Pre Syllabus

1) मराठी

सर्वसामान्य शब्दसमूह वाक्यरचना व्याकरण म्हणी व वाक्प्रचार यांचा अर्थ व उपयोग तसेच उताऱ्यावरील प्रश्नांची उत्तरे

2) इंग्रजी

Common Vocabulary, Sentence structure, Grammar, Use of Idioms & phrases and their meaning and comprehension of passage

3) सामान्य अध्ययन

भारताचा विशेषत: महाराष्ट्राचा इतिहास इतिहास (१८५७ ते १९९०)

भारताचा विशेषत: महाराष्ट्राचा भूगोल

भारतीय अर्थव्यवस्था:

- भारतीय आयात निर्यात,
- राष्ट्रीय विकासात सरकारी, सहकारी ग्रामीण बँकांची भूमिका
- शासकीय अर्थव्यवस्था अर्थसंकल्प,अर्थसंकल्प,लेखा,लेखापरीक्षण,इत्यादी
- पंचवार्षिक योजना,
- किंमती वाढण्याची कारणे व उपाय

4) भारतीय राज्यव्यवस्था

जागतिक तसेच भारतातील चालू घडामोडी:- राजकीय,औद्योगिक,आर्थिक,सामाजिक,शैक्षणिक, भौगोलिक,खगोलशास्त्रीय सांस्कृतिक,वैज्ञानिक इत्यादी

5) पर्यावरण

मानवी विकास व पर्यावरण, पर्यावरणपूरक विकास, नैसर्गिक साधन संपत्तीचे संधारण विशेषता वनसंधारण, विविध प्रकारची प्रदूषणे व पर्यावरणीय, आपत्ती, पर्यावरण संवर्धनात कार्यरत असलेल्या राज्य / राष्ट्र /जागतिक पातळीवरील संघटना / संस्था

I) Applied Mechanics -

a. Matrices-

Types of Matrices (Symmetric, Skew-symmetric, Hermitian, Skew Hermitian, Unitary, Orthogal Matrices), properties of Matrices, Rank of a Matrix using Echelon forms, reduction to normal form, PAQ in normal form, system of homogeneous and non-homogeneous equations. Linear dependent and independent vectors.

b. Partial Differentiation-

Partial Differentiation; Partial derivatives of first and higher order. Total differentials, differentiation of composite and implicit functions. Euler's theorem on homogeneous functions with two and three independent variables. Deductions from Euler's Theorem.

c. Applications of Partial Differentiation, Expansion of Functions, Maxima and Minima of function of two independent variables, Jacobian, Taylor's Theorem and Taylor's series, McLaurin's series.

d. Linear Differential Equations with Constant Coefficients and Variable Coefficients of Higher Order - Linear Differential Equation with constant coefficients - complementary function, particular integrals of differential equation, Cauchy's homogeneous linear differential equation and Legendre's differential equation, Method of variation of parameters.

e. Differentiation under Integral sign, Numerical Integration - Differentiation under Integral sign with constant limits of integration, Numerical Integration by (a) Trapezoidal (b) Simpson's 1/3(c) Simpson's 3/8 rule.

f. Double Integration -Change the order of integration, Evaluation of double integrals by changing the order of integration and changing to polar form.

g. Triple Integration and Application of Multiple Integrals - Application of double integrals to compute Area, Mass, Volume. Application of triple integral to compute volume.

II Engineering Mechanics -

a. System of Coplanar Forces - Resultant of concurrent forces, parallel forces & Non concurrent Non parallel system of forces. Moment of force about any point, Couples, Varignon's theorem. Distributed forces in plane. Centroid and Centre of Gravity, Moment of Inertia & its theorem.

b. Condition of equilibrium for concurrent forces, Parallel forces and Non concurrent Non parallel general system of forces & couples. Types of supports, loads, beams. Analysis of trusses.

c. Laws of friction, Cone of friction, Equilibrium of bodies on inclined plane. Application of problems involving wedges, ladders, screw friction.

d. Kinematics of particle: - Velocity and acceleration in terms of rectangular coordinate system, Rectilinear motion. Motion along plane curved path. Tangential and Normal components of acceleration. Motion Curves (a-t, v-t, s-t curves). Projectile motion. Relative motion. Newton's second law, work energy principle, Alembert's principles, equation of dynamic equilibrium. Moment of Energy principles: Linear momentum, principle of conservation of momentum, Impact of solid bodies, direct and oblique impact, impact of solid bodies, semi elastic impact and plastic impact.

