2. LATERAL ENTRY ADMISSION TO THE SECOND YEAR OF UG PROGRAMME

2.1 ELIGIBILITY:

A candidate shall be eligible for admission in the B.E./B.Tech. programs subject to the following conditions:

The candidate

(i) has passed

(a) diploma, in relevant* discipline, of minimum 3-years duration after matriculation from Polytechnic College/Institute affiliated with State Board of Technical Education/University, or recognized by UGC/AICTE with a minimum of 60% marks (55% for SC/ST) in aggregate or equivalent grade point.

OR

(b) diploma, in relevant* discipline, of minimum 2-years duration after 10+2 from Polytechnic College/Institute affiliated with State Board of Technical Education/University, or recognized by UGC/AICTE with a minimum of 60% marks (55% for SC/ST) in aggregate or equivalent grade point.

OR

(c) B.Sc. (Non-Medical) from recognized University with 60%(55% for SC/ST) marks in aggregate

(ii) has qualified LEET-TU with at least 20% aggregate marks (15% for SC/ST candidates).

(iii) possesses a good moral character.

(iv) is a citizen of India.

* The various UG programs and their relevant diploma disciplines are given as below:

SR. No.	Name of Programme	Relevant Disciplines of Diploma
1.	CHEMICAL ENGINEERING	Chemical Technology/ Chemical Engineering / Food Technology/Biotechnology / Mechanical
2.	CIVIL ENGINEERING	Civil Engineering/Architectural Assistantship
3.	COMPUTER ENGINEERING	Computer Engineering/Computer Programming & Application/ Computer Servicing & Maintenance/Information Technology/Electronics &Communication/ Electronics & Computer Engineering
4.	ELECTRICAL ENGINEERING	Electrical Engineering, Electrical & Electronics Engineering, Electronics Engineering, Electronics & Communication
5.	(a) ELECTRONICS & COMMUNICATION ENGINEERING (b) ELECTRONICS AND COMPUTER ENGINEERING (c) ELECTRONICS (INSTRUMENTATION & CONTROL) ENGINEERING	Electronics & Communication/ Electrical and Telecommunication Engineering/Electrical and Electronics/Electronics & TV Technology/ Electronics &Microprocessors/ Electronics and Instrumentation/ Electronics & Computer/ Computer Science & Engineering/Computer Science/ Computer Engineering/ Information Technology, Electrical & Electronics Engineering,

		Instrumentation Technology, Instrumentation & Process Control, Instrumentation & Control.
6.	(a) MECHANICAL ENGINEERING (b) MECHANICAL ENGINEERING (PRODUCTION) (c) MECHATRONICS	Mechanical Engineering/Production & Industrial Engineering/ Refrigeration & Air Conditioning/ Foundry Technology/Industrial/Production Engineering/Maintenance of Plant & Machinery/ Welding Technology/Tool and Die/ Automobile/ Mechatronics/Aerospace Engineering/ Aeronautical Engineering/Marine Engineering/ Mechanical Engineering (RAC).

Note: Candidates are required to fill one form for the discipline(s) mentioned at each SR. No. e.g., If a candidate is willing to apply for disciplines at SR. No. 4 and SR. No. 5, then he/she is required to fill two forms with requisite fee for each form and is also required to take the entrance test of each and If he/she is interested for applying in the two different disciplines mentioned at SR. No. 5 then he is required to fill one form and appear in single test corresponding to SR. No. 5 only.

2.2 NUMBER OF SEATS

Lateral Entry admission to B.E./B.Tech. programme for diploma holders & B.Sc. (Non-Medical) at the 2nd year (3rd Semester) level will be made through Lateral Entry Engineering Test (LEET) to be conducted by Thapar University (**LEET-TU**) for the following seats in various categories:

Categories → Disciplines ↓	General		SC (15%)		ST (7.5%)		PH (3%)		Grand Total	
	Diploma	B.Sc.	Diploma	B.Sc.	Diploma	B.Sc.	Diploma	B.Sc.	Diploma	B.Sc.
Chemical Engineering	7	7	1	1	1	1	0	0	9	9
Civil Engineering	9	9	2	2	1	1	0	0	12	12
Computer Engineering	32	32	7	7	3	3	1	1	43	43
Electrical Engineering	11	11	2	2	1	1	1	1	15	15
Electronics & Communication Engineering	12	12	2	2	1	1	1	1	16	16
Electronics and Computer Engineering	9	9	2	2	1	1	0	0	12	12
Electronics (Instrumentation & Control) Engineering	7	7	2	2	1	1	0	0	10	10
Mechanical Engineering	11	11	2	2	1	1	1	1	15	15
Mechatronics	2	2	1	1	0	0	0	0	3	3
Mechanical Engineering (Production)	4	4	1	1	1	1	0	0	6	6
Total	104	104	22	22	11	11	4	4	141	141

- In addition to above seats, 1% over and above seats are reserved for children of employees of Thapar University. The candidates seeking admission under this category are required to satisfy the eligibility as mentioned above at 2.1.

- Seats, if any in the reserve categories remained unfilled, such vacant seats shall be filled by General category candidates on the basis of merit. In case a SC seat remains vacant, it will be first offered to ST candidate or a vice versa before converting into General Category.

- In case of seat(s) meant for Diploma holders remaining vacant, the seat(s) shall not be offered to B.Sc.(Non-Medical) degree holders and vice versa.

- Vacant seats of first year of B.E./B.Tech. 2016 batch shall also be filled through lateral entry candidates in session 2017-18.

2.3   FEE: The candidates admitted through LEET-TU (2017) are required to deposit the same tuition fee and other dues as applicable to the candidates admitted in B.E./B.Tech. through JEE (Main)-2017 in the session 2017-18.

