and classification of fungi associate with leather processing, Morphology and physiology of fungi, Mycological problems of leather industry and their prevention.

Entomology: Influence of the following parasite diseases, skin leather quality and their prevention, warbles ticks, mosquito lice, insect damage to dry hides and skin caused by hide beetles and moths and their prevention.

Leather Biotechnology: Chemistry of DNA & RNA, structure conformation, classification of enzyme,essentials of biotechnology, restriction of enzyme.

UNIT-II

SKIN COMPOSITION, PROTEIN AND PRE-TANNING PROCESS

Chemical Constituents of hides and skins: Variation fibrous and non-fibrous proteins, non-proteinous skin components.

General and physical chemistry of proteins: with special reference to hide proteins, chemical constituents of hides and skins, reaction of proteins with acids, base and salts.

Structure of collagen: primary structure of collagen, amino acid composition, molecular conformation amino acid sequence in collagen in relation to molecular conformation- X-ray diffraction pattern, the triple helix structure, electron microscopy of the collagen fiber.

Aggregation phenomenon of collagen: precipitated form of collagen, Kinetics of fibril formation.

Thermal transition: Thermal transition in collagen and their relation with amino acid composition and environmental-temperature, Denaturation temperature, Mechanism of Denaturation process, Renaturation of gelatin solution.

Effect of enzymes on collagen: Collagenasis, proteolytic enzymes, selective proteolysis and telopeptides.

Reactive groups in collagen: Modification of reactive groups of collagen modified proteins.

Other skin properties: Keratin, Reticulin, elastin- their chemical composition, structure and functions, nonfibrous skin proteins.

Non proteinous skin components: Lipids, carbohydrates vitamins, mineral constituents.

Pre-tanning process: Flaying, curing, defect of hides and skins, chemistry and principle of different pretanning process- soaking, liming, deliming, bating, degreasing, pickling and depickling process control.

UNIT-III

INORGANIC AND ORGANIC TANNING

Theory & behavior of group elements: Werners co-ordination theory, behaviour of group elements, chromium, Aluminium, Zirconium, Iron, Titanium, Difference between salts of these elements.

Chrome Tanning: Chromium complexes and their structures, study on the phenomena of hydrolysis, olation, oxolation, polymerization of chrome complexes, masking principle of masking, affect of masking on chrome tannage, Method of chrome tannage, preparation of chrome liquors and powders, influence of reducing agent on nature of chrome complexes mechanism of chrome tanning, variable parameters of chrome tanning.

Vegetable tanning: Mechanism of vegetable tanning, factors affecting vegetable tannage, process of vegetable tanning.

Aluminium Tanning, Zirconium Tanning, Neutralization, Combination Tannage.

Collagen Tanning: Concept of tanning, leather properties of dependent on tanning.

Vegetable tannins, Hydrolysable tannins, Condensed tannins, Biosynthesis of plant polyphenols, Synthetic tannins, Resin and Polymeric Tannages, Aldehyde tannage.

UNIT-IV

POST TANNING AND FINISHING OPERATION FOR LEATHER MANUFACTURING

Chemistry of Bleaching and Mordanting agent: Dyeing: Principles of colour chemistry, Classification of leather dyes, Blending of dyes, Principles of color matching, Theory and mechanism of dyeing, Dyeing methods, Light fastness of dyeing, Dyeing auxiliaries such as leveling agents, wetting agents, Dispersing agents and Dye fixatives.

Leather Auxiliaries : Fat Liquoring agents, Pigments, Binders, Lacquers.

Washing, Neutralization, Oil, Fat and Fat liquoring.

Water Proofing.

Finishing Materials: Properties, Chemistry and methods of preparation of Nitrocellulose lacquers and lacquer Emulsions, Wax emulsions, Silicone emulsions.

UNIT-V

LEATHER PROCESSING

Processing of Leather From Goat skins: Glazed kid, resin uppers, glazed uppers, shoe suede, garment suede, Lining leathers. Chamois leathers, printed leathers, morocco and book binding leathers, E.I. Goat skins and their dressing into different types of leathers.

Processing of Leather From Sheep Skins: Vegetable tanning and chrome tanning of sheep skins, conversion into different types of finished leathers-sheep nappa, garment, suede, uppers. Lining leathers, glove leathers, diaphragm leathers.

Exotics and others:

Reptile leathers, hair on tanning and dressing of fur skins.

Upgrading of leathers:

Retanning special finishing effects for up gradation of lower ends like Embossing, screen printing block printing, transfer film finishing, seal and Sink finish, popcorn effect, punching etc. Roller coating and other modern equipments, Burnishable and oil pull up leathers

Heavy Leathers: Vegetable tanned sole leathers, Bag tanning, different types of finished leathers, Belting leathers, Harness and saddlery leathers, Chrome and waxed soles, picking band leathers. Picker and apron leathers, Hydraulic and pneumatic leather such as hand pump leathers.

Leather for liquification plants for air, Oil seal, Gas, etc. Sports Goods leathers like Football. Rugby ball, Volley ball, Hockey ball, Cricket Ball etc. Gloves leathers for wicket keepers, Batting, Boxing etc).

Light Leather: Full chrome retan, hunting suedes, softies, nappa, and burnishable Upper leathers, Printed, Shrunken grain and upholstery leathers Water proof and water repellent upper leather, Nubuk and white leather. E.I. tanning, dressing of E.I. tanned leathers in to upper, lining, Bag leather, leather for leather goods kattas, bunwar etc.

Different types of leathers using chrome splits, Formulation and different dyestuffs, fat liquors, retaining agents.

PAPER-II

UNIT-I

ANALYSIS OF WATER AND DIFFERENT CHEMICALS USED FOR MANUFACTURING OF LEATHER

Analysis of water: Type of water – principle of analytical method employed in analysis of water effect of hardness of water on various processes in leather manufacture softening of water.

Water Analysis: Temporary hardness, Permanent hardness, Total hardness, Chloride content, Sulphate content, Iron content.

Analysis of Various Chemicals and Auxiliaries used in Leather Processing: Analysis of common salt, Analysis of lime-available lime, Total bases, Analysis of sodium sulphide, Aluminum salt, Deliming agents, Bates, Neutralizing agents. Oils and Fats, sulfated oils, soap, fat liquors and other auxiliaries like resin binders, wax emulsions etc.

Analysis of Liquors of beam House Processes: Soak liquor, Analysis of used lime liquors-lime, sodium sulphide, salt content and Analysis of pickle liquor.

Analysis of Tanning Agent: Vegetable tanning materials and extracts, chrome extracts and liquors, zirconium and Aluminum Tanning agent, formaldehyde, Analysis of bate, Analysis of oils, moisture, acid value, saponification value, iodine value, unsaponifiables, Analysis of sulphate oils-moisture, pH, acid value, total alkalinity organically combined SO3, Na groups.

UNIT-II

PHYSICAL, CHEMICAL AND INSTIRUMENT ANALYSIS OF LEATHER AND QUALITY CONTROL OF LEATHER

Chemical analysis of pelts and Leathers: Principles and methods of analysis of limed and pickled pelt, chemical testing of vegetable tanned/chrome tanned/aluminum tanned/zirconium tanned/ formaldehyde tanned, combination tanned leathers.

Physical Testing of Leather: Sampling position for physical testing of leather. Different methods employ for physical testing of leather. Principle involved in Static and Dynamic methods of non destructive testing of leathers. Different methods in testing of colour fastness of leathers.

Standards and quality Control: Quality control in leather processing, Rectification of defects in hides, Skin and Leathers, control of yield, colour and finish of leather etc. Physical and chemical characteristics (standard specifications) of various types of leathers.

Instrument Analysis: Potentiometry, non-aqueous titrations, conductometry chromatography, spectrophotometry and colorimertry, ion-exchange resins, electrophoresis. Principles and their application analysis.

UNIT-III

TANNERY POLUTION AND TREATMENT

Pollution: Types of water pollution, physical, chemical, physiological and biological pollutants,Pollution effects of land ground after, surface water, aquatic life and sea.

Tannery Effluents: Types of tannery effluents, characteristics of effluents from Beam House Process, tan yard process and finishing yard process- Estimation of OD, BOD, COD, heavy metals(Ca, Cr, Pb and Hg) and total dissolved solids in waste water.

Primary treatments: Waste water drainage and collection system in tanneries, screens, equalization of waste water, primary treatment unit.
Secondary Treatment Systems: Lagoon treatment, aeration systems, trickling filter, design criteria, Biotechnology in effluent and disposals.
Effluent Disposal: Types of effluent disposal, standards and specification Indian Standards, specification for industrial effluent discharge.
Water for Tanning: Water for tanning process, recovery and reuse of water in tanning Industry, utilization of treated effluents.
Solid Waste Management: Solid wastes from tanneries origin and disposal, utilization sludge disposal from treatment system.

UNIT-IV

LEATHER TRADE ENGINNERING

Clutch mechanism, crank-slide and straight motion and lever mechanism and development of tannery machines.
Balancing and Vibration - their application in high speed slicking action for helically bladed cylinders, Bush, ball, roller and ring oil bearings, cam, springs and their application and function in tannery machines.
Development of hydraulic and pneumatic steering mechanisms accessories and control applied to tannery machines, air compressors, dust control equipment, blowers, etc. Automatic controls and their application in all Instruments, drying mechanisms and different types of dryers.
Detailed study of Beam-house, tanning and finishing machines, their description, construction with sketch, selection, Foundation and Erection of machinery. Latest development of leather processing vessels Internal transport, safety precautions, power, water and steam distribution, drainage and disposal in tanneries.
Maintenance of tannery buildings: Electrical, steam and water lines, tanning machinery, routing prevent maintenance, automatic and mechanization of tanneries.

UNIT-V

LEATHER PRODUCT TECHNOLOGY AND COMPUTER AIDED DESIGN

OVERVIEW: Classification of leather Goods & Garments. Selection of materials Grading and assorting of Leathers for Leather Goods & Garments. Property Requirement for Leather and Lining materials, Accessories for leather Goods and garments.
CUTTING: Hand and Machine Cutting, Pattern interlocking, various types of assembly Techniques, skiving, splitting, folding, Sewing Quality Control measures in Leather products manufacture.
Machinery needs for leather goods manufacture.
Organization, Classification of leather based sports goods.
Anatomy of human foot, Function of the foot, Foot comfort and Common foot abnormalities, Foot and Last measurement, Shoe sizing system and fittings. Designing and pattern making, Different types of footwear, Various components of footwear, Basics concepts of design and pattern cutting, Grading methods, Various allowances, Applications of computer aid designing, Materials of leather products- Selection of leather and non-leather materials for different components of footwear and garments.
Computer aided design, CAD, CPU, Data storage, Input/output devices, Function of CPU, Main memory and backup storage devices, Selection of Input/output devices, Operating system, Application of software for Footwear.

