TS ECET-2019

SYLLABUS FOR CIVIL 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 nonsingular matrices - Adjoint and multiplicative inverse of a square matrix-System of linear equations in 3 variables-Solutions by Crammer'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, submultiple angles – Transformations of Products into sum or difference and vice versa- Simple trigonometric equations–Properties of triangles–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, acute 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, equitation 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 Principles – 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 value, 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, nth order linear differential equation with constant coefficients both homogeneous and nonhomogeneous and finding the Particular Integrals for the functions e^{ax}, x^m, sin ax, cos ax or a polynomial of m-th degree(m=1,2).

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 theorem, change of scale property, multiplication and division by p, ILT by using partial fractions and convolution theorem. Applications of LT to solve ordinary differential equations to solve 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 $(–\pi, \pi)$.

PHYSICS (25Marks)

Unit-I: Units and dimensions:
Physical quantity-fundamental and derived physical quantities-units-fundamental and derived units-SI units-multiples and sub-multiple sin SI units-advantages of SI units-dimensions and dimensional formulae-dimensionless quantities- applications and limitations of dimensional analysis-problems.

Unit–II: Elements of vectors:
Scalar and vector quantities-examples-types of vectors-addition and subtraction of vectors-triangle law-parallelogram law-polygon law-resolution of a vector-unit vectors(i,j,k)-dot product and cross product of two vectors- characteristics of dot and cross products-examples- problems.

Unit-III: Kinematics and Friction
Equations of motion-acceleration due to gravity-equations of motion under gravity- projectile motion-examples-horizontal and oblique projections-expressions for maximum height, time of ascent, time of flight, horizontal range, problems. Friction- causes and types of friction-normal reaction-laws of friction-coefficients of friction-angle of friction-methods of reducing friction-

advantages and disadvantages of friction-motion of a body over a rough horizontal surface,–problems.

Unit-IV: Work, Power and Energy
Work, power and energy-definitions and units-potential and kinetic energies-examples and expressions-work-energy theorem – law of conservation of energy-problems.

Unit-V: Simple harmonic motion and Sound
Definition-conditions of SHM - examples of SHM - expressions for displacement, velocity, acceleration, time period, frequency and phase of SHM-time period of a simple pendulum-seconds pendulum-problems. Sound-musical sound and noise-noise pollution-Effects and methods of control of Noise Pollution-Beats and echo's-problems-Doppler effect– Explanation, and Applications --Reverberation-Sabine's formula-characteristics of a good building-problems.

Unit-VI: Heat and Thermodynamics
Expansion of gases-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-first law of thermodynamics - two specific heats of a gas-relation between Cp and Cv-problems-second law of thermodynamics.

Unit-VII: 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, types and applications-concept of super conductivity – and applications.

CHEMISTRY (25 Marks)

Unit I: Fundamentals of Chemistry:
Atomic structure: Introduction-Fundamental particles – Bohr's theory – Quantum numbers – Aufbau's principle – Hund's rule – Pauli's exclusion principle- Electronic configurations of elements up to atomic number 30, shapes of **s**, **p**, **d** orbital's.
Chemical Bonding: Introduction – types of chemical bonds – Ionic bond taking example of NaCl and MgO –characteristics of ionic compounds and covalent bond taking example H_2, O_2, N_2, HCl, characteristics of covalent compounds-Coordinate covalent bond.
Oxidation-Reductions: concepts of Oxidation-Reduction, Oxidation number and its calculations, differences between oxidation number and Valency.

Unit-II: Solutions:
Introduction classification of solutions, solute, solvent, concentration, mole concept–Molarity – Normality, equivalent weight using acids, bases and salts, numerical problems on Molarity and Normality**.**

Unit-III: Acids and Bases:

Introduction – theories of acids and bases – Arrhenius, Bronsted – Lowry theory – Lewis acid base theory – Ionic product of water - pH and related numerical problems – buffers solutions – Applications.

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-hand picking, levigation, froth floatation – extraction of crude metal – roasting calcination, smelting – alloys – composition and uses of brass, German silver and nichrome.

Unit-V: Electrochemistry:
Conductors, insulators, electrolytes - Arrhenius theory of electrolytic dissociation – electrolysis – Faraday's laws of electrolysis- numerical problems – Galvanic cell – standard electrode potential – electro chemical series –emf and numerical problems on emf of a cell.

Unit –VI: Corrosion:
Introduction – factors influencing corrosion - electrochemical theory of corrosion-composition cell, stress cell and concentration cells - rusting of iron and its mechanism – prevention of corrosion by (a) coating methods, (b) cathodic protection (sacrificial and impressive voltage methods).