2.4   GENERAL INFORMATION REGARDING LEET-TU OFFLINE ENTRANCE TEST INCLUDING ENTRANCE TEST SYLLABUS

I) For Diploma holders

There will be two papers as per details given below:
Paper-I General
Paper-II Professional

Duration of Test: 120 minutes (100 Questions)

The question paper will contain multiple choice objective type questions of one mark each.

Paper-I shall contain 40 questions in all with 10 questions in each of **Physics, Chemistry, Mathematics and English. Paper-II** shall contain 60 questions in the **relevant engineering discipline** each carrying one mark.

**Negative Marking: 1/4th*marks shall be deducted for each wrong answer.*

PAPER-I GENERAL

MATHEMATICS

Algebra: Quadratic equation, equations reducible to quadratic form, relation between roots and coefficients. Arithmetic progression, Geometric progression, series of natural numbers, partial fractions, Binomial Theorem and its applications. **Trigonometry:** Trigonometric ratios and their relations, Ratios of some standard angles, solution of trigonometric equations, sum and difference formulae, product formulas. Multiple and sub-multiple angles, solution of triangles.
Co-ordinate Geometry: Cartesian Co-ordinates, Equations of straight lines in various forms, Intersection of two straight lines, angles between two lines, Distance formulae, Equation of a circle in various forms, Tangent and normal to a circle. **Differential Calculus:** Concept of a function, limit, standard limits, Continuity, Differentiation, their geometrical and physical meanings, Differentiation from first principles, Differentiation of sum, product, quotient of functions, function of a function, Differentiation of implicit functions, trigonometric functions and logarithmic differentiation.
Integral Calculus: Definite and Indefinite integrals, method of integration by substitution, by parts and partial fractions, Integration of rational and irrational functions.

PHYSICS

Heat: Heat as a form of energy, Mechanical equivalent of heat (Joule's experiment), Specific heat of a gas, Measurement of temperature, Platinum resistance and thermoelectric thermometers, Temperature scales, kinetic interpretation of temperature. Thermal expansion. Modes of heat transfer, Searle's method and Lee's method for thermal conductivity, Black body radiations, Stefan's law. Wien's law.

Acoustics: Wave motion, velocity of sound, Newton's formula and Laplace's correction, Beats, Doppler Effect, Intensity of sound waves, Reverberation, Acoustics of buildings, Production and detection of ultrasonic waves.

Optics: Refraction through a compound plate, total internal reflection, Optical fiber, image formation by spherical mirrors/lenses, Lens maker's formula, Chromatic aberration and its removal, Optical instruments- simple and compound microscopes, Astronomical telescope, Magnifying power & resolving power, Huygerns principle & its applications, Young's double slit experiment, Diffraction through a single slit, Polarisation of light,

Electricity and Magnetism: Electric field and electric potential, Electric dipole and its field, Gauss's law and applications, Energy stored in a capacitor, Dielectrics, Current Electricity, Kirchoffs laws and applications, Slide wire bridge, Potentiometer, Ammeter, Voltmeter, Thermal and chemical effects of current.

Electromagnetism: Magnetic effects of current, Biot-Savart law and applications, Lorentz force, moving coil galvanometers, Laws of electromagnetic induction, Mutual and self-inductance, AC generator, Alternating currents, LR, CR, LCR, circuits.

Modern Physics: Determination of e/m and e of electron, Bohr's model and hydrogen spectra, Spectral series, Photoelectric effect, Matter waves.

CHEMISTRY

Structure and bonding: Fundamental particles, Heisenberg's uncertainty principle, Quantum numbers, Pauli's exclusion principle, Aufbau rule, Hund's rule, ionic and Covalent bond, orbital concept of covalency, Hybridizsation (sp, sp2 and sp3). **Chemical Equilibria, Electrochemistry and Redox Chemistry:** Balancing Chemical equations, Oxidation and Reduction reactions, electronic Concept, balancing redox reactions by oxidation number method. Faraday's laws of Electrolysis and its application in Electroplating, Electrometallurgy and Electrorefining, Degree of ionisation, Equilibria in aqueous solutions, solubility product and common ion effect, Modern concepts of acid & base, their strength and ionization constant, pH value, acid base titrations, choice of indicators and Buffer solutions.

Colloids and Water: Particle size and colloidal state, Preparation of colloids by dispersion and condensation, Stability and properties of colloids, Tyndell effect, Brownian movement, coagulation. Hard and soft water, degree of hardness and its determination, Disadvantage of hard water in industrial use and boilers.

Organic Chemistry: Nomenclature of organic compounds, IUPAC system. Saturated and unsaturated Hydrocarbons, Ethane, Ethylene and Acetylene. Substitution and addition reactions (preliminary ideas). Isomerisation (Chain position, functional, cis-trans and optical), Aldehydes and Ketones, preparation, properties and qualitative tests. Polymerisation, addition and condensation polymerisation, degree of polymerisation, Linear and cross linked polymers.

ENGLISH

Idioms and phrases and their usage, Correction of sentences, sentence structure, sequence of tenses, Parts of speech, Words often confused in the form of pair of words, Common synonyms and antonyms, Active and Passive voice, Direct and indirect speech, Punctuation.

PAPER–II PROFESSIONAL

A. For candidates seeking admission to the disciplines of MECHANICAL ENGINEERING/ MECHANICAL ENGINEERING (PRODUCTION)/MECHATRONICS

Manufacturing Process: Dry sand and green sand casting: Casting defects: Die casting, Continuos casting and Centrifugal casting, Welding Process: Gas welding, Arc welding, Resistance welding; Thermit welding: Soldering and Brazing: Welding defects and precautions, Elements of metal cutting; Cutting tools tool geometry, cutting fluids; Lathe and Milling operations: Grinding process, grinding wheel: Introduction to Broaching and gear generation processes; Electric discharge machinery. Water Jet machining and ultrasonic machining. Forming processes: Hot and Cold working: Rolling: Punching, blanking, shearing, spinning.

