

ECET-2020 SYLLABUS: MATHEMATICS (50 Marks)
(Common for Diploma)

Unit-I: 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, 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, 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, nth order linear differential equation with constant coefficients both homogeneous and non-homogeneous and finding the Particular Integrals for the functions e^{ax} , $\sin ax$, $\cos ax$, x^m (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 s, ILT by using partial fractions and convolution theorem. Applications of LT 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 $(-\pi, \pi)$.

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MODEL QUESTIONS FOR MATHEMATICS

1. Find the value of $\begin{vmatrix} 1 & 1 & 1 \\ 1 & 1+x & 1 \\ 1 & 1 & 1+y \end{vmatrix}$

- 1) $x+y$ 2) xy 3) 0 4) 1

2. Find a_0 if $f(x)=x$ in $(-\pi,\pi)$ is expanded as Fourier series

- 1) 1 2) 0 3) -1 4) none

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

- 1) $(1,-1)$ 2) $(1,1)$ 3) $(-1,0)$ 4) $(0,1)$

4. P.I. of $(D^2 + 9)y = \cos 3x$

- 1) $\frac{x \sin 3x}{3}$ 2) $\frac{x \sin 3x}{6}$ 3) $\frac{x \cos 3x}{3}$ 4) $\frac{x \cos 3x}{6}$

5. $L^{-1} \left\{ \frac{1}{s(s-1)} \right\} =$

- 1) $e^t + 1$ 2) $e^t - 1$ 3) $e^{2t} + 1$ 4) $e^{2t} - 1$

ECET-2020 SYLLABUS: PHYSICS (25Marks)
(Common for Diploma)

Unit-I: Units and dimensions: Physical quantity-fundamental and derived physical quantities-units-fundamental and derived units-SI units-multiples and sub-multiples in SI units-advantages of SI units-dimensions and dimensional formulae for physical quantities -dimensionless quantities-principle of homogeneity in dimensions- applications and limitations of dimensional analysis.

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, types and applications-concept of super conductivity , examples for super conducting materials – and 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-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-addition and subtraction of vectors-triangle law-parallellogram law- expression for magnitude direction in case of 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-V: Kinematics: Equations of motion-acceleration due to gravity-equations of motion under gravity- 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 projections - problems.

Unit-VI: Friction: Friction- causes and types of friction-normal reaction-laws of friction-coefficients of friction-angle 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 to come to rest over a rough horizontal surface - problems.

Unit-VII: Work, Power and Energy: Work, power and energy-definitions and units-potential and kinetic energies-examples and expressions-work-energy theorem – relation between kinetic energy and momentum - law of conservation of energy in case of freely falling body -problems.

Unit-VIII: Simple harmonic motion: Definition-conditions of 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 - musical sound and noise-noise pollution-Effects and methods to control Noise Pollution-Beats and echo’s and their applications -Doppler effect– Explanation, and Applications –Reverberation time -Sabine’s formula-characteristics 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 – explanation on the basis of molecular theory – angle of contact , capillarity and examples – formula for surface tension based on capillarity –viscosity and examples- Newton’s formula for viscosity- Poiseulle’s equation for coefficient for 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- state and explain kirchoff’s laws- expression for balancing condition of Wheat stone’s bridge- concept 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 uniform magnetic field – problems.

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MODEL QUESTIONS FOR PHYSICS

- 1) Dimensional formula for pressure
 - 1) ML^2T^{-3}
 - 2) $ML^{-1}T^{-2}$
 - 3) ML^0T^{-2}
 - 4) MLT^{-1}
- 2) On which principle optical fiber works
 - 1) Reflection
 - 2) Refraction
 - 3) Total internal reflection
 - 4) **Total internal refraction**
- 3) Volume of gas is doubled at constant temperature. If initial pressure of gas is 40 cm of Hg, find final pressure of gas.
 - 1) 80 cm of Hg
 - 2) 40 cm of Hg
 - 3) 60 cm of Hg
 - 4) **20 cm of Hg**
- 4) If two vectors $A=3i+3j-xk$ and $B=2i+2j+k$ are perpendicular find the ‘x’ value
 - 1) 30
 - 2) **12**
 - 3) 10
 - 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 ($g=9.8 \text{ m/s}^2$)
 - 1) 2940 J
 - 2) **0J**
 - 3) 2940m
 - 4) 300J

ECET-2020 SYLLABUS:**CHEMISTRY
(Common for Diploma)****(25 Marks)**

Unit I: Fundamentals of Chemistry: Atomic structure: Introduction-Fundamental particles of an atom – 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** orbitals.

Chemical Bonding: Introduction – Types of chemical bonds – Ionic bond - NaCl and MgO – Characteristics of ionic compounds - Covalent bond - H₂, O₂, N₂ - Characteristics of covalent compounds - Coordinate covalent bond –Definitions and examples, [NH₄⁺], [NH₃BF₃].

