

Revised Syllabus of Tripura Institute of Technology Lateral Entrance Examination (TITLEE)

1) Mathematics

Matrix & Vector Matrix: Definition - Order of a matrix - Leading element - Principal diagonal. Types of matrices - Null matrix - Square matrix - Identity matrix - Upper and lower triangular matrix - Symmetric matrix. - Determinant of a square matrix - Minors and cofactors - Procedures for evaluation - Properties of determinants (no deduction) - Evaluation of determinant by Chio's method (4th order) - Problems. - Concept of vector - Addition and subtraction of vectors - Multiplication of a vector by a scalar - Position vector of a point - Ratio formula - Rectangular resolution of a vector - Dot and cross product - Geometrical interpretation - Distributive law - Applications.

Calculus: Differential Coefficient- Differentiation of some standard functions from first principles- ($x^n, \sin x, \cos x, \tan x, e^x$ and $\log_a x$). - Differentiation of sum, product and quotient of function. - Differentiation of trigonometric and inverse trigonometric functions, Logarithmic functions, Exponential functions - simple problems. - Derivative of function of a function, implicit functions, parametric function. Logarithmic differentiation - simple problems. - Successive differentiation upto 2nd order - simple problems. - Physical meaning of derivative - Velocity and Acceleration - Maxima & Minima.

Concept of Integration: Integration as inverse operation of differentiation. - Fundamental Theorem of Integral calculus - Simple integration by substitution. - Integration by parts - Integration by partial fractions (for linear factors only). - Use of formulas $\int_0^\pi \sin nx \, dx$, $\int_0^\pi \cos nx \, dx$ and $\int_0^\pi \sin mx \cos nx \, dx$ for solving problems where m and n are positive integers. - Properties of definite Integral. - Applications of integration for - i). Simple problem on evaluation of area bounded by a curve and axes. ii). Calculation of Volume of a solid formed by revolution of an area about axes - Simple problems.

Differential Equations: Definition - Order and degree of a differential equation - Differential equations of 1st order and 1st degree - separation of variables - Problems. - Homogeneous differential equations - Equations reducible to the homogeneous form - Problems. - Exact differential equations - equations reducible to the exact form - problems. - Linear equations - Bernoulli's equations. - Differential equations of 2nd order with constant coefficients - Complementary function and particular integral - Problems.

Partial Differentiation: Function of two or more variables - Definition and meaning of partial derivatives (1st order). - Homogeneous functions - Euler's theorem on homogeneous functions (no deduction) - Problems.

Probability and Statistics: Introduction – Random experiment – Sample space – Events. – Classical and axiomatic definition of probability. – Addition and multiplication theorem – Related problems. – Statistics – Frequency distribution. – Measure of central tendency – Mean – Median – Mode – Standard deviation – Simple problems.

2) Physics

Force & Motion: Force, Resolution of force, Free body diagram, Conservation of linear momentum and its application, Impulse and its application, Angular displacement; angular velocity; angular acceleration and their relation with linear displacement; linear velocity and linear acceleration, Frequency and time period of revolution & rotation, Centripetal and centrifugal forces, their examples and applications, Banking of roads, Torque and its application, Conservation of angular momentum and its application, Concept of centre of mass and Centre of gravity, Moment of Inertia, rotational kinetic energy

Properties of Matter: Elasticity and its significance, Stress & Strain, Stress-Strain Curve, its significance and application, Hooke's Law, Moduli of elasticity, Poisson's ratio, Viscosity and its significance, Coefficient of viscosity: Terminal velocity, Stokes' law, Effect of temperature on viscosity, Application in hydraulic systems. Fluid motion, Streamline and Turbulent flow, Reynolds' number, Equation of continuity, Bernoulli's Theorem, and its applications.

Electrostatics & Magneto statics: Gauss law: Application of Gauss law to find the electric field intensity of a straight charged conductor, a plane charged sheet, and a charged sphere. Capacitor and its working, Types of capacitors, Capacitance and its units. Capacitance of a parallel plate capacitor, Series and parallel combination of capacitors, Magnetic field, Magnetic intensity, Magnetic flux, Magnetization. Galvanometer, Ammeter, Voltmeter, Conversion of a galvanometer into an ammeter and voltmeter, and conversion of an ammeter and voltmeter into a larger scale.

Current Electricity: Direct and alternating current, Resistance and its units, Specific resistance, Conductance, Specific conductance, Series and parallel combination of resistances. Factors affecting resistance of a wire, Ohm's law and its verification, Kirchhoff's laws, Wheatstone bridge and its applications (slide wire bridge only), Concept of terminal potential difference and Electro motive force (EMF), Heating effect of current, Electric power, Electric energy and its units, Maximum power transfer theorem.

Semiconductor Physics: Energy bands in solids, Types of materials (insulator, semiconductor, conductor) and their Band diagrams, Intrinsic and extrinsic semiconductors,

p-n junction, junction diode and V-I characteristics, different types of junction diodes and their applications. Diode as rectifier – half wave and full wave rectifier (Centre taped), n-p-n & p-n-p Transistor; Transistor as an amplifier (C-E mode), Photocells, Solar cells; working principle and engineering applications

Modern Physics: Lasers: Energy levels, Ionization and excitation potentials; Spontaneous and stimulated emission; Population inversion, Pumping methods, Optical feedback, Ruby, He-Ne, and semiconductor laser (characteristics only), Engineering and medical applications of lasers. Optical fiber, Refractive index, Total internal reflection, Critical angle, light propagation, acceptance angle, and numerical aperture (Expression only), Types of optical fiber, Applications of optical fiber in telecommunication, medical, and sensors, Nanoparticles and nanomaterials, properties at the Nano scale, Nanotechnology-based devices and applications.

