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

5.1 ELIGIBILITY:
A candidate shall be eligible for admission in the BE/BTech programmes 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) BSc(NonMedical) 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 programmes and their relevant diploma disciplines are given as below:

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Name of Programme</th>
<th>Relevant Disciplines of Diploma</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>(a) Chemical Engineering</td>
<td>Chemical Technology/ Chemical Engineering / Food Technology / Biotechnology / Mechanical</td>
</tr>
<tr>
<td></td>
<td>(b) Biochemical Engineering</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Civil Engineering</td>
<td>Civil Engineering/ Architectural Assistantship</td>
</tr>
<tr>
<td></td>
<td>(b) SOFTWARE ENGINEERING &amp; MGMT</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(c) COMPUTER ENGINEERING (HONOURS IN MACHINE LEARNING AND DATA ANALYTICS)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(d) COMPUTER ENGINEERING (HONOURS IN COMPUTER ANIMATION AND GAMING)</td>
<td></td>
</tr>
</tbody>
</table>
| 5. | Electronics & Communication Engineering  
| 6. | (a) Mechanical Engineering  
     (b) MECHANICAL ENGG(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. |

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

### 5.2 NUMBER OF SEATS

Lateral entry admission to the BE/BTech programme for diploma holders & BSc (Non Medical) at the 2nd year (3rd Semester) level will be made through Lateral Entry Engineering Test to be conducted by the University (LEET-TU) for the following seats in various categories:
<table>
<thead>
<tr>
<th>Category</th>
<th>General</th>
<th>SC (15%)</th>
<th>ST (7.5%)</th>
<th>PH (3%)</th>
<th>Grand Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Diploma</td>
<td>BSc</td>
<td>Diploma</td>
<td>BSc</td>
<td>Diploma</td>
</tr>
<tr>
<td>Biochemical</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Chemical Engineering</td>
<td>6</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Civil Engineering</td>
<td>8</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Computer Engineering</td>
<td>15</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Software Engineering &amp; Mgmt</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Computer Engineering (Honours in Machine Learning and Data analytics)</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Computer Engineering (Honours in Computer Animation and Gaming)</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Electrical Engineering</td>
<td>9</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Electronics &amp; Communication Engineering</td>
<td>14</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Electronics (Instrumentation &amp; Control Engineering)</td>
<td>9</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Mechanical Engineering</td>
<td>9</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Mechatronics</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Mechanical Engg(Productio n)</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>TOTAL</td>
<td>92</td>
<td>18</td>
<td>18</td>
<td>9</td>
<td>9</td>
</tr>
</tbody>
</table>

*The duration of the programme for students admitted in the 2nd year of BE(Industrial Engineering) will be four years and they will be awarded two degrees(BE & MBA) at the successful completion of their four year programme.*
These students shall commence their curriculum in Patiala Campus for BE(Industrial Engineering) and after 2 years shall move to Derabassi Campus for the MBA component. LMTSOM shall make the arrangements to do the laboratory components of BE (Industrial Engineering) at Patiala campus/ Derabassi campus for these students during the 4th or 5th year. The geographical location of 'Derabassi Campus' is at Dera Bassi (Mohali) on the periphery of UT of Chandigarh.

- 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 5.1.

- 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 BSc (Non-Medical) degree holders and vice versa.

- Vacant seats of first year of BE/BTech-2014 batch shall also be filled through lateral entry candidates in session 2015-16.

5.3 **FEES:** The candidates admitted through LEET-TU (2015) are required to deposit the same tuition fee and other dues as applicable to the candidates admitted in BE/BTech through JEE (main)-2015 in the session 2015-2016.
5.4 GENERAL INFORMATION REGARDING LEET-TU 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: 180 minutes (150 Questions)

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

Paper-I shall contain 60 questions in all with 15 questions in each of Physics, Chemistry, Mathematics and English. Paper-II shall contain 90 questions in the relevant engineering discipline each carrying one mark.

1/4th marks shall be deducted for 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 makers formula, Chromatic aberration and its removal, Optical instruments- simple and compound microscopes, Astronomical telescope, Magnifying power & resolving power, Huygens 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.
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, Hybridisation (sp, sp2 and sp3).
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.
A. For candidates seeking admission to the discipline of MECHANICAL ENGINEERING/INDUSTRIAL ENGINEERING (BE [IE]-MBA) /MECHATRONICS


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 Boltzmanns laws.


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, function of governors. Definitions of sensitivity,
stability, synchronism and hunting of governors, description and simple problems
on watt, porter and Hartnell governor.

