

TS ECET - 2023

Syllabus for Electronics and Communication Engineering

MATHEMATICS (50 Marks)

Unit-I: Matrices

Matrices: 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-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.

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 decomposition of the integrand, integration of trigonometric, algebraic, exponential, logarithmic and Hyperbolic functions– Integration by substitution –Integration of reducible and irreducible quadratic factors – 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 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, 2nd order linear differential equation 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).

Unit–VII: Laplace Transforms

Laplace Transforms (LT) of elementary functions-Linearity property, first shifting property, change of scale property, multiplication 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 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 FRICTION

Physical quantity - Fundamental and derived quantities – Unit –definitions - S.I units - Advantages of S.I. units - Dimensions and dimensional formula - definitions-units and dimensional formula for physical quantities - Principle of homogeneity - Applications of dimensional analysis–Friction – causes - types of friction - Normal reaction - Laws of static friction - coefficients of friction - expression-rough horizontal surface - expressions for Acceleration, Displacement, Time taken to come to rest and Work done - Advantages and disadvantages of friction - Methods to reduce friction – Problems on friction only.

Unit-II: ELEMENTS OF VECTORS

Scalar and vector quantities – definitions and examples –Graphical representation of a vector - Classification of vectors (Proper vector, Unit vector, Equal vector, Negative vector, Collinear vector and Position vector) Resolution of a vector - Triangle law of vector addition – Parallelogram law of vectors – statement- expression for magnitude and direction of resultant vector –derivation-illustrations (working of sling and flying bird) - Representation of a vector in unit vectors \mathbf{i} , \mathbf{j} and \mathbf{k} – Scalar product of vectors-definition- application to work done by force – properties of scalar product - Vector product of vectors –definition – Right hand thumb rule and right hand screw rule - application to moment of force - properties of vector product - area of parallelogram and triangle in terms of vector product - related problems

Unit-III: MECHANICS

Projectile motion – definition - examples - Horizontal projection – Time of flight and Horizontal

range – derivations - 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 - derivations – Circular motion, angular velocity, time period and frequency of revolutions–Definitions– Relation between linear velocity and angular velocity - derivation–centripetal force – centrifugal force – definitions and expressions only- application (banking of curved path) - angle of banking- expression only - related problems

Unit-IV: PROPERTIES OF MATTER

Elasticity and plasticity- definitions – examples - Stress and Strain – definitions and expressions - elastic limit - Hooke's law – statement - modulus of elasticity - Young's modulus – Derivation – Cohesive and adhesive forces - Surface tension - Illustrations - Capillarity –angle of contact – definition- examples for capillarity- Formula for Surface tension based on capillarity (no derivation) – Viscosity - Illustrations of viscosity - Newton's formula for viscous force – derivation - Coefficient of viscosity - Poiseuille's equation - Effect of temperature on viscosity of liquids and gases– streamlines - laminar flow - turbulent flow - Reynold's number - equation of continuity – statement - related problems.

Unit-V: HEAT AND THERMODYNAMICS

Heat – expansion of gases - Boyle's law –concept of absolute zero - Absolute scale of temperature – Charles' laws - Ideal gas equation – derivation - value of universal gas constant 'R' –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 heat of a gas – molar specific heat of a gas – definitions – derive relation between C_p and C_v - related problems.

Unit-VI: CONSERVATION LAWS AND ENERGY SOURCES

Work and Energy - Potential Energy and kinetic energy–examples – expressions for PE and KE - 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– Non renewable and renewable energy sources - related problems

Unit-VII: WAVES AND SOUND

Wave motion – definition and characteristics – audible range – infrasonic and ultrasonic – longitudinal and transverse waves – examples – Relation between wavelength, frequency and velocity of a wave – derivation –stationary waves- beats - applications of beats - Doppler effect – list the applications – ultrasound and radar in medicine and engineering as special emphasis- echo – definition - applications - relation between time of echo and distance of obstacle –derivation- Reverberation and time of reverberation - Sabine's formula - Free and forced vibrations - Resonance - Conditions of good auditorium - noise pollution – definition – causes, effects and methods to minimize noise pollution - problems

Unit-VIII: SIMPLE HARMONIC MOTION

Periodic motion - Simple Harmonic Motion (SHM)– definition - examples - Conditions for SHM – Projection of circular motion on any diameter of a circle is SHM - Expressions for Displacement, Velocity and Acceleration of a particle executing SHM – derivations - Time period, frequency, amplitude and phase of a particle in SHM - Ideal simple pendulum – time period of simple

pendulum –derivation - laws of simple pendulum-Seconds pendulum- problems

Unit-IX: MODERN PHYSICS

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 - concept of Refraction of light - critical angle and total internal reflection - principle of Optical fiber - Applications of optical fiber – LASER – definition and characteristics – principle of LASER - spontaneous emission and stimulated emission - population inversion - examples of LASER – Uses.

Unit-X: MAGNETISM

Magnetic field - magnetic lines of force -properties - Uniform and Non-uniform magnetic field – Magnetic length, pole strength – magnetic induction field strength- definition - Coulomb's inverse square law of magnetism - expression for 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 - Dia, Para and Ferro magnetic materials – examples - related problems.

