TG ECET-2026

SYLLABUS FOR ELECTRONICS AND COMMUNICATION ENGINEERING

MATHEMATICS (50 Marks)

UNIT-I: MATRICES AND DETERMINANTS

Definition of Matrix, Types of matrices-Algebra of matrices-Transpose of a matrix-Symmetric, skew symmetric matrices-Minor, cofactor of an element-Determinant of a square matrix up to third order – Properties - Laplace's expansion-singular and non-singular matrices- Adjoint and multiplicative inverse of a square matrix-System of linear equations in 3 variables-Solutions by Cramer's rule, Matrix inversion method-Gauss-Jordan method.

Partial Fractions: Resolving a given rational function into partial fractions.

Logarithms: Definition of logarithm and its properties, meaning of 'e', exponential function and logarithmic function.

UNIT–II: TRIGONOMETRY

Properties of Trigonometric functions– Ratios of Compound angles, multiple angles, sub multiple angles – Transformations of Products into sum or difference and vice versa. Properties of triangles: sine rule, cosine rule, tangent rule and projection rule. Solution of a triangle when (i) three sides (SSS), (ii) two sides and an included angle (SAS), (iii) one side and two angles are given (SAA). Inverse Trigonometric functions, Hyperbolic functions.

Complex Numbers: Definition of a complex number, Modulus, amplitude and conjugate of complex number, arithmetic operations on complex numbers - Modulus-Amplitude form (Polar form) - Euler form (exponential form).

UNIT–III: ANALYTICAL GEOMETRY

Straight Lines–different forms of Straight Lines, distance of a point from a line, angle between two lines, intersection of two non-parallel lines and distance between two parallel lines.

Circles - Equation of circle given center and radius, given ends of diameter-General equation-finding center and radius, center and a point on the circumference, 3 non-collinear points, center and tangent, equation of tangent and normal at a point on the circle.

Conic section – Properties of parabola, ellipse and hyperbola – Standard forms with vertex at origin and axis along co-ordinate axes only, simple problems.

UNIT–IV: DIFFERENTIATION AND ITS APPLICATIONS

Functions and limits – Standard limits – Differentiation of sum, product, quotient of functions,

function of function, trigonometric, inverse trigonometric, exponential, logarithmic, hyperbolic functions, implicit, explicit and parametric functions–Derivative of a function with respect to another function-Second order derivatives – Geometrical applications of the derivative(angle between curves, tangent and normal)–Increasing and decreasing functions–Maxima and Minima(single variable functions) using second order derivative only, Physical application – Rate measure - Partial differentiation–Partial derivatives up to second order–Euler's theorem.

UNIT–V: INTEGRATION AND ITS APPLICATIONS

Indefinite integral – Standard forms – Integration by substitution, Integration of trigonometric, algebraic, exponential, logarithmic and hyperbolic functions—Integration of reducible and irreducible quadratic factors, Integration by decomposition of the integrand, Integration by parts – Definite integrals and properties, Definite integral as the limit of a sum – Application of integration to find areas under plane curves and volumes of solids of revolution– Mean and RMS values, Trapezoidal rule and Simpson's 1/3 rule for approximation of integrals.

UNIT–VI: DIFFERENTIAL EQUATIONS

Definition of a differential equation-order and degree of a differential equation- formation of differential equations-solution of differential equation of the type first order first degree, variable-separable, homogeneous equations, exact, linear differential equation of the form $dy/dx+Py=Q$, Bernoulli's equation, 2^{nd} order linear differential equations with constant coefficients both homogeneous and non-homogeneous and finding the particular integrals for the functions e^{ax}, sin ax, cos ax, $ax^2 + bx + c$ (a, b, c are real numbers) and general solutions.

UNIT–VII: LAPLACE TRANSFORMS

Laplace Transforms (LT) of elementary functions-Linearity property, first shifting property, change of scale property, multiplication by t^n and division by t - LT of derivatives and integrals, Unit step function, LT of unit step function, second shifting property, evaluation of improper integrals, Inverse Laplace transform (ILT)-shifting theorems, change of scale property, multiplication by s^n and division by s, ILT by using partial fractions and convolution theorem. Applications of LT to solve linear ordinary differential equations up to second order with initial conditions.

UNIT–VIII: FOURIER SERIES

Fourier series, Euler's formulae over the interval $(C, C+2\pi)$ for determining the Fourier coefficients. Fourier series of simple functions in $(0, 2\pi)$ and $(-\pi, \pi)$, Fourier series for even and odd functions in the interval $(-\pi, \pi)$ – Half range Fourier series – sine and cosine series over the interval $(0, \pi)$.

