

## **SYLLABUS FOR THE JOINT ENTRANCE EXAMINATION FOR LATERAL ENTRY TO 2<sup>ND</sup> YEAR OF THE FOUR YEAR COURSE OF BACHELOR DEGREE IN ENGINEERING AND TECHNOLOGY.**

### **SYLLABUS**

- (A) For **Diploma holders in Engineering / Technology** : The questions will be set based on the prescribed diploma syllabus of The West Bengal State Council of Technical Education on the following six subjects
- (1) Engineering Mathematics
  - (2) Electrical Technology
  - (3) Computer Applications
  - (4) Environmental Engineering
  - (5) Engineering Mechanics / Basic Engineering (for Printing )
  - (6) Strength of Materials / 'Printers' Materials Science (for printing).
- (B) For **B.Sc, candidates** : A separate question paper on Mathematics will be set, based on B.Sc Mathematics pass course syllabus of the University of Calcutta.
- (C) For **Diploma holders in Pharmacy** : A separate question paper will be set based on the Diploma Level syllabus in Pharmacy as prescribed by the Pharmacy Council of India.

**As per the W.B. Joint Entrance Examinations Board Information Brochure - 2012**

## SYLLABUS

FOR ENGINEERING TECHNOLOGY BRANCHES ONLY

**(JELET)**

### ENGINEERING MATHEMATICS (FOR ALL BRANCHES)

#### MATRIX & VECTOR

Matrix - Definition - Order of a matrix - Leading element - Principal diagonal. Types of matrices - Null matrix - Square matrix - Identity matrix - Upper and lower triangular matrix - Symmetric matrix.

Determinant of a square matrix - Minors and cofactors – Procedures for evaluation Properties of determinants (no deduction) Evaluation of determinant by Ohio's method (4th order) - Problems.

Concept of vector -Addition and subtraction of vectors - Multiplication of a vector by a scalar - Position vector of a point - Ratio formula - Rectangular resolution of a vector - Dot and cross product - Geometrical interpretation - Distributive law -Applications.

#### NUMERICAL METHODS

Meaning of interpolation - Difference table - Newton's forward Interpolation formula (no deduction) – Problems.

Introduction to numerical integration - Formulae for composite trapezoidal and Simpson's 1/3 rule (no deduction) – Related problems

Numerical solution of non-linear equations - Formula for Newton-Raphson method (no deduction) - Problems.

Numerical solution of system of linear equation - Gauss-Elimination Method (no deduction) - Problems.

#### DIFFERENTIAL EQUATIONS

Definition - Order and degree of a differential equation - Differential equations of 1<sup>st</sup> order and 1<sup>st</sup> degree - Separation of variables - Problems.

Homogeneous differential equations - Equations reducible to the homogeneous form - Problems.

Exact differential equations - equations reducible to the exact form - problems Linear equations - Bernoulli's equations

Differential equations of 2nd order with constant co-efficients - Complementary function and particular integral - Problems.

#### PARTIAL DIFFERENTIATION

Function of two or more variables - Definition and meaning of partial derivatives (1st order). Homogeneous functions - Euler's theorem on homogeneous functions (no deduction) - Problems

#### PROBABILITY AND STATISTICS

Introduction - Random experiment - Sample space - Events Classical and axiomatic definition of probability Addition and multiplication theorem - Related problems. Statistics - Frequency distribution.

Measure of central tendency - Mean - Median - Mode - Standard deviation - Simple problems

**ELECTRICAL TECHNOLOGY  
(FOR ALL BRANCHES)**

**Kirchoff's law**

Kirchoff's voltage and current laws, Star-delta transformations - Simple problems on all topics.

**A. C. FUNDAMENTALS**

Concept & significance of R.M.S. value, peak value, average value, crest factor and form factor of sinusoidal voltage/current - Equation of instantaneous value of sinusoidal voltage/current - Simple problems on all.

**A, C. SERIES CIRCUIT**

R-L & R-C A.C. series circuit (no deduction, only the expressions of voltage, current & power for sinusoidal sources), power factor, power triangle simple problems

**STORAGE CELL, TRANSFORMER, MOTORS ETC.**

Basic Principle of: Storage cell, DC. motors, Transformer, A.C. generators & motors (No deduction & problems).

**MAGNETIC CIRCUIT**

Concept on magnetic circuit, Definitions and units of magnetic flux, m.m.t. and reluctance, analogy with electrical circuit, simple problems.

**MOTOR STARTER**

Need of motor starter mentioning some names useful for D.C. motors & A.C. motors.