13. INSTRUMENTATION AND CONTROL

PAPER-I

Basic Circuit Analysis :
Kirchoff's Laws – DC and AC circuits, Mesh and Nodal analysis for DC and AC circuits; Thevenin's, Norton, Superposition and maximum power transfer theorem; Magnetically coupled circuits; Transient response of RL, RC and RLC circuits. Characterization of two networks, Three phase circuits-balanced and unbalanced, phasor diagram of voltages and currents.
Electronic Devices and Circuits:
Diode, BJT, JFET, MOSFET-Structure, operation and Characteristics; LED,Laser Diode, Zenor diode-characteristics; Amplifiers-Small signal model analysis of CE, CB, CC amplifiers, gain and frequency response, multistage amplifiers, differential amplifiers; feedback amplifiers and oscillators; A/D and D/A converters, Boolean algebra, logic gates, design of arithmatric circuits, flip-flops, counter and shift registers.
Digital Signal Processing:
Classification of signals-continuous and discrete; energy and power, mathematical representation of signals; classification of system-continuous, discreate, linear, causal, time variance, stable, dynamic, spectral density, aliasing effect; Analog fitter design, bilinear transformation, Discrete Fourier Tansform, FIR and IIR fitter realization.
Basic Instrumentation Engineering:
Introduction to instruments and their representation, Functional elements of measurement system, classification of instruments, standards and calibration, measurement system performance static characteristics-Error analysis, loading effect, Dynamic characteristics.
Transdueers and Smart Sensors:
Classification of transducers, selection of transducers, characteristics of transducers, mathematical model of transducers-zero, first and second order transdueers response to impulse, step, ramp and sinusoidal inputs, variable resistance, inductance and capacitance transducers; LVDT, strain gauges temperature transducers construction, characteristic and applications; capacitive and piezoelectric transducers – frequency response, Hall effect transducers, photo detectors, digital transducer; smart sensors, fibre-optic sensors, MEMS, Nano Sensors.
Industrial and Analytical Instrumentation:
Pressure, flow, temperature, liquid level- Principle of Operation, installation and maintenance; calibration, measurement of force, torque, velocity, vibration, humidity, viscosity and density; spectrophotometers (UV and IR); pH meters, conductivity meters; Analysers (O_2, NO_2, H_2S), Chromatography, NMR spectroscopy, X-ray spectres copy and mass spectrometer.
Microprocessor and Microcontroller :
8085 and 8086 processor – Hardware, architecture, pinouts, functional building blocks of processor, memory organization, I/O parts and data transfer concepts, timing diagrams. Programming of 8085 Processor; 8051 Microcontroller-Hardware Architecture, pinouts-Functional building blocks, I/O parts and data transfer concepts, timing diagram, Interupts, Comparison to Programming Concepts with 8085, Peripheral Interfacing-Study and need, architecture, configuration and interfacing with ICs 8255, 8259, 8254, 8237, 8251, 8279; A/D and D/A converter interfacing with 8085 and 8051; Microcontroller Programming and applications-Data transfer, Manipulation, Control Algorithm and I/O Instructions-Simple programming exercises, key board and display interface – closed loop control of servo motors, stepper motor control, washing machine control.

PAPER-II

Control Systems :-
Open and closed loop systems, mathematical modeling of physical systems, Electrical analogy of mechanical and thermal systems, transfer function – Synchros, AC and DC servomotors – block diagram reduction techniques, signal flow graphs, Time response, time domain specifications, types of test input; first and second order system response, error efficient, steady state error; Root locus construction, Effects of P, PI, PID modes of feedback control, time response analysis, Frequency response – Bode Plot, polar plot, Correlation between frequency domain and time domain specifications – Effects of Lag, lead and lag-Lead compensation on frequency response; stability and compensator design – Characteristic equation, Routh-Hurwitz Criterion; Nyquist stability Criterion, state variable analysis , concept of state variables, solution of state and output equation in controllable canonical form – concepts of controllability and observability.
Power Electronics :-
Power Semiconductor devices – Study of switching devices, Diode, SCR, TRIAC, GTO, BJT, MOSFET, IGBT – Static and dynamic characteristics – triggering and commutation circuit for SCR, Design of driver and snubber circuit; Phase controlled converters – 2-pulse, 3-pulse and 6-pulse converters; Gate circuit schemes for phase control – dual converters, DC to DC Converters – Step-up and Step-down Chopper Control strategy; force commutated chopper; voltage commutated, currant commutated, load commutated, switched mode regulators – Buck, boost, buck-boost converters, AC to DC Converters, Inverters – single phase and three phase inverters.
Electrical Machines and Drives :-
DC machines – generators – construction, principle of operation, types, emf equation, open circuit, Internal and external characteristics. DC motors – principle of operation – back emf, need for a starter. Single phase transformers – construction, principle of operation, phasor diagram, losses, SC and OC test, efficiency and regulation. AC Machines – 3 Phase induction motor – Construction and principle of operation, torque-slip characteristics. Synchronous machines – Alternator and motor – Construction, operation and applications. Single phase induction motors. DC drives and AC drives. DC and AC servomotor, synchros, stepper motor – Construction and working
Process Control Instrumentation:-
Introduction to process control : Process control block diagram – control system evaluation, Signal conditioning (analog). Final control operation – signal conversion (analog to digital), Actuators (electrical, pneumatic and hydraulic) – Control elements (mechanical, electrical and fluid valves). Discrete state Process Control; Characteristics of the system, discrete state variables, process specifications. Controller principles: Process characteristics – control system parameters – discontinuous controller modes – two position, multiposition, floating control mode, Controller modes – Proportional, Integral and derivative Control mode. Analog controller, computer based control. Pneumatic controllers. Control loops : control system configurations – dead time process – Capacity, describing functions, dead Zone, Dead band, Cascade control, Feed forward control – load balancing, steady – state model, ratio control, inverse Control. Process loop turning : Control system quality. Process loop tuning – closed loop method, ultimate method (Ziegler Nichols method), damped oscillater method, process reaction curve method, frequency response method, comparing turning method.
Logic and Distributed System :-
Components of PLC – advantages over relay logic – architecture of PLC – Programming devices; discrete and analog I/O modules, programming languages – ladder diagram, programming timers and conters, design of PLC, Program control instruction, math instructions, sequence instructions : Use of PC and PLC, application of PLC, SCADA – data acquisition system, supervisory control, direct digital control, DCS – architecture, comparison, local control unit, Process interfacing issues, communication facilities, operator interfaces – low level and high level operator interfaces, operator displays, engineering interfaces – low level and high level engineering interfaces.

14. ARCHITECTURE

PAPER-I

1.BASIC DESIGN & ARCHITECTURAL DESIGN
Role of an Architect in the built environment; Building process; Role of other professional in building; Architects act, C.O.A., I.I.A., NASA; Form and Transformations – Understanding and application of Additive, Dimensional, Subtractive concepts. Order in Architecture – Understanding and Application of Geometrical, Structural, Dimensional, Material, Spatial Order etc. Anthropometrics Studies – Understanding and application of human dimensions and functions; Space-activity relationships; Understanding of measure drawings etc. Elements of Space making – Understanding and application of elements of space making e.g. Floor, Wall, Door, Window, Column, Stairs, Roofs etc.
2.BUILDING MATERIALS
Complete understanding of constituents, properties and application of traditional building materials e.g. Mud including stabilized earth, Burnt Brinks, Brick Tiles, Brick Ballast, Surkhi, Lime, Cement, Sand etc. Complete understanding of application of building materials e.g. Timber and its Classification, Characteristics, Defects, Preservation; Hardware e.g. Hinges, Handles, Knobs, Bolts, L-drops, Locks, Stoppers, Stays, Silencers, Chain guards, Closers, Catchers, Knockers etc. in various materials; Damp Proofing Courses e.g. Asphalt, Bitumen, Synthetic, etc.;
Cement Concrete and its types (Plain & Reinforced), Mixing, Curing, Water Cement Ration, Qualities and Workability etc.; Stone and its classification, availability, characteristics and application etc. Surface (Wall) Finishing & Painting and Polishing – Types and application of plasters; Jointing and Pointing; Cladding; Preparation of variety of surfaces; Application of various coats; Finishes – Lime/Colour wash; Dry distemper; Oil bound distemper, Cement paints; Acrylic emulsions; Synthetic enamels; Wall textures etc. Polishes and Varnishes. Roof Coverings and their constituents, properties and application of – Clay Tiles (Country, Allahabad, Mangalore tiles etc.); Stone Slating; Shingles; Thatch etc. Timber Products and their constituents, properties and application of – Variety of Plywood; Ply-board; Block board; Particle board; Wood wool cement board; Fiberboard; Compressed straw board; Cement fiberboard; Mineral fiber board; Veneers; Laminates etc. Glass & Ceramics Glass and their constituents, properties and application of – Translucent; Transparent and Special glasses; Glass bricks; Patch fittings for glazed partitions and shutters. Ceramics and their constituents, properties and application of – Terracotta; Faience; Fireclay; Stoneware; Earthware; Vitreous China; Porcelain etc. Adhesives and their constituents, properties and application of – Natural Adhesives – Animal; Casein; Bituminous etc. Thermoplastic Adhesives – Polyvinyl Acetate etc. Thermosetting Adhesives & Plastics – Urea Formaldehyde; Phenol Formaldehyde; Melamine Formaldehyde, Resorcinol Formaldehyde; Epoxide Resins etc. Rubber Adhesive.

3.BUILDING CONSTRUCTION

Element of Building – Terminology, Nomenclature of various parts of building from foundation to roof. Brick Work – Brick Terminology; Simple Bonds e.g. English bond & Flemish (single and double) bond in brick work for up to two brick thick walls; Details at quoins and junctions in English bond and Flemish bond for up to two brick thick walls; Details of piers (attached and detached); Buttresses; Lintel and Sill; Special Bond – Rat Trap Bond; Brick jaalis; Corbelling; Coping; String courses; Arches in brick and stone; Elementary principles; Centering; Cavity walls etc. Foundation – Its Need; Design criteria; Foundation concrete; Details of simple spread foundations for load bearing walls of various thicknesses up to two brick thick etc. Timber – Elementary carpentry; Common joints; Details of framed, ledged, braced and batten doors etc. D.P.C. – Horizontal and Vertical D.P.C. etc. Stone Work – Elementary Stone Masonry; Types of joints; Random, Course and Ashlar Stone Work in walls etc. Door, Window & Ventilator (Timber) – Types and details of Panelled door shutters and Mosquito proof door shutter; Types of Windows & Ventilators and details of glazed window and ventilator shutters and frames etc. Roof Terracing – Complete process of laying of terracing with provisioning of Gola & Khurra etc.; Lime concrete; Mud phaska with brick tiles; Brick coba etc. Temporary Timbering – Timbering of shallow trenches. Door (Timber Products) – Types and details of Flush door shutter with finishes. Door (Operational Mechanism) – Understanding of operational mechanism (automatic and manual) of variety of Sliding door shutters; Sliding-folding door shutters and Revolving doors shutters. Partition – Terminology; Partitioning methods with use of different materials e.g. Timber and Timber Products, Clay and Terracotta Brick/Block, Pre-cast Concrete Block, Wood Wool Cement Board, Compressed Straw Board, Glass and Glass Brick. Panelling (Timber & Timber Products) – Terminology; Panelling methods with use of materials e.g. Timber and variety of timber products. Brick Work Temporary Constructions - Shoring (Raking, Flying and Needle); Underpinning etc.

4.ARCHITECTURAL DRAWING

Basic Technical Drawing – Concept and types of line; Division of lines and angles; Drawing polygons; Inscribing and circumscribing circles in polygons; Drawing geometrical curves helix; Conoid etc. Orthographic Projections – Vocabulary and concepts of Planes of Projections, First angle projections, Projection of points, Lines and planes in different positions; Projection of regular rectilinear and circular solids (prisms, pyramids, cones, cylinders, spheres etc.) in different positions; Sections of regular rectilinear and circular solids (prisms, pyramids, cones, cylinders, spheres etc.) in varying conditions of sectional plane etc. Development of Surfaces – Vocabulary and concepts of cubes, prisms, cylinders, pyramids, cones and spheres etc. Solid Geometry – Vocabulary and concepts for construction of section, Intersection and interpenetration of solid forms.