Thermal Engineering: Basic concept of Thermodynamics : Energy, Thermo-dynamics systems, types (open and closed) Heat and work, specific heat, Enthalpy, laws of thermodynamics: Zeroth, First and Second Laws Reversible and irreversible process, Entropy.
Description of various types of Boilers, boiler mountings and accessories. Basic concepts of thermal conduction, convection and radiation. Basic equations of different cases of Conduction. Convection (natural and forced) and radiation. Concept of Black, white and opaque bodies, Stefan Boltzmans laws.

Mechanics of Solids: Concepts of bending moment and shear force. Bending moment and shear force diagrams for cantilevers, simply supported beams, overhanging beams subjected to concentrated and U.D. Ls. Concepts of torsion. Derivation of torsion equation for circular shafts. Close coiled helical spring subjected to axial load and twisting moment, stiffness of a spring. Its angle of twist, strain energy and proof resilience.

Metrology: Necessity and importance of Metrology in Engineering field, standards of measurements, line and wave length: Limits, fits and tolerances. Concept of interchangeability. Angle and Taper Measurements: Slip gages and dial indicator in taper measurement. Screw Thread Measurements: Measurements of Mojor diameter. Minor diameter, effective diameter, pitch. Angle and Form of threads for external and internal threads. Comparator: Types of Comparators (Mechanical, optical, electrical, electronic and pneumatic). Limit gauges: Go and No-go gauges. Alignment tests on lathe. Drilling machine. Milling machine and grinding machine.

Materials and Metallurgy: Introduction to Engineering materials, ferrous and nonferrous materials: Pig iron grey and white cast iron, alloying elements in steel and their effect. High speed steel, heat resistant steel and spring steel. Aluminum and its alloys. Bearing metals. Plastic materials, refractory materials, tempering, hardening and surface hardening processes, selection of materials for different components.

Industrial Engineering and Management: Work study, uses of work study: Objectives and basic procedure of Method study and work measurements. Types of inspection, inspection at various stages. Quality control: its advantages: Statistical quality control. Control charts and sampling plans. Types of production: Materials requirements planning, Plant location and layout, types of layouts and their comparison. Importance and advantages of standardization. Cost reduction through standardization. Management of men, materials and machines. Types of industrial organizations: Wages and incentives, trade unions: Role of technician in industry.

Refrigeration and Air Conditioning: Basic concepts and principles of refrigeration: Refrigeration methods. Air refrigeration cycle, vapour compression cycle, simple vapour absorption cycle, their applications and limitations. Refrigerants: Important properties of refrigerants, properties and applications of commonly used refrigerants such as R11, R12, R22, NH3 etc. Air conditioning, its concepts. Human comfort, application of air conditioning, Description of room air conditioning, packages air conditioner, central air conditioning system.

Theory of Machines: Simple mechanisms: Flywheels, Co-efficient of friction, Motion of a body along horizontal and inclined planes. Friction in screw jack, friction between nut and screw square and V-threads. Concept of power transmission, various power transmission systems with their merits and demerits. Flat and V-belts drives, ratio of tensions. Horse power transmitted, centrifugal tension, condition for maximum power transmission, and function of governors. Definitions of sensitivity, stability, synchornism and hunting of governors, description and simple problems on watt, porter and Hartnell governor.

B. For candidates seeking admission to the disciplines of ELECTRONICS & COMMUNICATION ENGINEERING, ELECTRONICS & COMPUTER ENGINEERING and ELECTRONICS (INSTRUMENTATION & CONTROL) ENGINEERING

Network Analysis: Circuit laws and their applications in solving problems, Network theorems, all types of network, one port, two port, symmetrical, unsymmetrical balanced, T. Ladder, lattice, bridge, their characteristic impedance. Attenuators, filters. Concept of different types of filters, Impedance matching of filters. Transmission lines, concept and applications, characteristics impedance, different methods of loading, concepts of reflection and standing waves.

Analog Electronics: PN junction diode, V-I characteristics, Diode as half wave, full wave and bridge rectifier, Zener diodes, Concepts of bipolar transistors and common base common emitter, common collector configuration and parameters. Different types of amplifiers, working principles and expression of voltage gain, current gain, input impedance, output impedance, etc. Working principles of Multi-vibrators, time base, operational amplifier, timer and regulated power supply.

Digital Electronics Binary and hexadecimal number system, Binary addition, subtraction, multiplication and division, Logic Gates, DE Morgan's Theorems, K-Map, TTL and MOS families, BCD, excess-3 and Gray code, Arithmetic circuits, Decoders, Multiplexers and De-Multiplexers, flip flops, Counters, Types of RAM/ROM, A/D and D/A conversion.

Computer Architecture and Microprocessors: Design of basic computer, Introduction to RISC, CISC architecture, Control Unit – Hard wired and Micro programmed, Pipeline processing, Memory Hierarchy, associative memory, cache memory, virtual memory, I/O organization. CPU, Microprocessor, structure of 8085. Instruction set, addressing modes, Instruction Cycle, Register Organization, Simple programming in assembly language. Input/output operations, concept of interrupts structure, Microprocessor applications.

Programming Language C: Constants, variables and data types, Operators and Expressions, Control Structures, Functions, Arrays, Pointers, Strings, Structure and Unions, File Handling.

Operating System (OS): System Software: Compiler, Assembler, Loader, Definition, types and importance of Operating Systems, Memory organization, Process Management Functions, Job Scheduler, Process Scheduler, Process synchronization, Memory Management Function, Segmentation, Swapping, Simple Paging System, Virtual Memory, I/O Management Functions, Dedicated Devices.

Communication Theory and Systems: Communication systems types, types of modulation, amplitude modulation, frequency modulation, AM modulators. Demodulation of AM waves, FM waves, transmitters and radio receivers. Antenna and wave propagation. Types and areas of applications. Conducting materials, low and high resistivity materials, super conductivity. Development of modern insulating materials. Magnetic materials, permeability, Hysteresis loop, soft and hard magnetic materials. Components, Capacitor, polyster, Metallised, polyster gap ceramic, paper and electrolytic types. Resistors of different types. Transformers, Inductors and RF Coils, Printed circuit boards.

