



## **SYLLABUS**

**FOR DIPLOMA HOLDERS IN ENGINEERING / TECHNOLOGY:** THE QUESTIONS WILL BE SET BASED ON THE PRESCRIBED DIPLOMA SYLLABUS OF THE JHARKHAND COMBINE/AIEEE/KITT/COMMED/ WEST BENGAL STATE COUNCIL OF TECHNICAL EDUCATION ETC. ON THE FOLLOWING SUBJECTS

- (1) ENGINEERING MATHEMATICS<sup>IMP</sup> (FOR BOTH LEET AND JHARKHAND COMBINED)**
- (2) ELECTRICAL TECHNOLOGY<sup>IMP</sup>**
- (3) COMPUTER APPLICATIONS<sup>IMP</sup>**
- (4) ENVIRONMENTAL ENGINEERING**
- (5) ENGINEERING MECHANICS**
- (6) STRENGTH OF MATERIALS**
- (7) PHYSICS<sup>IMP</sup> (ONLY FOR JHARKHAND COMBINED)**
- (8) CHEMISTRY (ONLY FOR JHARKHAND COMBINED)**
- (9) ENGLISH (ONLY FOR JHARKHAND COMBINED)**

***ENGINEERING MATHEMATICS<sup>IMP</sup> (for all branches)***

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**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 1st order and 1st 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

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## ***ELECTRICAL TECHNOLOGY<sup>IMP</sup> (for all branches)***

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### **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.

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# *COMPUTER APPLICATIONS<sup>IMP</sup> (for all branches)*

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## **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, and 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 loping 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)

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## *ENVIRONMENTAL ENGINEERING (for all branches)*

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### **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 inertia! 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).

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# *ENGINEERING MECHANICS (for all branches)*

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## **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-planar 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 tactically indeterminate).

## **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**

Concept & definition - center of mass - centroid

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 2nd semester]

Finding the centroid of the following areas by any method:

- i. uniform triangular lamina,
- ii. uniform rectangular lamina,
- iii. uniform circular lamina,

Finding the centroid of the following sections using the method of moment:

- i. t-section,
- ii. equal and unequal angle-sections
- iii. equal and unequal l-sections
- iv. different cut-out

Sections as shown in the figures.

### **Module 7 Moment of Inertia**

Introduction - definition and unit

$m_i$  of a lamina

Theorems of finding out  $m_i$  by:

- i. parallel axis theorem, and
- ii. perpendicular axis theorem.

Radius of gyration

Finding out  $m_i$  of the following sections using formula only.

- (i) rectangular section
- (ii) square section
- (iii) circular section
- (iv) triangular section

$m_i$  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  $s = vt$ ,  $v = u + ft$ ;  $s = ut + \frac{1}{2}ft^2$ ;  $v^2 = u^2 + 2fs$ )

Newton's second law of linear motion  $p = mv$  (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 ( $\frac{1}{2}mv^2$ ). Laws of conservation of energy. Change of Kinetic energy - work done by acting force simple numerical problems.

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## ***STRENGTH OF MATERIALS (for all branches)***

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### **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 – B**

#### **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).

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## *PHYSICSIMP (for all branches)*

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### **First year engineering physics syllabus**

#### **1.0 Units, Dimension and Measurements (2)**

##### 1.1 units, dimension

- concept of unit of physical parameters
- fundamental and derived units
- SI systems of units of different physical parameters`
- dimension with examples of different physical parameters.

#### **2.0 Mechanics (10)**

##### 2.1 motion along a straight line and force

- concept of scalar and vector quantities
- equations of motion with constant acceleration(derivation not required)
- equations of motion of falling body under gravity
- simple problems on linear motion
- newton's laws of motion, action and reaction, tension
- force, inertia, momentum, impulse and impulsive
- Force with practical examples (basic idea)
- conservation of linear momentum.

#### **3.0 Gravitation (5)**

- newton's laws of gravitation
- newton's gravitational constant (g) and its SI unit
- acceleration due to gravity (g) and its relation with "g"
- variation of g with altitude and latitude(deduction not required)
- simple problems

#### **4.0 Work, Power and Energy (review) (5)**

- work, power and energy with their units and mathematical expressions
- relation between horse power and watt
- different forms of mechanical energy : pe, ke and their expressions ( derivation )
- conservation of energy and transformation of energy with examples, simple problems

#### **5.0 Properties of Matter: (6)**

##### **5.1 Properties of Solid: (3)**

- plasticity and elasticity in solids
- deformation of bodies by the action of external forces - change in size and change in shape
- unit of stress – tensile stress, compressive stress and Shear stress with examples
- unit of strain – tensile strain., volume metric strain and shear strain
- hooke's law
- modulus of elasticity – young's modulus, bulk modulus and modulus of rigidity. Poison's ratio and their units
- stress – strain curve