5.APPLIED MECHANICS AND STRUCTURAL DESIGN

Elements of Statics – Force, Law of parallelogram of forces, Law of triangle of forces, Polygon Law of forces, Resolution of forces; Resultant of number of concurrent coplanar forces; Condition of equilibrium; Moment of force; Moment and arm of couple; Theorems on couples. Simple Stresses and Strains – Elasticity; Stress; Strain; Types of stresses; Elastic limit; Hook's law, Modulus of elasticity; Modulus of rigidity; Bulk modulus; Stresses in composite bars/section; Modular ratio; Equivalent area of a compound section; Primary or Linear strain; Poison's ratio; Shear stress; Principal stresses and strains (for simple cases); Mohr's circle etc. Centre of Gravity & Moment of Inertia – Methods of finding out center of gravity of simple figures; Centre of parallel forces; Important theorems; Calculation of moment of inertia of different shapes and its application; Moment of inertia of composite sections etc. Shear Force and Bending Moments – Shear force and Bending moment calculation and their diagrams for cantilever and simply supported beam and overhanging beam. Stresses in Beams – Simple beams bending; Section modulus; Moment of resistance; Shear stress in section of beam etc. Stresses in Trusses – Perfect frame; Deficient frame, Redundant frame; Type of supports and their reactions; Analysis of cantilever and simply supported trusses by Analytical method, Method of sections and Graphical method etc. Torsional Stress in circular shaft – Pure torsion; Theory of pure torsion; Torsional moment of resistance; Assumptions in the theory of pure torsion; polar modulus; Power transmitted by a shaft; Torsional rigidity etc. Plain Cement Concrete – Concrete mix; Curing and strength of concrete; Effect of temperature; Shrinkage; Fatigue; Concrete mix; Curing and strength of concrete; Effect of temperature; Shrinkage; Fatigue etc. Deflection of Beams (Cantilever and Simply Supported) – Calculation of slope and deflection by Double Integration; Macaulay's Method and Moment area Method; Conjugate beam method etc. Column and Struts – End conditions; Buckling and critical loads; Slenderness ratio; Various column theories; Stress distribution of the section of an eccentrically loaded rectangular column; the middle third rule; Core or kernel of section (Rectangular and Circular sections) etc. Elastic Theorems & Energy Principles and its Application in Simple Cases – Strain energy stored due to axial loading and due to bending; Law of reciprocal deflections; Betti's law; The first theorem of Castiglione; The second theorem of Castiglione etc. Statically Indeterminate Structures – Degree of indeterminacy; External and internal indeterminacy; Calculation of degree of indeterminacy for beams and frames etc. Fixed Beams – B.M. Diagram for a fixed beam for various loading; Effects of sinking of support; Advantages and disadvantages of fixed beams etc. Continuous beams – Clapeyron's theorem of three moments for two to three span of continuous beam; Effects of sinking of support etc. Moment Distribution Method – Basic Proposition; Relative stiffness; Analysis of continuous beams and portal frames for simple loading etc. Slope Deflection Method – Basic concepts; Basic formulae; Application to analyse Continuous beams and Portal frames for simple loading etc. Introduction to Design Methods – Working stress design; Ultimate load design; Limit state design; Limit state design versus Working stress design; Building code etc. Limit state design method – Understanding of Limit state; Characteristic strength and characteristic load; Design values; Partial safety factors; Factored loads; Stress strain relationship for concrete and steel; Yield stress; Provisions of IS codes; Loads and Load combination. Detailing of Reinforcement – Requirements of good detailing; Nominal cover to reinforcement; Spacing of reinforcement; Reinforcement requirements; Reinforcement splicing; Anchoring reinforcing bars in flexure; Curtailment of tension reinforcement in flexural members; Bar bending schedule etc. Analysis & Design of Singly & Doubly Reinforced Rectangular sections and Flanged Beams section – Bending of beam assumption; Moment of resistance; Modes of failure; Maximum depth of neutral axis; Limiting values of tension steel & moment of resistance etc. Shear and Development Length – Shear stress; Diagonal tension; Shear reinforcement; Spacing of shear reinforcement; Development length; Anchorage bond; Flexural bond etc.

6.ART IN ARCHITECTURE

Vocabulary of art; Relevance of art in architecture; Elements of Design – Line, Direction, Shape, Size and Form etc. Principles of Design – Unity, Texture, Colour, Tone Direction, Proportion, Form and shape, Solids and Voids etc. Different eras and movement in Art and their association with Architecture – Renaissance; Baroque; Realism; Impressionism; Fauvism; Cubism; Expressionism; Surrealism etc. Contemporary arts and artist in India – Works of Rabanindra Nath Tagore, Nand Lal Bose, Jamini Roy, Amrita Sher Gill, M.F. Hussain, Satish Gujral, S.H. Raza etc. Suitable materials for murals, sculptures, furniture, pottery and fountains for indoors and outdoors.

7.ECOLOGY & ENVIRONMENT

Vocabulary of ecology and environment; Basic concepts of ecology; Ecological factors – light & temperature, precipitation, humidity, gases/wind, topography etc; Global warming & climate change; Loss of bio-diversity; Desertification; Deforestation etc. Ecosystem – Kind of ecosystem; Structure; Function and energy flow of ecosystem; Ecological succession; Ecosystem development; Climax concept etc. Soil – Edifice Factors – Definition of soil; Formation of soil; Soil profile; Classification; Soil complex; Soil depletion, degradation and conservation; Relation of soil and build environment etc. Water Regimes – Water in nature; Water balance problem; Surface/ground water; Sources of water pollution; Ground water pollution; Marine pollution; Prevention control of pollution; Conservation & management; Impact of human intervention on water. Air Pollution – Kinds of air pollution; Sources of air pollutants; Effects – Depletion of Ozone; Acid Rain; Prevention & control of air – pollution; Noise pollution; Effect of human habitat and human activity on atmosphere etc. Built Environment and Ecology – Interrelationship between man, nature and built-form etc.

8.SURVEYING

Vocabulary of surveying & leveling; Principles of surveying; Units of measurement; Scale; Signs convention etc. Chain Survey – Instruments used; Types of chain; Instruments for ranging, Setting out angles; Erecting perpendiculars; Selection of station; Methods of taking offset and Obstacles in chaining etc. Plane Table Survey – Plane table and accessories; Methods of plane table survey – Radiation; Intersection; Traversing and resection etc. Compass Survey – The prismatic compass; Surveyor compass and its uses; Reduced and whole circle bearing; Magnetic declination; Effect of local attraction etc. Leveling & Contouring – Types of level; Booking and reduction of levels; Profile & cross section leveling; Errors in leveling etc. Theodolite – Definition of different terms; Temporary adjustments; Uses of instrument; Measuring horizontal and vertical angles; Method of repetition; Extension of lines etc.

9.BUILDING SERVICES

WATER SUPPLY

Vocabulary of water supply; Need to protect water; Requirements of water supply to different types of buildings; Sources of water supply; Quantity and quality of water; Conveyance and distribution of water; Overhead tank; Underground tanks; Pipe appurtenances; Hot and cold water supply system in a low rise and high rise buildings; Distribution system in campus; Pipes and their size; Jointing and different fittings etc. Rainwater harvesting in buildings and building premises etc.

SANITATION

Vocabulary of sanitation; Purpose and principles of sanitation; Collection and conveyance of waste matter; Quantity and Quality of refuse; Design and construction of sewer's and sewer appurtenances; Garbage and sewage disposal; Roof and surface water drainage; Rain water storage and water harvesting principles and methods; Sanitary appliances; Traps their variety; Pipes and joints; Sanitary pipes works below and above ground level. Knowledge of plumbing and sanitary system for a residence.

ELECTRICAL

Terminology and architectural symbols (as per NBC/NEC) for electric installations in buildings; Need to generate and save electricity; Transmission and distribution of electricity (single and three phases); Procuring service connection etc. Lighting accessories – Wires and cables; Metering; Distribution panels/boards etc. for single and three phase supply; Guidelines for installation of fittings etc. Design of simple light and fan circuits; System of connection of appliances and accessories e.g. series and parallel connection; Joint box system; Looping-in system etc. Various types of internal wiring systems e.g. cleat, casing and capping, batten and conduit (surface & concealed). Protection against excess current, short circuit earth fault and protection against electric shock; Various types of protection devices e.g. switches, fuses and circuit breakers; Need for earthing of domestic fittings and appliances; Earthing and its relation with soil resistivity; Earth electrodes; Earth wires etc. Load assessment and selection of appropriate cross section of the conductor.

ILLUMINATION

Terminology and units; Light and its characteristics – scattering, propagation, transmission, reflection, absorption, refraction and dispersion of light; Electromagnetic spectrum and visible radiation. Types of illumination schemes e.g. Ambient, Task, Focal and Decorative etc; Design considerations for illumination Schemes. Methods for lighting calculation – Watts per square meter, Light flux and Point to point method. Sources of light (Electrical) – Incandescent; Halogen; Low pressure (fluorescent, compact fluorescent, sodium, cold cathode neon); High pressure (mercury, metal halide, sodium); LED; Fiber optics etc. Types of Luminaries – Indirect; Semi-indirect; General diffusing; Semi-direct and Direct etc. Electrical and Illumination needs for individual spaces e.g. Living room, Dining room, Bed room, Kitchen, Toilet, Staircases and Corridors etc. Types of electrical luminaries; e.g. Recessed mounted luminaries, Spot/Projectors; Surface mounted luminaries; Decorative luminaries; Pendant luminaries; Free-floor-standing luminaries; Up lights; Trunking lighting systems; Down Lights etc.

AIR CONDITIONING SYSTEMS

Vocabulary of air conditioning services; Principles of Air Conditioning System Design; Refrigeration Cycle; Psychometric chart; Cooling load etc. AC systems – Comfort cooling systems & their working – Unitary air conditioning – window AC & split AC; Package AC system; Evaporative cooling systems; Central air conditioning their parts – A.H.U.; Cooling plant; Cooling tower etc. Air Distribution Systems – Fans; Filters; Fan coil units; Ductwork; Outlets; Dampers etc.

LIFT SERVICES

Vocabulary of lift services; Average travel lift carrying capacity; Rated load; Rated speed; RTT etc.; Grouping of lifts and design standards of a lift lobby; Types of Lifts; Working of lifts with details of lift section describing various parts of lifts. Types of Escalators; Function and Working of Escalators.

10.VERNACULAR ARCHITECTURE

Vocabulary of Vernacular Architecture; Sense of Place, Spontaneity & variation; Control; Open ended form relationship; Symbols & Meanings; Issues of concern in present day architecture and causative forces of the vernacular form etc. Vernacular and traditional architecture of India, specifically in varied climatic zones etc.

11.INTERIOR & FURNITURE DESIGN

Vocabulary of interior design; Enclosing elements e.g. walls, floors, ceilings, openings, staircases, furniture; Design elements e.g. color, light, textures etc. Principles of interior design etc. History of Interior & Furniture Design – Evolution from ancient to modern, post-modern ideologies to contemporary (Egyptian, Greek, Roman, Gothic, Baroque, Renaissance, Arts and Crafts Movement, Art Nouveau, De Stijl, Modernism, Post

Modernism and Contemporary), etc. Ergonomics, materials, finishes & their applications in Furniture & other Interior Elements; Characteristics and workability of various materials used in interiors etc. Modular concepts in furniture design; Mass production and fabrication; Codes and specifications etc.