C. For candidates seeking admission to the disciplines of COMPUTER ENGINEERING

Analog & Digital Electronics: PN junction diode, V-I characteristics, Diode as half wave, full wave and bridge rectifier, Zener diodes, CB, CE, CC configuration of the transistor, Binary and hexadecimal number system, Binary addition, subtraction, multiplication and division, Logic Gates, DE Morgan's Theorems, K-Map, TTL and MOS families, BCD, excess-3 and Gray code, Arithmetic circuits, Decoders, Multiplexers and De-Multiplexers, flip flops, Counters, Types of RAM/ROM, A/D and D/A conversion.

Programming Language C: Constants, variables and data types, Operators and Expressions, Control Structures, Functions, Arrays, Pointers, Strings, Structure and Unions, File Handling.

System Analysis and Design: Systems Development Life Cycle, Feasibility Study, cost and benefit analysis, Requirement Specifications and Analysis.

Introduction to Databases

Architecture and structure of Database Management System, data independence, ER Diagrams, Introduction to network, hierarchical and relational model, Domain, Attributes, Tuples and Relations, Entity and referential integrity, keys, Normalization, First, Second and Third normal forms, Boyce/Codd normal form, Structured Query Language: DDL and DML statements.

Data Structure: Basics, Arrays, Operations on arrays with Algorithms (searching, traversing, inserting, deleting), Traversing a linked list, searching linked list, Insertion and deletion into linked list, Application of linked lists, doubly linked lists, Stacks, Queues, Binary Trees, Search algorithm (Linear and Binary), Sorting algorithms (Bubble Sort, Insertion Sort, Quick Sort, Selection Sort, Merge Sort, Heap Sort) and their comparisons.

Computer Architecture: Instruction Code, Instruction Cycle, Instruction types, Design of basic computer, Register Organization, Addressing modes, Introduction to RISC, CISC architecture, Control Unit – Hard wired and Micro programmed, Pipeline processing, Memory Hierarchy, associative memory, cache memory, virtualmemory, I/O organization.

Data Communication and Computer Networks: LAN, MAN and WAN, OSI Model, Topologies, Basic access protocols: CSMA/CD, Token Passing, Ethernet, Error Detection, Network connectivity Devices, NICs, Hubs, Repeaters, Multiplexers, Modems, Routers and Protocols, Firewall, ATM, Different classes of IP addressing, Protocol Suites.

Object Oriented Programming Using C++: Procedure oriented programming Vs. Object oriented programming (OOP), Classes, Objects, reusability, encapsulation, dynamic binding, message passing, Constructor and Destructor, Member Functions, Overloading Member Functions, Inheritance, Protected, private and public data, types of inheritance, single inheritance, hierarchical inheritance, multiple inheritance, Polymorphism and Virtual Functions.

Operating System (OS): System Software: Compiler, Assembler, Loader, Definition, types and importance of Operating Systems, Memory organization, Process Management Functions, Job Scheduler, Process Scheduler, Process synchronization, Memory Management Function, Segmentation, Swapping, Simple Paging System, Virtual Memory, I/O Management Functions, Dedicated Devices.

D. For candidates seeking admission to the discipline of ELECTRICAL ENGINEERING

Introduction: Comparison of copper and aluminum as electrical conducting material. Development of modern insulating materials. Development of dynamo grade and transformer grade silicon sheet steel materials. Circuit laws and their applications in solving problems. Concept of permeability, reluctance, mmf, coreless. Concept of phase difference, phase representation of alternating quantities.

Poly Phase System: Production of rotating magnetic field in electrical machines. Characteristics of D.C. machines. Shunt series and compound types, speed control of D.C. motors. Transformer-single phase, three phase, phasor diagrams, equivalent circuits, testing, regulation, losses, efficiency, parallel operation, maintenance.

Three Phase Induction Motor: Slip, torque & their various relations. Torque-slip characteristics, equivalent circuit, starting, testing, speed control, maintenance.

Single Phase Induction Motor: Torque/Speed characteristics, methods of producing starting torque, capacitor, shaded pole and reluctance motors.

AC Series Motor, Universal Motor: Synchronous machines: Speed/frequency relation, EMF equation, winding coefficients, synchronous impedance concept, phasor diagram, Regulation. Parallel operation, V curves, starting.

Measuring Instruments: Indicating, integrating and recording instruments: deflecting, controlling and damping torques; moving coil and moving iron instruments, sources of errors extension range Watt-meters, Dynamometer type, maximum demand indicators, Energy-meters-single phase and three phase, Megger, Earth tester, Multi-meter, power factor meter.

Electronic Instruments: VTVM, CRO, Electronic multi-meter, analog multi-meter, digital meters. Measurement of inductance and capacitance and capacitance, power measurements in 3 ph. Circuits.

Transmission System: Selection of voltage, comparison of A.C. and D.C. systems, comparison of 3 ph. & 1ph. Systems. Electrical features of transmission line: Calculation of resistance, inductance and capacitance in a.c. transmission lines. Problems on efficiency and regulation, corona. Distribution system: Layout of H.T. and L.T. distribution system. Comparison of overhead and underground distribution system. Estimation, Generation. Conventional and Non-conventional sources of energy. Different types of power stations. Comparison, Load estimation – concept, types of power stations, comparison, Load estimation, concept of regional and national grid. Switch gear system: - Circuit breakers, Types, ratings, Comparison, Protection: - Fuses, relays, types & characteristics, comparison. Protection schemes of generators, transformers, bus bars, feeders.

