

**महाराष्ट्र अभियांत्रिकी सेवा, गट- अ व ब संयुक्त (पूर्व) परीक्षा व स्वतंत्र (मुख्य) परीक्षा**  
**Maharashtra Engineering Services, Group-A & B Combined (Pre) Exam. & Separate (Main) Exam.**

- परीक्षेचे टप्पे : १) पूर्व परीक्षा - १०० गुण,  
 २) मुख्य परीक्षा- ४०० गुण,  
 ३) मुलाखत - ५० गुण

**महाराष्ट्र अभियांत्रिकी सेवा संयुक्त (पूर्व) परीक्षा**  
**Maharashtra Engineering Services Combined (Pre) Examination**

प्रश्नपत्रिकांची संख्या - एक

लेखी परीक्षा - १०० गुण,

**परीक्षा योजना**

प्रश्नपत्रिका क्र.	विषय (संकेतांक क्र.२०)	प्रश्न संख्या	गुण	दर्जा	माध्यम	कालावधी	प्रश्नपत्रिकेचे स्वरूप
पेपर क्र.१	मराठी	१०	१०	बारावी	मराठी	दीड तास	वस्तुनिष्ठ बहुपर्यायी
	इंग्रजी	१०	१०	पदवी	इंग्रजी		
	सामान्य अध्ययन (General Studies)	२०	२०	पदवी	मराठी व इंग्रजी		
	अभियांत्रिकी अभियोग्यता चाचणी (Engineering aptitude test)	६०	६०	पदवी	इंग्रजी		

**अभ्यासक्रम**

अ. क्र.	घटक
१.	<b>मराठी</b> : सर्व सामान्य शब्दसमूह, वाक्यरचना, व्याकरण, म्हणी व वाक्प्रचार यांचा अर्थ व उपयोग तसेच उतान्यावरील प्रश्नांची उत्तरे .
२.	<b>इंग्रजी</b> : Common Vocabulary, Sentence structure, Grammar, Use of Idioms & phrases and their meaning and comprehension of passage.
३.	<b>सामान्य अध्ययन :-</b>
	(१) भारताचा विशेषतः महाराष्ट्राचा इतिहास (१८५७ ते १९९०)
	(२) भारताचा विशेषतः महाराष्ट्राचा भूगोल
	(३) भारतीय अर्थव्यवस्था १. भारतीय आयात – निर्यात २. राष्ट्रीय विकासात सरकारी, सहकारी, ग्रामीण बँकांची भूमिका ३. शासकीय अर्थव्यवस्था - अर्थसंकल्प, लेखा, लेखापरीक्षण, इत्यादी.

	४. पंचवार्षिक योजना ५. किंमती वाढण्याची कारणे व उपाय.
	<b>(४) भारतीय राज्यव्यवस्था</b>
	<b>(५) जागतिक तसेच भारतातील चालू घडामोडी :-</b> राजकीय, औद्योगिक, आर्थिक, सामाजिक, शैक्षणिक, भौगोलिक, खगोलशास्त्रीय, सांस्कृतिक, वैज्ञानिक, इत्यादी .
	<b>(६) पर्यावरण :-</b> मानवी विकास व पर्यावरण, पर्यावरण-पूरक विकास, नैसर्गिक साधनसंपत्तीचे संधारण विशेषतः वनसंधारण, विविध प्रकारची प्रदूषणे व पर्यावरणीय आपत्ती, पर्यावरण संवर्धनात कार्यरत असलेल्या राज्य / राष्ट्र/ जागतिक पातळीवरील संघटना / संस्था.
<b>४.</b>	<b>अभियांत्रिकी अभियोग्यता चाचणी (Engineering aptitude test):- (६० प्रश्न/६० गुण)</b>
<b>I)</b>	<b>Applied Mechanics –</b>
<b>a.</b>	<b>Matrices</b> – Types of Matrices (Symmetric, Skew-symmetric, Hermitian, Skew Hermitian, Unitary, Orthogonal 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>b.</b>	<b>Partial Differentiation</b> - 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.
<b>c.</b>	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.
<b>d.</b>	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.
<b>e.</b>	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.
<b>f.</b>	Double Integration – Change the order of integration, Evaluation of double integrals by changing the order of integration and changing to polar form.
<b>g.</b>	Triple Integration and Application of Multiple Integrals – Application of double integrals to compute Area, Mass, Volume. Application of triple integral to compute volume.

