ENTRI

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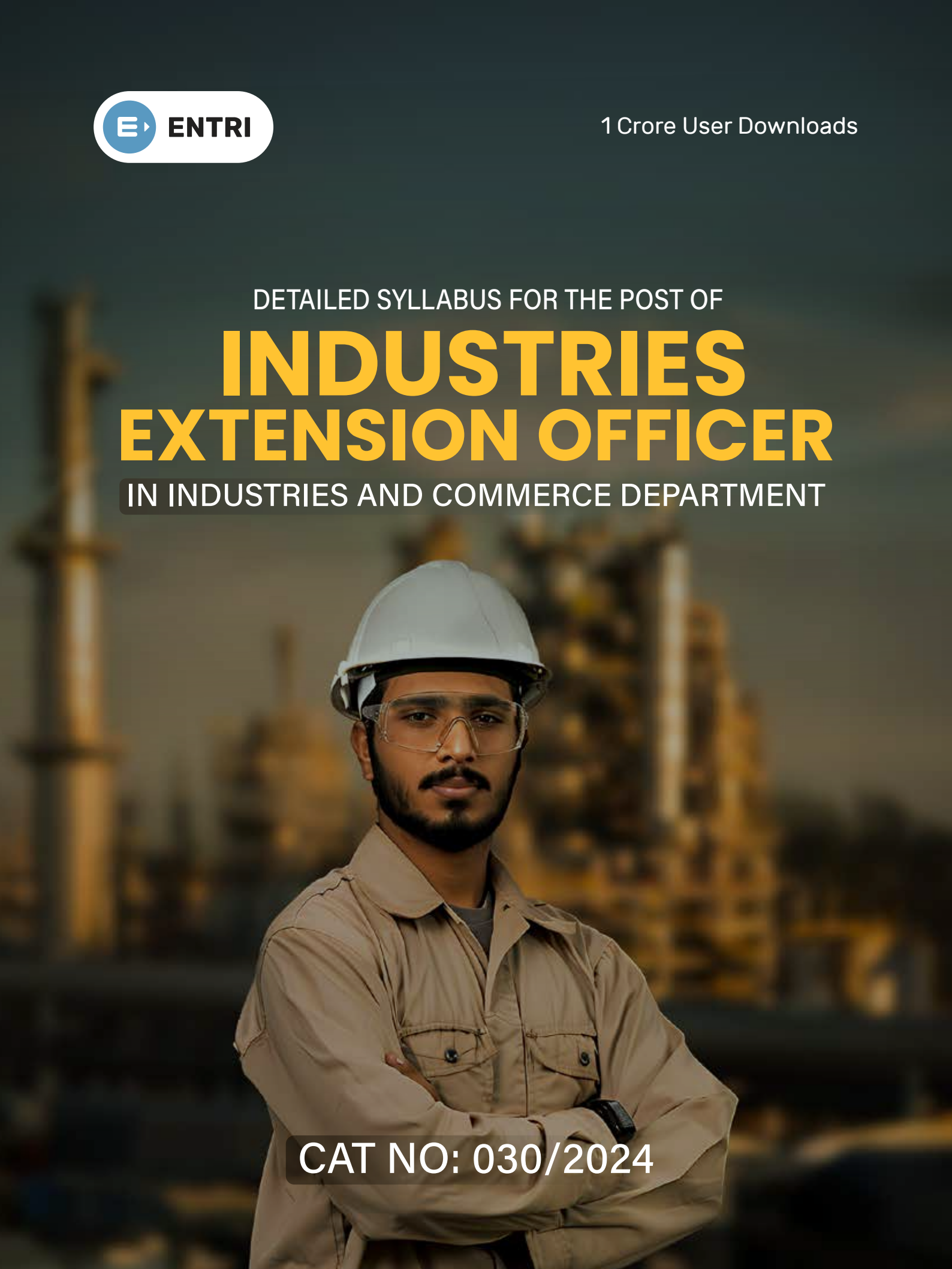
DETAILED SYLLABUS FOR THE POST OF

INDUSTRIES EXTENSION 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 nonlinear) equations, second order linear equations with constant coefficients(homogeneous and nonhomogeneous), EulerCauchy 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, expectationmultiple random variables, i.i.d random variables and Central limit theorem.

- **Module V** (4 marks)

  Numerical Methods: Numerical solutions of linear and nonlinear algebraic equations NewtonRaphson method and RegulaFalsi method, Interpolationfinite

differences, Newton's forward and backward difference method, Lagrange's method, Numerical integrationTrapezoidal rule and Simpson's 1/3rd rule.

PART II

ENGINEERING PHYSICS

(30 MARKS)

- **Module I** (10 marks)

  Applied Optics

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

- **Module II** (10 marks)

  Solid state Physics

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

- **Module III** (10 marks)

  Acoustics

  - Classification of Acoustic waves based on frequency.
  - Acoustic Absorption, Reverberation, Reverberation time, Sabine's formula, and Acoustics of buildings.
  - 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 Electroluminescent, Biopolymersexamples & applications. Conducting polymers – doping in conducting polymers, Polyaniline and polyacetylenesynthesis, 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 UVVIS and Infrared spectroscopy Electromagnetic radiations, electronic transitions1,3-butadiene, 1,3,5-hexatriene.

  Beer Lambert's Law. Types of molecular vibrations and modes of vibrations in CO2 and H2O. Identification of inter and intra molecular Hydrogen bonding using IR Spectra-examples.

Module 3: Environment

(10 marks)

Air Pollution: Pollutants and their sources, Climate ChangeGreen House gasses 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 Liion 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

Thank You!