

## **B.Tech (Part Time) Qualifying Examination Syllabus**

### **I. Civil Engineering**

Mathematics- Basics of Trigonometry, Matrices, Differentiation and integration. Construction/building materials, masonry and building components, Mechanics and Theory of structures-Forces, moments and torsion, moment of inertia, stresses and strains, bending stress, analysis of beams, columns and trusses. Surveying- basics, compass survey, leveling, tacheometry. RC Design of beams and columns, design of steel members and connections. Irrigation Engineering – Hydrology, head work and weirs, storage works and distribution works. Geotechnical Engineering- index properties of soil, consistency, compaction, permeability, and bearing capacity, different type foundations. Environmental Engineering- Quality of water, purification of water, sanitary engineering, sewage treatment and disposal, solid waste disposal, air pollution. Transportation Engineering- Construction of roads-different types, traffic volume, construction of railways.

### **II. Mechanical Engineering**

Basic mathematics: Basic algebra-permutation, combination, Binomial theorem, Differential and Integral calculus-basic concepts, Statistics- measures of central tendency and dispersion

Engineering graphics: Scales-need and importance, Theory of projections, sectional views, isometric views

Strength of materials: Simple stress and strain, Mechanical properties and testing, shear force and bending moment diagrams, Principal planes and principal stresses, Stresses in beams, Deflection of beams, Torsion of a shaft, Thin cylinders and spheres

Material science and Production Engineering: Introduction to material science, structure of metals and their deformation, fundamentals of heat treatment, Basic concepts of welding, metal casting, metal cutting and machine tools, Metal forming, Unconventional machining processes, Metrology- Basic concepts

Fluid Mechanics and hydraulic Machines: Introduction, manometry, Hydraulic force, Buoyancy and Floatation, Fluid kinematics, Fluid dynamics and flow measurements, Flow through pipes, Impact of jets, Hydraulic turbine, Hydraulic pump

Thermal Engineering: Laws of thermodynamics, Ideal gases and gas processes, Properties of pure substance, properties of gases and gas mixtures, thermo dynamic relations Equilibrium and stability, Air standard cycles, Working of IC engines, Heat exchanger, cooling and lubrication, air compressors, Nozzles and steam turbines, basic concepts of refrigeration and air conditioning

Automobile Engineering: Introduction to Power systems, Transmission system, steering system, braking system, suspension system, automobile pollution and control, safety devices

Industrial Engineering and management: Introduction, Break even analysis, inventory control, forecasting, work study, material Requirement Planning, Principles of management, Quality planning and its development

### III. Chemical Engineering

#### Technical Mathematics

**Matrices:** Matrix notation, order of a matrix, and type of matrices: - Square matrix, unit matrix, Zero matrix, and Singular matrix.

**Determinants:** Determinants of second and third order matrices, minors and cofactors, Cramer's rule, solution of simultaneous linear equations in three unknowns by Cramer's rule.

**Binomial series:** Idea of  $nCr$ , Value of  $nCr$ .

**Trigonometric functions:** Definition of trigonometric functions of an angle in any quadrant, Signs of trigonometric functions of related angles.

**Properties of trigonometric functions:** Addition formulae, Multiple and Sub-multiple formulae, Sum and Product formulae, simple problems.

**Co-ordinate geometry:** Straight line-Slope, Equations of a straight line.

#### Engineering Graphics

**Projection of points, lines and planes:** Projection of points in different quadrants, Projection of straight lines (in first quadrant only)- parallel to one or both planes, parallel to one plane and perpendicular to other. Projection of planes (in first quadrant only)-perpendicular to both planes, parallel to one plane and perpendicular to other plane.

#### Fluid Mechanics

Properties of fluids – compressible and incompressible fluids – viscosity – definition, units.

Fluid pressure – units and its measurements – concept of fluid heads and its calculations, gauge pressure.

Fluid dynamics: - Types of fluid flow in pipes, viscous and turbulent flow, Reynold's experiment, critical velocity, problems, types of fluid heads.

Bernoulli's Theorem: - Application to simple problems, head developed by a pump – H.P of a pump and efficiency.