E. For candidates seeking admission to the discipline of CIVIL ENGINEERING

Structural Engineering: Simple stresses and strains, Elasticity, Hooke's Law, Moduli of Elasticity and Rigidity. Stresses and strains of homogeneous materials and composite sections. Types of beams and supports and loads, concept of bending moment and shear force. Bending moment and shear force diagrams for simple cases. Deflection in beams. Moment area theorem, Bending and shear stresses in circular, rectangular, T and L sections, Comparison of strength of the above sections, Design of singly and doubly Reinforced beams, Design of Columns-Types of Columns. Short and long column, load carrying capacity, effective length of column, lateral and helical ties. I.S. Specifications for reinforcement detailing. Design of slabs types of slabs, one-way slab, two-way slab, I.S. specifications for Reinforcement detailing method of design as per I.S. code. Design of foundations-isolated footing rectangular footing, square footings, circular footings. Design of tension members in structural steel, gross area, net area, tension splice, design of tension member. Design of compression members, column splice, load carrying capacities. Design of beams in structural steel.

Surveying: Linear measurements with tape, corrections, chain surveying, offsets, perpendicular offset, oblique offset, measurement of offsets, limiting length of offset, Field book, Instructions for booking field notes, Instruments for setting out right angles, Compass surveying, Prismatic compass. Surveyor's compass, comparison between prismatic and surveyor's compass, meridians & bearings, calculation of included angles from bearings, calculation of bearing from including angles, local attraction, magnetic declination levelling, types of levels. Principles of levelling, Classification of levelling. Rise & Fall method, Height of Instrument method, various corrections in levelling. Theodolite surveying, measurement of angle by theodolisty.

Transportation Engineering: Introduction of Transportation Engineering, Traffic Engineering, Road materials, Geometric design, Design of flexible and rigid pavements, Road maintenance, Railway Engg. Rails, Sleepers, ballast, points and crossing, Track laying and track maintenance, typical sections of tunnel, method of construction of tunnels in soft rock.

Soil and Construction Engineering: Foundations-types, construction details, walls, load bearing and non-load bearing walls, brick masonry, bonds in masonry, stone masonry, type

of a stone masonry, partition walls, doors. Floors-types of floors, construction procedure, maintenance of buildings, properties of bricks and stones, cement, aggregates, workability of concrete, Batching, mixing, compaction, placing, curring of concrete. Properties of hardened concrete. Introduction to soil mechanics, Soil classification. Index properties of soil, Shear strength concept.

Fluid Mechanics, Irrigation and Water Supply Engineering: Specific weight, density, specific gravity, viscosity, vapour pressure, cohesion, adhesion, surface tension, capilarity and compressibility. Pressure, intensity of pressure, pressure head, and pascal's Law and its applications. Total pressure, resultant pressure and center of pressure on rectangular, triangular, trapezoidal, circular and curved surfaces. Atmospheric, gauge and absolute pressure, simple differential manometers. Steady and unsteady flow, laminar and turbulent flow, uniform and non-uniform flow. Discharge and continity equation, Bernoulli's theorem, statement and description, venturimeter, orifices, time of emptying tanks of uniform cross section by a single orifice. Laminar and turbulent flow explained through. Reynolds experiments. Reynolds number and critical velcity and velcity distribution, losses in pipes, hydraulic gradient line, and total energy line flow from one reservoir to another through a long pipe of uniform and composite section. Water hammer, uniform and non-uniform flow, discharge through channels using chezy's formula and Manning's formula. Most economical sections, rectangular, trapezoidal and circular. Measurement of discharge by notches and weirs, measurement of velocity by Pitot tube and current meter. Introduction to irrigation Engg. Flow irrigation, head works and river training works, water logging, water supply, sources   of water, Water treatment. Types of pipes, lying of pipes. Quality of sewage, laying of sewers, Building drainage and rural sanitation.

F.   For candidates seeking admission to the discipline of CHEMICAL ENGINEERING

Basic Chemical Engineering: Units & conversions, Dimensional analysis, Gas Law, Material Balance consisting key components, simultaneous Equation by pass and recycle. Energy Balance. The first law type of heat effects, heat capacities, thermochemistry.

Fluid Flow and Mechanical Operation: Flow of incompressible Fluids, Laminar and Turbulent Flow in Pipes, Frictional Losses in pipes.

Flow Measurement: Pitot tube orfice meter, venturmeter, Rotamater, Weir & Notches, (their construction and derivation with formula).

Transportation of Fluids: Classification of Pumps, construction and operation of reciprocating, rotary, centrifugal and gear Pumps. Different type of valves, fans, blowers and compressors, Description of various size reduction equipments and laws for power requirement. Separations, Screening, filtration thickeners, classifiers, Centrifuges and cyclone separator.

Heat Transfer & Mass Transfer
Heat Transfer: Conduction, Fourier's law, Heat Flow through composite walls, Cylinders and spheres, insulations.

Convection: Natural & Forced convection, LMTD, Significance of Reynold number, Prandit's number and Grashof Number.

Radiation: Kirchoff's Law, Emissive power, wein's displacement law, Stefan Boltzman law, Emissivity, Absorptivity, Black Body and Green Body radiations. Boiling, Condensation and evaporation, Heat Exchanger: Double Pipe Shell & Tube.

Mass Transfer: Principles and Description of various unit operations involving mass transfer such as Distilation, Absorption, Extraction, crystallization & Drying.

Unit Processes & Process Technology: Principles of some unit Processes such as Nitration. Sulphonation, Halozenation, Oxidation, Reduction, and Products based on them. Basic Processes for the manufacture of products such as sugar, Fertilizer. Dyestuffs and paints.

Process Instrumentation & Control: Principle and Application of following Instruments device. Pressure and Vacuum Gauge. Thermometer and Pyrometer, Liquid Level meter: Visual indicators. Float actuated level meter.

Analyzers: PH meter, oxygen analyzer colorimetric analyzers. Infra-red& near Infix analyzer.

Transmission: Pneumatic and Inductance transmission. Concept and advantage of automatic Process Control.