(B) For candidates seeking admission to the discipline of ELECTRONICS &
COMMUNICATION ENGINEERING, ELECTRONICS (INSTRUMENTATION &
CONTROL) ENGINEERING

Basic Circuit Elements: Circuit laws and their applications in solving problems.
Characteristics and applications of different types of diodes, Concepts of bipolar
transistors and common base common emitter, common collector configuration
and parameters.

Amplifiers: Different types of amplifiers, working principles and expression of
voltage gain, current gain, input impedance, output impedance, etc.

Network Analysis: Working principles of Multivibrators, time base, operational
amplifier, timer and regulated power supply. 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. Automatic Telephony.

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, polyether, Metallised, polyether
gap ceramic, paper and electrolytic types. Resistors of different types.
Transformers, Inductors and RF Coils, Printed circuit boards.

Measuring Instruments: Multimeters, types, application, different types of mV
meters and mA meters-extension of range. CRO, operation, working applications,
Audio power meter, impedance bridges. Q-meter, Regulated power supply, block
diagram, significance, Digital instruments, block diagram, comparison with analog
instruments.

Microprocessors and its applications: Microprocessor, structure of 8085. Instruction
set and addressing mode. Simple programming in assembly language.
Input/output operations, concept of interrupts structure and programming of
8155/8156. Microprocessor applications.

Transducers: Electro-acoustic transducer, microphones, loudspeakers, sound
recording in different types, hi-fi and PA system. VCR and Video recording. T.V.
equipment and Video display unit.

Power Electronics: Thyristor, principle, characteristics and applications in industry.
TV Engineering: Introduction to Monochrome TV receiver circuits and basics of colour TV systems.

(C) For candidates seeking admission to the discipline 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

Introduction to Databases

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, virtual memory, I/O organization.

Data Communication and Computer Networks

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)


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.


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


(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

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.


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, Pascal’s Law and its applications. Total pressure, resultant pressure and centre 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 nonuniform flow. Discharge and continuity 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 velocity and velocity distribution, losses in pipes, hyraulic gradient line, total energy line flow from one reservoir to another through a long pipe of uniform and composit 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 pipeps. Quality of sewage, laying of sewers, Building drainage and rural sanitation.

(f) For candidates seeking admission to the discipline of CHEMICAL ENGINEERING and BIOTECHNOLOGY

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.


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 law’s for power requirement. Separations, Screening, filtration thickeners, classifiers, Centrifuges and cyclone separator.

Heat Transfer & Mass Transfer


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


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

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


Analysers: PH meter, oxygen analyzer colorimetric analyzers. Infra red & near Infrix analyzer.


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 a:b:c is
   (A) 1 : 3 : 2 (B) 1 : 2 : 3 (C) 1 : 2 : 5 (D) 1 : 2 : 2 : 3

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/hr  
(D) 6000-10,000 lits/sqm/hr

MECHANICAL ENGINEERING/ INDUSTRIAL ENGINEERING*(BE [IE]-MBA)/MECHATRONICS

1. When fluid flows in a pipe, the Nusselt number can be calculated from the relation  
(A) \( V.D. \) / \( \rho C_p \)  
(B) \( hD/K \)  
(C) \( K.D/C_p \)  

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/Biotechnology

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
1. A direct coupled amplifier has a gain of 1000 and 3 dB frequency of 1000 KHz. What is its unity gain frequency?
   (A) 100 KHz  (B) 1000 KHz  (C) 10^6 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 up to full load:

<table>
<thead>
<tr>
<th></th>
<th>PF</th>
<th>Slip</th>
<th>Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A)</td>
<td>increases</td>
<td>increases</td>
<td>increases</td>
</tr>
<tr>
<td>(B)</td>
<td>decreases</td>
<td>increases</td>
<td>increases</td>
</tr>
<tr>
<td>(C)</td>
<td>decreases</td>
<td>decreases</td>
<td>decreases</td>
</tr>
<tr>
<td>(D)</td>
<td>increases</td>
<td>decreases</td>
<td>decreases</td>
</tr>
</tbody>
</table>

I) For BSc (Non-Medical) holders

Duration of test: 180 minutes (150 Questions)

Physics (40 Questions) Chemistry (40 Questions) Mathematics (40 Questions) and English & Reasoning (30 Questions)

1/4th marks shall be deducted for 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 μ 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 auxochromes. 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.


**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 α-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 $\psi$ and $\psi^2$, 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,
Demiouvre’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 inertia. Conservative forces, frictional forces. Gravitaional


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;