Friction in straight pipe – Hagen Poiseuille equation for viscous flow (no derivation) and problems.

Friction losses in pipe fittings – equivalent length, expansion and contraction losses.

Flow measurement: - Flow metering- classification of flow measuring equipments.

Fundamentals of flow control mechanism and valve classification.

Pump classification – Positive displacement and Centrifugal.

Centrifugal pumps: - Basic working principles, types of impellers for different fluids.

#### Chemical Process Principles

Units and dimensions, conversion of units: Chemical formulae, mass relation, chemical reactions, gm atom, gm mole, kg atom, kg mole, Relation between mass and volume of gaseous substances.

Average molecular mass, density, specific gravity of ideal gases and mixtures.

Material Balances – not involving Chemical Reactions.

Explain the terms systems & surrounding, pressure, volume temperature, work, energy, internal energy, total heat, concept of perfect gas, thermodynamic explanation of the first and second law of thermodynamics.

## **Heat Transfer & Evaporation**

Heat transfer by conduction in solids – steady state and unsteady state flow – definition – units of heat flow. Fourier's law of conduction.

Forced convection: Heat transfer by forced convection inside tubes for laminar and turbulent flow.

Mechanism of natural convection – heat transfer in boiling liquids - regimes of boiling.

Elementary idea of black body – grey body - emissivity – emissive power – radiation laws.

Heat Transfer Equipment: Parallel flow – counter current flow – cross flow heat exchangers – Fouling effect calculation – LMTD.

Evaporation – Examples of industries where evaporation is used as a unit operation. Types of evaporators – basis of classification.

## **Mass Transfer**

Diffusion: Molecular diffusion – molar flux – Fick's rate equation.

Absorption: Mechanism of Absorption – conditions of equilibrium between gas and liquid – Henry's law – factors controlling rate of absorption.

Humidity: General mechanism of diffusional processes – Definitions and mathematical expressions for

molal humidity – Absolute humidity – Relative humidity – percentage humidity.

Drying: Purpose and industrial applications – drying equipment – classification.

Distillation: Distillation as an inter phase mass transfer – industrial application – definition of terms – less volatile, more volatile, low boiling, high boiling – vapour – liquid equilibrium diagrams and their importance.

## **Chemical Technology**

Sulphuric acid – Raw materials – Sulphur – pyrites – production of sulphur dioxide. DCDA process with flow – sheet.

Manufacture of Hydrochloric acid by synthesis process with flow sheet.

Caustic Soda – raw materials – purification – membrane cells.

Ammonia Synthesis – theoretical principles – equilibrium reaction, catalyst, space velocity. Different source of synthesis gas low and high pressure process for the manufacture of Ammonia.

Hydrogenation – Purpose of hydrogenation, chemistry and process details.

Soaps and detergents – study of different types of toilet soaps and washing soaps. Raw materials, manufacturing process for toilet & laundry soaps.

Manufacture of pulp and paper – Raw materials – Chemistry of wood pulping process.

Sugar: Manufacture of raw cane sugar.

## **Particle Technology**

Filtration as a solid, liquid separation and its application in industry. Classification of filters - atmospheric, pressure and vacuum filters – field of application and constructional details.

Continuous filter – rotary drum – working cycle – methods of cake discharge.

Size Reduction: Types of crushing equipment, coarse crushers –Intermediate crushers –fine grinders –open circuit grinding – closed circuit grinding. Laws of crushing – Kick's law – Rittingers law – Bonds law.

Types of screening equipment – grizzlies – trammels, shaking screens, vibrating screens. Air separation methods: cyclone separator – air separator – bag filter.

Sedimentation separation in liquid medium – batch sedimentation – application of batch settling tests

to design of continuous thickeners.

Purpose of agitation – agitation equipment – propellers, paddles and turbines.

Conveyor types – Belt conveyor – Chain conveyor – Scraper conveyor – Apron conveyor – Bucket conveyors – Bucket elevators – Screw conveyors – Pneumatic conveyors – Pneumatic conveying.