12.HOUSING

Housing Need and Demand in India – Present and Future; House, Housing and Settlement; Detached and Attached House Types; Net & Gross Residential Density; Perceived Density; Zoning etc. Settlement Patterns – Human settlement; Settlement types and patterns; Relation of housing in present day context with relation to human settlement patterns etc. Issues Affecting Housing – Climate Change; Social Factors; Affordability; Health; Safety & Security; Noise Control; Utilities and Services etc. Objectives and role of government, urban local bodies and other agencies in housing development; Census; NSSO; HUDCO; State Housing Board; NBO etc. Housing schemes – Rajiv Awas Yojana (RAY); Pradhan Mantri Awas Yojna (PMAY); Site & Services Scheme; Rental Housing Policy; Slum Rehabilitation Policy etc. Housing categories e.g., Condominiums, Co-operative Housing, Affordable Housing, Rural Housing, - Their Advantages and disadvantages; Neighborhood Planning etc.

13.BUILDING SOCOILOGY

Vocabulary of sociology; Sociology and Architecture; Basic concepts – Society, Group, Community (Rural and Urban), Association, Institution etc. Culture and Society – Concepts of culture, Cultural identity and cultural diversity, Factors of socio-cultural changes etc. Social Development – Concepts of social development; Types of development – rural, urban and rurban etc. Demography – Population growth and its impact; Population subsistence; Migration etc. Social Institutions – Family; Marriage; Religion etc. Social Infrastructure – Education; Health; Recreation etc.

14.SPECIFICATIONS, COST ESTIMATION AND BUDGETING

Specifications – specifications of various materials and building works as per National Building Code (NBC) and Energy Conservation Building Code (ECBC) etc. Estimation – Types of Estimates – Preliminary; Plinth area; Cubical content; Approximate quantity, Detailed/Item rate method estimates etc. Method of Estimation – Separate/individual wall; Centre line methods etc. Rate Analysis – Labor out turn and norms of consumption of basic materials; Principles of analysis of rates; Market/DSR rates of labor and materials. Preparation of Bill of Quantities (BOQ). Accounting Procedures – P.W.D./C.P.W.D. accounts procedure; Measurement book; Daily labor; Muster roll; Stores, stock and issue of material from stock; Indent form; Impress account; Cash book; Mode of payment etc. Valuation; Budgeting for projects etc.

15.PROFESSIONAL PRACTICE

The architectural profession and the role of professional bodies and statutory bodies e.g. the Indian Institute of Architects etc. Their objectives, working constitution, bye laws, categories of membership, election procedure etc; Detailed study of the Architects' Act 1972; Council of Architecture and its role etc. Conditions of engagement of an architect – Duties, responsibilities and liabilities of an architect towards the profession and society, Scale of professional charges and mode of payment; Code of professional conduct and ethics; Need and types of competitions; Procedure for conducting competitions etc. Tenders and Contracts – concept of contract and essential elements of contract; Tenders; their need and types; Preparation of tender documents and procedure for awarding tenders and award of projects; Type of building contracts; Preparation of contract document – General conditions of contract, defect liability period, running & final payment, retention amount and virtual completion etc. Office organization and Management – Setting up practice e.g. Business organization, Types of offices – Proprietorship, Partnership, Private Limited etc.; Salaried appointments – Public sector, Private sector, Understanding of Income tax and GST; Understanding of office accounting procedures; Office procedure in government organization etc. Concepts of Valuation; Classification and types of valuation; Elements and factors affecting valuation; Valuation of immovable properties; Techniques for valuation of landed and building property etc. Concept and need of Arbitration; Law governing arbitration in India – Salient features of the Indian Arbitration Act 1940 and provisions in subsequent amendments; Role of arbitrator; Nature of arbitration; Appointment of arbitrator and umpires, Conduct, powers and duties of arbitrators and umpires; Procedure of arbitration and preparation of awards etc.

16. URBAN DESIGN

Urban Space – Historical and contemporary example of urban space e.g. Piazza del campo, St. Peters, Campidglio, St. Marco; Yerba Buena garden, San Francisco, Pike place market, Seattle Washington; Indian cases, particularly towns on bazaars & streets etc. Urban design Parameters – Space and place; Morphology; Urban form and structure; Fabric; Texture, Grain; Enclosure; Human scale; complexity etc. Basic Principles and Theories of Urban Design – Theories related to visual or perception aspect (Garden Cullen); Theories related to physical aspect (Kevin lynch); Theories related to social aspect (Jane Jacob) etc. Urban Design Details – Urban outdoor lighting; Urban green infrastructure; Acoustic consideration for urban fabric Air quality at street level etc.

17. HISTORY OF ARCHITECTURE

Understanding of the development of architectural form with reference to technology, style and character of following styles of architecture. Also to comprehend and analyze spatial character, scale and structure through historical and traditional built forms of the following periods. – Prehistoric Age; Birth of Civilization; Ancient River Valley Civilizations of Egypt and Mesopotamia; Ancient Civilization of Aegean; Classical Period of Greece and Rome etc. – Indus valley civilization; The Aryan civilization; Buddhist; Hindu – Indo-Aryan and Dravidian; Jain etc. – Early Christian; Byzantine; Romanesque; Gothic; Renaissance; Mannerism; Baroque etc. – The Sultanate Style; Provincial; Mughal; Colonial etc.

18. ARCHITECTURAL PHOTOGRAPHY

Vocabulary of architectural photography, Various types of compositions framing, silhouette photography etc. Types of Camera – Use of various cameras; Lenses and accessories; SLR, DSLR cameras; lenses for different focal lengths for various contexts; Use of wide angle, normal, tele, zoom, macro, close up lenses etc. Filters-UV, Skylight, Colour filters, special effect filter etc. Shutter speeds – Slow, normal and high and their various applications etc. Apertures – Application of various apertures to suit different lighting conditions and to enhance depth of fields etc.

PAPER-II

1.ARCHITECTURAL DESIGN

Structural Systems – Understanding and application of various structural systems e.g. Trabeated. Arcuated, Vector, Form Active, Tensile etc and their relation to form, materials and function; Their mechanism of load bearing, adaptability, efficiency and limitations. Context – Understanding and application of the importance of 'context' and built urban environment in design. Sustainability – Understanding and application of active methods for achieving sustainability e.g. Water harvesting, Waste management, Solar and Wind Energy etc.

2.BUILDING MATERIALS

Metals (Ferrous) – Constituents, properties and application of – Iron (Pig, Cast & Wrought); Variety of Mild Steel sections – Sheets (plain & corrugated), Flats, Bars (round & square), Angles (Equal and Unequal), R.S. Sections (I beams, Channels, Tees); Hollow Tubular sections available for application in building industry; Stainless steel and Alloys. Floor & Floor Finishes – Constituents, properties and application of – Brick; Cement Concrete; Stone; Terrazzo; Chequered Tile; Ceramic Tile; Vitrified Tiles; Wooden etc. Reinforced Brick Work and their constituents, properties and application of – Types, Mixing, Curing, Water Cement Ratio, Qualities and Workability. Metals (Non Ferrous) – Constituents, properties and application of – Copper & Copper based alloys (Brass & Bronze); Tin; Cadmium; Chromium; Zinc; Lead and Nickel etc; Metal Coatings – Electroplating, Anodizing etc. Various additives and admixtures and their constituents, properties and application of – Cementitious (crystalline) systems; Integral systems; Proprietary systems; Cementitious Coating system etc. Construction equipments and their application – Electric hand tools; Vibrators; Pumps; Compactors/Rollers; Earth Moving & Excavation – Dozers; Scrappers; Graders; Shovels; Backactor; Dragline; Trencher sets. Transportation – Lorries; Trucks; Dumpers; Hoist; Cranes (mobile, static, tower); Concrete mixers and pumps for ready mix concrete etc. Gypsum & Asbestos Products – Constituents, properties and application of Gypsum Boards, Suspended Ceiling (Board & Tiles), Gypsum Plaster; Their components and accessories; Their jointing and finishing; Constituents, properties and application of Asbestos Cement products etc. Water Proofing Compounds – Constituents, properties and application of Neoprene, Butyl, EPDM, PVC, Polyurethene etc. Plastics and Rubbers Thermoplastics – Constituents, properties and application of Polythene, Polyvinyl chloride, Polypropylene, Polymethyl methacrylate, Acrylonitrile butadiene styrene etc.; Thermosetting Plastics – Constituents, properties and application of Phenol formaldehyde, Urea formaldehyde, Melamine formaldehyde, Polyurethane, Silicone resin etc.; Constituents, properties and application of Rubber etc. Forms of Steel for Industrial construction & Roofing products – Classification, availability, characteristics and uses of forms of steel and first to fourth generation steel roofing products. Advanced Structural Concretes, Materials for Pre-Stressing – Classification, availability, characteristics and uses of Structural light weight concrete, High strength concrete etc. Forms & Materials for Speedy Construction – Classification, availability, characteristics and uses of Reinforcement types, RMC etc.; Advanced Formwork systems – Table Form/Flying Form; Column Formwork Systems, Horizontal Panel Systems, Vertical Panel Systems, Jump Form, Slip form & Tunnel Form.

3.BUILDING CONSTRUCTION

Structural Steel Works – Typical metal joinery – Mechanical (riveted & bolted), Soldering and Brazing and welding; Detailing of structural steel work – Beam to Column joint, Beam to Beam joint, Column Splice, Column Base, Roof Truss to Column Joint; Steel Stairs etc. Doors & Windows (Metals) – Mild steel L and Z section; Pressed steel section etc. Shutters (Operational Mechanisms) – Application of operational mechanism (automatic and manual) of variety of Rolling shutters and Collapsible shutters etc. Reinforced Brickwork – Reinforced brick piers, lintels, slabs and projections etc. Floor/Dado/Skirting – Complete process of laying of floor and skirting – Brick, Cement Concrete, Mosaic and Terrazzo floors. Laying and fixing of Stone slabs, Chequered Tile, Ceramic tiles, Vitrified tiles and Wooden (parquet and plank) on subfloors and walls. Doors, Windows & Partitions (Aluminum) – Classification, availability, characteristics and uses of Doors frames and shutters; Windows Frames and Shutters; Partitions Framework & fixing with other suitable materials etc. Temporary Constructions – Classification, availability, characteristics and uses of Centering, Shuttering and scaffolding R.C.C. (Formwork & Laying) – Foundations – Isolated, Combined, Cantilever, Eccentric footing; Grillage and Raft foundation; Pile foundations – details of pile, varieties of piles, pile caps; Columns, Lintel, Projections/Chujjas and Beams; Staircases – Waist and Folded slab; understanding of steel reinforcement types, laying, bending and binding. Partitions & False Ceilings (Gypsum Board) – Classification, availability, characteristics, uses and construction details of Metal Stud Partition (single layer); Suspended Ceilings etc. Water Proofing Works – Classification, availability, characteristics, uses and construction details of Basements, Toilets, Kitchens, Terrace gardens etc. Joints – Classification, availability, characteristics, uses and construction details of Expansion joints; Seismic joints etc. Doors & Windows (P.V.C.) – Classification, availability, characteristics, uses and construction details of Door Frame and Shutters; Windows Frames and Shutters etc. Defects and Remedies – Classification, availability, characteristics, uses and construction details of various defects in buildings and their remedies; Defects caused by dampness, Defects caused by applied forces and changes in size. Industrial Construction (Structural Steel Works) – Classification, availability, characteristics, uses and construction details of Portal Frame Construction, North-light truss and Lattice girder roof with various roof coverings. Pre-stressed Concrete – Methods of pre-stressing, types of post-tensioning systems; Types of pre-stressed concrete structures – Beams (Short span, medium span, long span), Girders & Joists. Slabs (one way, two way, flat slabs, hollow core slabs, planks), Single & Double T slabs. Channel sections, Folded plate structures etc.; Composite construction. Prefabrication & Precasting – Classification, availability, characteristics, uses and construction details of open prefab system, large panel prefab system, joints, pre-casting methods, materials, on-site and off-site prefabrication, components, etc.; Precast RCC Frames – Beams and Column Frames, Wall Frames, Hollow core slabs, Planks and Tee slabs resting on Beam & Column frames and Wall frames. Connections between various components – beam to column, column to column, beam to slab, wall to slab etc. Speedy Construction – Methods, Types of floor construction – cast in situ, precast & composite construction; One-Way Slabs – Solid slabs, Slabs with wide beams, Ribbed slabs (One-Way Joists); One-Way joists with wide beams; Troughed slabs (ribbed slabs with integral beams and level soffits); Two-Way Slabs – Solid slabs; Waffle slabs designed as Two-Way slabs; Waffle slabs designed as Two-Way slabs with integral beams and level soffits; Flat slabs; Flat slabs with drops; Flat slabs with column heads; Waffle slabs designed as flat slabs; Lift slab construction; Cast-in-situ service & stair cores; Cross wall & Box frame construction etc. Modular Coordination – Aims, basis, planning, dimensioning; Assembly of components, tolerances, positioning of functional elements – slabs, walls, staircases etc.

