SYLLABUS FOR TEST I

Core Mathematics

Calculus: Functions and graphs; limit and continuity; Applications of Derivatives, Applications of Definite Integrals, Convergence of Infinite sequences and series, Maclaurin and Taylor series. Functions of several variables, Limits and Continuity in Higher Dimensions, Partial derivatives, The chain rule, Directional Derivatives and Gradient vectors, Tangent planes and Normal lines, Extreme values and saddle points, Double Integrals, Triple Integrals, Line and surface Integrals, Conservative fields, Curl and divergence, Theorems of Green, Gauss and Stokes.
Linear Algebra: Matrix Algebra, Row reduction method, Rank and inverse of a matrix, System of linear equations, Vector space; basis and dimension; linear transformation; range and kernel of a linear transformation; Eigenvalues and eigenvectors. **Complex Variables:** Analytic functions, Cauchy's theorems; Cauchy's integral formula, Taylor Series and Laurent Series; Calculus of residues and applications.
Probability and Statistics: Sample space and events, Conditional probability and independence; Random variables and probability distributions; Independent random variables; Mathematical expectation; mean and variance; Geometric, Binomial, Poisson's, Exponential, Gamma and Normal distributions; sum of independent random variables; law of large numbers; Central limit theorem, Marginal and conditional distributions; Sampling distribution, Point estimation, Statistical intervals based on a Single sample, Tests of hypotheses based on a single sample, test for mean using normal and Students t-distribution; Correlation and linear regression.
Differential Equations: First order differential equations (linear and nonlinear), higher order linear differential equations with constant coefficient, method of variation of parameters, Cauchy-Euler's equation, Fourier Series, Laplace Transform, Initial and boundary value problems, Partial differential equations, Method of separation of variables.
Numerical Methods: Solution of nonlinear algebraic equations: Newton's method, Secant method, Fixed point iteration method, method of false position, Solution of system of linear equations: Direct methods & Iterative methods, LU decomposition, Integration by Trapezoidal and Simpson's rule.

English Language and Logical Reasoning

(a) English Language

This test is designed to assess the test takers' general proficiency in the use of English language as a means of self-expression in real life situations and specifically to test the test takers' knowledge of basic grammar, their vocabulary, their ability to read fast and comprehend, and also their ability to apply the elements of effective writing.

1. Grammar	
1.1	Agreement, Time and Tense, Parallel construction, Relative pronouns
1.2	Determiners, Prepositions, Modals, Adjectives
1.3	Voice, Transformation
1.4	Question tags, Phrasal verbs
2. Vocabulary	
2.1	Synonyms, Antonyms, Odd Word, One Word, Jumbled letters,
Homophones, Spelling	

2.2	Contextual meaning.
2.3	Analogy
3. Reading Comprehension	
3.1	Content/ideas
3.2	Vocabulary
3.3	Referents
3.4	Idioms/Phrases
3.5	Reconstruction (rewording)
4. Composition	
4.1	Rearrangement
4.2	Paragraph Unity
4.3	Linkers/Connectives
(b) Logical Reasoning	
The test is given to the candidates to judge their power of reasoning spread in verbal and nonverbal areas. The candidates should be able to think logically so that they perceive the data accurately, understand the relationships correctly, figure out the missing numbers or words, and to apply rules to new and different contexts. These indicators are measured through performance on such tasks as detecting missing links, following directions, classifying words, establishing sequences, and completing analogies.	

5. Verbal Reasoning	
5.1	Analogy
Analogy means correspondence. In the questions based on analogy, a particular relationship is given and another similar relationship has to be identified from the alternatives provided.	
5.2	Classification
Classification means to assort the items of a given group on the basis of certain common quality they possess and then spot the odd option out.	
5.3	Series Completion
Here series of numbers or letters are given and one is asked to either complete the series or find out the wrong part in the series.	
5.4	Logical Deduction – Reading Passage
Here a brief passage is given and based on the passage the candidate is required to identify the correct or incorrect logical conclusions.	
5.5	Chart Logic
Here a chart or a table is given that is partially filled in and asks to complete it in accordance with the information given either in the chart / table or in the question.	
6. Nonverbal Reasoning	
6.1	Pattern Perception
Here a certain pattern is given and generally a quarter is left blank. The candidate is required to identify the correct quarter from the given four alternatives.	

6.2 Figure Formation and Analysis

The candidate is required to analyze and form a figure from various given parts.
6.3 Paper Cutting
It involves the analysis of a pattern that is formed when a folded piece of paper is cut into a definite design.
6.4 Figure Matrix
In this more than one set of figures is given in the form of a matrix, all of them following the same rule. The candidate is required to follow the rule and identify the missing figure.
6.5 Rule Detection

Here a particular rule is given and it is required to select from the given sets of figures, a set of figures, which obeys the rule and forms the correct series.

SYLLABUS FOR TEST II

Chemical Engineering

Chemical Process Calculations

Chemical Process Calculations: Units and Dimensions, Chemical Equation and Stoichiometry, Thermodynamic properties of Gases, Vapors, Liquids and Solids, Steady and unsteady state mass and energy balances, Phase Equilibria (multiphase, multicomponent), reacting and non-reacting systems, recycle, bypass and purge calculations, Combustion Calculations.

Reference books:
(1) Himmelblau, D. M. Riggs, J. B. “Basic principles & calculations in chemical Engg”, PHI, 8th ed., 2015.
(2) Felder, R. M. & R. W. Rousseau, “Elementary Principles of Chemical Processes”, John Wiley & Sons, Inc., 4th ed., 2011.

Fluid Mechanics

Fundamental Concepts and Fluid Statics, basic concept of Newtonian and non-Newtonian fluids, head losses, velocity and pressure drop calculation. Integral and Differential Analyses for Fluid Motion, Internal and External Fluid Flow and Flow through Packed & fluidized beds, Dimensional Analysis, flow meters, pumps and compressors.

Reference books:

(1) R. W. Fox, A. T. McDonalds, and P. J. Pritchard, "Introduction to Fluid Mechanics", John Wiley and Sons Inc., 8th ed., 2013.

(2) W. L. McCabe, J. C. Smith, and P. Harriott, "Unit Operations of Chemical Engineering”, McGraw Hill Inc., 7th ed., 2014.

Chemical Engineering Thermodynamics

First and Second laws of thermodynamics. Applications of first law to close and open systems. Second law and Entropy. Thermodynamic properties of pure substances: Equation of State and residual properties, properties of mixtures: partial molar properties, fugacity, excess properties and activity coefficients; phase equilibria: predicting VLE of systems; chemical reaction equilibrium.

Reference books:

(1) J. M. Smith, H.C. Ness, and M. Abbott, B Bhatt (Adapted), “Introduction to Chemical Engineering Thermodynamics”, McGraw Hill Education, 7th ed., 2009.

(2) Y. V. C. Rao, “Chemical Engineering Thermodynamics”, Universities Press, 1997.