**MOTORS FOR INDUSTRIAL USES**

Simple Electrical Circuit for motor installation, using block diagram of different components.

**POWER GENERATION, TRANSMISSION & DISTRIBUTION**

Brief idea about the power generation, transmission and distribution using block diagram of different stages.

**VOLTAGE STABILISER & UPS SYSTEM**

Brief idea about the operational principle of voltage stabilizer and UPS system (no description of internal circuit)

**HOUSE WIRING**

Simple idea house wiring starting from commencement of supply, using necessary diagram, role of fuses / MCB, fault finding & earthing concept.

**LIGHTING SCHEMES**

Types of lighting scheme and factors considered for designing lighting schemes i.e. illumination level, uniformity of illumination, colour of light, glare, mounting height, spacing between luminaries, colour of surrounding walls etc.

**WATTMETER & MEGGAR**

Uses & connection diagram of Wattmeter - Use of Meggar with circuit diagram.

**ELECTRICAL ENERGY MEASUREMENT**

Electrical energy measurement (no mathematical deduction & description of apparatus) - circuit diagram for single-phase energy-meter connection.

## **COMPUTER APPLICATIONS & PROGRAMMING (FOR ALL DISCIPLINES) DETAIL COURSE CONTENT**

### **Group - A — FUNDAMENTALS OF COMPUTER**

#### **Module 1 — INTRODUCTION TO COMPUTER**

- 1.1 Brief history of evolution of computers
- 1.2 Various components of computer (brief knowledge)
- 1.3 Hardware-CPU, inputs output system, primary memory, secondary memory.
- 1.4 Peripherals devices - Printers, plotter, scanners, digital cameras, web cam sound card & speaker systems, dicta phone
- 1.5 Software Operating system, system software like compilers and device drivers, and various application software (definitions only).

#### **Module 2—INFORMATION REPRESENTATION**

- 2.1 Number System : Binary, Octal & Hexadecimal
- 2.2 Conversion of number systems, signed and unsigned representation
- 2.3 Binary arithmetic & compliments,
- 2.4 Character codes : ASCII, BCD & Gray codes

### **Group - B - SOFTWARE CONCEPTS**

#### **Module 3—BASIC OF SOFTWARE**

- 3.1 Classification of Software systems-system software and application software.
- 3.2 Basic concepts of compilers, interpreters, assemblers and device drives
- 3.3 Operating system - Single user, multi user, graphical user interfaces and characters user interfaces.
- 3.4 Case studies : MS-DOS, Windows

### **Group - C — INTRODUCTION TO PROGRAMMING**

#### **Module 4 — INTRODUCTION TO PROGRAMMING**

- 4.1 Algorithm and flowchart
- 4.2 Different types of programming languages - machine level, assembly level and high-level languages (basic concepts only)
- 4.3 Brief introduction to different high-level languages including C
- 4.4 Basics of C-Language
- 4.5 Branching and looping statements
- 4.6 Arrays and user-defined functions

### **Group - D — COMPUTER NETWORKING AND INTERNET**

#### **Module 5 - COMPUTER NETWORKING AND INTERNET**

- 5.1 Basics of Computer Networking - LAN, MAN, WAN (definitions only)
- 5.2 Client - Server architecture (elementary level)
- 5.3 Internetworking concepts of World Wide Web, domain name system emails
- 5.4 Web browsing, use of search engines, web site hosting (elementary level)

## **ENVIRONMENTAL ENGINEERING (FOFI ALL. BRANCHES)**

### **AIR & ENVIRONMENT INTRODUCTION**

Man & Environment. Overview (socio-economic structure & occupational exposures) - Scope of Environmental Engineering - pollution problem due to urbanisation & industrialisation.

### **AIR POLLUTION**

Causes of air pollution - types & sources of air pollutants - Climatic & Meteorological effect on -air pollution concentration -formation of smog & fumigation

### **ANALYSIS OF AIR POLLUTANTS**

Collection of Gaseous Air Pollutants - Collection of Particulate Pollutants -Analysis of Air Pollutants like: Sulphur dioxide - Nitrogen oxide - Carbon monoxide -Oxidants & Ozone - Hydrocarbons - Particulate Matter

### **AIR POLLUTION CONTROL MEASURES & EQUIPMENT**

Control of Particulate Emission - Control of Gaseous Emission - Flue Gas Treatment Methods: Stacks Gravitational and Inertial Separation. Settling Chambers, Dynamic Separators. Cyclones Filtration, Liquid Scrubbing. Spray Chambers. Packed Towers. Orifice and Venturi Scrubbers, Electrostatic Precipitators. Gas/ solid Absorption, Thermal Decomposition.