4.ARCHITECTURAL DRAWING

Metric Drawing – Vocabulary and concepts of types, uses and advantages; Isometric, Axonometric and Pictorial view etc. Perspective Drawing – Vocabulary and concepts of application and use; Differences with metric projections; Anatomy of a perspective e.g. cone of vision, station point, picture plane, eye level, horizon line, ground line, vanishing point, etc.; Types of perspective – One point, Two points and Three point perspectives etc. Shades and Shadows – Vocabulary and concepts of values in shades and shadows; Constructing shadows in plan, elevations and 3-D etc.

5.STRUCTURAL DESIGN

Analysis and Design of R.C.C. Slab – Analysis and Design of one way, two way and flat slabs and detailing of its reinforcement etc. Analysis and Design of R.C.C. Beam

(Continuous) – Analysis and Design of R.C.C. continuous beam and detailing of its reinforcement etc. Analysis & Design of Portal frame (R.C.C.) – Analysis and design of portal frame (Single bay, Single storey) with fixed and hinged base, in R.C.C. etc. Analysis and Design of R.C.C. Stairs – Type of stairs; Effective span of stairs; Loading on stairs; Analysis and design of stairs (dog legged with waist slab) and detailing of its reinforcement etc. Elementary Soil Mechanics – Classification of Soil; Properties of Soil; Safe bearing capacity; Active & Passive earth pressure etc. Analysis & Design of R.C.C. Column – Effective height of column; Assumptions; Minimum eccentricity; Analysis and design of short R.C.C. column under pure axial load as well as under axial load and bending moment and detailing of its reinforcement etc. Analysis & Design of R.C.C. Foundation & Footing – Type of foundation; Depth of foundation; Theory & design of axially loaded isolated square footing and detailing of its reinforcement; Pile foundation – Introduction, classification and its application etc. Analysis and Design of R.C.C. Retaining wall – Types of retaining walls; Analysis and Design of cantilever retaining walls and detailing of its reinforcement etc. Analysis and Design of Steel Structure – Various types of connections – Riveted connection – Introduction, Classification, Strength of riveted joint; Bolted connection – Introduction, Classification of bolts based on type of load transfer, Terminology, Specifications for spacing and edge distance of bolt holes as per I.S. 800-2007, Types of bolt connections, Type of actions on bolts, Design strength of plates in a joint, Design strength of bearing bolts; Welded connection – Introduction, Types of welded joints, Important specifications for welding as per IS code, Design strength of welded joints; Analysis and Design of various types of members – Tension members – Design Strength, Analysis and design; Compression members – Slenderness ratio, Actual length, Effective length, Design strength, Analysis and design; Steel Structure – Understanding of Miscellaneous Structural Elements – Beam and plate girder & its use in building industry; Grillage foundation and its components & its use in building industry; Types of roof trusses and nomenclature of its members etc.

6.ART APPRECIATION

Grammar of the language of art – Natural; Realistic; Symbolic; Abstract; Modern; Contemporary etc. Ideologies of Aesthetics in Art – Understanding of Ideologies of aesthetics in art while discussing the art of Western and Oriental; Plato, Aristotle, Baumgartan, I.A. Richards, Leo Tolstoy, Sigmund Freud; Shadanga; Six limbs of Indian painting; Rasa theory of 'Bharat Muni'; Iconography etc. Development of Art Development of art over the period of time; tracking the progress in art in aspects of the Functional diversity of styles; Art as from of social consciousness; Impact of Cultural and Religion on art; Understanding the role of art in contemporary society etc.

7.CLIMATOLOGY

Vocabulary of climate; Importance of climate in architecture; Factors affecting climate; Elements of climate; Solar radiation, temperature, wind, humidity & precipitation and their measurement etc. Climate types – Climate types all over the world; Tropical climate; climate zones, their characteristics & responses of the traditional/vernacular, Micro Climate & Site Climate etc. Human thermal comfort – Body's heat production & heat loss; Comfort zone; Bio-climatic chart; Effective temperature isopleths etc.; Various models of Thermal Comfort – Static & Adaptive Mode, thermal indices & their applicability. Solar chart – Solar position of a place, azimuth, altitude, incidence, using shadow angle protractor for designing shading devices. Daylight – Natural lighting; Glare; Day light factor & factors affecting day-lighting in various space types; Principles of day-lighting in tropics. Ventilation & Air Movement – Requirement; Size & position of openings; Air-flow pattern inside & outside buildings etc. Orientation – Orientation of buildings in relation to sun & wind; Design strategies in different climate zones; Vernacular and contemporary responses to climate etc.

8.ADVANCED SURVEYING & GEOMATIC TECHNIQUES

Total Station Survey – Working principle of total station and its use; Use of software for different applications etc. Photogrammetry – Vocabulary, Principles and application of photogrammetry and stereoscopy in surveying etc. GIS (Geographic Information System) – Understanding and application of geographical concepts and terminology; Difference between Image Processing system and GIS, Utility of GIS; Raster and Vector Data; Raster Versus Vector; Raster to Vector conversion; Remote Sensing Data in GIS; Topology and Spatial Relationship; Data storage verification and editing; Data preprocessing; Geo-referencing; Interpolation of data; Database Construction; Data Output; GIS analysis functions; Generation of thematic maps; Digital Elevation Model (DEM) etc. Remote Sensing – Understanding concepts of remote sensing; Electromagnetic spectrum; Platforms and sensors; Remote sensing data products; Understanding of visual and digital image interpretation techniques and image processing software; Field verification etc. GPS (Global Positioning System) – Understanding concepts of GPS surveys; GPS data collection for mapping etc.

9.BUILDING SERVICES

FIRE PROTECTION

Causes and spread of fire; Fire triangle/tetrahedron; Classes of fire; Combustibility of materials and fire resistance etc. Fire Detection & Alarm Systems; Equipment – Heat & Smoke sensors etc. Firefighting equipment & Extinguishing techniques; Ladders; Snorkel ladder; Firefighting pump and water storage; Hose and hose fittings; Dry and wet risers; Automatic sprinklers; Portable fire extinguisher etc. Means of escape; Fire escape staircase; Fire doors; Water curtain etc.

ELECTRONIC SECURITY AND SURVEILLANCE SYSTEMS

Perimeter Protection – Barriers, Doors, Gates, Turnstiles and Fences; Intrusion Detection Sensors and Systems – Outdoor & Indoor. Access Control Systems; Locks & Emergency Exits; Visitor Management Systems; Identification Systems – PIN, Card, Wireless and Biometric systems etc. Security Lighting; Illumination including Infra-red; Understanding CCTV cameras – Pan, Tilt & Zoom mechanisms; Digital and Analog Recording etc.

ADVANCED SERVICES

Gas Installation – L.P.G/Bio-gas installations, their location and layouts in residential and non-residential buildings etc. Automated Parking System – Vocabulary; Types; Working and Advantages of automated parking systems etc. Mechanical Ventilation – Standard requirements of ventilation for different conditions of living and work places; Conditions for comfort; Control of quality, quantity, temperature and humidity of air etc. Waste Treatment & Management – Vocabulary; Reduce-Reuse-Recycle; Waste collection; Treatment & disposal; Thermal treatment; Dumps and Landfills; Biological waste treatment; Waste water treatment etc. Integrated Building Management System – Objectives of the Integrated Building Management System, Various components of IBMS; Types of integration with the utility, safety and security systems and its designing and installation etc.

10.ARCHITECTURAL CONSERVATION

Vocabulary of conservation; Various issues and practices of Conservation; values and ethics; Causes of defects and decay of a heritage structure; Natural agents of deterioration and loss; Documentation for the conservation & restoration of the any Heritage built form; Status of conservation in India and the various agencies involved in the field of conservation worldwide and their policies; Various guidelines for the preservation, conservation and restoration of buildings; Management of historic sites; Understanding of various charters; Character and issues of heritage towns in India; Role of INTACH, UNESCO, ICOMOS and other such organizations etc.

11.DISASTER MITIGATION AND MANAGEMENT

Hazards & Disasters; Indian scenario; Understanding of disaster; Hazard and its classification; Vulnerability; Capacity; Risk etc. Various Types of disasters – Cause, adverse effects, distribution patterns, mitigation measures of Earthquake, Tsunami, Cyclone, Flood, Landslide etc. Disaster Management cycle – Disaster Preparedness; Disaster Management Act; guidelines NDMA; Vulnerability Assessment & warning systems; Risk assessment etc. Disaster Response; Programmes for disaster reduction, Communications. Disaster Mitigation; Pre disaster, emergency, transition and recovery; Disaster management plan; Natural crisis management committee; State crisis management group; Disaster Damage Assessment etc. Disaster Resistant Construction Techniques; Risk reduction measures through land use control; site planning and land management; design and construction of structures for above mentioned disaster.

12.URBAN PLANNING

Elements and planning principal of cities; Shapes of city plan in accordance to road networks; Concepts, theories and principles of urban planning of cities – Indus Valley, Ancient (Vedic), City beautiful movement (Chicago, Chandigarh), Urban Utopia (Broadacre), Garden city (Letchworth); Radbum Theory (Radbum) and Neighborhood planning etc. Understanding of planning process; Relevance of standards in planning as per URDPFI guidelines prepared by TCPO etc. Awareness of concepts related to various traffic problems in India; Understanding of PCU; Traffic volume; Road capacities; Road types and their sections and intersections; Traffic calming as per IRC guidelines; New concepts in mass and rapid transportation systems e.g. BRT, LRT and Metro rail etc. Modern Approach in Planning – Green City, Compact City, Smart City etc.

13.BUILDING ECONOMICS

Vocabulary of Economics; Scarcity; Utility – Marginal, Total & Average; Laws of Demand and Supply; Economic system in India; Building Efficiency; Building Life-cycle; Costs and Benefits of Building – Monetary and Non-Monetary etc. Project Financing – Equity; Financing Institutions in Financing Process; Interim Finance and Permanent Financing; Bank Loan – Simple Interest and Compound Interest; Types of Mortgage; Lease Arrangements etc. Economic performance of building – Decision Making using techniques of economic performance to measure tangible and non-tangible issues – Cost-Benefit Analysis, Incremental Analysis and Multi-Criteria analysis etc.

14.LANDSCAPE DESIGN

Factors affecting Landscape; Elements of Landscape Design – Natural and design elements; Principles of Landscape. Design – Unity, Symmetry, Balance, Hierarchy, Repetition, Sequence etc.; Different garden styles etc. Landscape Engineering – Road and Parking; Paths and Plazas; Wall, Steps, Ramps and Decks; Planters, Bed edges and Terraces; Pools and Water bodies; Terrace landscape and Vertical garden etc. Classification of Plants – Trees, shrubs, groundcovers, flowering plants, creepers and climbers etc.

