नगरपरिषद अभियांत्रिकी सेवा (सर्वसाधारण) संयुक्त पूर्व परीक्षा अभ्यासक्रम	
अ.क्र.	विषय
1.	मराठी: सर्वसामान्य शब्दसंग्रह, वाक्यरचना, व्याकरण, म्हणी व वाक्यप्रचार यांचा अर्थ आणि उपयोग तसेच उताऱ्यावरील प्रश्नांची उत्तरे
2.	इंग्रजी: Common Vocabulary, Sentence Structure, Grammar, Use of Idioms and phrases & their meaning and comprehension of passage.
3.	सामान्य अध्ययन
3.1	भारताचा विशेषत: महाराष्ट्राचा इतिहास
3.2	भारताचा विशेषत:महाराष्ट्राचा भूगोल
3.3	• भारतीय अर्थव्यवस्था • भारतीय आयात निर्यात • राष्ट्रीय विकासात सरकारी, सहकारी, ग्रामीण बँकांची भूमिका • शासकीय अर्थव्यवस्था - अर्थसंकल्प लेखा ,लेखापरीक्षण इत्यादी • किंमती वाढण्याची कारणे व उपाय
3.4	भारतीय राज्य व्यवस्था: • भारताच्या घटनेचा प्राथमिक अभ्यास, • संसद व राज्य विधान मंडळ इ. • राज्य व्यवस्थापन (प्रशासन) • ग्रामीण व शहरी प्रशासन
3.5	चालु घडामोडी - जागतिक व भारतासंबंधी
3.6	पर्यावरण • मानवी विकास व पर्यावरण, • पर्यावरण पुरक विकास, • नैसर्गीक साधनसंपत्तीचे संधारण • विशेषत,वनसंधारण: . विविध प्रकारची प्रदुषणे व • पर्यावरणीय आपत्ती, पर्यावरण संवर्धनात कार्यरत असलेल्या राज्यजागतिक / राष्ट्र/ संस्था/पातळीवरील संघटना
4	Engineering Aptitude Test (अभियांत्रिकी अभियोग्यता चाचणी)
I	**Applied Machanics (Mathematics) (16 marks)**

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 fast and higher order. Total differentials, differentiation of composite and implicit functions. Elder'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, Machlaurin'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 – (14 marks)**
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, D'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 (10 marks)**
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 masonary.
(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 (10 marks)**
(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 Ist and IInd 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 (10 marks)**
(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.
VI	**Basic Computer Engineering**
1	Principles of Object-Oriented Programming Elements of computer systems, DOS Commands & Linux environment, Language Processors, Object-Oriented Programming Paradigm and benefits, Applications of OOP
2	Object-Oriented Systems Development Object-Oriented Analysis: static and dynamic modeling, and Design: class design and algorithm design, case studies.
3	Beginning with C++ Tokens, Expressions, Control Structures, Array, Functions, Structures and Unions

4	Class and Objects Specifying a Class, Defining Member Functions, Private Member Functions, Static Data and Member Functions, Arrays of Objects, Friend Functions.
5	Working with Files Classes for File Stream Operations and I/O stream operation Opening and Closing a File, Detecting end-of-file, more about Open: File Modes, Sequential Input and Output operations.
6	Introduction to Graphics and data structures Primitive operations, basic operations, line function, circle, ellipse, rectangle, font, color, text, Introduction to data structure and application, searching and sorting.