

# TS ECET-2021

## SYLLABUS: 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 nonsingular 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. Solving 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: Properties of Modulus, amplitude and conjugate of complex numbers, arithmetic operations on complex numbers—Modulus-Amplitude form (Polar form) - Euler form (exponential form)-Properties.

### 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.

### Unit-IV: Differentiation and its Applications

Functions and limits – Standard limits – Differentiation from the First Principle – 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 - 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, 2<sup>nd</sup> 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 (I LT)-shifting theorem, 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 only.

## **Unit–VIII: Fourier series**

Define 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  $(-\pi, \pi)$ .

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# TS ECET-2021

## MODEL QUESTIONS FOR MATHEMATICS

1. If the determinant of the transpose of the matrix  $\begin{bmatrix} 2 & 2 & 2 \\ 2 & 2+x & 2 \\ 2 & 2 & 2+y \end{bmatrix}$  is positive, then the point (x,y) lies in

- 1) I and II quadrants 2) **I and III quadrants** 3) II and IV quadrants 4) III and IV quadrants

2. If  $f(x)=x^2$  in  $(-\pi,\pi)$  and  $f(x) = \sum_{n=0}^{\infty}(a_n \cos nx + b_n \sin nx)$ , then  $a_1 =$

- 1) 4 2) **-4** 3)  $-4\pi$  4)  $4\pi$

3. If  $\frac{1}{x^2(x+1)} = \frac{A}{x+1} + \frac{B}{(x)^2} + \frac{C}{x}$  then  $A+B+C =$

- 1) 0 2) 3 3) 2 4) **1**

4. The general solution of the corresponding Homogeneous differential equation of  $(D^2 + 9)y = \cos 3x$  is

- 1) **A cos 3x + B sin 3x** 2)  $A \cos 3x + B x \sin 3x$  3)  $\frac{x \cos 3x}{3}$  4)  $\frac{x \sin 3x}{6}$

5. If  $L^{-1} \left\{ \frac{1}{s(s^2+1)} \right\} = \int_0^t f(t) dt$ , then  $f(t) =$

- 1) **sint** 2)  $1 - \cos t$  3)  $\arctan t$  4)  $1 + \sin t$

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# TS ECET-2021

## SYLLABUS: PHYSICS

(25Marks)

**Unit-I: Units and dimensions:** Physical quantity-fundamental and derived physical quantities-units-fundamental and derived units-SI units-advantages of SI units-dimensions and dimensional formulae for physical quantities -principle of homogeneity in dimensions

**Unit-II: Modern physics:** Photo electric effect–explanation and its laws-applications of photo electric effect (photocell)-Einstein’s photoelectric equation–critical angle and total internal reflection– optical fibers - principle, working- Basic concept of super conductivity , examples of super conducting materials and their applications.

**Unit-III: Heat and Thermodynamics:** Boyle’s law-Absolute scale of temperature-Charles laws-Ideal gas equation-Universal gas constant and its value-SI Units-problems - isothermal process-adiabatic process- statements of first law and second law of thermodynamics - two specific heats of a gas-relation between  $C_p$  and  $C_v$ -problems.

**Unit-IV: Elements of vectors:** Scalar and vector quantities-examples-types of vectors-triangle law-parallelogram law- expression for magnitude and direction of resultant of two vectors using parallelogram law -resolution of a vector-unit vectors (i,j,k)-dot product and cross product of two vectors- properties of dot and cross products-examples- problems.

**Unit-V: Kinematics:** Projectile motion-examples-horizontal and oblique projections- expression for path of projectile in case of oblique projection - expressions for maximum height, time of ascent, time of flight, horizontal range in case of oblique projection - problems.

**Unit-VI: Friction:** Friction- causes and types of friction-normal reaction-laws of friction-coefficients of friction-methods to reduce friction-advantages and disadvantages of friction-expression for acceleration of a body over a rough horizontal surface – expressions for displacement and time taken by a body to come to rest over a rough horizontal surface - problems.

**Unit-VII: Work and Energy:** Work and energy-definitions and units-potential and kinetic energies-examples and expressions-Work-Energy theorem – law of conservation of energy in the case of freely falling body -problems.