15.PROFESSIONAL PRACTICE

Law related to Land – Understanding of the Land Acquisition Act – 1894 and its subsequent amendments through Act of 2013 and 2015; LAND ACQUISITION AMENDMENT BILL 2018; Notification to acquire land under various sections, concept of public purpose and compensation apportionment etc. The Uttar Pradesh Urban Buildings (Regulation of Letting, Rent and Eviction) Act, 1972-its important provisions and effect on the urban development; Urban Development Law – Understanding of the UP Urban Planning and Development Act-1973 – Concept of Urban Development Authority its power authority and Role in regulating the urban development; Salient features of the provisions of the act; The Uttar Pradesh Slum Areas (Improvement and Clearance) (Amendment) Act-1981 and its important provisions for achieving etc. Law of Easement – Concept of Easement and essential elements of valid easement; creation of easement – Types of Easement, Easement by prescription, Easement by necessity and quasi easement; Termination, suspension and revival of easement and other related concepts etc. Mercantile Law – The Contract Act – 1872 and subsequent amendments – Concept of Agreement; Essential elements of Contract; Flaws in contract etc.; Indian Partnership Act – 1932 and subsequent amendments; Relationship of Partners; sharing of profits; Exit of a partner; Liabilities of and rights of other partners etc. The Law of Environment – Understanding of purpose, provisions, and the impact of various components of the environmental law e.g. The National Green Tribunal Act-2010; The Air (Prevention and Control of Pollution) Act-1981; The Water (Prevention and Control of Pollution) Act-1974; The Environment Protection Act, 1986; The Hazardous Waste Management Regulations etc. Real Estate (Regulation and Development) Act, 2016 (RERA) – Understanding of real estate; Need of the RERA and its impact on real estate; RERA authority; Registration under the Act; Role and responsibilities and liabilities of architects under the provisions of the RERA etc.

16.BUILDING CONSTRUCTION MANAGEMENT

Vocabulary of construction management; Project management concepts-objectives & scope, planning/monitoring and control, scheduling/Quality and cost; Theory of probability and statistics; Cost model and cost optimization etc. Construction Management Techniques – Construction Planning scheduling and controlling phases; Levels of details & time scale Resource scheduling; Smoothing & leveling; Project execution; Monitoring & progress reporting; Use of Management techniques – Bar charts and limitations of bar charts; Mile Stone Chart etc. PERT and CPM – Event; Activity; Dummy; Network rules; Graphical guidelines for network; Numbering of events; CPM network analysis & PERT time estimates; Time computation & network analysis; Cost time analysis in network planning using CPM etc. Resource Allocation & Quality Control – Resource usage profile – Histogram, Resource smoothing and Resource leveling; Planning of temporary services at the site; Safety precautions at construction sites; Security of materials at building site; Stages of inspection and quality control etc.

17.THEORY OF ARCHITECTURE

Understanding of the various theories and concepts of design and how philosophy, style and strategies are related to architecture of following periods. Pre Modern – Antonio Gaudi; Charles Rennie Mackintosh, Antonio Sant Elia; Adolf Loos; Auguste Perret, Peter Behrens; Bruno Taut, Gerrit Reitveld, Tatlin. Modern – Gropius, Mies Van der Rohe; Frank Lloyd Wright, Le Corbusier, Alvar Aalto, Terragini; Louis Kahn. Post Modern – Spatial/Deconstruction (Frank O Gehry, Michael Graves, Peter Eisenman, Moore, Richard Meier, Robert Venturi, Zaha Hadid, Coop Himmelblau, Richard Rogers, Tadao Ando, Rem Koolhas, Herzog and de Meuron, Daniel Libeskind); Historicism (Michael Graves & Robert Venturi, Brnard Tschumi); Urbanist (Mario Botta, Aldo Rossi, Cesar Pelli); Classicists (Arata Isozaki, Michael Graves, Mario Botta); Revivalists (Louis I Kahn, James Stirling, Charles Gwathmey, Richard Meier); Vernacular (Hasan Fathy);

Philosophy (Charles Jencks, Bernard Tschumi, Peter Eisenman, John Hejduck); Critical Regionalism (Charles Correa, B.V. Doshi, Tadao); Materialist (Peter Zumthor) etc.

18.ARCHITECTURAL ACOUSTICS

Vocabulary of acoustics; Science of sound; Characteristics of audible sound – Propagation, Velocity, Frequency, Pitch, Quality/timbre, Loudness and Intensity; Behavior of audible sound in enclosures – Reflection, Absorption, Diffraction and Transmission of sound; Common acoustical defects and recommended remedies – Echo, Sound foci, Dead spots, Sound shadows, Resonance, Insufficient loudness, External noise and Reverberation; Sabine's expression for calculation of Reverberation time; Absorbents and absorption coefficient etc.; Noise control – Noise and its types; Noise pollution; Sources of indoor noise; Indoor noise levels; Planning and design against indoor noise; Sources of outdoor noise; Traffic noise levels; Planning and design against outdoor (traffic & buildings in built-up area) noise. Constructional measures for sound insulation of buildings – Materials, Hollow & composite wall construction, Floors & Ceilings; Properties of good acoustical materials. Sound system – Sound reinforcement system; Public address system; Sound system equipment e.g. Amplifiers, Microphones, Speakers, Mixers, Conference systems and accessories etc. Acoustical design principles and factors – Acoustical design principles for Auditoriums, Cinema halls, Conference rooms etc.; Factors e.g. Site selection & planning, Dimensions Shape, Seats & seating arrangements; Treatment of interior surfaces; Reverberation & sound absorption etc.

15. PHYSICS
PAPER-I

1. Mathematical Physics

Dimensional analysis. Vector algebra and vector calculus, concept of Tensor, Linear ordinary differential equations of first & second order, special functions (Legendre, Hermite, Bessel, Laguerre functions). Fourier series, Fourier and Laplace transforms.

Partial differential equations (Laplace, wave and heat equations in two and three dimensions).

Elementary probability theory, random variables, binomial, Poisson and normal distributions. Central limit theorem.

2. Classical Mechanics and Properties of Matters

Newton's laws of motion, Dynamic of System of particle and rigid body, Center of mass and Center of Gravity, conservation law's of Energy , momentum and angular momentum, central force and its characteristics , Keplar's law's of planetary motion, Reduction of Two body Central Force Problems, Planate and Satellite, Orbital and escape velocity, communication satellite. Virtual and Actual Displacement, D' Alembert's Principle, Generalized co-ordinates, Lagrangian equations, Hamiltonian functions and equations, cyclic co-ordinates, Poisson Brackets and canonical transformations, Hamilton-Jacobi Theory, Inertial and non-inertial frame of references, Events, Galilean transformations, Galilean invariance and variance, special theory of Relativity, Lorentz transformations, Relativity of simultaneity and colocality, Length contraction, Time Dilation, Velocity addition theorem, Non- relativistic and relativistic particles, Relativistic Dynamics, Mass-energy equivalence, Doppler effect in light.

Elastic behavior of loaded wire, Elastic constants, Torsion of Cylinder, Bending of beam, Cantilever, surface tension, surface energy, angle of contact, capillarity, Excess pressure, Ideal fluid, hydro dynamical equations based on conservation of mass, Momentum and energy, Viscous force (Newton's law, Poiseuille law, Stokes law).

3. Thermodynamics and Statistical Physics

Four Laws of thermodynamics and their consequences Carnot cycle, Heat engine, Refrigerator. Thermodynamic potentials, Maxwell's relations, Joule's effect and Joule's Thomson effect, Transport Phenomenon of gases, Kinetic theory of matters, conduction, convection, Black Body Radiation Kirchhoff's laws, Planck's distribution law and deduction of Stefan's law, Wien's law and Rayleigh-Zeans law, Phase space (μ and λ) , Macrostate and microstate, Micro-canonical, Gibb's- canonical, Grand-connonical ensembles and Partition functions, Classical and Quantum statistical mechanics, Maxwell speed distribution Ideal Bose and Fermi gases, Bose Eintein condensation, Thermodynamic and statistical Entropy and theorems, Gibb's paradox and its resolution. First and second order phase transition.

4. Optics and Acoustics

Cardinal points, Huygens and Ramsden eyepiece Defect of visions, Human eye and camera, Telescope and microscope, Theories of light, concept and condition of interference, Young's double slits, Biprism, Colour in thin films, Newton's ring, Michelson interferometer, Fabry-Perot inter-ferometer, Fresnel and Fraunhoffer's Diffraction , Zone Plate, Single slit and multiple slits diffraction, plane Grating, Resolving Power of Grating and optical instruments, Limit and criteria of resolution.

Unpolarised and polarised light, Plane of vibration and plane polarization, Polarization by Reflection, Refraction, Double refraction, Dichroism, Law of Malus, Nicol Prism, Retaradation Plates (Half and Quarter), Babinet compensator, Optical rotation, Polarimeters, Coherence (Temporal and Spatial), Induced emission, Spontaneous emission, Induced absorption, Einstein's A & B co-efficients, components of Laser, Types of pumping, Ruby lasers, He-Ne lasers, Semi-conductor lasers, Holography and Photography, Medical application of lasers, Undamped, Damped, Forced and Resonance Vibrations, Lissajous figures, Velocity of Sound, Plane progressive and stationry waves, Vibration of Stretched strings and organ Pipes, Reflectivity and Transmittivity at boundry, Phase velocity and Group velocity.

PAPER-II

5. Electromagnetism

Electric Flux, Gauss law in electrostatics and its applications, Electric Field and Potential Due to Dielectric sphere and Electric Dipole, Laplace and Poisson equations, Gauss law in magnetostatics, Behavior of dipole in uniform and non-uniform fields, (magnetic – chemical and Heating), effect of currents, Biot-savart law and its applications, Ampere's circuital law and its applications, Lorentz force, cyclotron (limit and modification), Galvanometer, Ammeter, Voltmeter, Magnetic Flux, Laws of electro-magnetic induction, static and dynamic Induced emf , Self and Mutual induction and inductance, Laws of Electrostatics, Laws of magnetostatics, laws of electromagnetism, equation of continuity and modification of Ampere's circuital law, Conduction and displacement current, Maxwell's equations in free space and Dielectries, Electromagnetic waves, Poynting vector, Dispersion relation in Plasma, Transmission line and Waveguide.

6. Quantum Mechanics

Wave particle duality, Matter waves, Uncertainity Principle, Photoelectric and Compton effect, Davisson – Germer experiment Wavepacket, Schrodinger equation (Time dependent and Time independent), Physical Significance of wave function, Normalisation, Orthogonality, Orthonormality, Eigen value equation, Eigen value, Eigen function, Expectation value, Ehrenfest Theorem, Dirac function and Kronecker delta, Particle in a box, Potential step, Potential barrier, Harmonic oscillator, Rigid Rotator, Hydrogen Atom, Spherical harmonics, Commutation and Non commutation Relations, Pauli spin matrices, Operators, Exchange degeneracy.

7. Atomic, Molecular, Nuclear and Particle Physics

Bohr's and Sommer feld Atomic Models, Hydrogen like atoms , effect of nuclear motion, Optical spectra and X-Ray spectra, Duan-hunts law, Moseley law, Vector atom model, Sodium D1 and D2 lines, Bohr megneton, Larmor frequency, Stern- Gerlach experiment, Selection rules, Spectral terms, L-S coupling, J-J coupling, Lande-g factor, Zeeman effect (Normal and anomalous), Paschenback effect, Stark effect, Electronic, Rotational, Vibrational molecular Spectra, Raman effect, phosphorescence effect,

Laws of Radio activity, Earth and Carbon dating, Mass defect, Packing fraction, Binding energy, Binding energy curve, Nuclear fission and fusion , Nuclear Reactor, Nuclear reaction, Q- values, Chain reaction (Controlled and un-controlled), Thermo nuclear reactions, Hydrogen bomb, Semi-empirical – mass formula, Liquid drop model, Shell model, Collective model, Nuclear forces, Fundamental particles, four fundamental interactions, classification of elemintry particles on the basis of Spin, Mass and Interaction, Quantum numbers (Charge, Spin, Parity, Isospin , Strangeness) Of-Elementary particles, Quark model , Baryons, Leptons, Mesons, Conservation laws.