##### **5.2 Properties of Fluid (3)**

- streamline and turbulent flow of fluid
- co-efficient of viscosity
- critical velocity and its derivation
- stoke's formula and reynolds's number

#### **6.0 Heat (10)**

##### **6.1 Heat and Temperature (review) (2)**

- heat and temperature
- fixed points and different scales of temperature - Fahrenheit, Celsius and kelvin and their relationships



## **6.2 Measurement of Heat (4)**

- quantity of heat, units of heat-joule and calorie
- specific heat of solid, heat capacity ,water equivalent
- principle of calorimeter, measurement of specific heat
- change of state : latent heat, evaporation & boiling,
- Effect of pressure
- idea of two specific heat capacities of gas:  $c_p$  and  $c_v$  and their relationships
- simple problems

## **6.3 Thermal Expansion & Transmission of Heat (4)**

- expansion of solid – linear, superficial and
- Cubical co-efficient of expansion & their units
- different modes of transmission of heat :
- Conduction, convection and radiation ,
- Steady state of temperature condition
- co-efficient of thermal conductivity & its unit
- good conductors and bad conductors of heat
- simple problems

## **7.0 Sound: (7)**

### **7.1 simple harmonic motion (3)**

- simple harmonic motion and its characteristics
- time period, frequency & amplitude of vibration
- mathematical expression of shm
- examples of shm: simple pendulum (derivation not required)
- simple problems

### **7.2 Production and Propagation of Sound (2)**

- natural vibration, forced vibration with examples
- resonance of sound with examples

- principle of resonance to find out velocity of sound in air
- velocity of sound , newton's formula and
- Laplace correction (idea only, no deduction)
- introduction to ultrasound

### **7.3 Reflection of Sound (2)**

- echo, reverberation and reverberation time
- acoustics of buildings, absorption power of a surface

#### **Text books:**

1. Engineering physics - r.k. Gaur, s.l. Gupta
2. Physics for engineers - m.r srinivasan
3. A text book of physics - c. R. Dasgupta part i & ii
4. Elements of higher secondary physics (part i & ii) - d. Dutta, b. Pal & b. Chaudhuri
5. Physics vol. I, ii – h. C verma
6. Pradeep's fundamental of physics vol i & ii – kl ghambhir & kl gogia
7. Comprehensive physics - - narindra kumar

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# *CHEMISTRY (for all branches)*

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## **First year engineering chemistry syllabus**

### **104 Engineering Chemistry-1**

#### **1.0 General Chemistry (14)**

##### **1.1 Atomic Structure (5)**

- An overview with respect to atomic models, electronic configuration & principles involved there in.
- Concept of various kinds of bonding and their properties.
- Mole concept /Avogadro's no.'s and related numerical

##### **1.2 Solution (5)**

- unit of solution and their application in titration with the use of Indicators.
- solubility products and their application in precipitation / salting out of soap and in quantitative analysis.
- buffer solution – numericals

##### **1.3 Colloids (4)**

- introduction, classification and properties
- application of colloid in environmental, agriculture and food
- Industries
- Emulsions

#### **2.0 Chemical Kinetics & Chemical Equilibrium (5)**

- rate of reactions and factors effecting rate of rk
- concept of chemical equilibrium, equilibrium constant
- relation between  $k_c$ ,  $k_p$  &  $k_x$
- lechatelier's principle

## **2.0 Electrochemistry (4)**

- introduction to electrolytes, electrolysis, faraday's law of electrolysis and its applications specially in electroplating
- electrochemical cell (galvanic cell) and cell reactions
- electrodes and electrode potential

## **4.0 Metallurgy (4)**

- mineral and ores
- operation involved in extraction of metal from ores
- important alloys and its applications (steel, brass & bronze)

## **5.0 Corrosion and Protective Coatings: (5)**

- introduction, kinds, causes and effect of corrosion
- protective measures against corrosion
- paints

## **6.0 Polymers & Plastics: (4)**

- concept of polymer & plastics
- kinds, properties and uses of plastics
- manufacturing methods of plastics

## **7.0. Biotechnology (4)**

- introduction & development of biotechnology, scope, importance and application of biotechnology

### **Text books:**

1. Environmental chemistry by a k dey
2. Engineering chemistry : jain & jain
3. Engg chemistry - kataria sons publications
4. Engg chemistry – uppal

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*ENGLISH (for all branches)*

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**Synonyms. Antonyms, error detection etc.**