### **METHODS & APPROACH OF AIR POLLUTION CONTROL**

Controlling smoke nuisance — Develop air quality criteria and practical emission standards — creating zones suitable for industry based on micrometeorology of air area — Introducing artificial methods of removal of particulate and matters of waste before discharging to open atmosphere

### **WATER & ENVIRONMENT WATER SOURCES**

Origin of waste water — Type of water pollutants and their effects

### **DIFFERENT SOURCES OF WATER POLLUTION**

Biological Pollution (point & non-point sources) - Chemical Pollutants: Toxic Organic & Inorganic Chemicals - Oxygen demanding substances - Physical Pollutants: Thermal Waste - Radioactive waste - Physiological Pollutants: Taste affecting substances - other forming substances

### **WATER POLLUTION & ITS CONTROL**

Adverse effects on : Human Health & Environment, Aquatic life, Animal life, Plant life — Water Pollution Measurement Techniques - Water Pollution Control Equipment & Instruments - Indian Standards for Water Pollution Control

### **SOIL & ENVIRONMENT**

#### **SOIL. POLLUTING AGENCIES & EFFECT OF SOLUTION**

Liquid & Solid Wastes - Domestic & industrial Wastes - Pesticides - Toxic: Inorganic & Organic Pollutants - Soil Deterioration - Poor Fertility, Septicity. Ground Water Pollution, Concentration of Infecting Agents in Soil

#### **SOLID WASTE DISPOSAL**

Dumping domestic & Industrial Solid Wastes: Advantages & Disadvantages -incineration: Advantages & Disadvantages - Sanitary Land Field: Advantages & Disadvantages - Management of Careful & Sanitary Disposal of Solid Wastes

#### **NOISE & ENVIRONMENTAL MANAGEMENT SYSTEM NOISE POLLUTION & CONTROL**

Noise Pollution: Intensity, Duration - Types of Industrial Noise - ill effects of Noise -Noise Measuring & Control - Permissible Noise Limits

#### **ENVIRONMENTAL LEGISLATIONS, AUTHORITIES & SYSTEMS**

Air & Water Pollution Control Acts & Rules (Salient Features only) – Functions of State / Central Pollution Control Boards - Environmental Management System ISO 14000 (Salient Features only).

**ENGINEERING MECHANICS  
 (FOR ALL BRANCHES EXCEPT PRINTING)**

**GROUP-A**

**Module 1 INTRODUCTION**

Concept of Engineering Mechanics - Statics & Dynamics - Scalar Quality -Vector Quality-Addition & Subtraction of Vectors- Basic units- Derived Units-SI units-Principles of dimensional homogeneity.

**Module 2 SYSTEM OF FORCES**

Definition of a force with explanation - Linear representation of force - System of co-planar forces - Parallelogram Law of Forces - Composition and Resolution -Transmissibility of forces - Action and Reaction - Triangle Law & Polygon Law of forces - Determination of Resultant by Analytical and graphical method with equalitarian space diagram - Vector diagram.

**Module 3 MOMENTS & COUPLES**

Definition of moment of a force about a point - Physical significance of moment -Moment of a system of parallel and inclined forces - Varignon's Theorem -Definition of moment of a couple - Physical significance of Couples Equivalent couples -Resultant of any number of coplanar couples - Replacement of a force about a point by an equal like parallel force together with a couple -Properties of couples.

**Module 4 CONDITION OF EQUILIBRIUM**

Lami's Theorem - Triangle Law & Polygon Law of equilibrium - Conditions of equilibrium of co-planer system of concurrent forces - Conditions of equilibrium of co planar system of non-concurrent parallel forces (like & unlike) - Conditions of equilibrium of co-planar system of non-concurrent non-parallel forces (simple problems excluding statically indeterminant).

**GROUP-B**

**Module 5 FRICTION**

Definition - Useful and harmful effects of friction - Laws of Static friction - Coefficient of friction - Angle of friction - Angle of repose - Equilibrium of a body on a rough inclined surface with and without external force

**Module 6 CENTRE OF GRAVITY**

- 6.1 Concept & definition - Centre of mass - Centroid
- 6.2 Methods of finding out centroids of simple area by :
  - (i) Geometrical consideration and (ii) Method of Moments.
  - [\*\* Method of integration should be learnt in Strength of materials on 2<sup>nd</sup> Semester]
  - Finding the centroid of the following areas by any method :
  - (i) uniform triangular lamina, (ii) uniform rectangular lamina, (iii) uniform circular lamina,
- 6.3 Finding the centriod of the following sections using the method of moment:
  - (i) T-section, (ii) equal and unequal angle-sections, (iii) equal and unequal I-sections, (iv) different cut-out sections as shown in the following figures.



