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 स्वरुप
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.	**मराठी :** सर्व सामान्य शब्दसमूह, वाक्यरचना, व्याकरण, म्हणी व वाक्प्रचार यांचा अर्थ व उपयोग तसेच उता-यावरील प्रश्नांची उत्तरे .
२.	**इंग्रजी :** Common Vocabulary, Sentence structure, Grammar, Use of Idioms & phrases and their meaning and comprehension of passage.
३.	**सामान्य अध्ययन :-**
	(१) भारताचा विशेषत: महाराष्ट्राचा इतिहास (१८५७ ते १९९०)
	(२) भारताचा विशेषत: 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.
	(४) भारतीय राज्यव्यवस्था
	(५) जागतिक तसेच भारतातील चालू घडामोडी :- राजकीय, औद्योगिक, आर्थिक, सामाजिक, शैक्षणिक, भौगोलिक, खगोलशास्त्रीय, सांस्कृतिक, वैज्ञानिक, इत्यादी .
	(६) पर्यावरण :- मानवी विकास व पर्यावरण, पर्यावरण-पूरक विकास, नैसर्गिक साधनसंपत्तीचे संधारण विशेषत: वनसंधारण, विविध प्रकारची प्रदूषणे व पर्यावरणीय आपत्ती, पर्यावरण संवर्धनात कार्यरत असलेल्या राज्य / राष्ट्र/ जागतिक पातळीवरील संघटना / संस्था.
४.	**अभियांत्रिकी अभियोग्यता चाचणी (Engineering aptitude test):-(६०प्रश्न/६०गुण)**
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, 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 -**
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**
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**
(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**
(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.

दिनांक – १५/४/२०१७

अवर सचिव
महाराष्ट्र लोकसेवा आयोग

महाराष्ट्र अभियांत्रिकी सेवा (यांत्रिकी), गट-अ व ब (मुख्य) परीक्षा
Maharashtra Engineering Services (Mechanical), Group-A & B (Main) Examination

परीक्षेचे टप्पे:- **लेखी परीक्षा**— ४०० गुण **मुलाखत** - ५० गुण

परीक्षा योजना

विषय	संकेतांक	प्रश्नसंख्या व गुण	दर्जा	माध्यम	कालावधी	प्रश्नपत्रिकेचे स्वरुप
यांत्रिकी अभियांत्रिकी — पेपर क्र. १	९६३	१०० / २००	**बी. ई. (यांत्रिकी)**	इंग्रजी	**दोन तास**	**वस्तुनिष्ठ बहुपर्यायी**
यांत्रिकी अभियांत्रिकी - पेपर क्र. २	९६४	१००/ २००	**बी. ई. (यांत्रिकी)**	**इंग्रजी**	**दोन तास**	**वस्तुनिष्ठ बहुपर्यायी**

-: अभ्यासक्रम :-

Paper — I

Sr. No.	Topic
1.	**Applied Thermodynamics** – Zeroth law of Thermodynamics, First law of Thermodynamics, Second law of Thermodynamics, calculation of work and heat in various processes; Second law of Thermodynamics; Thermodynamics property charts and tables, availability and irreversibility, Thermodynamic relations.
2.	**Fluid Mechanics and Turbomachinery** – Fluid definition and properties, Newton's Law of viscosity concept of continuum, Classification of fluid, Fluid statics, manometry, buoyancy, force of submerged bodies, stability of floating bbodies, viscous flow of incompressible fluid, boundary layer, elementary turbulent flow, flow through pipes, head losses in pipes. Impulse and reaction principles, velocity diagrams, Pelton-wheel, Francis and Kaplan turbines.
3.	**Heat Transfer** – Modes of heat transfer; one dimensional heat conduction, resistance concept and electric analogy, heat transfer through fins; unsteady heat conduction, lumped parameter system, thermal boundary layer, dimensionless parameters in free and forced convective heat transfer, heat exchanger performance, LMTD and NTU methods; radiative heat transfer, Stefan Boltzmann law.
4.	**Refrigeration and Air Conditioning.** Vapour and gas refrigeration and heat pump cycle; properties of moist air, psychrometric chart, basic psychrometric processes.
5.	**Internal Combustion Engine** Classification of I.C. Engine, circle Analysis of IC, SI, CI engines, Super charging/ Turbocharger Performance characteristics of SI and CI, Air pollution due to IC engine and its norms, engine fuels, engine lubricants, engine cooling, Introduction to CNG, LPG, wankle engines etc., Recent development in IC engine.
6.	**Power Plant Engineering** Thermal Power Plant- Analysis of steam cycle – Carnot, Rankine, Reheat cycle and Regenerative cycle. Layout of Power Plant, layout of pulverized coal burners, fluidized bed combustion, coal handling system, ash handling system. Forced draught and induced draught fans, boiler feed pumps, super heater regenerators, condensers, boilers, de-aerators and