**Unit-VIII: Simple harmonic motion:** Definition-conditions of Simple Harmonic Motion (SHM) - examples of SHM - expressions for displacement, velocity, acceleration, time period, frequency and phase of SHM- expression for time period of a simple pendulum- laws of simple pendulum -seconds pendulum-problems.

**Unit-IX: Sound:** Sound- longitudinal wave and transverse wave - noise pollution-Effects and methods to control Noise Pollution-Beats and echo and their applications -Doppler effect - statement– Physical explanation and applications –Reverberation time -Sabine’s formula-characteristics/conditions of a good auditorium - problems.

**Unit-X: Properties of matter:** Define terms - elasticity, plasticity – stress and strain – units – Hooke’s law – definition of surface tension, examples – angle of contact , capillarity and examples – formula for surface tension based on capillarity (no derivation) –viscosity and examples- Newton’s formula for viscosity- Poiseulle’s equation for co-efficient of viscosity- effect of temperature on viscosity of liquids and gases- problems.

**Unit-XI: Electricity and Magnetism:** Ohm’s law –Specific resistance, Conductance and their units- statements and explanation of kirchoff’s laws- expression for balancing condition of Wheatstone bridge- Working principle of meter bridge-coulomb’s inverse square law in magnetism- magnetic field – magnetic lines of force- magnetic induction field strength and units – moment of couple acting on a bar magnet placed in a uniform magnetic field – problems.

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## TS ECET-2021

### MODEL QUESTIONS FOR PHYSICS

- 1) Dimension of mass in Universal gravitational constant  
1) 0                                  2) 1                                  3) -1                                  4) 2
- 2) If  $\vec{F} = 2\hat{i} + 3\hat{j} - 4\hat{k}$  and  $\vec{S} = 4\hat{i} - 2\hat{j} + n\hat{k}$  then the work done is zero. The value of n is  
1) 0                                  2)  $\frac{1}{2}$                                   3)  $\frac{3}{2}$                                   4) 1
- 3) The nature of velocity-time graph of a freely falling body is  
1) parabola                                  2) ellipse  
3) **straight line passing through the origin**                                  4) straight line with +ve y axis intercept
- 4) A particle is performing SHM with a time period T. Then the time taken by the particle to reach half the amplitude from its mean position is  
1)  $\frac{T}{12}$                                   2)  $\frac{T}{3}$                                   3)  $\frac{T}{6}$                                   4)  $\frac{T}{2}$
- 5) A given mass of gas at  $27^{\circ}$  is heated in a glass flask at constant pressure so that its volume is doubled. Then the final temperature of the gas is  
1)  **$327^{\circ}\text{C}$**                                   2)  $227^{\circ}\text{C}$                                   3)  $430^{\circ}\text{C}$                                   4)  $530^{\circ}\text{C}$

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# TS ECET-2021

## SYLLABUS: CHEMISTRY

(25 Marks)

**Unit I: Fundamentals of Chemistry: Atomic structure:** Introduction- Atomic number – atomic mass number – Bohr's theory – Aufbau's principle – Hund's rule – Pauli's exclusion principle- Electronic configurations of elements up to atomic number 30, Differences between orbit and orbital - shapes of **s, p, d** orbitals.

**Chemical Bonding:** Introduction – Electronic theory of valency - Types of chemical bonds – Ionic bond - NaCl and MgO – Characteristics of ionic compounds - Covalent bond - H<sub>2</sub>, O<sub>2</sub>, N<sub>2</sub> (Lewis dot model) - Characteristics of covalent compounds - Coordinate covalent bond – Definition and examples, [NH<sub>4</sub><sup>+</sup>], [NH<sub>3</sub>BF<sub>3</sub>].

**Oxidation-Reductions:** Electronic concept of Oxidation and Reduction - Oxidation number and its calculations - Differences between oxidation number and valency.

**Unit-II: Solutions:** Introduction – Definition of solution, solute and solvent - Classification of solutions based on physical state - Mole concept - Molecular weight, equivalent weight of acids, bases and salts - Molarity, Normality and numerical problems.