PHYSICS (25 Marks)

UNIT-I: UNITS, DIMENSIONS AND MEASUREMENTS

Physical quantity – Fundamental and derived quantities, unit – definitions – system of units – Advantages of S.I. units.

Dimensions and dimensional formula – definitions, units and dimensional formulae for physical quantities, Dimensionless quantities, Principle of homogeneity, Applications of dimensional analysis – Checking the correctness of physical equations – conversion of unit from one system to another system – problems on density, force and energy.

UNIT-II: VECTORS

Scalar and Vector quantities – definition and examples, representation of a vector, Classification of vectors - Proper vector, Equal vectors, Unit vector, Negative vector, null vector and Position vector, Resolution of a vector.

Lami's theorem, Parallelogram law of vectors – statement- expression for magnitude and direction of resultant vector – derivation, Representation of a vector in unit vectors **i**, **j** and **k** – numerical problems.

Scalar product of vectors - application to work done by force and power – properties of scalar product – Numerical problems.

Vector product of vectors – Right hand thumb rule and right hand screw rule - application to torque - properties of vector product - Application to area of parallelogram and triangle - numerical problems.

UNIT-III: MECHANICS

Concept of Friction - Normal reaction, Angle of friction, Motion of a body over a rough horizontal surface - expressions for Acceleration, Displacement, Time taken to come to rest - derivations, inclined plane - Motion of a body over a smooth inclined plane and rough inclined plane–forces acting on the body - angle of repose, Application of friction – brake system in bicycle – numerical problems.

Projectile motion – definition – examples, Horizontal projection - Oblique projection, Expression for path of a projectile in oblique projection – derivation, Maximum height, Time of ascent, Time of descent, Time of flight, Horizontal range and maximum horizontal range in oblique projection – derivations, numerical problems.

Circular motion – definition of angular displacement, angular velocity, angular acceleration, frequency and time period, Relation between linear and angular velocity – derivation – related numerical problems, Central force – examples, Expressions for centripetal and centrifugal forces (no derivation), Applications of centripetal and centrifugal forces - Banking of roads and its expression, bending of cyclist and principle of centrifuge - related numerical problems.

UNIT-IV: PROPERTIES OF MATTER

Elasticity – Elastic body – definition - examples, Stress and Strain – definitions and expressions, types of stress and strain, elastic limit - Hooke's law – statement – modulus of elasticity, significance of stress and strain curve -Young's modulus – Derivation, numerical problems.

Surface tension - Capillarity –angle of contact – definition- examples for capillarity- Formula for Surface tension based on capillarity (no derivation), effect of temperature and impurity on surface tension, applications and illustrations of surface tension, numerical problems.

Viscosity - Newton's formula for viscous force – derivation - Coefficient of viscosity - Poiseuille's equation (formula only), Effect of temperature on viscosity of liquids and gases, applications of viscosity, numerical problems.

Concept of fluid motion – streamline and turbulent flow, Reynold's number, equation of continuity, Bernoulli's theorem (only formula) and applications - related problems.

UNIT-V: CONSERVATION LAWS AND ENERGY SOURCES

Work, Power and Energy – explanation, Potential Energy and Kinetic energy –examples – expressions for Potential energy and Kinetic energy – derivations, Work-Energy theorem – derivation, Law of conservation of energy – examples, Law of conservation of energy in the case of freely falling body – proof – Illustration of conservation of energy in the case of simple pendulum, related problems.

UNIT-VI: HEAT

Heat – thermal expansion of solids – Coefficients of expansions, Boyle's law – statement, concept of absolute zero - Absolute scale of temperature, Charles' laws, Ideal gas equation – derivation - value of universal gas constant 'R', Gas equation in terms of density, Isothermal and Adiabatic processes - Differences between isothermal and adiabatic processes, Internal energy and External work done, Expression for work done – derivation, first law of thermodynamics – application of first law to isothermal and adiabatic processes, second law of thermodynamics, specific heats of a gas, related numerical problems.

UNIT-VII: SIMPLE HARMONIC MOTION

Periodic motion - Simple Harmonic Motion (SHM) – definition – examples, Conditions for SHM, Time period, frequency, amplitude and phase of a particle in SHM, Expressions for Displacement, Velocity, Acceleration, Time period and frequency of a particle executing SHM – derivations.

Ideal simple pendulum – time period of simple pendulum – derivation, laws of simple pendulum, Second's pendulum - related numerical problems.

UNIT-VIII: SOUND

Stationary waves, beats - applications of beats, echo – definition - applications - relation between time of echo and distance of obstacle.