3) Electrical and Electronics Engineering

Electrical Engineering

Introduction to Passive and Active Components: Resistances, Capacitors, Inductors, Voltage Source, Current Source, A.C & D.C Signal, periodic/non-periodic signals, Kirchhoff's voltage and current laws, Star-delta transformations – Simple problems on all topics.

AC Fundamentals: Cycle, Frequency, Periodic time, Amplitude, Angular velocity, RMS value, Average value, Form Factor, Peak Factor, impedance, phase angle, and power factor; Mathematical and phasor representation of alternating emf and current, A.C in resistors, inductors and capacitors; A.C in R-L series, R-C series, R-L-C series and parallel circuits; Power in A.C. Circuits, power triangle, simple numerical on all relevant topics.

Electromagnetics Circuits and Its Application: EMF, Current, Potential Difference, Power and Energy; M.M.F, magnetic force, permeability, hysteresis loop, reluctance, leakage factor and BH curve; Electromagnetic induction, Faraday's laws of electromagnetic induction, Lenz's law; Dynamically induced emf; Statically induced emf; Equations of self and mutual inductance; Analogy between electric and magnetic circuits. Basic working principle of transformer, DC motor and generator– Simple problems on all topics.

Electronics Engineering

Basic Electronics: Semiconductor, type, biasing of PN diode, VI characteristics of PN diode, Rectifier-type and operation. Bipolar Junction Transistor-types, operation, configurations, applications, JFET and MOSFET-type, operation, VI characteristics, idea of drain resistance, transconductance, amplification factor, Operational amplifiers- ideal Op-amp, practical Op-amp, open loop and closed loop configurations, design of adder, subtractor, comparator, differentiator and integrator circuits, simple numerical on all relevant topics.

Digital Electronics: Difference between analog and digital operations, Logic levels, Logic gates, Boolean algebra, idea of combinational and sequential circuits such as half adder, full adder, multiplexer, demultiplexer, encoder, decoder etc. and simple numerical on all relevant topics.

4) Computer Applications

Introduction to Computer: Brief history of Evolution of computer – Various components of Computer (brief knowledge) -Hardware – CPU, Input Output System, Primary Memory, Secondary Memory.

Information Representation Number System: Binary, Octal & Hexadecimal and conversion of number systems, Signed and unsigned representation. Binary arithmetic and compliments. Character Codes: ASCII, BCD and Gray Codes.

Basic of Software: Classification of Software Systems - System Software and application software. Basic concepts of compilers, interpreters, assemblers and device drives. Operating System – Single user, multi user, graphical user interface and characters user interfaces. Case studies: MS – DOS, Windows.

Introduction to programming: Algorithm and flowchart. Different types of programming languages – Machine level, assembly level and high level languages (basic concepts only). Brief introduction to different high level languages including C. Basic of C-language. Branching and loping statements. Array and user defined functions. Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs. Functions, Parameter passing in functions, call by value, passing arrays to functions: idea of call by reference, Recursion Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Structure Structures, Defining structures and Array of Structures, Pointers, Idea of pointers, Defining pointers, Use of Pointers in self-referential structures.

5) Engineering Mechanics

Basics of mechanics and force system: Significance and relevance of Mechanics, Applied mechanics, Statics, Dynamics. Space, time, mass, particle, flexible body and rigid body. Scalar and vector quantity, Units of measurement (SI units) - Fundamental units and derived units.

Force – unit, representation as a vector and by Bow's notation, characteristics and effects of a force, Principle of transmissibility of force, Force system and its classification.

Resolution of a force - Orthogonal components of a force, moment of a force, Varignon's Theorem.

Composition of forces – Resultant, analytical method for determination of resultant for concurrent, non-concurrent and parallel co-planar force systems – Law of triangle, parallelogram and polygon of forces.

Equilibrium: Equilibrium and Equilibrant, Free body and Free body diagram, Analytical and graphical methods of analysing equilibrium

Lami's Theorem – statement and explanation, Application for various engineering problems. Types of beam, supports (simple, hinged, roller and fixed) and loads acting on beam (vertical and inclined point load, uniformly distributed load, couple),

Beam reaction for cantilever, simply supported beam with or without overhang – subjected to combination of Point load and uniformly distributed load.

Beam reaction graphically for simply supported beam subjected to vertical point loads only.

Friction: Friction and its relevance in engineering, types and laws of friction, limiting equilibrium, limiting friction, co-efficient of friction, angle of friction, angle of repose, relation between co-efficient of friction and angle of friction.

Equilibrium of bodies on level surface subjected to force parallel and inclined to plane. Equilibrium of bodies on inclined plane subjected to force parallel to the plane only.

Centroid and centre of gravity: Centroid of geometrical plane figures (square, rectangle, triangle, circle, semi-circle, quarter circle)

Centroid of composite figures composed of not more than three geometrical figures

Centre of Gravity of simple solids (Cube, cuboid, cone, cylinder, sphere, hemisphere)

Centre of Gravity of composite solids composed of not more than two simple solids.

Trusses: Assumptions for Analysis of Trusses, Arrangement of Members of Plane Trusses – Internal Stability,

Equations of Condition for Plane Trusses, Static Determinacy, Indeterminacy, and Instability of Plane Trusses

Analysis of Plane Trusses by the Method of Joints, Analysis of Plane Trusses by the Method of Sections