Unit-VII: Water Technology:
Introduction – soft and hard water – causes of hardness – types of hardness –disadvantages of hard water – degree of hardness, units and Numerical problems– softening methods – permutit process – ion exchange process – qualities 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 stetting plastics - preparation and uses of the following plastics: 1. Polythene, 2. PVC, 3. Teflon, 4. Polystyrene, 5.Urea formaldehyde – Rubber – natural rubber – processing from latex –Vulcanization – Elastomers – Butyle 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 – understand the terms lithosphere, hydrosphere, atmosphere bio sphere, biotic component, energy component pollutant, receptor, sink, particulate, DO, BOD, Threshold limit value, COD- Air pollution - causes-Effects - Forest resources, uses and

over exploitation, deforestation acid rain, green house effect –ozone depletion – control of Air pollution – Water pollution – causes – effects – control measures. Renewable and Non Renewable energy sources – concept of ecosystem – producers, consumers and decomposers – Biodiversity, threats to Biodiversity.

CIVIL ENGINEERING (100 Marks)

ENGINEERING MECHANICS:
UNIT – I :
Forces and moments- Vectors and scalars, resultant forces at a point, types of supports, types of loading. Centroid – rectangle, triangle, parallelogram, circle, semicircle, trapezium. Location of centroid of T,L,I, channel , Z sections. Buildup sections. Moment of Inertia – T,L,I and builtup sections, radius of gyration of builtup sections. Polar moment of inertia of solid and hollow circular sections using perpendicular axis theorem only.

STRENGTH OF MATERIALS:
UNIT-II:
Simple stresses and strains - ductile materials-Mechanical properties of materials- Hooke's law - lateral strain-Poisson's ratio-Elastic constants and the relation between them- Composite sections-Resilience-Strain energy-Gradual and sudden loading- Shear force and Bending Moment Diagrams for cantilever, Simply supported, fixed, continuous and overhanging beams subjected to Point loads and UDL.

UNIT-III:
Theory of simple bending-assumptions-bending equation-bending stresses-Section Modulus-Shear stress distribution across various sections like rectangular, circular and I- sections-Torsion-solid and hollow circular shafts subjected to pure tortion – shear stress – distribution in shafts – power transmitted by circular shafts.

THEORY OF STRUCTURES:
UNIT-IV:
Deflection of cantilevers and simply supported beams-Double Integration and Macaulay's methods-Mohr's theorems for slopes and deflections-Moment area method- Columns and struts-types-slenderness ratio- Euler's and Rankine's formulae for axial loading. Dams and retaining walls-conditions for stability-middle third rule-Rankine's formula for active earth pressure. Thin cylinders – failures, strain and changes in dimensions.

REINFORCED CONCRETE STRUCTURES:
UNIT-V:
Grades of concrete, characteristic strength, Modulus of Elasticity-I.S.456-2000- Philosophy of Limit state design. Limit state of Strength and Serviceability, partial safety factor-design strength of materials and design loads-assumptions.
Analysis and Limit state design of rectangular beams-Singly, Doubly reinforced and T-beams. Shear in RCC beams, lintels and sunshades-Development length.

Slabs-analysis and limit state design of one-way and two-way slabs as per IS.456-2000. Torsion reinforcement. Design of continuous slabs and beams-Deflection check for Slabs and beams. Detailing of reinforcement in singly reinforced and doubly reinforced simply supported beams of rectangular sections and lintels, one way and two way slabs.

UNIT-VI: Columns: Codal provisions of I.S 456-2000-short and long columns-different shapes-design of short columns by limit state method-long columns- concept, effective length for different end conditions. Footings-Isolated column footings-one way shear and two way shear. Stairs-types, loads on stairs.

Working stress method of design: Basic principles, neutral axis, lever arm-Design and analysis of Singly reinforced simply supported rectangular beams. Comparison of Limit state and Working stress methods.

SURVEYING:
UNIT-VII:
Chain surveying- purpose and principle- errors and corrections- different operations in chain surveying- obstacles – methods of calculation of area. Compass Surveying- purpose and principle- bearings- traversing using prismatic compass- local attraction-errors. Levelling-definitions- component parts- errors – classification of levelling - contouring- characteristics and methods. Theodolite- principles and component parts- fundamental lines and relationship among them- adjustments of theodolite- measurement of horizontal and vertical angles - errors-traverse computations- bowditch and transit rule. Tacheometry- principle- stadia tacheometry-tangential tacheometry, Principle and uses of E.D.M, Electronic Theodolite, Total Station, Global positioning System – Importance, G.I.S – Use and applications in Civil Engineering, Curves-simple, curves , elements of simple curve, setting out of simple curves by chain & tape, single &double theodolite method.