Doppler effect in sound (no derivation, formulae only) – list the applications – ultrasound and radar in medicine and engineering - derivation - Reverberation and time of reverberation - Sabine's formula - Free and forced vibrations - Resonance - Conditions of good auditorium, noise pollution – causes, effects and methods to minimize noise pollution, related numerical problems.

UNIT-IX: MAGNETISM AND ELECTRICITY

Basics of magnetism, Coulomb's inverse square law in magnetism, moment of couple on a bar magnet placed in a uniform magnetic field – derivation, expression for magnetic induction field strength at a point on the axial line of a bar magnet – derivation.
Kirchhoff's laws in electricity, Wheatstone bridge – balancing condition, application of Wheatstone bridge – Meter bridge,
Concept of electromagnetic induction – self induction and mutual induction, Faraday's Laws, Lenz's law, principle and working of transformer - types of transformers, types of magnetic materials – dia, para and ferromagnetic materials, related numerical problems.

UNIT-X: OPTICS

Light theories - dual nature, reflection, refraction, and interference.
Photo electric effect - Einstein's photo electric equation – Work function and threshold frequency - laws of photo electric effect - applications of photo electric effect – photo cell.

UNIT-XI: MODERN PHYSICS

LASER – definition, Spontaneous emission and Stimulated emission – principle and working of LASER, characteristics of LASER- types of LASER, applications of LASER.
Total internal reflection, critical angle, conditions for total internal reflection, Principle and working of Optical fiber – types - Applications of optical fiber –Nano technology, nano particles and nano materials - applications and devices, Superconductivity - basic concept - applications of Superconductors.

UNIT-XII: SEMICONDUCTOR PHYSICS

Energy bands in solids - valence band- conduction band – forbidden gap – Energy band diagram of conductors, insulators and semiconductors – concept of Fermi level - Intrinsic semiconductors - examples - Concept of holes in semiconductors - Doping - Extrinsic semiconductors - P-type and N-type semiconductors, PN Junction diode – Forward Biasing and Reverse Biasing - Volt-Ampere (V-I) characteristics - Applications of PN diode - Diode as rectifier (half wave rectifier), Light Emitting Diode – principle and working, solar cell – principle and working.

CHEMISTRY (25 Marks)

UNIT-I: FUNDAMENTALS OF CHEMISTRY

Atomic Structure: Introduction – Atomic number – Mass number - Isotopes and Isobars - Bohr's Atomic Theory - Orbitals - Shapes of s, p and d orbitals – Aufbau principle - Hund's rule - Pauli's exclusion principle - Electronic configuration of elements

Chemical Bonding: Introduction – Electronic theory of valency - Types of chemical bonds - Ionic, Covalent, Co-ordinate covalent, Metallic and Hydrogen bonds with examples - Properties of Ionic and Covalent compounds - Types of Hydrogen bonds – Effect of hydrogen bonding on physical properties.

Oxidation - Reduction: Electronic concept of Oxidation, Reduction, Oxidation Number - Calculations.

UNIT-II: SOLUTIONS AND COLLOIDS

Introduction - Solution – Solubility - Classification of solutions based on physical state - Atomic weight, Molecular weight, Equivalent weight - Mole concept – Molarity and Normality - Numerical problems on mole, molarity and normality – Colloids - Types of colloids - Lyophilic and Lyophobic colloids - Protective Colloids - Gold number - Properties of Colloids - Industrial applications of colloids.

UNIT-III: ACIDS AND BASES

Introduction - Theories of acids and bases and limitations - Arrhenius theory - Bronsted -Lowry theory - Lewis's acid base theory - Ionic product of water - pH and related numerical problems - Buffer solutions - buffer action - Applications of buffer solutions - Ostwald's theory of indicators.

UNIT-IV: ENVIRONMENTAL SCIENCE

Introduction - Environment - Scope and importance of environmental studies - Important terms - Concept of ecosystem - Producers, consumers and decomposers - Food chain - Food web - Carbon and nitrogen cycles - Biodiversity, definition and threats to Biodiversity - Forest resources - Deforestation – Green Chemistry – E-waste – Management of e-waste.

UNIT-V: WATER TECHNOLOGY

Introduction - Soft and hard water - Causes of hardness – Types of hardness - Disadvantages of hard water using in industries - Degree of hardness - Softening methods - Permutit process and Ion exchange process - Drinking water - Municipal treatment of water for drinking purpose – Osmosis and Reverse Osmosis - Advantages of Reverse osmosis – Desalination by Electro dialysis – Defluoridation – Nalgonda Technique.