Controllers: Pneumatic, Electronics, hydraulic, FD, TI, ID Controllers.

Engineering Material: Types of Different materials, such as metals, alloys and polymer their structure. Composition and application of these materials for various situations in Chemical Industry.

Sample Questions PAPER – 1(GENERAL)

PHYSICS

1.   The earth receives solar radiation, from which one can find the temperature of the surface of the sun. The approximate temperature of sun's surface is

   (A) 600 K   (B) 900 K   (C) 60,000 K   (D) 6,000 K
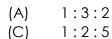2.   The characteristics of a fuse wire should be

   (A)low resistivity and high melting point. (B) high resistivity and high melting point. (C)high resistivity and low melting point. (D) low resistivity and low melting point.

CHEMISTRY
1.   When HCl gas is passed through a saturated brine solution, NaCl is precipitated because
   (A)   NaCl is not soluble in acidic solution.
   (B)   Solubility product of NaCl decreases in presence of H^+ ion.
   (C)   Saturated solution cannot hold any more solute, hence NaCl precipitates.
   (D)   In presence of Cl^- ion, ionic concentration exceeds solubility product of NaCl, therefore NaCl separates out.
2.   When 13.5 gm of Al is deposited on passing current through molten Alumina, the number of faradays of electricity consumed would be
   (A) 0.5   (B) 1.0   (C) 1.5   (D) 2.0

MATHEMATICS

1. If the quadratic equation $(a^2+b^2)x^2+2b(a+c)x+(b^2+c^2)=0$ has equal roots, then
   (A) a, b and c are in A.P.   (B)a, b and c are in G.P.
   (C) a, c and b are in A.P.   (D) a, c and b are in G.P.

2. If the angles of a triangle ABC are in the ratio 1:2:3, then the sides of the triangle are in the ratio:

(A)	1 : 3 : 2	(B) 1 : 2 : 3
(C)	1 : 2 : 5	(D) 1 : 3 : 1

ENGLISH

1. Choose the appropriate antonym for the following: "Fundamental"

(A) superfluous (B) superficial (C) profound (D) particular

2. Choose the most appropriate ACTIVE form for the PASSIVE sentence given below:

PASSIVE: "They are likely to be punished"
ACTIVE:
- (A) It is likely that they will be punished.
- (B) It is likely for someone to punish them.
- (C) It is likely that someone will punish them.
- (D) Someone is likely to punish them.

PAPER – II (PROFESSIONAL)

COMPUTER ENGINEERING

1. The structure of the Colpitts oscillator is related to the
   - (A) Hartley oscillator
   - (B) Wein Bridge oscillator
   - (C) Phase shift oscillator
   - (D) Square wave oscillator

2. Microprogramming refers to
   - (A) Developing software for a small computer, like a palmtop.
   - (B) Programming in any situations where the memory available is very low
   - (C) Control programs for controlling gates within a CPU.
   - (D) Writing programs in assembly language.

CIVIL ENGINEERING

1. A combined footing is generally used when
   - (A) Number of columns is more than two and they are spaced far apart.
   - (B) Number of columns is two and they are spaced far close to each other.
   - (C) Number of columns is two and they are spaced far apart.
   - (D) There is only one column.

2. In slow sand filters, the rate of filtration of water is in the range of
   - (A) 175-250 lits/sqm/hr
   - (B) 500-1000 lits/sqm/hr
   - (C) 1000-5000 lits/sqm/kr
   - (D) 6000-10,000 lits/sqm/hr

MECHANICAL ENGINEERING/MECHANICAL ENGINEERING (PRODUCTION) /MECHATRONICS

1. When fluid flows in a pipe, the Nusselt number can be calculated from the relation

   (A) $V.D.\rho/\mu$ (B) $\mu.C_p/K$ (C) $h.D/K$ (D) $K.D/C_p$

2. Angle of torsion refers to the
   - (A) Maximum angle by which the shaft bends during power transmission.

(B)   Angle through which one end of a shaft will twist relative to the other end.
(C)   Angular velocity of the shaft in radians.
(D)   Angular moment at the cross section.

CHEMICAL ENGINEERING

1.   Stainless steel 316 contains
      (A)   18% chromium and 11% nickel
      (B)   16% chromium and 13% nickel
      (C)   11% chromium and 18% nickel
      (D)   No chromium and 8% nickel.

2.   The viscosity of a liquid
      (A)   Is directly proportional to temperature.
      (B)   Is inversely proportional to temperature.
      (C)   Is directly proportional to the square root of temperature.
      (D)   Is inversely proportional to the square root of temperature.

ELECTRONICS & COMMUNICATION ENGINEERING/ELECTRONICS (INSTRUMENTATION & CONTROL) ENGINEERING/ELECTRONICS & COMPUTER ENGINEERING

1.   A direct coupled amplifier has a gain of 1000 and 3 dB frequency of 1000KHz. What is its unity gain frequency?

      (A)   100 KHz   (B) 1000 KHz   (C) 10^8 Hz   (D) 10 KHz

ELECTRICAL ENGINEERING

1.   For parallel operation of two alternators, which of the following factor(s) should be identical for both?

      (A) Voltage only   (B) Frequency
      (C) Phase sequence   (D) All of the above.

2.   Mark the correct answer below as the load on an induction motor is increased upto full load:

	PF	Slip	Efficiency
(A)	increases	increases	increases
(B)	decreases	increases	increases
(C)	decreases	decreases	decreases
(D)	increases	decreases	decreases

II)   For B.Sc. (Non-Medical) holders

Duration of test: 120 minutes (100 Questions)

Physics (30 Questions), Chemistry (30 Questions), Mathematics (30 Questions) and English & Reasoning (10 Questions)

Negative Marking: 1/4th marks shall be deducted for each wrong answer.

CHEMISTRY

Periodic Table: Periodic classification of elements and periodicity in properties; general properties of s, p, d and f block elements.