**Unit-III: Acids and Bases:** Introduction – Theories of acids and bases – Arrhenius theory - Bronsted – Lowry theory – Lewis theory – Ionic product of water - pH and related numerical problems pertaining to strong acids and bases – Definition of buffer – Types of buffer – Acidic buffer ( Acetate buffer) – Basic buffer (Ammonia buffer) without buffer action – Applications without explanation.

**Unit – IV: Principles of Metallurgy:** Characteristics of metals and distinction between metals and non-metals. Definitions of metallurgy, ore, gangue, flux, slag – Concentration of ore by froth floatation process – Roasting, calcination, smelting – Alloys – Composition and uses of brass, German silver and nichrome.

**Unit-V: Electrochemistry:** Conductors - Metallic and electrolytic conductors- Insulators, electrolytes (strong and weak) - Arrhenius theory of electrolytic dissociation – Electrolysis of fused NaCl –Electrolytic refining of copper - Faraday's laws of electrolysis- Numerical problems – Galvanic cell – Electrode potential - Standard electrode potential – Electro chemical series – Significance of electro chemical series without explanation - emf and numerical problems on emf of a cell ( based on  $EMF = E_R - E_L$  formula).

**Unit –VI: Corrosion:** Introduction – Definition of corrosion - Factors influencing rate of corrosion - Electrochemical theory of corrosion- Composition cell, stress cell and concentration cell - Rusting of iron and its mechanism – Prevention of corrosion by (a) protective coatings - Metallic (anodic and cathodic coatings), Inorganic and Organic coatings ( only examples) (b) cathodic protection (sacrificial anode method and impressed voltage method).

**Unit-VII: Water Technology:** Introduction – Soft and hard water – Causes of hardness – Types of hardness – Disadvantages of hard water in industries – Degree of hardness, units (ppm and mg/litre) and Numerical problems on hardness of water – Softening methods – Permutit process – Ion exchange process – Characteristics of drinking water – Municipal treatment of water for drinking purpose - Osmosis and reverse Osmosis - Advantages of Reverse Osmosis.

**Unit-VIII: Polymers:** Introduction – Polymerization – Types of polymerization – Addition, condensation polymerization with examples – Plastics – Types of plastics – Advantages of plastics over traditional materials – Disadvantages of using plastics - Thermo plastics and thermo setting plastics– Differences between thermo plastics and thermo setting plastics - Preparation and uses of the following plastics: 1. Polythene, 2. PVC, 3. Teflon, 4. Polystyrene, 5. Urea formaldehyde 6. Bakelite. – Rubber – Natural rubber – Processing of rubber from latex – Vulcanization – Elastomers – Butyl rubber, Buna-s, Neoprene rubber and their uses.

**Unit-IX: Fuels:** Definition and classification of fuels based on physical state and occurrence – Characteristics of good fuel - Composition and uses of gaseous fuels. (a) Water gas, (b) producer gas, (c) natural gas, (d) coal gas, (e) bio gas, (f) acetylene.

**Unit-X: Environmental Chemistry:** Introduction – Environment – Lithosphere, hydrosphere, atmosphere, biosphere, biotic component – Definitions of pollutant, contaminant- receptor, sink, particulate with examples, Definition and significance (without explanation) of DO, BOD, Threshold limit value, COD - Forest resources, uses and over exploitation - Deforestation - Air pollution - Causes-Effects- - Acid rain - Green house effect – Ozone depletion – Control of Air pollution ( Basic level only) – Water pollution – Causes – Effects – Control measures of water pollution ( Basic level only) - Renewable and Non Renewable energy sources with examples – Concept of ecosystem – Producers, consumers and decomposers – Biodiversity, threats to Biodiversity.

