DETAILED SYLLABUS FOR THE POST OF INDUSTRIES EXTENTION OFFICER IN INDUSTRIES AND COMMERCE DEPARTMENT
CAT NO: 030/2024

TOTAL : 100 MARKS

PART I - ENGINEERING MATHEMATICS - 40 MARKS

Module I (8 marks)

Linear Algebra: Matrix algebra, systems of linear equations, row echelon form and rank of a matrix, fundamental theorem for linear systems, eigenvalues and eigenvectors.

Module II (12 marks)

Calculus: Functions of single variable, limit, continuity and differentiability, mean value theorems, increasing and decreasing functions, maxima and minima, evaluation of definite and improper integrals, evaluation of area using definite integral, limit and continuity of functions of two variables, partial derivatives, rate of change, local linear approximations, chain rule, total derivative, maxima and minima, double and triple integrals, evaluation of area using double integrals

Module III (4 marks)

Ordinary Differential Equation (ODE): First order (linear and non-linear) equations, second order linear equations with constant coefficients(homogeneous and non-homogeneous), Euler-Cauchy equations, initial and boundary value problems.

Module IV (12 marks)

Probability and Statistics: Mean, median, mode and standard deviation, correlation, Karl Pearson correlation coefficient, linear regression, probability, conditional probability, independent events, Baye's theorem, discrete and continuous random variables, expectation, mean and variance, binomial distribution, Poisson distribution, exponential distribution, uniform distribution and normal distribution, discrete and continuous bivariate distributions, marginal distributions, independent random variables, expectation-multiple random variables, i.i.d random variables and Central limit theorem

Module V (4 marks)

Numerical Methods: Numerical solutions of linear and non-linear algebraic equations - Newton-Raphson method and Regula-Falsi method, Interpolation-finite differences, Newton's forward and backward difference method, Lagrange's method,

Numerical integration-Trapezoidal rule and Simpson's 1/3rd rule

PART II - ENGINEERING PHYSICS - 30 MARKS

Module I (10 Marks)
Applied Optics

1. Lasers and Applications.
2. Fibre optics ±Step index Fibre, Graded index Fibre, Acceptance angle, Numerical Aperture, Fibre sensors, Fibre optic Communication.
3. Photonics - LED and Solar cell

Module II (10 Marks)
Solid state Physics

1. Semiconductors - Intrinsic and Extrinsic semiconductors, p-n junction, Energy band, Biasing of p-n junctions, I-V Characteristic of p-n junction.
2. Superconductors -Transition temperature, Critical field, Type I and Type II superconductors, Meissner effect, BCS theory, Applications of superconductors.

Module III (10 Marks)
Acoustics

1. Classification of Acoustic waves based on frequency.
2. Acoustic Absorption, Reverberation, Reverberation time, Sabine© formula, and Acoustics of buildings.
3. Ultrasonics - Applications - Sonar, NDT, Medical applications.

PART III - ENGINEERING CHEMISTRY - 30 MARKS

Module 1: Chemistry of Materials (10 marks)

Nanomaterials: classification based on dimensions and materials, Synthesis by sol gel method and chemical reduction, carbon nanotubes, fullerenes, graphene-structure and applications.
Glass: Composition and properties of Soda lime glass, safety glass, borosilicate glass, coloured glass, photosensitive glass.
Cements: Classification of cement, ingredients and their role, Manufacture of cement and the setting process.
Polymers: Industrial manufacture of the following polymers: ABS & Kevlar.

Speciality Polymers - Electro-luminescent, Biopolymers-examples & applications. Conducting polymers ± doping in conducting polymers, Polyaniline and polyacetylene-synthesis, structure and applications.

Module 2: Instrumental Methods of Analysis (10 marks)

Thermal Analysis: Principle and applications of Thermogravimetric Analysis (TGA) & Differential Thermal Analysis (DTA).

Chromatography: Principle and applications of Column chromatography, Thin Layer Chromatography, Gas Chromatography and High-Performance Liquid Chromatography.

Scanning Electron Microscopy (SEM)

Spectroscopy: Principle and Applications of UV-VIS and Infrared spectroscopy -Electromagnetic radiations, electronic transitions-1,3-butadiene, 1,3,5-hexatriene. Beer Lambert's Law. Types of molecular vibrations and modes of vibrations in CO_2 and H_2O. Identification of inter and intra molecular Hydrogen bonding using IR spectra-examples.

Module 3: Environment (10 marks)

Air Pollution: Pollutants and their sources, Climate Change-Green House gases and Global warming, Ozone depletion.

Water pollution: Effluent treatment plants (primary, secondary and tertiary treatment). Industrial effluent from the following industries and industrial waste management: electroplating, textile, and petrochemicals. Water treatment and purification (reverse osmosis, ion exchange).

Energy and Environment: Sources of energy: Coal, petrol and Natural gas, Nuclear Fusion / Fission, Solar energy, Hydrogen, geothermal, Tidal and Hydel etc. Nuclear Pollution: Disposal of nuclear waste, nuclear disaster and its management. Battery: Working of Li-ion Battery, Hydrogen oxygen Fuel Cell.

NOTE: - It may be noted that apart from the topics detailed above, questions from other topics prescribed for the educational qualification of the post may also appear in the question paper. There is no undertaking that all the topics above may be covered in the question paper