Hard and Soft Acids and Bases: Classification of acids and bases as hard and soft. Pearson's HSAB concept, acid-base strength and hardness and softness. Symbiosis, theoretical basis of Hardness and softness, electronegativity and hardness and softness.

Metal-ligand Bonding in Transition Metal Complexes: Limitations of valence bond theory, an elementary idea of crystal-field theory, crystal field splitting in octahedral, tetrahedral and square planar complexes, factors affecting the crystal-field parameters.

Magnetic Properties of Transition Metal Complexes: Types of magnetic behavior, methods of determining magnetic susceptibility, spin-only formula. L-S coupling, correlation of μs and μeff values, orbital contribution to magnetic moments, application of magnetic moment data for 3d-metal complexes.

Organometallic Chemistry: Definition, nomenclature and classification of organometallic compounds. Preparation, properties, bonding and applications of alkyls and aryls of Li, Al, Hg, Sn and Ti, metal-ethylenic complexes and homogeneous hydrogenation, mononuclear carbonyls and the nature of bonding in metal carbonyls. Organomagnesium compounds: the Grignard reagents formation, structure and chemical reactions. Organozinc compounds: formation and chemical reactions.

Spectroscopy: Electromagnetic radiation, regions of the spectrum, basic features of different spectrometers, statement of the Born-Oppenheimer approximation, degrees of freedom.

UV-Visible Spectroscopy: Beer-Lambert's law, molar absorptivity, presentation and analysis of UV spectra, types of electronic transitions, effect of conjugation. Concept of chromophore and auxochrome. Bathochromic, hypsochromic, hyperchromic and hypochromic shifts. UV spectra of conjugated enes and enones.

Infrared absorption spectroscopy: molecular vibrations, Hooke's law, selection rules, intensity and position of IR bands, measurement of IR spectrum, fingerprint region characteristic absorptions of various functional groups and interpretation of IR spectra of simple organic compounds.

Nuclear magnetic resonance (NMR) spectroscopy: 1H NMR spectroscopy, nuclear shielding and deshielding, chemical shift and molecular structure, spin-spin splitting and coupling constants, areas of signals, interpretation of PMR spectra of simple organic molecules.

Stereochemistry of Organic Compounds: Concept of isomerism. Types of isomerism, Optical isomerism - elements of symmetry, molecular chirality, enantiomers, stereogeniccentre, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogeniccentres, diastereomers, threo and erythrodiastereomers, meso compounds, resolution of enantiomers, inversion, retention and racemization. Relative and absolute configuration, sequence rules, D & L and R & S systems of nomenclature. Geometric isomerism - determination of configuration of geometric isomers. E & Z system of nomenclature, geometric isomerism in oximes and alicyclic compounds. Conformational isomerism conformational analysis of ethane and n-butane, conformations of cyclohexane, axial and equatorial bonds, and conformation of mono substituted cyclohexane derivatives. Newman projection and Sawhorse formulae, Fischer and flying wedge formulae.

Heterocyclic Compounds: Molecular orbital picture and aromatic characteristics of pyrrole, furan, thiophene and pyridine. Synthesis, properties and chemical reactions with particular emphasis on the mechanism of electrophilic substitution. Mechanism of nucleophilic substitution reactions in pyridine derivatives. Preparation and reactions of indole, quinoline and isoquinoline with special reference to Fisher indole synthesis, Skraup synthesis and Bischler-Napieralski synthesis. Mechanism of electrophilic substitution reactions of indole, quinoline and isoquinoline.

Organic Synthesis via Enolates: Acidity of a-hydrogens, alkylation of diethyl malonate and ethyl acetoacetate. Synthesis of ethyl acetoacetate: The Claisen condensation. Keto-enol tautomerism of ethyl acetoacetate. Alkylation of 1,3dithianes. Alkylation and acylation of enamines.

Carbohydrates: Classification and nomenclature. Monosaccharides, mechanism of osazone formation, interconversion of glucose and fructose, chain lengthening and chain shortening of aldoses. Configuration of monosaccharides. Erythro and threodiastereomers. Conversion of glucose into mannose. Formation of glycosides, ethers and esters. Determination of ring size of

monosaccharides. Cyclic structure of D-(+)- glucose. Mechanism ofmutarotation. Structures of ribose and deoxyribose. Amino Acids, Peptides, Proteins and Nucleic Acids: Classification, structure and stereochemistry of amino acids. Acid-base behavior, isoelectric point and electrophoresis. Preparation and reactions of a-amino acids. Structure and nomenclature of peptides and proteins. Classification of proteins. Peptide structure determination, and group analysis, selective hydrolysis of peptides. Classical peptide synthesis, solid-phase peptide synthesis. Structures of peptides and proteins. Levels of protein structure. Protein denaturation/renaturation.

Nucleic acids: Constituents of nucleic acids. Ribonucleosides and ribonucleotides. The double helical structure of DNA.

Synthetic Polymers: Addition or chain-growth polymerization. Free radical vinyl polymerization, ionic vinyl polymerization, Ziegler-Natta polymerization. Polyesters, polyamides, phenol formaldehyde resins, urea formaldehyde resins, epoxy resins and polyurethanes. Natural and synthetic rubbers.

Atomic Structure: De Broglie hypothesis, the Heisenberg's uncertainty principle, Significance of ψ and $\psi2$, quantum numbers, Schrödinger wave equation and its importance, physical interpretation of the wave function. Hund's rule and electronic configuration of elements.

MATHEMATICS

Algebra: Set theory, Relations, Mapping and its applications, Permutations and combinations, Types of matrices, Rank and inverse of a matrix, Linear independence and linear dependence, Solution of system of linear equations, Eigen values and Eigen vectors of a matrix, Cayley Hamilton theorem.