UNIT-VI: ELECTROCHEMISTRY

Conductors, insulators, electrolytes – Types of electrolytes - Arrhenius theory of electrolytic dissociation - Electrolysis – Electrolysis of fused NaCl and aqueous NaCl –Applications of electrolysis - Faraday's laws of electrolysis - Numerical problems.

UNIT-VII: METALLURGY

Characteristics of metals - Distinguish between metals and non metals - Mineral, Ore, Gangue, Flux, Slag - Concentration of ore - Construction and operation of Reverberatory furnace and Blast furnace - Methods of extraction of crude metal - Roasting, Calcination, Smelting – Alloys - Purpose of making alloys - Composition and uses of Brass, German Silver, Nichrome, Stainless Steel and Duralumin.

UNIT – VIII: CORROSION

Corrosion - Factors influencing the rate of corrosion – Dry and wet theories of corrosion – Composition cell, Stress cell and Concentration cell - Rusting of iron and its mechanism - Prevention of corrosion – Protective coatings - Cathodic protection - Paint – Constituents of paint – Functions of constituents of paint.

UNIT – IX: POLYMERS

Polymers - Polymerization - Types of polymerizations – Addition polymerization and Condensation polymerization - Plastics - Types of plastics - Advantages of plastics over traditional materials - Disadvantages of using plastics - Preparation and uses of the following plastics: 1. Polythene 2. PVC 3. Teflon 4. Polystyrene 5. Urea formaldehyde 6. Bakelite - Compounding and moulding of plastics – Natural rubber – Vulcanization of natural rubber - Elastomers – Preparation and uses of Butyl rubber, Buna-S rubber and Neoprene rubber - Fibre - Preparation and uses of Nylon 6,6 and Polyester (Polyethylene terephthalate) - Biodegradable polymers and their general applications.

UNIT – X: FUELS AND LUBRICANTS

Definition and classification of fuels - Characteristics of good fuels - Calorific value - HCV and LCV - Calculation of oxygen required for combustion of methane and ethane – Preparation method, composition, calorific value, and uses of some gaseous fuels; a) CNG b) LPG c) Water gas, d) Producer gas, e) Coal gas, and f) Bio gas – Explosives – Classification of explosives – Applications of explosives – Lubricants – Classification and functions of lubricants.

UNIT XI: ELECTROCHEMICAL CELL - BATTERIES

Galvanic cell - Standard electrode potential - Reference electrodes - Types of reference electrodes - Electro chemical series - EMF of cell – batteries - Types of batteries - Fuel cells.

UNIT – XII: ENVIRONMENTAL STUDIES

Introduction - Classification of air pollutants based on origin and states of matter - Air pollution – Causes, effects and controlling methods of air pollution - Water pollution – Causes, effects and controlling methods of water pollution – Soil pollution – Causes of soil pollution – General effects of soil pollution - Controlling methods of soil pollution – Carbon Trading.

ELECTRONICS AND COMMUNICATION ENGINEERING (100 Marks)

UNIT I: ELECTRONIC DEVICES AND CIRCUITS

Semiconductor diodes – Varactor diode – Zener diode – Clippers and Clampers-Transistors– FETs – UJT (characteristics only) – Power supplies – Rectifiers and Filters – Half wave, Full Wave and Bridge type – Shunt capacitor, LC and CLC & CRC filters – Series and Shunt regulators, RC regulators – Transistor amplifiers – CE, CC and CB configurations – Biasing techniques – Stabilization in amplifiers, Stability factor-RC coupled amplifiers, Differential amplifier – Feedback, Power and Tuned amplifiers - LC and Crystal oscillators – Operational amplifiers – Characteristics and applications – Astable and Monostable Multivibrators using 555 timers-Schmitt Trigger – Sweep circuits – Miller and Bootstrap circuits, VCO, PLL- Fabrication of ICs.

UNIT II: CIRCUIT THEORY

Ohms' Law, KCL & KVL-Mesh current and Node voltage analysis – Crammer's Rule – Concept of graph-nodes, junctions, loops - Constant K LPF & HPF – T type &π type Attenuator – Network theorems – Thevenin's, Norton's, Maximum Power transfer, Superposition and Reciprocity theorems– Star to Delta and Delta to Star transformations. Series and Parallel Resonance – Q factor – Selectivity – Bandwidth- Transient analysis-RC and RL, Linear wave shaping circuits. Transmission Lines – Characteristic Impedance – Reflection Coefficient – SWR – Transmission Line losses and Impedance matching.