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) - 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 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 – Faraday's laws of electrolysis- Numerical problems – Galvanic cell – Electrode potential - Standard electrode potential – Electro chemical series – emf and numerical problems on emf of a cell.

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 (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 – Degree of hardness, units and Numerical problems– 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, 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.

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MODEL QUESTIONS FOR CHEMISTRY

- Which one of the following is non directional orbital.
1) **s** 2) p 3) d 4) f
- Units of molarity.
1) gram equivalents/litre **2) moles/litre** 3) moles/Kg 4) Grams/litre
- Standard electrode potential of Hydrogen electrode is
1) 1.0 V 2) 2.0 V **3) 0.0V** 4) 1.5V
- Which among the following is not a fuel?
1) Natural Gas 2) Water Gas **3) N₂ Gas** 4) Bio Gas
- pH value of 0.001M HCl solution is
1) 2 2) 1 **3) 3** 4) 4

ECET-2020 SYLLABUS:
ELECTRONICS AND INSTRUMENTATION ENGINEERING
(100 Marks)

UNIT-I: Electrical Engineering: Basic principles of electricity: Ohm's law, Kirchhoff's laws, Ideal voltage source, Ideal current source and its conversions, Units of work, Power and energy, Heating effects of electric current, Biot-Savart's law, Fleming's rules, Faraday's laws, Lenz's law, Self and Mutual inductance, Lifting power of magnet.

Electrostatics: Laws of electrostatics, Coulomb's laws, Permittivity, Dielectric strength, Dielectric constant, Energy stored in a capacitor.

Batteries: Primary cell, Secondary cell, Different types, Charging and discharging, Maintenance free batteries.

Single phase transformers: Construction features, Principles, Auto transformer.

Network theorems & Machines: Motors and generators, A.C. machines, Node voltage and Mesh current analysis, Crammer's rule, Dual network theorem, Reciprocating theorem for impedance matching, Superposition theorem, Thevenin's and Norton's theorems, DC Maximum power transfer theorem, Resonance in series and parallel circuits, Q-factor,

AC Machines: Alternator, Induction motor, Synchronous motor.

UNIT-II: Industrial electronics: Photo transistor, Photo conductive device, Photo multiplier, Solar cell, Opto coupler, Dot matrix display, Seven segment display, Bar graph display, Induction heating, Di-electric heating and Resistance welding, Generation and applications of Ultrasonics.

Control engineering: Basics of open loop and closed loop control systems. Linear & Non-linear systems, Time-variant & Time-invariant systems, Continuous data, Sampled data & Digital control systems, Transfer functions, Block diagram reduction, Properties and limitations of Transfer functions, Mason's gain formula, Signal flow graphs, Time response of first order and Second order systems, Concept of stability(Routh-Hurwitz criterion).

UNIT-III: Electronics: Resistors, Capacitors and Inductors and their specifications, Chokes, Self inductance, Mutual inductance, AF, RF Chokes, Applications of transformers, Basics of Switches, Fuses, Relays, Microphones and Loud speakers, PCBs, Conductors, Semi conductors and Insulators, Formation of P-N junction, Forward and Reverse biasing voltages, Zener diode, Varactor diode, Tunnel diode and their applications, Diode as rectifier, Half wave rectifier, Full wave rectifier, Need for filter, Classification of filters, Working of clipper and clamper using diodes, Formation, Working and Configurations of PNP and NPN transistors, Construction and working of FET, MOSFET, UJT, SCR, Diac and Triac.

Amplifiers: RC coupled amplifier, Transformer coupled amplifier, Darlington and Cascaded amplifiers, Class-A and Class-B push-pull amplifier, Complementary type power amplifier, Oscillator principle, RC phase shift oscillator and Wien bridge oscillator, Hartley oscillator, Colpitt's oscillator, Bootstrap sweep circuit, Current sweep circuit using transistor, Bistable, Astable and Monostable multi vibrators using transistors, Transistor as an amplifier in different configurations, AC and DC load line, Biasing methods, Operating points, Stabilization

techniques, Direct coupled amplifier, Differential amplifier, Positive and Negative feedback amplifiers.

Types of ICs: Based on integration (SSI, MSI, LSI and VLSI), Heat sinks.

UNIT-IV: Digital Electronics: Number systems, Different postulates, De-Morgan's theorems, Simplification of Boolean expressions, K-map (up to 3 variables reductions), Logic gates, Half adder, Full adder, Serial adder, Parallel adder, 2's complement subtractor. RS, T, D and Master-slave JK type flip-flops and Encoders, Decoders, 4x1 Multiplexer, 1x4 De-multiplexer, Counters, Modulus of counter, Synchronous, Asynchronous counters and their working, Decade counter, Ripple counter, Binary counter, Registers, Shift registers, Universal shift register, Basic memories (RAM and ROM), Analog to Digital Converters (Counter type, Successive approximation type) and Digital to Analog Converters (R-2R ladder type, Weighted resistor type).