Calculus: Limits, Continuity and Differentiability, Rolle's and Mean value theorems, Successive differentiation, Partial differentiation, Maxima and Minima of function of one and two variables, Maclaurin's and Taylor's theorem for functions of one and two variables, Definite integral and its applications, Beta and gamma function, Double integral and its applications, Laplace and inverse Laplace transform and their properties, Convolution theorem.

Differential Equation: Ordinary differential equations of first order and their solutions, linear differential equations of higher order with constant coefficients, Classification of partial differential equations, Partial differential equations of first order, Lagrange's solution, Charpit's method.

Analysis: Riemann integral, Integrability of continuous and monotonic functions, Mean value theorems of integral calculus, Infinite series and their convergence, Demoivre's theorem and its applications, Functions of complex variables, Analytic function, C-R equations.

Abstract Algebra: Groups, Subgroups and their properties, Lagrange's theorem, Rings, Subrings, Integral domain and Field, Vector spaces, Subspaces and their properties, Inner product spaces, Orthogonal vectors.

Numerical Analysis: Solution of non-linear equations using iterative methods, Interpolation for equally and unequally spaced data, Trapezoidal and Simpson's rules for integration.

Statistics, Probability and Linear Programming: Measures of central tendency, Dispersion, Skewness and kurtosis, Correlation and regression, Basic concepts of probability, Conditional probability, Baye's theorem, Discrete and continuous distributions (Binomial, Poisson and Normal), Fundamentals of linear programming problems, Graphical solution, Simplex method and its variants.

PHYSICS

Mechanics and Waves: Newton's laws of motion and applications, variable mass systems, projectiles. Rotational dynamics-kinetic energy, angular momentum, theorems of moment of intertia. Conservative forces, frictional forces. Gravitaional potential and intensity due to spherical objects. Central forces, Kepler's problem, escape velocity and artificial satellites. Streamline motion, viscosity, Applications of Bernoulli's equation and Stokes' law. Special

relativity, length contraction, time dilation, mass-energy relation. Simple harmonic motion, Lissajous figures. Damped oscillation, forced oscillation and resonance. Beats, Phase and group velocities. Longitudinal waves in solids. Doppler Effect, Ultrasonic and their applications.

Geometrical and Physical Optics: Laws of reflection and refraction from Fermat's principle. Matrix method in paraxial optics- thin lens formula, nodal planes, system of two thin lenses. Chromatic and spherical aberrations. Huygens' principle-reflection and refraction of waves. Interference of Light-Young's experiment, Newton's rings, interference by thin films, Michelson interferometer. Fraunhofer diffraction-single slit, double slit, diffraction grating, resolving power. Production and detection of linearly, circularly and elliptically polarised light. Double refraction, quarter-waves plates and half-wave plates. Optical activity and applications. Elements of fiber optics- attenuation; pulse dispersion in step index and parabolic index fibers; material dispersion. Lasers, characteristics of laser light-spatial and temporal coherence.

Heat and Thermodynamics: Thermal equilibrium and temperature. The zeroth law of thermodynamics. Heat and the first law of thermodynamics. Efficiency of Carnot engines. Entropy and the second law of thermodynamics. Kinetic theory and the equation of state of an ideal gas. Mean free path, distribution of molecular speeds and energies. Transport phenomena. Andrew's experiments-van der Waals equation and applications. Joule-Kelvin effect and applications. Brownian motion. Thermodynamic Potentials-Maxwell relations. Phase transitions. Kirchhoff's laws. Black-body radiation- Stefan-Boltzmann law, spectral radiancy, Wien displacement law, application to the cosmic microwave background radiation, Planck radiation law.

Electricity and Magnetism: Electric charge, Coulomb's law, electric field, Gauss' law. Electric potential, van de Graff accelerator. Capacitors, dielectrics and polarization. Ohm's law, Kirchhoff's first and second rules, resistors in series and parallel, applications to two-loop circuits. Magnetic field-Gauss'law for magnetism, atomic and nuclear magnetism, magnetic susceptibility, classification of magnetic materials. Circulating charges, cyclotron, synchrotron. Hall Effect. BiotSavart law, Ampere's law, Faraday's law of induction. Lenz's law. Inductance. Alternating current circuits-RC, LR, single-loop LRC circuits, impedance, resonance, power in AC circuits. Displacement current, Maxwell's equations.

Atomic and Nuclear Physics: Photoelectric effect, Einstein's photon theory. Bohr's theory of hydrogen atom. Stern-Gerlach experiment, quantisation of angular momentum, electron spin. Pauli Exclusion Principle and applications. Zeeman Effect. X-ray spectrum. Compton Effect, Compton wavelength. Wave nature of matter, de Broglie wavelength, wave-particle duality. Heisenberg's uncertainty relationships. Schroedinger's equation-eigenvalues and eigen functions of (i) particle in a box, (ii) simple harmonic oscillator and (iii) hydrogen atom. Natural and artificial radioactivity. Binding energy of nuclei, nuclear fission and fusion. Classification of elementary particles.

Solid State Physics: Crystal structure, x-ray diffraction, Bragg's law, Bonding, covalent, ionic, metallic, Van der Walls bonding, Magnetism, Dia, Para and Ferromagnetism, Hysteresis. Thermal properties, lattice vibrations, Debye model. Band structure, energy band, energy gap, metals, insulators and semiconductors.

ENGLISH, ANALYTICAL REASONING & MENTAL ABILITY

Interpersonal skills including communication skills, anonyms/synonyms, sentence completion, active/passive voice, prepositions, direct/indirect speech, idioms & phrases. Critical reasoning, visual reasoning, assumption-premise-conclusion, assertion and reasons; statements and assumptions, identifying valid inferences, identifying strong arguments and weak arguments, statements and conclusions; cause and effect, identifying probably true, probably false, definitely true, definitely false kind of statement; linear arrangements, matrix arrangements, puzzles, family tree problem, symbol based problems; coding and decoding, sequencing, identifying next number in series, etc;