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## TS ECET-2021

### MODEL QUESTIONS FOR CHEMISTRY

- The number of unpaired electrons present in sulphur.  
1) 3      2) 2      3) 1      4) 4
- What is the conjugate base of  $\text{H}_2\text{O}$ .  
1)  $\text{H}_3\text{O}^+$       2)  $\text{H}^+$       3)  $\text{OH}^-$       4)  $\text{O}^{2-}$
- Which one of the following cause temporary hardness to water?  
1)  $\text{CaCl}_2$       2)  $\text{MgSO}_4$       3)  $\text{NaCl}$       4)  $\text{Ca}(\text{HCO}_3)_2$
- 0.4 grams of  $\text{NaOH}$  is added to 100 ml of 0.1 M  $\text{NaOH}$  solution and the volume of solution is made to 200ml by adding water. Calculate the molarity of the resulting solution?  
1) **0.1M**      2) 0.2M      3) 0.3M      4) 0.4M
- Monomers used for the preparation of Bakelite  
1) Urea and formaldehyde      2) aniline and formaldehyde  
3) **Phenol and formaldehyde**      4) Phenol and urea

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# TS ECET-2021

## SYLLABUS: ELECTRICAL & ELECTRONICS ENGINEERING

(100Marks)

### UNIT I:-BASIC ELECTRICAL ENGINEERING

Ohms and Kirchoff's Laws, series and parallel resistance circuits, star/delta transformation, Network theorems, work Power and Energy, Heating effects of Electric current, Magnetic effects of Electric current, Electromagnetic Induction, Electrostatics, Types of electrical Engineering materials-Conducting, Semi conducting, Magnetic, Insulating, Dielectric materials-Properties and uses-Special purpose materials. Batteries, Types, Properties and applications.

### UNIT II: - D.C. MACHINES AND MEASURING INSTRUMENTS

D.C. Generators: Construction, Operation, types, EMF Equation, Windings, Armature reaction, Characteristics, Efficiency and Parallel operation, Applications. DC Motors: Principle of operation, Back EMF, Torque Equation, Types, Characteristics, Starters, Speed Control, Losses, Efficiency and Testing. Measuring Instruments: Classification, Deflection, Controlling and damping torques, shunts and multipliers - Construction, Working Principle of Operation of moving Coil, Moving Iron, Dynamometer type, Induction type meters, Errors, Instrument Transformers, Induction type Energy meter, Shunts and Multipliers, Measurement of Resistance, Megger, Potentiometer, Transducers and Sensors – Types, Thermistor, Thermocouple, LVDT and Strain gauges. Electronics and digital instruments. Rectifier type, Digital Multimeter, Digital Energy meter, Digital Frequency meter and Clamp meter.

### UNIT III: A.C. CIRCUITS AND TRANSFORMERS:

A.C. Circuits: Fundamentals, Average value, RMS value, form factor and peak factor of periodic wave forms. Series and parallel AC Circuits, Resonant circuits, Polyphase Circuits, Measurement of power by 2 Wattmeter's method for balanced loads. Transformer: Single-phase Transformer, Construction, Operation, EMF Equation, Equivalent circuit, regulation, All day efficiency, Testing, Three-phase Transformers, Auto-Transformers

### UNIT IV: - A.C. MACHINES

Alternators: Construction, Operation, EMF equation, regulation, testing and parallel Operation. Synchronous Motors: Operation and performance, effects of field excitation, 'V'-Curve and inverted 'V'- Curve, methods of Starting and uses. Hunting and its effects. Three-Phase induction Motors: Construction, Principle of Operation, Torque Equation, Slip- torque characteristics, losses, efficiency, testing, circle diagram, speed control, starters, double-cage motor and applications.

Single-phase Motors: Induction Motor: Types, Principle of operation, applications. Single Phase commutator motors: Types, Principle of operation and applications.



## **UNIT V:-POWER SYSTEM GENERATION & PROTECTION**

Generating Stations: Conventional and Non-conventional sources of energy, working, Components, Thermal, Hydel, Nuclear and Gas Power stations, types, Comparison Renewable energy sources, Solar, Photovoltaic and windmill, Pollution control, Combined Working, Power Stations auxiliaries, Switch gear Power Systems Protection: Circuit Breakers – Types, Principles of operation and uses, Current Limiting, fuses and reactors, Relays – Classification, Principle of Operation of Induction type over current relay, Directional over current relays, distance relays, Protection of alternators, Transformers, Bus-bars, Transmission lines and feeders, Lightning arrestors, neutral grounding.

