

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:**

S. No.	Name of Programme	Relevant Disciplines of Diploma
1.	(a) Chemical Engineering (b) Biotechnology	Chemical Technology/ Chemical Engineering/ Food Technology/Biotechnology/Mechanical(for Chemical)
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 Engg., Electronics, Electronics &Communication
5.	(a) Electronics & Communication Engineering (b) Electronics (Instrumentation & Control) Engineering	Electronics & Communication / Electronics & TV Techonology/ Electronics & Microprocessors/Electronics & Computer Engineering/Instrumentation and control Engineering/Instrumentation & Process Control Engineering.
6.	(a) Mechanical Engineering	Mechanical Engineering/Production & Industrial

(b) Industrial Engineering*(BE[IE]-MBA) (c) Mechatronics	Engineering/ Refrigeration & Air Conditioning/ Foundry Technology / Industrial/Production Engineering / Maintenance of Plant & Machinery / Welding Technology/ Tool and Die/ Automobile/Mechatronics.
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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:

Category	General		SC (15%)		ST (7.5%)		PH (3%)		Grand Total	
	Diploma	BSc	Diploma	BSc	Diploma	BSc	Diploma	BSc	Diploma	BSc
Biotechnology	2	3	1	0	0	0	0	0	3	3
Chemical Engineering	6	6	1	1	0	1	0	0	7	8
Civil Engineering	7	7	1	2	1	0	0	0	9	9
Computer Engineering	12	13	3	3	2	2	1	0	18	18
Electrical Engineering	9	10	1	1	2	1	0	0	12	12
Electronics & Communication Engineering	13	13	3	2	1	2	1	1	18	18
Electronics (Instrumentation & Control) Engineering	9	9	1	2	2	0	0	1	12	12
Mechanical Engineering	9	8	2	2	0	1	1	1	12	12
Mechatronics	3	2	0	1	0	0	0	0	3	3
Industrial Engineering* (BE[IE]-MBA)	2	2	1	1	0	0	0	0	3	3
TOTAL	72	73	14	15	8	7	3	3	97	98

***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-2013 batch shall also be filled through lateral entry candidates in session 2014-15.

5.3 **FEE:** The candidates admitted through LEET-TU (2014) are required to deposit the same tuition fee and other dues as applicable to the candidates admitted in BE/BTech through JEE (main)-2014 in the session 2014-2015.

5.4 IMPORTANT DATES AND INFORMATION:

The online application form is available on www.thapar.edu. Fill the complete details and then take the **print out** of the form. Paste a recent passport size photograph on it. Please keep one copy of the printout of completely filled form as it will be required at the time of document checking during counselling. You can pay the required amount online or attach DD (in favour of Thapar University and payable at Patiala) and send it to "Incharge Admission Cell" Thapar University, Patiala (Punjab)-147004.

Application fee:

Amount to be deposited with print out of application forms taken from website.	Rs 1500
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IMPORTANT DATES

	LEET
Last date for receipt of completed application forms.	June 04, 2014
Date of Entrance test to be conducted by TU	ONLINE Entrance test (June 24 – 29, 2014)

	Browse www.thapar.edu for details
Display of result of Entrance Test	July 07,2014

Admission schedule:

LEET Admission schedule:

Counselling including deposit of fee : July 18, 2014
 Last round of counselling for vacant seats if any : July 29, 2014

Venue for counseling/document checking: University Auditorium

FOR ANY OTHER DETAILS INCLUDING ELIGIBILITY CRITERIA, FEE ETC

CONTACT (0 8288008120, 8288008121) Email: admissions@thapar.edu Website: www.thapar.edu
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IMPORTANT NOTE: Candidates are advised to regularly browse www.thapar.edu for information/instructions regarding admissions. No separate letters shall be sent.

All applications must be sent to "Incharge Admission Cell" Thapar University, Patiala (Punjab)-147004.

Documents required at the time of counselling:

Candidates must bring with them following original certificates and **a set of attested copies of all the certificates** at the dates specified hereunder for various programmes.