**Module 7 MOMENT OF INERTIA**

- 7.1 Introduction - definition and unit
- 7.2 M I of a lamina
- 7.3 Theorems of finding out M I by :
  - (i) Parallel axis theorem, and, (ii) Perpendicular axis theorem.
- 7.4 Radius of Gyration
- 7.5 Finding out M I of the following sections using formula only.
  - (i) rectangular section, (ii) Square section , (iii) circular section, (iv) triangular section
- 7.6 M I of irregular areas such as I-sections, T-sections, - Related simple problems.

### **Module 8 SIMPLE MACHINES**

Definition of Machine - Difference between Machine & Lever - Mechanical Advantage, Velocity Ratio and Efficiency with their relationship - Frictional Effort Load -Condition of reversibility / irreversibility - Law of Lifting Machines - Maximum mechanical advantage - Maximum efficiency - Effort vs. load curve -Efficiency vs. load curve - (Different types of lifting machine with their mechanical advantage, velocity ratio & efficiency such as wheel and axle (simple & differential), Crab winch (single & double purchase), Weston pulley block, worm & worm wheel, simple screw jack.

### **GROUP-C**

#### **Module 9 RECTILINEAR MOTION**

Motion equations (with deduction  $S = V \times t$ ;  $V = u \pm f t$ ;  $S = u. t \pm 1/2 f t^2$ ;  $V^2 = U^2 \pm 2 f S$ )

Newton's Second Law of linear motion  $P = mf$  (deduction) -Conservation of momentum of a body -No Numerical problems

#### **Module 10 CURVILINEAR MOTION**

Angular displacement -Angular speed -Angular velocity- Relation between angular speed & angular velocity - Angular acceleration - Relation between linear & angular velocity - Relation between linear & angular acceleration - Centripetal and centrifugal force (numerical problems)

#### **Module-11 WORK POWER ENERGY**

Definitions. Units, Potential Energy ( $mgh$ ): Kinetic Energy ( $1/2 m v^2$ ). Laws of conservation of Energy. Change of Kinetic energy-Work done by acting force Simple numerical problems.



**STRENGTH OF MATERIALS  
(ALL BRANCHES EXCEPT PRINTING)**

**GROUP —A**

**Module 1 : SIMPLE STRESSES & STRAINS**

- 1.1 Scope of subjects Use of structure, importance of knowledge of stress, strain and deformation in structure, safety and economy.  
Engineering materials: Definitions and examples  
Mechanical properties of engineering materials: Elasticity, Plasticity, Ductility; Hardness. Fatigue. Creep Brittleness (definition, examples and applications).
- 1.2 Stress and strain Tensile, Compressive, Shear
- 1.3 Stress-strain diagram: Principles of tensile testing in universal testing machine's showing salient points such as elastic limit, proportional limit, yield points, breaking points etc., ultimate stress, working stress and factor of safety.
- 1.4 Stress - Strain relations: Hooke's law, Young's Modulus, Modulus of rigidity, Poisson's ratio.

**GROUP— 8**

**Module 2 : SHEAR FORCE & BENDING MOMENT**

- 2.1 Definition and Types of beams, supports and loads.
- 2.2 Shear force and bending moment in beams: Definitions, sign conventions and inter - relationships
- 2.3 Shear force and bending moment diagrams (with simple problems):
  - (i) Cantilever beams with point loads and Uniformly Distributed Loads (UDL);
  - (ii) Simply supported beams with point loads and UDL.
  - (iii) Simply supported overhanging beam with point load

**Module 3 : BENDING STRESSES IN BEAMS**

- 3.1 Pure bending of beam: Assumptions, deduction of bending equation with usual notations, moment of resistance, section modulus
- 3.2 Problems on bending stress about axis parallel to the plane of bending For rectangular circular & I – section.

**GROUP —C**

**Module 4 : DEFLECTION OF BEAMS**

- 4.1 Differential equation of elastic curve — Relation among deflection, slope, shear force, bending moment and rate of loading — Sign convention of slope and deflection
- 4.2 Standard formula (no proof, only simple problems) for maximum slope of deflection of
  - (a) cantilever beam subjected to point load at free end, uniformly distributed load on entire span;
  - (b) simply supported beam carrying a point load at mid span, uniformly distributed load on entire span.