UNIT III: INDUSTRIAL ELECTRONICS

Thyristor family – SCR, DIAC & TRIAC – Off Line and On Line UPS – Working & Applications of SMPS – Working of Servo stabilizer - Opto electronic devices – LDR (characteristics and applications) – Transducers – LVDT – Strain Gauge, Working of RTD - Thermocouple - Pulsed echo ultrasonic flaw detector – Industrial heating methods-Induction and dielectric heating- Types of electrical welding-Resistive welding- Applications of Transducer in servo motor - Architecture of PLCs - Ladder symbols – diagram, working- PLCs types - Features of Siemen's, Allenbradly-Applications of PLCs – Importance of SCADA. Basics of Control Systems – Open loop – Closed loop – Transfer function.

UNIT IV: COMMUNICATION SYSTEMS

Analog modulation– Need for modulation – Types of modulation – AM, FM , PM, SSB, VSB – Modulation Index in AM & FM– Bandwidth in AM & FM – Frequency deviation in FM – Need for pre-emphasis and de-emphasis– Transmitters – Low level and High level – Receivers– Block diagram of TRF Receiver and its limitations-Super heterodyne Receiver – Need for AVC-Fading-AM and FM receivers - choice of IF - Foster-Seely discriminator.

Pulse modulation, Sampling, PAM,PWM,PPM– PCM, Delta modulation – Error detection and correction - Digital modulation – ASK, FSK, PSK and QAM – Generation and detection – Multiplexing – TDM , FDM- Multiple access – TDMA, FDMA, CDMA – Internet Telephony.

Wave Guides – Rectangular – Dominant mode – Phase and Group velocity – Cut off wavelength –

Microwave components – E&H plane Tee-Need for isolator and circulator, Directional coupler - Applications of Magnetron – Working principle and application of Klystron and TWT, Reflex Klystron oscillator – Microwave semiconductor devices – working principle and applications of GUNN Diode, IMPATT diode – Applications of TRAPATT Diode - Radar – Range equation – Pulsed radar – Radar displays – Duplexer – CW radar and MTI radar - Satellite communication – Uplink and Downlink frequencies – Definitions of Perigee, Apogee, Azimuth and elevation angles – Types of satellites – Types of transponders – Satellite on board –Earth station system

UNIT V: DIGITAL ELECTRONICS

Number systems – Logic gates – Boolean algebra – Digital IC logic families TTL, CMOS IC's – Adders and Subtractors, Multiplexers, De multiplexers-Encoders-Decoders, Comparators – Flip-flops– Registers and Counters – Memories – RAM, ROM, Applications of Flash ROM – D/A converters – Binary weighted, R-2R Ladder, A/D Converter – Counter Ramp and Successive approximation types.

UNIT VI: MICROCONTROLLERS, PROGRAMMING, INTERFACING & APPLICATIONS

Block diagram of 8051 architecture – Pin diagram of 8051 – Instruction Set of 8051 – Addressing modes of 8051 – Subroutines – Use of input and output machine related statements – Time delay program – Internal memory organization – Interrupts of 8051 – Peripheral ICs – 8255 - Interfacing of push button switch - Interfacing of 7 Segment display – Interfacing of LED-LCD pins and interfacing of LCD- Interfacing of 4 X 4 matrix key board –RS 232 – Block diagram of 8251 and 8257 - Pin diagram of 8251 and 8257 - DB25 & DB9 connector.

UNIT VII: CONSUMER ELECTRONICS

Television Picture elements – Scanning and synchronization – Blanking and interlacing – composite video signal, flicker, CCIR standards – Positive and Negative modulation – Color TV – Additive and subtractive mixing – Types of color TV systems – NTSC, PAL and SECAM – Block diagram of color TV transmitter – Block diagram of Color TV receiver – PAL system processing – DTH system – Features of HDTV and Smart TV.

UNIT VIII: DATA COMMUNICATIONS AND COMPUTER NETWORKS

Transmission Media – Twisted pair – UTP – STP – Coaxial cable – Optical fiber – Comparison of transmission media- Shannon Capacity theorem – Network Topologies – BUS, STAR, RING – Switching – Packet and Circuit switching – OSI 7 layer model and functions – CSMA and token ring – Properties and operations – Wireless LAN – Bluetooth technology – WAN architecture – Packet transmission – ARPANET – ISP and ISDN architectures – WAN Protocols – TCP / IP features and comparison – Ports and Sockets – Domain Name System – Email – File transfer protocol – Proxy server and Web server architecture-List HTTP commands – security services-Message confidentiality-Message integrity – Message authentication – Entity authentication – Web Browser Architecture-Key management-Digital signature – Firewalls in securing networks.