- **Copy of the Application form**
- 10+2 /diploma/graduation/post graduation DMC
- Matriculation/Higher Secondary Certificate showing Date of Birth
- Result Card of Entrance Exam
- Admit Card of Entrance Exam
- Character Certificate
- Medical Fitness Certificate
- Reserved Category Certificate on the prescribed proforma and signed from the competent authority (if applicable)
- Affidavit required in case of discontinuity of studies
- Undertaking by candidates not having result of qualifying exam as per prescribed format.
- Migration Certificate
- Income Certificate
- **Check list proforma**

Commencement of session: July 21, 2014

HOW TO APPLY

- 1 Candidates seeking admission in TU shall fill up the online form available on our website www.thapar.edu. Kindly fill the complete details and then take two print outs of the form and paste a recent passport size colored photograph.

Application fee paid Online: Please send one of the printouts of form to the Incharge Admission Cell. The hardcopy of application form alongwith required documents should reach the University within 7 days after the last date of submission of online applications.

Application fee paid through DD: Please send one of the printouts by attaching the required amount of DD (in favour of Thapar University and payable at Patiala).

Retain second copy of the printout of the form to be produced at the time of document checking of original documents during counseling.

Important Note: A candidate cannot claim admission merely by filling the application form and paying the application fee. If he/she fulfils the eligibility criteria as per the prospectus, only then he/she shall be considered for admission during counseling. So, candidates are advised to read eligibility and other conditions before filling the form.

- 2 The original certificates and set of attested copies of the certificates are required to be produced at the time of document checking.
- 3 Every candidate must indicate in his/her application the category of seat for which he/she wants to apply. **A copy of the certificate of the reserved category (if applicable) shall be attached.**
- 4 Application completed in all respects should reach the INCHARGE ADMISSION CELL, THAPAR UNIVERSITY, PATIALA -147004, on or before the last prescribed date of the respective programmes.
- 5 Incomplete application in any manner and received after the due date/time will be rejected. The University does not take any responsibility for postal delay or loss in transit of the application form, demand draft, withdrawal form or any other communication in this regard.
- 6 The specimens of the format of the required certificates are available on our website for the guidance of candidates. Each certificate must be submitted on the prescribed format and must be issued by the competent authority as mentioned, under proper seal/stamp of their office on a date prior to or on the last date for submission of application form.
- 7 **PENALTY FOR WRONG INFORMATION/SUPPRESSION OF INFORMATION.**

If at any stage it is found that a candidate has concealed, suppressed or distorted any information/fact, in the application form, his/her admission to the

University, if granted, shall stand cancelled. He/she will have no claim, whatsoever, against the University.

8 The provisions of Prospectus 2014-15 may be changed by the competent authority without any notice.

9 In case of any dispute, the decision of the Director, TU, Patiala shall be final and binding on the candidates.

10 **For candidates other than BE/BTech**

Candidates who are appearing in the final exam of the qualifying degree/diploma(for LEET) are eligible to apply. Such candidates have to furnish following undertaking at the time of counselling.

"I am applying on my own risk and responsibility as my final result of the Qualifying exam has not been declared.

I do hereby declare that I do not have any backlog paper in any of the previous semesters (Years) of study of the qualifying exam and also I do not expect any backlog in my final exam.

I assure you that I will produce the proof of passing of my Qualifying examination with the minimum percentage of marks required on or before December 31, 2014, failing which my admission shall stand cancelled and I shall not claim any right on any count whatsoever."

11 **Candidates applying for more than one discipline (whether in same or other department) of LEET programmes are required to fill separate application form for each discipline.**

INSTRUCTIONS FOR ONLINE ENTRANCE TEST

1 Entrance test shall be conducted ONLINE.

2 Candidates will be able to generate 'Admit Card' from April 16-June 17, 2014 provided their DD alongwith print out of application form reaches Thapar University in time. The login id and password created by candidate at the time of filling the application form shall be used to register for generation of Admit card.

Note: The Admit card shall be issued provisionally to the candidate subject to his/her satisfying the eligibility condition.