**Module 5 : COLUMNS & STRUTS**

- 5.1 Definitions of Columns & Struts — Long, Medium & Short columns — Effective Length — Slenderness Ratio — Critical load — Safe load — Different kinds of end conditions — Euler's formula for critical load (no deduction and no problem).



## **BASIC ENGINEERING FOR PRINTING (FOR PRINTING TECHNOLOGY ONLY)**

### **SIMPLE STRESSES & STRAIN**

Introduction — Elasticity — Stress and Strain.

Types of Stresses: Tensile Stress and Compressive Stress.

Elastic Limit — Hook's' Law — Modulus of Elasticity (Young's Modulus)

Deformation of a body due to Force acting on it — Simple problems.

Principle of Superposition — Simple problems on uniform cross-section.

### **MECHANICAL DRIVE**

Different types of Mechanical drive and their uses only.

Belt & pulley drive Different types belt and pulley drive — Open belt drive and cross belt drive.

Types of belt and types of pulley — Velocity ratio.

Simple problems.

### **GEAR DRIVE**

Types of gear and their uses. Definition of different parts of Spur gear. Velocity ratio of spur gear. Simple problems.

### **MEASURING INSTRUMENTS**

Types of measuring instruments and their uses.

Description, working principle, care & maintenance of Vernier Callipers and outside micrometer.

Reading of Vernier callipers and outside micrometer.

### **FASTENING METHOD**

Different types of fastening method with examples Types of nuts, bolts and their uses Welding, Soldering & Brazing and their uses Different types of rivet and riveted joints.

### **PRINTERS' MATERIAL SCIENCE (FOR PRINTING TECHNOLOGY ONLY)**

**Colloids** - Definition of colloid, properties of lyophilic and lyophobic colloids, stability of colloids, protective action of lyophilic colloids, gold number, definition of gel and emulsion, application of colloids, gels and emulsions in printing.

**Polymers** - Uses of natural polymers (casein, cellulose, dextrin, egg albumen gelatine, fish glue, gum Arabic and starch) and synthetic polymers (polyethylene, polypropylene, Teflon, polyvinyl acetate, polyvinyl alcohol, polyvinyl chloride, phenolic resin, amino resin and polyester resin) in printing.

**Chemistry of photography** - Constituents of a photographic emulsion, uses of gelatine, preparation of the emulsion, lattice structure of silver chloride and silver bromide, lattice defects, latent image formation by Gurney-Mott Theory chemistry of photographic development fixing photographic reduction and chemistry intensification, chemical reversal, elementary idea of silverless films.

**Chemicals required for Image carriers** - a) letterpress and flexography - photopolymeric stereo making, b) lithography - (graining, coating, developing, etching, lacquering, stencil removing, gumming, desensitising) (i) negative working plates-albumen plate, PS. diazo and photo-polymer plates, driographic (waterless) plate (ii) positive working plates - gum deep etch plate, PS. plate, diffusion transfer plate c) gravure - cylinder making (sensitising, developing, etching, finishing) d) silk screen - (coating, developing, hardening, stencil removing) direct, indirect, direct-indirect and capillary method

**Surface tension** - Definition, contact angle, choice of metals for image carriers on the basis of contact angle, role of surface tension in wetting of the non-image areas of a lithographic plate by water and the image areas by ink.

**Fountain solution** - Constituents, use of each constituent, PH and conductivity,

**Printing ink** - Differences between liquid ink and paste ink, Raw materials of ink colourant (pigment and dyestuff), solvent, plasticiser, resin, oil, drier and additives (wax antioxidant, surfactant), ink strength, ink drying - penetration, oxidation quickset, evaporation, radiation polymerisation (UV and electron beam), IR radiation; rheology of paste inks in terms of viscosity, thixotropy, visco-elasticity, tack, length and flow. Different types of inks - quick set, heat set, moisture set inks, sheet fed web fed inks, water-based inks. Characteristics of letterpress, offset, gravure, flexographic and screen inks.

**Paper** - Paper manufacture - sulphate process of chemical pulp preparation, bleaching, beating, internal and external sizing, coating. Paper characteristics paper grain, dimensional strength, paper acidity runnability & printability Requirements of letterpress, lithographic, gravure, flexographic and screen-printing papers

**Adhesives** - Characteristics of class-1, 2 & 3 adhesives, adhesives used in lamination & book binding, requirement of an adhesive pH of ink, paper and adhesives.