DETAILED SYLLABUS FOR THE POST OF
ASSISTANT PROFESSOR IN PRODUCTION ENGINEERING IN
TECHNICAL EDUCATION DEPARTMENT

(Category No: 481/2019)

Part I :

a) MATHEMATICS (ENGINEERING)

Matrices: Rank, systems of linear equations, consistency, eigen values, eigen vectors, Cayley Hamilton Theorem, diagonalisation, linear dependence and independence of vectors.

Partial Differentiation: Partial derivatives, Euler's theorem on homogeneous functions, total derivatives, Jacobians, Taylor's series (one and two variables) – Maxima and minima of functions of two variables – Lagrange' s method.

Vector Differentiation: Scalar and vector functions, differentiation of vector functions – velocity and acceleration – scalar and vector fields – operator ᷇ – Gradient – Directional derivative – Divergence – Curl – irrotational and solenoidal fields – scalar potential.

Laplace Transforms: Transforms of elementary functions, shifting property – inverse transforms – transforms of derivatives and integrals – transform of functions multiplied by t and divided by t – convolution theorem, solution of ordinary differential equations with constant coefficients using Laplace transforms.

Ordinary Differential Equations: First Order ordinary differential equations, systems of linear first order ordinary differential equations, linear ordinary differential equations of higher order with constant coefficients, linear second order ordinary differential equations with variable coefficients (Cauchy and Legendre equations), Method of Laplace transforms for solving ordinary differential equations.

Complex Analysis: Analytic functions, conformal mappings, bilinear transformations, complex integration, Cauchy's integral theorem and formula, Taylor and Laurent's series, residue theorem.

Fourier Series: Fourier series of periodic functions of period 2π and 2ℓ, odd and even functions, Half range expansions.

b) BASIC CIVIL ENGINEEERING

Mechanics – statistics – Coplanar forces – conditions of equilibrium. Support reactions – Simply supported and overhanging beams. Friction – Laws of friction – applications. Centre of gravity and moment of inertia of plane areas. Dynamics – rectilinear motion – Newton's laws of motion – curvilinear motion.
Building materials – common building materials – stone, brick, cement, steel, aggregate, concrete, timber – properties, IS specification. Building construction – types and functions of the following structural components of buildings – foundations and superstructure.

Surveying – principle of surveying – linear measurements using chain – levelling work – reduction of levels.

c) BASIC MECHANICAL ENGINEERING

Zeroth, first and second laws of thermodynamics, CI and SI Engines, properties of steam. Centrifugal and reciprocating pumps, hydraulic turbines, refrigeration and air conditioning, hydro-electric, thermal and nuclear power plants, mechanical power transmission systems such as belt, rope, chain and gear, manufacturing process – casting, forging, rolling, brazing, soldering, and welding, machining process – turning, shaping, drilling, grinding and milling. Conic sections and miscellaneous curves, orthographic, isometric and perspective projections.

Part II :

a) BASIC ELECTRICAL ENGINEERING

Ohm's law, Kirchoff's laws – solution of series and parallel circuits with dc excitation.
Magnetic circuits: MMF, field strength, flux density, reluctance, electromagnetic induction, Faraday's laws, Lenz's law, statically and dynamically induced emfs, self and mutual induction, co-efficient of coupling.
Principle of generation of alternating current – waveforms – frequency, period, average and rms values, form factor.
Generation of 3 phase ac voltage, star and delta connections, voltage & current relationships in star and delta (balanced system only).
Principle of operation of dc motor & generator, single phase transformer and three phase induction motor.
Types of lamps, necessity of earthing.

b) BASIC ELECTRONICS ENGINEERING

Devices – working principle of PN junction, Zener diode and BJT.
Systems – Rectifiers : Half wave, Full wave and Bridge. Filters: Capacitors and Inductors.
Amplifiers & Oscillators – Common Emitter RC coupled amplifier and its frequency response.
Principles of Wein-bridge oscillator. Op-amps: Basics, inverting and non-inverting amplifier.
Communication – Need for modulation, principles of AM and FM.
Measurements – Working principles of CRO and Multimeter.

c) BASIC COMPUTER SCIENCE

Functional units of a computer.
Programming in C – control structures, functions.

Part III :   PRODUCTION ENGINEERING

Module I :

Foundry: Mould materials, types of moulds, pattern making, allowances, types of casting processes – solidifications, casting defects and testing.

Metal Joining Processes: Classifications – arc, gas, pressure and special types like ESW, EBW, LPW and welding of dissimilar materials – testing of welding joints – welding process variables.

Forming Processes: Theory of stress and strain, various press working operations – forging, rolling, extrusion, drawing, explosive and hydraulic forming, bending, shearing and spinning.

Module II :

Types of cutting tools, tool geometry, cutting processes, types of chips, machinability, tool life, tool wear, cutting fluids, calculation of cutting force.

Basics of machine tools like, lathe, shaper, milling, drilling, grinding, boring and finishing operations.

Un-conventional machining – parameters and materials of tool and work – types like EDM, ECM, CHM, USM, LBM, EBM and PAM.

Classification of tool materials and properties – crystal structures – phase diagrams – powder metallurgy – process, characteristics, merits and applications.

Module III :

Basics of NC, CNC and DNC – types and elements – FMS – CIM – drives, controls, sensors, feedback devices, ACC and ACO – basics of RP – manual and computer aided part programming – Group technology – Industrial automation.

Module IV :

Theory and concepts of kinematics and mechanisms – governors – gears and gear trains – cams – velocity and acceleration analysis – balancing – vibration.
Machine element design theory – tool design – Degree of freedom, types of locaters and clamping – jig and fixtures – design of dies.
Concept and theory of accuracy, precision, sensitivity, calibration – standards – linear and angular measuring instruments – measurement of flow, temperature, pressure, force and velocity – limits, fits and tolerance – surface finish / roughness measurements – transducers and strain gauges.

Module V :

Functions of management, decision making, authority, responsibility, span of control – types of organizations – plant layout – principles of material handling – concept of ERP – PPC – product design and development – maintenance and replacement of equipments.
Work study and method study – wages and incentives – industrial psychology – work measurement.
Process charts and control charts – inventory management – TQM, ISO, six sigma – LP models – transportation and assignment problems, networking techniques.

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