3 After registering, the candidate shall take out two print outs of 'Admit Card', paste latest photograph on each and then come to the entrance test centre. Alongwith admit cards, the candidate will also carry any one of the identity proof (Original) with him/her like Passport/Voter I Card/ PAN Card/ Driving License. One copy of the admit card shall be retained by the entrance test centre. The candidate shall keep the other copy (duly acknowledged by the examiner at test centre) to be shown at the time of document checking.

4 **The entrance test shall contain objective type questions. Other details are as under:**

SNo	Name of the programme	Duration of Entrance Test	Number of questions in the entrance test
1	LEET	3 hours	150

- 5 While registering for ONLINE entrance test on our website, the candidate shall choose entrance test centre of his/her choice from the available list and any one slot available in the test period given above i.e. (**June 24 – 29, 2014**). Once slot is chosen, it cannot be changed thereafter.
- 6 Filling of valid mobile number is mandatory.

Instructions for counseling for programs other than BE/BTech

Admission shall be made on the basis of the merit of prescribed Entrance Test of respective programmes and fulfillment of other conditions as per procedure detailed in the Prospectus.

General Instructions:

- 1 In case of a tie among candidates securing equal marks in the merit list, the same will be broken in accordance with the following criteria:
- (a) Candidate senior in age shall rank higher in order of merit.
- (b) In the case of a tie in age also, a candidate getting higher percentage of marks in the qualifying examination shall be ranked higher in order of merit.
- (c) In the case of a tie in percentage of marks in the qualifying examination also, a candidate securing higher percentage of marks in matriculation/secondary or equivalent examination shall rank higher in order of merit.

2 Withdrawal of Seat / Refund of fee:

Candidate wishes to withdraw the seat, must submit the application to IN-CHARGE, ADMISSION CELL, Thapar University. The fee will be refunded after adjusting all the outstanding dues, if any. The candidates are advised to mention their Account Number and IFSC code of the bank for the prompt refund.

	Date of Receipt of Application		Amount to be refunded
(i)	One day before the final counseling or before the start of the session	:	After deducting Rs. 1000/- of the total fee deposited.
(ii)	From the date of final counselling and up to September 30, 2014	:	50% Tuition Fee + 50% Development Fee + University Security and Alumni Fee + 50% of all Hostel dues (if applicable)
(iii)	After September 30, 2014	:	University Security + Alumni Fee

- 3 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.
- 4 **Candidates from physically handicapped category are required to produce the Medical Certificate from the Chief Medical Officer of the District concerned, which should indicate the extent of permanent disability in support of their claim. Minimum 40% permanent disability is required to be eligible under this category.** Further, the above provisions will be subject to the decision of the Admission Committee of the University whether such a candidate would be able to pursue the studies at the University with the specific disability. The decision of the Admission Committee in this regard shall be final.
- 5 No separate letters for counseling/document checking/deposit of fee shall be issued for any programme.
- 6 **Admitted candidates will have to submit the migration certificate from the earlier University/Board within a month of their admission.**
- 7 Electronic gadgets such as Mobile Phones, Pagers, etc. are not permitted in the Examination Centre.
- 8 The statements made in this Prospectus and all other information, contained herein are believed to be correct at the time of publication. However, the University reserves the right to make at any time, without notice, changes in and/or additions to the regulations of University and conditions governing the conduct of students, requirements for degree, fee and any other information, or statements contained in this Prospectus either on its own or under any rules or regulations imposed by UGC/MHRD. No responsibility will be accepted by the University for hardship or expense encountered by its students or any other person for such changes, additions, omissions or errors, no matter how they are caused.
- 9 All disputes will be subject to jurisdiction of the Courts at Patiala only. The person in whose name the University can sue or be sued shall be the Registrar, Thapar University, Patiala.
- 10 The students of all the regular programmes are not allowed to join any job till they complete all the requirements for the award of degree. Only part-time students are allowed to join job.
- 11 In case,
a selected candidate submits false information about fee, eligibility, rank of entrance test
or
a candidate who is not offered any seat but deposits the full fee

then seat allotted to him/her shall stand cancelled.

- 12 Candidates must be medically fit and must bring along with them a medical fitness certificate signed by a Gazetted Medical Officer at the time of admission on the prescribed proforma as per Annexure-IV.