<b>II</b>	<b>Engineering Mechanics -</b>
<b>a.</b>	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>b.</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.
<b>c.</b>	Laws of friction, Cone of friction, Equilibrium of bodies on inclined plane. Application of problems involving wedges, ladders, screw friction.

<b>d.</b>	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.
<b>III</b>	<b>Elements of Civil Engineering</b>
<b>a.</b>	<b>Materials and Construction –</b>
(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>b.</b>	<b>Uses of maps and field surveys -</b>
(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.

<b>IV</b>	<b>Elements of Mechanical Engineering</b>
(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.
<b>V</b>	<b>Elements of Electrical Engineering</b>
(1)	D.C. circuits : Kirchoff'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, Thevenin'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.

दिनांक – १५/४/२०१७

अवर सचिव  
महाराष्ट्र लोकसेवा आयोग

**महाराष्ट्र अभियांत्रिकी सेवा (विद्युत), गट –अ व ब (मुख्य) परीक्षा**  
**Maharashtra Engineering Services (Electrical), Gr.A & B**  
**(Main) Exam.**

परीक्षेचे टप्पे :- लेखी परीक्षा - ४०० गुण,

मुलाखत - ५० गुण.

**-: परीक्षा योजना :-**

विषय	संकेतांक	दर्जा	माध्यम	प्रश्नसंख्या व गुण	कालावधी	प्रश्नपत्रिकेचे स्वरूप
विद्युत अभियांत्रिकी पेपर क्र.- १	०२२	बी.ई. (विद्युत)	इंग्रजी	१००/२००	दोन तास	वस्तुनिष्ठ बहुपर्यायी
विद्युत अभियांत्रिकी पेपर क्र.- २	०२३	बी.ई. (विद्युत)	इंग्रजी	१००/२००	दोन तास	वस्तुनिष्ठ बहुपर्यायी

**-: अभ्यासक्रम :-**

**Electrical Engineering- Paper - I**

Sr. No	Topics
1.	Work, Power and Energy, Resistance, capacitance and inductance, DC circuits, KCL, KVL, Network theorems, fundamentals, RL, RC and RLC circuits, Steady state and transient responses. Series and parallel AC circuits, Three phase circuits, Power calculation in balanced and unbalanced circuits, Linear and non linear loads.
2.	Basics of electromagnetic and electro static, series and parallel magnetic circuits, energy stored in fields, types, construction, operation of single and three phase transformers, equivalent circuit and phasor, diagrams, OC and SC tests, regulation and efficiency calculation, parallel operation, field tests before commissioning.
3.	Fundamentals of energy conversion, Construction and theory of DC machine, DC generator characteristics, Starting, braking and speed control of DC motors, Application of DC machines.
4.	Principle, types, performance characteristics, starting and speed control of single phase and three phase induction motors, Equivalent circuits, phasor diagrams, applications. VFD for induction motors. Energy saving opportunities in using VFD.
5.	Principle, types of synchronous motors, performance characteristics, starting and speed control of single phase and three phase synchronous motors, Equivalent circuits, phasor diagrams, applications. VFD for synchronous motors.
6.	Analog and Digital electronics fundamentals, devices and characteristics, amplifier and oscillator circuits, Operational amplifier, Gates, flip-flops, Combinational and sequential circuits, ADC and DACs.
7.	Sensors and transducers, Performance characteristics of measuring instruments, instrument transformers, measurement of physical parameters such as pressure, force, temperature, flow, vibration, torque, etc. Principles of feedback, transfer function, block diagram, steady state error, Steady state and transient specifications, Bode plot, Nyquist plot and Root locus, Relative and absolute Stability considerations.
8.	Power Devices- Types, Characteristics of various power electronic devices, Triggering and protection circuits, Controlled and uncontrolled rectification, DC to DC converters, DC to AC conversion, modulation techniques, SPWM. Fundamentals of electric drives, 4 quadrant operation, theory and analysis