8. Electronics and Condensed Matters

Intrinsic and extrinsic semi conductors, P –N Junction & Zener Diode and their characterstic, Rectifier and filters, Bipolar and Unipolar transistors, Input and Output characterstics curve, Hybrid Parameters, Gains (Resistences, Current, Voltage, Power), Voltage and Power Amplifiers, Feedback Amplifiers, Operational Amplifiers and its application, Oscillators, Modulators, Detectors, Supersonics, Ultrasonic (Production, Detection and Applications), Multimeters, CRO, Opto electronic devices (LED, Photo detectors, Photo transistors, Solar cells).

Analog and Digital signals, Logic Gates (NOT, AND, OR, NAND, NOR, XOR, XNOR) and their switching circuit, Logic symbols, Truth Tables, Venn diagram, Boolean functions, K-Map, Adder and Subtractor, Boolean Theormes, A/D, D/A, Resistors, Counters, Comparators, Flip-flops, Micro processors, Bravais Lattices, Reciprocal Lattices, Electron Diffraction, Bonding of Solids, liquid Crystals, Free Electron and Band theory of Solids, Electron motion in Periodic Potential, Effective mass of free electrons and holes, Specific heat of Solid (Classical and Quantum theories), Hall effect and Thermo electric Power, Super conductivity (Type-I and Type- II), Super conductors, Josephson Junction, BCS theory, Cooper pairs, Super fluidity. Dia, Para, Ferro, Antiferro, Ferri magnetism.

16. CHEMISTRY
PAPER-I
Inorganic Chemistry

Bohr's theory and its limitation, De-broglie equation, Heisenberg's principle of uncertainty, Pauli's exclusion principle, Hund's rule of maximum multiplicity, Aufbau principle. Planck's quantum theory- Wave Particle duality. Schrodinger wave equation. Angular momentum, quantisation of electronic energies (qualitative treatment of hydrogen atom)

Periodicity in properties of atoms: Atomic and Ionic radii, Ionisation potential, Electron affinity, Electronegativity, Hydration energy, Lattice energy.

Chemical bonding: Valence bond theory, Hybridisation, Valence shell electron pair repulsion theory (VSEPR), M O theory - molecular orbital diagram of homo and hetero nuclear diatomic molecules.

General properties of s and p-block elements.

Chemical effects of unclear transformation- Nuclear fission and fusion. Radioactive isotopes and their applications.

Oxidation - Reduction, Oxidising and Reducing agents, balancing of redox reactions.

Concepts of acids and bases- Bronsted –Lowry theory, Lewis concepts of acids and bases. Hard and fast acid and bases.

Polymers: Definition and classification of polymers, properties of polymers with special reference to polyethene, polyvinyl chloride.

Pollutants and their influence of environment, Chemical toxicology.

Symmetry and Group Theory: Symmetry elements and symmetry operations, definition of group and sub-groups, point symmetry groups assignment of point groups of molecules like NH3, H2O, PCl5 and XeF4.

Chemistry of Transition elements: General Characteristics: variable oxidation states, colour, complex formation, magnetic and catalytic properties.

Chemistry of lanthanides and actinides: lanthanide contraction. Oxidation states. Spectral and magnetic properties. Principle of separation and isolation.

Coordination Chemistry: IUPAC system of nomenclature of complex compounds, Isomerism, valence bond theory and its limitation. Crystal Field theory: d- orbital splitting in octahedral and tetrahedral complexes, weak and strong field octahedral complexes, spectrochemical series. Electronic spectra of d-block elements. Complexes, selection rules for electronic transitions. Spectroscopic ground states for d1 to d9 systems.

Main Group Elements and their Chemistry: Oxyacids of nitrogen, phosphorous and sulphur, Interhalogens and pseudohalides, Noble gas compounds, boranes, carboranes borazines and posphazines, silicates and silicones.

Organometallic Chemistry: Synthesis, Structure and bonding of organometallic compounds, Homogeneous catalytic reactions Pi-acid metal complexes.

Bio-inorganic and Supramolecular Chemistry:

Essential and trace elements in biological processes, Haemoglobin and myoglobin, Biological role of alkali and alkaline earth metals with special reference to Ca2+, Photosynthesis and Nitrogen fixation. Supramolecular Chemistry: Introduction and nomenclature of supramolecules, molecular recognition and carrier design.

Physical Chemistry

Solid state Chemistry: Crystalline State of Solids, Unit cell, Bravais lattices, Miller Indices, Diffraction of X-rays by crystalline solids, Crystal defects and non-stoichiometry, Perfect and imperfect crystals, Frenkel and Schottky defects, Properties of solids ionic conductivity and diffusion and ferroelectric properties. Electronic properties and band theory- band structure of metals. Semiconductors (extrinsic and intrinsic), n-p-junction, super conductors.

Surface phenomenon: Surface tension, adsorption on solids, electrical phenomenon at interfaces including electro-kinetic, micelle and reverse micelle.

Chemical Equilibria: Le-chatelier's principle and its application: Free energy and entropy of mixing, partial molar quantities, Gibbs-Duhem equation, Phase diagram of one and two component system and phase rule.

Thermodynamics: First law of thermodynamics, Heat capacities at constant volume and pressure and their relationship, Joule-Thomson coefficient, calculation of w, q, dU and dH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process. Hess's law of heat summation and its applications, Heat of reaction at constant pressure and at constant volume, enthalpy of neutralization, bond energy and its calculation from thermos-chemical data.

Second law of thermodynamics- definition, Gibbs (G) and Helmholtz (A) Functions, thermodynamical quantities, variation of G and A with P, V and T, Carnot cycle and efficiency. Concept of entropy, changes in ideal gases and mixing of gases. Third law of thermodynamics- statement and concept of residual entropy.

Spectroscopy: Time- dependent states and spectroscopy, absorption and emission of radiations and selection rules, line shapes and widths.

Magnetic- Resonance spectroscopy, principle and application, chemical shift and spin-spin coupling first order spectra of A3, X, AX and AMX system. Electronic spectroscopy of diatomic molecules, rotational fine molecules.

IR spectroscopy, Symmetry properties and nuclear spin affect, Raman Effect, vibration of polyatomic molecules.

Electrochemistry: Quantitative treatment of Debye-Huckel Theory of ion-ion interaction and activity coefficient. Thermodynamics of double layer. Determination of association constant (Ka) from conductance data, Application of measurement of electrochemical rate constant.

PAPER-II

Organic Chemistry

Stereochemistry: Element of symmetry, chiralandaehiral molecules, R, Snomen clature, diastereomerism in acyclic compounds. Methods of asymmetric synthesis. Stereospecific andstereo-selective reactions. Interconversion of Fischer, Newman and Sawhorse projections. E, Z isomerism, conformation alanalys is of monoanddi substituted cyclohexanes. Effect of confirmation on reactivity in acyclic compounds and cyclohexanes.

Nucleophilic aromatic substitution: aromatic SN1 and SN2 Mechanism, leaving group and attacking nucleophile, evidences of neighbouring group participation, classical versus non-classical carbonium ion-the present status. Addition to carbon-carbon multiple bonds, electrophilic, free radical and nucleophilic addition. Esterification and hydrolysis of esters: evidence for tetrahedral intermediate, BAC2 and AAC2 mechanism and elimination reaction: the E1, E2 and E-CB mechanism, Hoffmann versus Saytezeff elimination, competition between elimination and substitution reaction.

Common Organic Reaction and Mechanism:

Aldol,Perkin,Dieckmanncondensation,Reformatsky,Benzoin,Wittig,Reimer-Tiemann, Diels-Alder, Robinson annulation, Ene Barton reaction, Hofmann-Loffor-Freytage reactions, Shapiro reaction, Sharpless epoxidation reaction, Mannich reaction,MichaelreactionStrokeenaminereactionStetterreactionandBaylis-Hillmanreaction.

Rearrangements: Pinacol-Pinacolone, Wagner-Meerwein, Demjanove, Beckmann, Hofmann, Curtius, Schmidt, Lossen, Sommelet-Hauser, Favoroskii and Baeyer-Villiger rearrangement.

Organicsynthesis: Synthesis and any di andtrisubstituted benzene derivativesfromanymonosubstitutedbenzeneorbenzeneitself.Synthesisofsimplecompoundsusing C-Cbondformingre actions in volving Wittig, Wittig Honner, Gilmann Reagents, organolithiums, Grignards, Robinsonannulation, Dickmanncondensation, Knovenagel, Mannisch. Stork enamine and Vilsmeyer reactions and umplolung (1,3-dithane). Synthetic transformation s involving Swernoxidation, BirchWolfKishner and metalhydride reductions, catalytic hydrogenations andreagents like tributyltin hydride, trimethylsilyl iodide, LDA,n-BuLi, Raneynickel, NBSChromiumreagents,DCCandPd. Application of protective group concept (aldelydes,ketonesandcarboxylicacids) during multistep synthesis. Spectral identification of organic intermediates by IR (functional group) PMR and CMR and Mass. spectra. (Simplemoleculesonly).

Heterocyclic Chemistry: Heterocyclic compounds with five and six membered ring-Pyraxoles, imidazoles, pyridine and quinolone, applications of heterocyclic compounds-caffine, diazepam and phenothiazines.

Pericyclic reactions: Molecular orbital symmetry, frontier orbital of ethylene, woodword-Hoffmann correlation diagrams, cycloaddition, functional tautomerism Ene reaction.

Photochemistry of aromatic compounds: ring isomerisation and cyclisation reactions, Photochemistry of carbonyl compounds, intramolecular and intermolecular hydrogen abstraction. Norrish cleavage (Type I and II)

Chemistry of natural products: Terpenes and alkaloidsvitamins and Hormones-introduction of fats soluble and water-soluble vitamins, functions of vitamin A,D,E,K, Vitamin-B complex and Vitamin C. Introduction, Classification and characteristics of hormones with special reference to thyroid hormones(thyroxin).

Molecules of life processes: Sugar, DNA and RNA, Enzymes- definition, classification and applications.

17. ENGLISH

PAPER-I : English Grammar

1. Comprehension
2. Spelling Rules
3. Articles
4. Parts of Speech
5. Tenses
6. Active and Passive Voice
7. Direct and Indirect Speech
8. Question Tag
9. Simple, Complex and Compound Sentences
10. Transformation of Sentences
11. Synthesis of Sentences
12. Correct Usage
13. Infinitive, Gerund and Participle
14. Vocabulary : Antonyms, Synonyms, One Word Substitution, Homophones and Homonyms
15. Idioms and Phrases
16. Word Formation
17. Preposition
18. Auxiliaries and Modals
19. Comparison of Adjectives
20. Figures of Speech

PAPER-II : English Literature

A – Major Authors and Their Works

1. Geoffrey Chaucer
2. Christopher Marlowe
3. Francis Bacon
4. William Shakespeare
5. John Milton
6. Alexander Pope
7. John Dryden
8. William Wordsworth
9. P.B. Shelley
10. John Keats
11. Charles Lamb
12. Jane Austen
13. Alfred Tennyson
14. Matthew Arnold
15. Thomas Hardy
16. Charles Dickens
17. W.B. Yeats
18. T.S. Eliot
19. G.B. Shaw
20. John Galsworthy
21. Kamala Das
22. Nissim Ezekiel
23. Robert Frost
24. Walt Whitman
25. William Faulkner

B – Literary Criticism

1. Aristotle
2. John Dryden
3. William Wordsworth
4. S.T. Coleridge
5. Matthew Arnold
6. T.S. Eliot

C – Literary Forms and Movements

18. MATHEMATICS

PAPER-I

1-Real Analysis :

Functions of Several variables: Eucledian spaces, continuous functions, derivatives in an open subset of Rn, Chainrule, Partial derivatives, interchange of order of differentiation, Derivatives of higher orders, Taylors's theorem, Inverse function theorem, implicit function theorem.