HYDRAULICS:
UNIT-VIII:
Fluid properties-specific weight –mass density-specific gravity-surface tension- capillarity-viscosity. Atmospheric pressure, gauge pressure and absolute pressure. Fluid pressure on plane surfaces-Centre of pressure, measurement of fluid pressure using piezometer and manometers. Types of flows-uniform, non uniform, steady, un steady, laminar and turbulent flows. Energies of liquid in motion-continuity equation. Bernoulli's theorem-Pitot tube- Venturimeter. Flow thorough small and large orifices, free orifices, submerged orifices, co- efficients of orifices-Cc, Cv and Cd. Flow through internal, external, convergent and divergent mouthpieces. Types of Notches-rectangular and triangular, flow over notches. Types of Weirs- sharp crested and broad crested-mathematical formulae for discharge-Francis and Bazin.

UNIT-IX :
Flow through pipes-major and minor losses-Chezy's and Darcy's formulae for loss of head due to friction-HGL & TEL- Reynold's number for laminar and turbulent flows. Flow through open channels-rectangular and trapezoidal-chezy's formula for discharge-Kutter's and Manning's equation for Chezy's constants-Most economical sections. Reciprocating and Centrifugal pumps

without problems. Classification of Turbines- Kaplan, Francis and Pelton wheel without problems-use of Draft tube. Hydro-electrical installations-components and uses.

IRRIGATION ENGINEERING:
UNIT X :
Necessity of Irrigations - Perinnial and inundation Irrigation , Flow and Lift Irrigation, Principal crops-kharif and rabi seasons-Duty, delta and base period. Methods of Irrigation-check flooding, basin flooding, contour bunding, furrow, sprinkler and drip Irrigations. Hydrology – Rainfall, types of Rain gauges, types of catchments-rainfall and runoff. Measurement of velocity of flow in streams-Ryve's and Dicken's formulae for computing maximum flood discharge. Classifications of Head works-component parts of diversion head works. Weirs and Barrages. Perculation and uplift pressures. Types of Reservoirs-dead storage, live storage and surcharge storage.

UNIT XI :
Storage Head works-different types of dams-rigid and non rigid dams- gravity dams-low and high dams. Elementary profile of a dam. Failures of gravity dams-drainage galleries. Ogee and siphon spillways. Earth dams— types, failures and precautions. Phreatic lines and drainage arrangements in earthen dams. Distribution works-classifications and alignment of canals-typical cross section of a canal-berm and balanced depth of cutting- canal lining. Cross drainage works –types and functions**.**

TRANPORTATION ENGINEERING:
UNIT XII :
Importance of transportation engineering – I.R.C. – Classification of roads as per I.R.C., recommended I.R.C. values of camber for different roads. Gradients – Ruling gradient, limiting and exceptional gradient Recommended I.R.C values of gradients, Different systems of classification of soils – Textural classification – I S classification of soils, Bearing capacity – importance in foundation design.
Highway surveys and Traffic Engg.- Traffic census and its importance, Road intersections-Traffic signs- Informatory signs- Mandatory signs, Cautionary signs. Highway constructions and Manintenance- Purpose of road drainage- surface and sub-surface drainage, Typical cross section of highway in cutting and embankment. Water bound macadam roads, Cement concrete roads. Permanent way of Railways, Importance of Railways- Gauge, Types of gauges, Structure of permanent way –different types of rails, requirements of a good rail, Sleepers- functions, Types of sleepers, characteristics of a good sleeper –spacing of sleepers-sleeper density.
Bridges, Culverts and Causeways: Brides, classification based on material, position of bridge floor and form / type of superstructure- selection of site for a bridge. Types of Culverts – Types of cause ways.

ENVIRONMENTAL ENGINEERING:
UNIT XIII :
Environment and Ecology- Ecology and Ecosystem, Quality of water, Need for protected water supply, Total quantity of water for a town, per capita demand and factors affecting demand, Forecasting population by arithmetical, geometrical and incremental increase methods, Sources

and conveyance of water: surface sources, underground sources, Types of Intakes. Quality and purification of water-Tests of water, Disinfection of water.

Distribution System: Methods of supply, Storage- underground and overhead-service reservoirs, Types of layout- dead end, grid, radial and ring system their merits and demerits and their suitability. General layout of water supply arrangements in buildings.

System of sewage disposal-types of sewerage systems, Quantity of discharge in sewers, dry weather flow, variability of flow. Different shapes of cross-section for sewers, Strength of sewage, sampling of sewage, characteristics of sewage - Characteristics of Industrial waste water-principles of treatment, Preliminary treatment, secondary treatment. Sewers – sewer appaurtences- shapes, merits and demerits.