	of DC drives, converter and chopper fed DC drives, Voltage, frequency and V/F controlled drives, slip power recovery schemes, fundamentals of wind power generation and grid interface.
9.	Power generation in India and Maharashtra, Renewable Generation, Various types of power plant, major equipment in power plants, Major issues with wind and solar power generation and grid interface. Steady state performance of overhead transmission lines and cables, per unit quantities, Bus admittance and impedance matrices, symmetrical components.
10.	Calculation of sag and tension in transmission of lines, Analysis symmetrical and unsymmetrical faults, principle of active and reactive power transfer and distribution. Load flow studies, steady state and transient stability, voltage stability, voltage control, economic load dispatch, load frequency control in power systems.

## Electrical Engineering - Paper - II

Sr. No.	Topics
1.	Principle of circuit breaking, arc extinction and arc interruption for AC and DC breaker, Various types of circuit breakers and their applications, Ratings of breakers, isolators and major HV switchgear.
2.	Principle of over current, earth fault, differential, and distance protection. Concepts of solid state and numeric relays. Protection of generator, transformer, transmission lines, substation, busbar, induction motors. Various LT switchgear devices such as MCCB, ELCB.
3.	Specification of impulse wave, multistage impulse generator, insulation coordination, Routine and type tests for cables and transformers, Lightning protection, Early emission arrestors. Power quality issues, Reactive and harmonic compensation, FT devices and their applications, Passive and Active filters, HVDC transmission.
4.	Energy scenario in India, Energy policies, pricing and reforms, Energy conservation Act, 2001, Electricity Act, 2003. Energy management objectives, Electricity billing, electrical load management and MD control, Tariffs, PF improvements and benefits.
5.	Basic terms in lighting systems and features, lamp types and their features, Recommended illumination levels for various tasks, methodology of lighting system energy efficiency study, Illumination system design for residential, commercial, industrial categories. Solar powered illumination and economics associated.
6.	DG set selection and installation factors, Operational features, Energy performance assessment of DG sets, Energy saving majors for DG sets, Synchronization of DGs with utility supply. Parallel operation. UPS technology, types and specifications, Performance assessment.
7.	Pump types and characteristics, Pump curves, Factors affecting pump performance, Efficient pumping system operation, Energy conservation in pumping systems. Fan and compressor types, Fan and compressor performance evaluation and efficient system operation, Compressor capacity assessment, Energy saving opportunities in fans and compressors.
8.	HVAC and refrigeration system, Types of refrigeration system, Common refrigerants and properties, Compressor type and applications, Selection of suitable refrigeration system, Factors affecting performance and energy efficiency of refrigeration plants, Energy saving opportunities.
9.	Underground cable and cable accessories, cable in underground structure, cable installation in conduit, cable joints, cable fault detection, over-current protection and lightning protection of underground systems, operation and maintenance of underground system. Grounding systems, Equipment, Ground fault protection, Isolated neutral grounding, Grounding for hazardous locations, substation, tower grounding.
10.	Substation design, bus designs, substation layout, grounding and ground grid design, substation structures, major substation equipment, auxiliary equipment, substation automation, Commissioning and start up. Industrial, residential and commercial wiring, electrical system design, design and audio and video systems, Lifts and Elevator systems, safety norms and codes. Fire fighting apparatus and systems.

दिनांक – १५/४/२०१७

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