	cooling towers. Hydro power plant – Rainfall, run off and its measurement hydrographs, flow duration curve, reservoir storage capacity, classification of plants – run off river plant, storage river plant, pump storage plant, layout of hydroelectric power plant. Nuclear Power Plant – Introduction of Nuclear Engineering, fission, fusion, nuclear materials, thermal fusion reactor and power plant – PWR, BWR, liquid metal fast breeder, reactors, reactor control, introduction to plasma technology. Diesel and gas turbine power plant – General layout, advantage and disadvantage component, performance of gas turbine power plant, combine heat power generation.
7.	**Renewable Energy Sources** ***Solar Energy*** - Solar concentrators and tracking, Dish and Parabolic trough concentrating generating systems, Central tower solar power plants; Solar Ponds. Basic principle of power generation in a PV cell; Band gap and efficiency of PV cells, solar cells, characteristics, manufacturing methods of mono and poly-crystalline cells; Amorphous silicon thin film cells.
	Wind Energy - Basic component of WEC, Type of wind turbine – HAWT, VAWT, Performance parameters of wind turbine, Power in wind, Wind electric generators, wind characteristics and site selection; wind farms for bulk power supply to grid.

Paper - II

Sr. No.	Topic
1)	**Strength of Materials** Stress and Strain, Elastic Constants: Poission's Ratio, Modulus of elasticity, Modulus of rigidity, Bulk modulus, Shear Force and Bending Moment diagram, Deflection of Beams, Thin Cylindrical and Spherical Shells, Strain Energy, Torsion.
2)	**Theory of Machines and Vibration** Kinematics - Structure, Machine, Link and its types, Kinematics pairs, Kinematic chain and mechanism, Grubler's criteria, Inversions of kinematics chains, inversions of-four bar chain, single slider crank chain and double slider crank chain. Displacement, Velocity and acceleration analysis of plane mechanisms; dynamic analysis of linkages; cams; gears and gear trains; flywheels and governors; balancing of reciprocating and rotating masses; gyroscope. Free and forced vibration of single degree of freedom systems, effect of damping , vibration isolation, resonance critical speeds of shafts.
3)	**Design of Machine Elements** Design consideration in castings & forgings, theories of failure, Design for static loadings, Design against fluctuating loads, Design of shafts, Design of springs, Design of belts.
4)	**Materials Technology** Strain Hardening, Constitution of Alloys, Iron-Carbon Equilibrium Diagram, Heat Treatment of Steels, Cast Irons, Introduction to International Standards/Codes, Non Ferrous Metals and Alloys, Fatigue Failure, Creep, Alloy Steels, Strengthening mechanism, Powder Metallurgy.
5)	**Production Process, Planning and Control** Casting, Forming and Joining Processes - Non Destructive Techniques, Mechanics of machining; basic machine tools; single and multi-point cutting tools, tool geometry and materials, tool life and wear; economics of machining; principles of non-traditional machining processes; principles of work holding, design of jigs and fixtures. Forecasting models, aggregate production planning, scheduling, materials requirement planning.
6)	**Mechanical Measurements** Limits, Fits and tolerances; linear and angular measurements; comparators; gauge design; interferometry; form and finish measurements; alignment and testing methods; tolerances analysis in manufacturing and assembly.

दिनांक – १५/४/२०१७

अवर सचिव
महाराष्ट्र लोकसेवा आयोग