Solid waste disposal and sanitation in buildings. methods of disposal, Sanitary fittings. Rural water supply and sanitation- Disinfection of wells, Rural sanitation and sanitary latrines, biogas production technology.

DESIGN OF STEEL STRUCTURES

UNIT XIV : Loads considered in the design of steel structures as per I.S. 875-1987, Standard structural sections , Concept of Limit State Design. Design of Fillet Welded Joints- types of joints, stresses in welds as per I.S.800-2007. Tension members and forms of tension members, different modes of failures, calculation of net effective sectional area of single angle with welded connection only. Different forms of compression members. Behavior of compression members- classification of cross-sections, effective lengths for different end conditions- Codal provisions of single or double lacing and battening for built up columns(no problems).

Analysis and design of steel beams- concept of limit state design of beams, shape factor and plastic properties of beams –problems on shape factor. Laterally supported beam – Laterally unsupported beams, effective strength of compression flanges, Resistance to shear buckling, shear buckling design methods. Design of roof trusses – Loads of roof trusses as per I.S. 875.

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TS ECET-2019

MODEL QUESTIONS FOR CIVIL ENGINEERING

MATHEMATICS

1. If ω is a cube root of unity then $\begin{vmatrix} 1 & \omega & \omega^2 \\ \omega & \omega^2 & 1 \\ \omega^2 & 1 & \omega \end{vmatrix}$ =

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

2. If $\dfrac{2x+5}{(x+1)^4} = \dfrac{A}{(x+1)^3} + \dfrac{B}{(x+1)^4}$ Than (A,B)=

1) (1,2)   2) (1,3)   3) (2,3)   4) (2,4)

3.   Tan-1(1/2) + Tan-1(1/3) =

1) 0   2) $\frac{\pi}{3}$ 3) $\frac{\pi}{6}$ 4) $\frac{\pi}{4}$

4. $\int_0^{\frac{\pi}{2}} \log{(\cot x)}\,dx =$

1) 1   2) 0   3) 2log2   4) None

5.   The differential equation $\frac{dy}{dx} + \frac{ax+hy+g}{hx+by+f} = 0$ is called

1) Homogenous   2) Linear   3) Exact   4) None

PHYSICS

1)   Dimensional formula for stress

1) ML2T-3   2) ML-T-2   3) ML0T-2   4)MLT-1

2)   On which principle optical fiber works

1) Reflection   2) Refraction   3) Total internal reflection   4) Total internal refraction

3)   Relation between centigrade and Kelvin scale of temperature

1) T=t+273   2) T=t-273   3) t=T+273   4) t=T-273

4)   Find the dot product of two vectors
A=2i+3j+4k and B=4i-2j+3k

1) 26   2) 14   3) 22   4)0

5)   A work done by a man in carrying a load of 60 Kg over his head when he travels a distance of 5m in horizontal direction is (g=9.8 m/s2)

1) 2940 J   2) 0J   3) 2940m   4) 300J

CHEMISTRY

1. The Oxidation number of Mn in MnO^-_4 is

   1) +5   2) +6   3) +7   4) +4

2. The molarity of 10% NaOH solution is

   1) 0.025   2) 0.25   3) 2.5   4) 25

3. Galvanic cells are the cells which convert

   1) Electrical energy to chemical energy   2) Chemical energy to electrical energy
   3) Chemical energy to Mechanical energy   4) Potential energy to Kinetic energy

4. The exhausted cation exchange resin can be regenerated by using

   1) NaCl   2) NaOH   3) HCl   4) NH_3

5. Which of the following is not a lew is base

   1) H_2O 2) BF_3 3) NH_3 4) CH_3OH

CIVIL ENGINEERING

1. What is the bending moment formula for simply supported beam with central point load.

   1) Wl / 2   2) $Wl^2 /8$ 3) $Wl^2 /2$ 4) $WL^2 / 2.$

2. If W.C.B is 120^0, then reduced bearing

   1) S 30 ^{0} E   2) S 60^0 E   3) N 30^0 W   4) S 30^0 W

3. What is the relation between C_d, C_v, C_c with orifices.

   1) $C_d = C_c / C_v$ 2) $C_c = C_v \times C_d$ 3) $C_d = C_v \times C_c$ 4) $C_v = C_d \times C_c$

4. What is the minimum number of bars required for a circular column?

   1) 5   2) 4   3) 6   4) 8

5. What is the quantity of water required per capita per day?

   1) 238 liters   2) 480 liters   3) 135 liters   4) 90 liters.