Unit-XI: ELECTRICITY AND MEASURING INSTRUMENTS

Ohm's law – Ohmic and non ohmic conductors – examples - Temperature dependence of resistance – coefficients of resistance with examples - Specific resistance – units – conductance- series and parallel combination of resistors - moving coil galvanometer - conversion of galvanometer into ammeter and voltmeter with diagram (qualitatively) – Kirchoff's current and voltage laws in electricity – Expression for balancing condition of Wheatstone's bridge – derivation – Meter bridge –working with neat diagram –Superconductivity-definition-superconductors - definition and examples – applications - related problems.

Unit-XII: ELECTRONICS

Solids – definition – energy bands in solids- valence band, conduction band and forbidden band – Energy band diagram of conductors, insulators and semiconductors – concept of Fermi level - Intrinsic semiconductors - examples - Concept of holes in semiconductors - Doping - Extrinsic semiconductor - P-type and N-type semiconductors - PN Junction diode – Forward Bias and Reverse Bias - Applications of PN diode - Diode as rectifier – principle – principle of Light Emitting Diode and solar cell.

CHEMISTRY (25 Marks)

Unit-I: Fundamentals of Chemistry

Atomic Structure: Introduction - Atomic number - Mass number- Bohr's Atomic theory - Aufbau principle - Hund's rule - Pauli's exclusion Principle- Orbitals, shapes of s, p and d orbitals - Electronic configuration of elements

Chemical Bonding: Introduction - Electronic theory of valency - Types of chemical bonds - Ionic, covalent and co-ordinate covalent bond with examples - Properties of Ionic and Covalent compounds

Oxidation-Reduction: Electronic Concepts of Oxidation-Reduction, Oxidation Number-calculations.

Unit -II: Solutions and Colloids

Introduction-Classification of solutions based on physical state- Molecular weights, Equivalent weights - Expression of concentration - Mole concept, Molarity, Normality, Numerical problems on Mole, Molarity and Normality - Colloids- Types of colloids- Lyophilic and Lyophobic colloids - Industrial applications of colloids.

Unit -III: Acids and Bases

Introduction - theories of acids and bases and limitations - Arrhenius theory-Bronsted-Lowry theory - Lewis acid base theory - Ionic product of water - pH and related numerical problems - Buffer solutions- buffer action - applications of buffer solution.

Unit -IV: Environmental Studies-I

Introduction - environment -scope and importance of environmental studies- important terms - renewable and non-renewable energy sources - Concept of ecosystem, producers, consumers and decomposers - Biodiversity, definition and threats to Biodiversity- Forest resources- Over exploitation-Deforestation.

Unit -V: Water Technology

Introduction -soft and hard water - causes of hardness – types of hardness -disadvantages of hard water - degree of hardness (ppm) - softening methods - permutit process - ion exchange process - drinking water - municipal treatment of water for drinking purpose - Osmosis, 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 -VI I: Metallurgy

Characteristics of Metals - distinguish between Metals and Non Metals- Ore, Gangue, Flux and Slag - Concentration of Ore -Froth floatation - Methods of Extraction of crude Metal - Roasting, Calcination and Smelting - Alloys-purpose of making alloys - Composition of Brass, German silver, Nichrome, Stainless steel and Duralumin

Unit –VIII: Corrosion

Introduction - factors influencing the rate of corrosion - electrochemical theory of corrosion - composition, stress and concentration cells- rusting of iron and its mechanism - prevention of corrosion - coating methods, Paints-constituents and characteristics of paints-cathodic protection

Unit –IX: Polymers

Introduction - polymerization - types of polymerization - addition, condensation with examples - 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 - Rubber - Elastomers –Preparation of Butyl rubber, Buna-s rubber, Neoprene rubber and their uses-Fibres-Preparation and uses of fibres-Nylon 6,6-

Polyester

Unit –X: Fuels

Definition and classification of fuels- characteristics of good fuel - Calorific value-HCV and LCV- Calculation of oxygen required for combustion of methane and ethane - composition and uses of gaseous fuels - a) Water gas b) Producer gas, c) Natural gas, d) Coal gas, e) Bio gas and f) Acetylene.

Unit –XI: Electro Motive Force

Galvanic cell – standard electrode potential -electro chemical series -emf of cell – Batteries-Types of batteries-Fuel cells.

Unit –XII: ENVIRONMENTAL STUDIES-II

Introduction- classification of air pollutants based on origin and states of matter - Air pollution; causes and effects - control methods - Water pollution; causes and effects - control measures.

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 Multi vibrators 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 – Cramer'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.

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 –

Wave Propagation – Ground, Sky and Space wave.

Pulse modulation, Sampling, PAM,PWM,PPM– PCM, Delta modulation – RZ and NRZ line coding – Error detection and correction - Digital modulation – ASK, FSK, PSK and QAM – Generation and detection – Multiplexing – TDM , FDM- Multiple access – TDMA, FDMA, CDMA – Internet Telephony- Antennas – Radiation resistance – Beam width – Polarization – Directivity – Efficiency – Bandwidth – Gain – Front to back ratio – Folded dipole – Arrays – Broadside – End fire – Yagi Uda antenna-Turnstile antennas-loop antenna-horn antenna-helical antenna -Binomial antenna – Rhombic antenna – Log periodic antenna – Parabolic reflectors - Cassegrain feed arrangement – Beam width, gain and applications..

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 – 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.