III Elements of Civil Engineering

a. Materials and Construction

(1) Use of basic materials cement, bricks, stone, natural and artificial sand, Reinforcing Steel- Mild, Tor and High Tensile Steel. Concrete types - PCC, RCC, Pre-stressed and Precast. Introduction to smart materials. Recycling Of materials.

(2) Substructure - Function of foundations, (Only concepts of settlement and Bearing capacity of soils). Types of shallow foundations, (only concept of friction and bearing pile).

(3) Superstructure - Types of loads: - DL and LL, wind loads, earthquake considerations. Types of construction - Load bearing, framed, composite. Fundamental requirements of masonry.

(4) Introduction to automation in construction: - Concept, need, examples related to different civil engineering projects.

b. Uses of maps and field surveys - (1) Various types of maps and their uses. Principles of surveys. Modern survey method using levels, Theodolite, EDM, lasers, total stations and GPS. Introduction to digital mapping. Measuring areas from maps using digital planimeter.

(2) Conducting simple and differential leveling for seeking out various benchmarks, determining the elevation of different points and preparation of contour maps. Introduction to GIS Software and other surveying soft-wares with respect to their capabilities and application areas.

IV Elements of Mechanical Engineering

(1) Thermodynamics- Thermodynamic work, p-dV work in various process, p-V representation of various thermodynamic processes and cycles. Ideal gas equation, properties of pure substance, Statements of I st and II nd law of thermodynamics and their applications in mechanical engineering. Carnot cycle for Heat engine, refrigerator and heat pump.

(2) Heat transfer - Statement and explanation of Fourier's Law of heat conduction, Newton's law of cooling, Stefan Boltzmann's law. Conducting and insulation materials and their properties. Selection of heat sink and heat source.

(3) Power plants - Thermal, Hydro-electric, nuclear and solar wind hybrid power plants

(4) Machine elements: Power transmission shafts, axles, keys, bush and ball bearings, Flywheel and Governors.

(5) Power Transmission Devices – Types of belts and belt drives, Chain drives, type of gears, Types of couplings, friction clutch (cone and single plate), brakes (types and application only). Application of these devices.

(6) Mechanism : (Descriptive treatment only) Slider crank mechanism, Four bar chain mechanism, List of various inversions of four bar chain mechanism, Geneva mechanism, Ratchet and Paul mechanism.

(7) Materials use in Engineering and their Application Metals – Ferrous and Non-ferrous, Non metallic materials, Material selection criteria, Design consideration, Steps in Design.

(8) Introduction to Manufacturing processes and Their Applications – Casting, Sheet metal forming, Sheet-metal cutting, Forging Fabrication, Metal joining processes.

(9) Machine Tools (Basic elements, Working principle and types of operations) Lathe Machine –Centre Lathe Drilling Machine – Study of pillar drilling machine. Introduction to NC and CNC machine, grinding machine, Power saw, Milling Machine.

V Elements of Electrical Engineering

(1) D.C. circuits: Kirchhoff's laws, ideal and practical voltage and current source, Mesh and nodal analysis (super node and super mesh excluded), Source transformation, Star-delta transformation, Superposition theorem, Thevein's theorem, Norton's theorem, Maximum power transfer theorem.

(2) A.C. Circuits : Generation of alternating voltage and current, RMS and average value, form factor, crest factor, AC through resistance, inductance and capacitance, R-L, R-C, and R-L-C series and parallel circuits, phasor diagrams, power and power factor, series and parallel resonance, Q-factor and bandwidth

(3) Three phase circuits : Three phase voltage and current generation, star and delta connections (balanced load only), relationship between phase and line currents and voltages, Phasor diagrams, Basic principle of wattmeter, measurement of power by two wattmeter method.

(4) Single phase transformer : Construction, working principle, Emf equation, ideal and practical transformer, transformer on no load and on load, phasor diagrams, equivalent circuit, O.C. and S.C. test, Efficiency.