Lebesgue outer measure, Measurable sets, Measurable functions, Borel and Lobesgue measurability.

Integration of non-negative functions, Integration of series, Riemann and Lebesgue integrals.

Functions of Bounded variation.

Measure and outer measure Extension of a measure, Uniqueness of extension, Completion of a measure, Measure spaces, Integration with respect to a measure. The Lp-spaces, Convex functions, Jensen's inequality, Holder and Minkowski inequalities, Completeness of Lp, Convergence in measure.

2-Complex Analysis:

Cauchy-Goursat theorem, Poisson integral formula, Cauchy's integral formula for derivatives, Cauchy's inequality, Liouville's theorem, Morera's theorem, Taylor's and Laurent's theorems, Maximum modulus principle, Schwarz lemma, Meromorphic functions, Inverse function theorem.

Residues, Cauchy's residue theorem, Evaluation of integrals.

Weierstrass factorization theorem, Gamma function, Riemann zeta function, Mittag-Leffler's theorem, Riemann mapping theorem.

Analytic continuation, Uniqueness of analytic continuation along a curve, Power Series method of analytic continuation, Natural boundary, Schwarz reflection principle. Harnack's inequality and theorem.

Canonical products, Jensen's formula, Hadamard's three circles theorem, Order of an entire function, Exponent of convergence, Borel's theorem, Hadamard's factorization theorem.

3-Topology :

Completeness of metric spaces, Cantor's Intersection theorem, Dense sets, Baire's category theorem, Separable spaces, Continuous functions, Uniform continuity, Isometry and homeomorphism, Compactness, Sequential compactness, Totally bounded spaces, Finite intersection property.

Definition and examples of topological spaces, Neighbourhoods, Closed sets, Limit point and derived sets, Closure, interior, exterior and boundary of a set, Dense and nowhere dense sets, Bases and sub-bases, Subspaces and relative topology, Metric topology and equivalent metrics.

Characterization of topology in terms of Kuratowaski closure operator and fundamental system of neighbourhoods.

Continuous maps and homeomorphisms.

First and second countable spaces, Lindelof's theorem, Separable spaces.

Separation axioms, To, T1, T2, T3 Tychonoff (T3/2) and T4 spaces Urysohn's lemma, Tietze extension theorem.

Compactness, Continuous functions and compact sets.

Connected spaces, connectedness on the real line, components, Locally connected spaces.

Tychonoff product topology, projection maps, separation axioms and product spaces, connectedness and product spaces, compactness and product spaces, countability and product spaces.

4. Rigid Dynamics :

Moments and product of interia, momental ellipsoid, Equimomental systems, Principal axes.

D'Alembert's principle, General equations of motion of a rigid body, Motion of the centre of inertia and motion relative to the centre of interia.

Motion about a fixed axis, Compound pendulum,

Motion of rigid body in two dimensions under finite and impulsive forces. Conservation of momentum and energy, Lagrange's equation, Euler's equations of motion, Hamilton's principle, Hamilton's equations of motion.

5.Calculus of Variations :

Variational problems with fixed boundaries – Euler's equation for functionals containing first order derivative and one independent variable, functionals dependent on higher order derivatives, functionals dependent on more than one independent variable, variational problems in parametric form, Invariance of Euler's equation under coordinate transformation.

Variational problems with moving boundaries : Functionals dependent on one and two

functions, one sided variations.

Sufficient conditions for an extremum : Jacobian and Legendre conditions, Second variation, Variational principle of least action.

6.Discrete Mathematics:

Formal Logic – Statements, symbolic Representation and Tautologies, Quantifiers, Predicates and Validity, Propositional Logic.

Semigroups and Monoids – Definitions and Examples, Homomorphisms of Semigroups and Monoids, congruence relation and Quotient Semigroup, Subsemigroup and sub-monoids, direct products, basic homomorphism theorem.

Lattices – Lattices as partially ordered sets, their properties, Lattices as Algebraic system, Sub-lattices, direct product and Homomorphisms, complete, complemented and Distributive Lattices.

Boolean Algebras – Boolean Algebras as Lattices, Various Boolean Identities, switching algebra example, Sub-algebras, Direct products and Homomorphisms, Join-irreducible elements, Atoms and Minterms, Boolean forms and their equivalence, Minterm Boolean forms, sum of products, Canonical Forms, Minimization of Boolean Functions, Applications of Boolean Algebra to switching theory, the Karnaugh Map Method.

Graph Theory – Definition of Graphs, Paths, Circuits, Cycles and Subgraphs, Induced Subgraphs, Degree of a vertex, Connectivity, Planar Graphs, trees, Euler's formula for connected planar graphs, complete and complete Bipartite Graphs, Kuratowski's theorem and its use,

Spanning trees, matrix representation of graphs, Euler's theorem on the existence of Eulerian Paths and circuits, directed graphs, Indegree and Outdegree of vertex, Weighted undirected Graphs, directed trees, search Trees, Tree Traversals.

7.Mathematical Statistics:

Moments, method of least squares and curve fitting, moments of bivariate distribution, correlation coefficient and regression, partial and multiple correlation for three variables.

Probability : Axiomatic definition of probability, Independent events, Baye's theorem, discrete and continuous random variables.

Probability distribution functions : Binomial, Poisson's and normal probability distributions. Chi square distribution, t-, f- and z- distributions.

PAPER-II

1. Abstract Algebra :

Groups- Normal and subnormal series, composition series, Jordan-Holder theorem, Solvable groups, Nilpotent groups, p-Sylow subgroups, Cauchy's theorem, Conjugacy relation, Class equation, Direct product, Sylow theorems, Structure theorem for finite abelian groups.

Rings- Integral domain, Imbedding theorem, prime and maximal ideals, Quotient rings, Euclidean rings, Polynomial rings, Gaussian rings, unique factorization theorem.

Modules- Modules and submodules, quotient module, Isomorphism theorem, cyclic modules, simple modules, semi-simple modules, Sehuler's Lemma, Free modules.

Field Theory- Extension fields, algebraic and transcendental extensions separable and inseparable extensions, normal extensions, perfect fields finite fields, Primitive elements, Algebraically closed fields, Automorphisms of extensions, Galois extensions, fundamental theorem of Galois theory solution of polynomial equations by radicals.

Canonical Forms- Similarity of linear transformations, Invariant subspaces reduction to triangular forms, Nilpotent transformations, Index of nilpotency, Invariants of a nilpotent transformation, The primary decomposition theorem, Jordan blocks and Jordan forms.

2. Fluid Dynamics :

Kinematics- Lagrangian and Eulerian method, Equation of continuity, Boundary surface, Stream lines, Path lines and streak lines, Velocity potential, Vortex line, Rotational and irrotational motion.

Equation of motion- Euler's and Lagrange's equation of motion, Bernoulli's equations, Equation of impulsive action.

Motion in two dimensions- Sources and Sinks, stream or current function, Complex potential, Doublets, Images Milne-Thomson circle theorem, Theorem of Blasius, Flow and circulation, Kelvin's circulation theorem, Performance of irrotational motion, Kinetic energy of infinite liquid.

Motion of cylinders- General equation of cylinder, Kinetic energy, Motion of circular and elliptic cylinders, Liquid streaming past a fixed circular/elliptic cylinder, Kinetic energy of elliptic cylinder.

Motion of Spheres- Motion of a sphere through liquid at rest of infinity, liquid streaming past a fixed sphere, Equation of motion of a sphere, Stoke's stream function.

3. Functional Analysis :

Normed linear spaces, Banach spaces, Continuous linear transformations, spaces of continuous linear transformations from a linear space to a Branch space, Continuous linear functionals.

Hahn-Banach theorem for real linear spaces, complex linear spaces, and normed linear spaces, Natural imbedding of N in N **, open mapping theorem, closed graph theorem, conjugate of an operator, Banach-Steinhaus theorem, Uniform boundedness theorem and some of its consequences.

Conjugate spaces, Weak of weak* topologies on conjugate space, Simple applications to reflexive separable spaces and to the calculus of variations.

Hilbert spaces, Schwarz's inequality, Orthogonal complement of a subspace, Orthonormal sets, Bessel's inequality, Continuous linear functionals, Riesz representation theorem, Reflexivity of Hilbert spaces, adjoint of an operator, self-adjoint operators, normal and unitary operators, Projections.

Finite dimensional spectral theory: Determinant and the spectrum of an operator, the spectral theorem.

4. Integral Equations :

Definition and classification of integral equations.

Fredholm integral equation of the second kind with separable kernel, reduction to a system of algebraic equations. Method of successive appoximations, interative scheme for Fredholm integral equation of second kind, condition of uniform convergence and uniqueness of series solution, resolvent kernel, Eigen values and eigen functions, Classical Fredholm theory.

Conversion of differential equations into integral equations, initial value problems, application of inerative scheme to Volterra integral equation of second kind, method of successive approximations for Volterra integral equations.

Integral transform methods :

Fourier transform, Laplace transform, convolution integral, application to Volterra integral equations with convolution type kernels.

Symmetric kernels:

Complex Hilbert space, Orthonormal system of functions, Fundamental properties of eigen values and eigen functions for symmetric kernels, Hilbert-Schmidt theorem and its immediate consequences, solution of integral equations with symmetric kernels.

5. Partial Differential Equations :

Nonlinear partial differential equations of the first order, Cauchy's method of characteristics, Compatible systems of first order equations, Charpit's method, Special types of first order equations, solutions satisfying given conditions, Jacobi's method.

Partial differential equations of the Second order with variable coefficients, Canonical forms, Separation of variables, Nonlinear equations of the second order-Monge's method, Laplace equation, wave equation and diffusion equation.

6. Analytical Dynamics :

Generalized coordinates, Holonomic and non-holonomic systems, Sclronomic and rheonomic systems, generalized potential, Lagrange's equations, uniqueness of solution, Energy equation for conservative fields.

Hamilton's canonical equations, Cyclic coordinates, Routh's equations, Poisson Brackets, Poisson Identity, Jacobi-Poisson theorem. Shortest distance, Minimum surface of revolution, Brachistochrone problem, Isoperimetic Problems.

Hamilton's principle, Principle of least action, Poincare Cartan integral invariant, Hamilton-J acobi equation, Lagrange's brackets. Invariance of Lagrange's brackets and poisson brackets under canonical transformations.

7. Operations Research :

Operations research and its scope, Necessity of operations research in industry.

Linear Programming : Simplex method, Big-M Mehod, Duality and sensitivity analysis. Transportation and Assignment problems.

Game Theory:

Two-Person zero-sum games, Games with mixed stategies, Graphical solution, solution by linear programming.

Sequencing Models:

Assumptions for sequencing problem, Processing n jobs through two machines, Processing n jobs through three machines, Processing two jobs through m machines.

Network Analysis : Construction of a network diagram. PERT and CPM, Time estimates in PERT, Project Crashing.