UNIT-V: Electronic Measuring instruments:

Analog Instruments: PMMC movement, Ammeter, Voltmeter and Ohm meter using PMMC movement, Extension of range of Ammeter and Voltmeter, Rectifier type Voltmeter and Ammeter, Principle of Moving Iron instruments, FET input voltmeter, Differential voltmeter, Wheatstone bridge, Maxwell bridge, Schering bridge, Megger.

Digital instruments: Digital multi meter, Digital LCR meter, Ramp type digital volt meter, Successive approximation type digital volt meter, Digital frequency meter.

Cathode Ray Oscilloscope: CRT, Time base generator, Deflection sensitivity, Triggered sweep circuits, CRO applications, Storage oscilloscopes, Digital oscilloscopes, Dual trace oscilloscope.

Signal generators & Other instruments: AF Oscillator, RF Signal generator, Function generator, Q-Meter, Distortion Factor Meter, Digital IC tester, Logic analyzer, XY recorders, Plotters, Signature analyzer.

UNIT-VI: Process Instrumentation: Fundamentals of Instrumentation, Basic transducer theory for the measurement of displacement (LVDT, Potentiometer, inductive, capacitive, RVDT), Angular velocity (Moving iron, Moving coil type), Temperature (Liquid filled in thermometers, Thermometers, RTD, Thermo couple, Thermistor, Pyrometers, Bi-metallic strips), Pressure (Elastic elements, Strain gauge, Piezoelectric transducer, Force balance transducer, Pressure multiplier, Dead weight tester), Flow (Bernoulli's theorem, Head type flow meters, Rota meter, Electromagnetic flow meter, Anemometers, Ultrasonic flow meter, mechanical flow meters, thermal flow meters), Pneumatic transmitters, PH, Conductivity, Weight, Humidity, Different methods of Level measurement, Viscosity and Density, Flame sensors, Leak detectors, Noise sensors, Torque transducers.

Measurement of various Parameters in: Power plants, Petro chemical, Iron and Steel, Paper and Pulp plants.

UNIT-VII: Process Control: Different process variables, Process characteristics, ON-OFF Control, Proportional, Integral and Derivative Controllers, PID Controller, Tuning of PID Controller, Actuators (Pneumatic, Electro-Pneumatic, Hydraulic) P to I and I to P converters, Solenoid valve, Stepper motor actuator, Basics of control valves, Cascade Controller, Ratio Controller, Feed forward control systems, Adaptive Control, Line Diagrams, Letter Codes, Standards.

UNIT-VIII: Communications and Linear IC Applications:

Need for modulation and Types of Modulation, SSB, DSB and VSB transmission, AM and FM Transmitters, AM and FM Detectors, Basics of Pulse Modulation and Applications

Characteristics of Operational Amplifier : Applications of Operational Amplifier like Summer, Integrator, Differentiator, Inverter, Voltage follower, Voltage to Current Converter, Current to Voltage Converter, Op-amp based LPF, HPF, BPF, BSF, Comparator, Isolation amplifier, Square wave Generator, Triangular wave generator, Mono Stable Multi-vibrator, Astable multi-vibrator, Wien-bridge Oscillator, Instrumentation Amplifier, Schmitt Trigger, ADC and DAC, Applications of 555 timer IC (Mono stable multi vibrator, Astable multi vibrator, Square wave generator), Regulated power supply using 78XX regulator.

UNIT-IX: Analytical instrumentation: Electromagnetic Spectrum, Beer Lambert's Law, Mono chromator, Light Sources and Detectors, Spectrophotometer (UV, Visible, IR), Flame Photometer, Spectrofluorometer, Interferometer, Refractometer, Polari meter, Different types of Gas Analyzers, Mass Spectrometer, Liquid Chromatography and Gas Chromatography, Auto analyzer

Nuclear Instrumentation: Alpha, Beta, Gamma particle radiations, Neutron radiation, Different detection methods of radiation.

UNIT-X: Microcontroller & PLCs: Architecture and Instruction set of 8051 Microcontroller, Programming concepts of 8051, interfacing peripherals (8255, 8251 and 8257) and Applications of 8051. Basics of PLC architecture, Instruction set of PLC and PLC ladder diagrams of various applications, Basic concepts of SCADA, DDC, DCS, DAS, ROBOT, CNC, Data loggers.

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MODEL QUESTIONS FOR ELECTRONICS AND INSTRUMENTATION ENGINEERING

1. LVDT is used for measurement of
1) Pressure 2) Temperature 3) **Displacement** 4) Flow
2. Half adder is used to add
1) **2 bits** 2) 3 bits 3) 4 bits 4) 1 bit
3. Which of the following is used for the measurement of very low light intensities?
1) Photo transistor 2) Photo Diode
3) Photo conductive device 4) **Photo multiplier**
4. SI unit of current is ____
1) Volt 2) **Ampere** 3) Ohm 4) Watt.
5. Ideal current source has ____ input impedance.
1) Low 2) High 3) Medium 4) **Infinity.**