13 MODES OF PAYMENT OF APPLICATION FEE AND OTHER DUES:

13.1 **APPLICATION FEE : In the form of DD or through Online payment.**

13.2 **TOTAL FEE:**

- i) **Receipts in any Axis Bank/Kotak Mahindra Bank account-to-account transfer):** It is available in all the branches of **Axis Bank/Kotak Mahindra Bank**. A sample payment pay-in-slip is enclosed at Annexure-IX. The system generates **Journal Number** which is to be used for linking the payment. The students are instructed to get the 6-10 digit **journal number** from the branch where they have made the payment and feed the same in the web site where the details are captured along with date of payment. The deposit of amount in the below mentioned account of the University will not give any right to the depositor for jurisdiction of the station where it has been deposited in any manner what so ever it may be.

For depositing money through AXIS/KOTAK MAHINDRA BANK, a candidate can deposit money in favour of the following account:

AXIS Bank	KOTAK MAHINDRA BANK LTD
910010028666757	02630020000237

- ii) In the form of Demand Draft (DD), the DD of requisite amount should be made in favour of Thapar University, Patiala and payable at Patiala. The DD must reach the University on or before the prescribed date otherwise the candidature shall be cancelled.
- iii) **Candidates depositing total fee through AXIS/KOTAK MAHINDRA BANK must enter complete details in 'Fee Confirmation Slip' (FCS) available at www.thapar.edu on or before the respective last prescribed date. In case, a candidate fails to enter the details, his/her candidature will not be processed further.**

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.

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, Hybridisation (sp , sp^2 and sp^3).

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

Manufacturing Process: Dry sand and green sand casting; Casting defects: Die casting, Continuous 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, Thermodynamics 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 Boltzmann's 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 Major 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 non-ferrous materials : Pig iron grey and white cast iron, alloying elements in steel and their effect. High speed steel, heat resistant steel and spring steel. Aluminium 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 organisations : 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, 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, polyster, Metallised, polyster 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

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, virtual memory, 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 Wattmeters, Dynamometer type, maximum demand indicators, Energymeters-single phase and three phase, Megger, Earth tester, Multimeter, power factor meter.

Electronic Instruments: VTVM, CRO, Electronic multimeter, Analog multimeter, 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 theodolite.

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, curing 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, capillarity 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, hydraulic gradient line, 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, laying of pipes. 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.

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

Flow Measurement: Pitot tube orifice meter, venturimeter, Rotameter, 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 law's 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 Distillation, Absorption, Extraction, crystallization & Drying.

Unit Processes & Process Technology : Principles of some unit Processes such as Nitration. Sulphonation, Halozonation, 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.

Analysers: PH meter, oxygen analyzer colorimetric analyzers. Infra red & near Infrax 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 a:b:c is
(A) 1 : $\sqrt{3}$: 2 (B) 1 : $\sqrt{2}$: $\sqrt{3}$
(C) 1 : 2 : 5 (D) 1 : 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/kr
 - (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) $V.D.\rho / \mu$
 - (B) $\rho.C_p/K$
 - (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/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) 10^8 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 |

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_s and μ_{eff} 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, stereogenic centre, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centres, diastereomers, threo and erythro diastereomers, 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, 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 α -hydrogens, alkylation of diethyl malonate and ethyl acetoacetate. Synthesis of ethyl acetoacetate: the Claisen condensation. Keto-enol tautomerism of ethyl acetoacetate. Alkylation of 1,3-dithianes. 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 threo diastereomers. Conversion of glucose into mannose. Formation of glycosides,

ethers and esters. Determination of ring size of monosaccharides. Cyclic structure of D-(+)- glucose. Mechanism of mutarotation. 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 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 ψ and ψ^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, 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 inertia. Conservative forces, frictional forces. Gravitational 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 fibre optics-attenuation; pulse dispersion in step index and parabolic index fibres; 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 radiance, 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 Graaff 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. Biot-Savart 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. Schrodinger's equation-eigenvalues and eigenfunctions 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 Waals 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, synonyms/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;