Mains Syllabus

Civil Engineering, Paper - I

1. **Building Construction & Materials**: Properties of wet and hardened concrete, tests on concrete, factors affecting strength of concrete, water-cement ratio, aggregate-cement ratio, mix design, additives, design of form work, types of formwork. Stones, bricks, cements, lime, mortar, timber, plastic, concrete, steel, paints and varnishes. Principles of building planning and design, integrated approach, building byelaws, building services such as vertical transportation, water supply sanitation, thermal ventilation, lighting, acoustics, fire protection, electrical fittings. Foundations, stones, brick and block masonry, steel and reinforced cement concrete structures,floors, doors and windows, roofs, finishing works, water proofing.

2. **Strength of materials**: Stresses, strains, principal stresses, bending moments, shear forces and torsion theory,bending theory of beam, deflection of beam, theories of buckling of columns.

3. **Theory of structures:** Analysis of beams, frames and trusses, slope deflection method, moment distribution method.

4 Structural analysis: Analysis of arches and suspension cables, influence lines, stiffness and flexibility matrix methods.

5 Steel structures: Design of bolted and welded connections, columns, footings, trusses, steel beams, plate girders.

6 Design of reinforced concrete structures (Working stress and limit state): Design of slab, beams, columns, footing. retaining walls, tanks, building frames, staircases.

7 Pre-stressed Concrete: Principles of pre-stressing, materials used and their properties, permissible stresses as per I.S. codes, systems of pre-stressing, losses in pre-stress, design of pre-tensioned and post-tensioned beams simply supported, rectangular and T- beams, cable profile, end block design, bridge girder.

8 Construction Planning and Management: Elements of scientific management, elements of material management, safety engineering, network analysis, construction equipment, site layout, quality control.0

9 Computer-aided analysis and design of structures, application of computer programming to structures. numerical methods such as

i. finding area by Simpson's rule, trapezoidal rule;
ii. Finding root of an equation by a) Newton-Raphson techniques b) Bisection method
iii. Solution of simultaneous equations by a) Gauss elimination method, b) Gauss-Jordan method, c) Iteration method.

2. Civil Engineering, Paper -II

Topics

1 Surveying: Classification of surveys, measurement of distances-direct and indirect methods, optical and electronic devices, prismatic compass, local attraction; plane table surveying, levelling, calculations of volumes, contours, theodolite, theodolite traversing, omitted measurements, trigonometric levelling, tacheometry, curves, Photogrammetry, geodetic surveying, hydrographic surveying.

2 Estimating, Costing and Valuation: Specification, estimation, costing, tenders and contracts, rate analysis, valuation

3 Geo-technical Engineering: Geotechnical properties, stresses in soil, shear resistance, compaction, consolidation and earth pressure, stability of slopes, bearing capacity, settlements, shallow and deep foundations, cofferdams, ground water control.

4 Fluid Mechanics: Properties of fluids, fluid statics and buoyancy, kinematics and dynamics, flow measurement, flow in open channel, flow in closed conduits, dimensional and model analysis, losses in pipe flow, siphon, water hammer, boundary layer and control, pipe network.

5 Fluid Machines: Hydraulic turbines, centrifugal pumps, reciprocating pumps, power house, classification and layout.

6 Engineering Hydrology: Hydrological cycle, precipitation, evaporation, infiltration, runoff, hydrographs, reservoir planning & sediment control, floods, flood routing, ground water.

7 Irrigation Engineering: Water requirement of crops, methods of irrigation, lift irrigation, water logging, dams,spillways, energy dissipation, diversion head works, canal and canal structures, cross drainage works, river training works.

8 Highway Engineering: Planning of highway systems, alignment and geometric design, horizontal and vertical curves, grade separation, materials and different surfaces and maintenance, rigid and flexible pavement, traffic engineering.

9 Bridge Engineering: Selection of site, types of bridges, discharge, waterway, spans, afflux, scour, standards,specifications, loads and forces, erection of superstructure, strengthening.

10 Tunnelling: Open cuts, surveys, criteria for selection of size and shapes, driving in soft and hard grounds, mucking, dust control, ventilation, lighting and drainage, special methods of tunnelling.

11 Environmental Engineering

a. Water Supply Engineering: Sources of supply, design of intakes, estimation of demand, water quality standards, primary and secondary treatment, maintenance of treatment units, conveyance and distribution of treated water,rural water supply.

b. Waste Water Engineering & Pollution control: Quantity, collection and conveyance and quality, disposal, design of sewer and sewerage systems, pumping, characteristics of sewage and its treatment, rural sanitation, sources and effects of air and noise pollution, monitoring, standards

c. Solid Waste Management: Sources, classification, collection and disposal