## **UNIT VI: - TRANSMISSION AND DISTRIBUTION**

Transmission and distribution: Types of supply systems, Transmission line parameters, inductance and capacitance, performance of short and medium lines, regulation, Ferranti effect, Corona, Skin effect, Basic concepts of HVDC Transmission, types, advantages and disadvantages of HVDC Transmission. Components of lines, supports, conductor spacing, ground clearance and sag, insulators, voltage distribution across the string, string efficiency, methods of improving string efficiency. Types of sub-stations and Substation equipment. Cables – Classification, insulation resistance, specifications. Distribution – Radial and ring distributors, variation of load voltage.

## **UNIT VII: - ELECTRIC UTILISATION AND TRACTION**

Electric Lighting: Requirements of good lighting different types of lamp fittings- laws of illumination Electric heating, Requirements of good heating element, Types of resistance heating, Electric arc furnaces, Types of induction heating, Dielectric heating-Principle of operation, Applications, Electric heating and welding, Types of welding, Welding generator and welding transformer, Applications

Electric Traction: Systems of Train Electrification, Speed-time Curves for different services, Schedule speed, Tractive Effort, Traction system auxiliaries, Traction motor, Supply systems

## **UNIT VIII: - ELECTRICAL INSTALLATION AND ESTIMATION**

Electric Wiring: Tools, Wires, Types of wiring, Accessories, Lamp Circuits, Estimating and costing of domestic, industrial, power, irrigation pump sets, over head lines and 11KV Substations, Rural electrification, departmental tests, earthing, maintenance of electrical machines.

## **UNIT IX: - BASIC ELECTRONICS AND DIGITAL ELECTRONICS**

Semi-Conductor devices, PN diode, Zener diode, Characteristics, PNP and NPN Transistors, Transistor configurations and biasing methods, characteristics, half and full wave rectifiers, Bridge rectifiers, Filters, Zener diode regulation. Special devices: UJT, FET, JFET, MOSFET, Amplifiers: Types, Principles of operation, Characteristics, Multistage, Coupled amplifiers, Power amplifiers, and Feedback amplifiers. Oscillators: Types, working principle of operation and applications. Digital Electronics: Different numbering systems, inter conversions, Boolean Algebra, Logic families, performance of AND, OR, NOT, NOR, NAND, EX-OR gates, combinational Logic Circuits, sequential logic circuits, Registers and Memories, A/D and D/A converters, counters and flip-flops.

## UNIT X: - POWER ELECTRONICS

Power Electronic Devices: Construction and working of SCR, DIAC, TRIAC, IGBT, LASCR, Volt-ampere characteristics, Triggering of SCR using UJT, Commutation of SCR and SCR Protection. Converters, AC regulators, Choppers, Inverters

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## TS ECET-2021

### MODEL QUESTIONS FOR ELECTRICAL AND ELECTRONICS ENGINEERING

1. If the current changes from 5A to 3 A in 2 seconds and the inductance is 10H, Calculate the emf
  - 1) 5V
  - 2) **10 V**
  - 3) 15 V
  - 4) 20 V
  
2. The armature of DC motor is laminated to \_\_\_\_\_
  - 1) To reduce mass
  - 2) To reduce hysteresis loss
  - 3) **To reduce eddy current loss**
  - 4) To reduce Inductance
  
3. The open circuit test in a transformer is used to measure
  - 1) Copper loss
  - 2) Winding loss
  - 3) Total loss
  - 4) **Core loss**
  
4. A 3-phase 440V, 50Hz induction motor has 4% slip. The frequency of rotor current will be
  - 1) 50Hz
  - 2) 25Hz
  - 3) 5Hz
  - 4) **2Hz**
  
5. The r.m.s value and mean value is the same in the case of
  - 1) Triangular wave
  - 2) Sine wave
  - 3) Half wave rectified sine wave
  - 4) **Square wave**

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