

महाराष्ट्र राजपत्रित तांत्रिक सेवा (पूर्व) व (मुख्य) स्पर्धा परीक्षा
Maharashtra Gazetted Technical Services (Pre) and (Main) Competitive Examination

परीक्षेचे टप्पे: १) लेखी पूर्व परीक्षा (संयुक्त) - २०० गुण
 २) लेखी मुख्य परीक्षा (स्वतंत्र) - ४०० गुण
 ३) मुलाखत - ५० गुण

महाराष्ट्र राजपत्रित तांत्रिक सेवा संयुक्त (पूर्व) परीक्षा
Maharashtra Gazetted Technical Services Combined (Pre) Examination

प्रश्नपत्रिकेची संख्या:- एक

-: परीक्षा योजना :-

संकेतांक	विषय	प्रश्नसंख्या	गुण	दर्जा	माध्यम	परीक्षेचा कालावधी	प्रश्नपत्रिकेचे स्वरूप
०१४	मराठी	१००	२००	बारावी	मराठी	एक तास	वस्तुनिष्ठ बहुपर्यायी
	इंग्रजी			पदवी	इंग्रजी		
	सामान्य क्षमता चाचणी			पदवी	मराठी व इंग्रजी		

टीप : नकारात्मक गुणदान — प्रत्येक चुकीच्या उत्तराकरीता २५% किंवा १/४ एवढे गुण एकूण गुणांमधून वजा/ कमी करण्यात येतील.

-: अभ्यासक्रम :-

अ.क्र.	विषय
१)	मराठी - सर्वसामान्य शब्दसंग्रह, वाक्यरचना, व्याकरण, वाक्यप्रचार व म्हणी यांचा अर्थ आणि 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 क्षमता चाचणी
i)	चालू घडामोडी - जागतिक तसेच भारतातील.
ii)	भारतीय राज्यव्यवस्था
iii)	सामान्य विज्ञान व तंत्रज्ञान — अ) भौतिकशास्त्र (Physics), ब) रसायनशास्त्र (Chemistry), क) Remote Sensing, Aerial and drone photography, GIS and it's application etc. ड) Information and communication technology
iv)	भारताचा व महाराष्ट्राचा भूगोल
v)	General mental ability (logical reasoning, analytical ability , problem solving, basic numeracy)
vi)	पर्यावरण :- 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.

Date :- 16/ 06/ 2021

Place :- Mumbai

Under Secretary

Maharashtra Public Service Commission

महाराष्ट्र राजपत्रित तांत्रिक सेवा (मुख्य) स्पर्धा परीक्षा
अभियांत्रिकी सेवा (स्थापत्य), गट - अ व ब (मुख्य) परीक्षा
Maharashtra Gazetted Technical Services (Main) Competitive Examination
Engineering Services (Civil), Gr. A & B (Main) Examination

परीक्षेचे टप्पे :- लेखी परीक्षा - ४०० गुण,

मुलाखत - ५० गुण.

-: परीक्षा योजना :-

विषय	संकेतांक	माध्यम	दर्जा	प्रश्नसंख्या	गुण	कालावधी	प्रश्नपत्रिकेचे स्वरूप
स्थापत्य अभियांत्रिकी पेपर क्र. १	०१८	इंग्रजी	बी.ई. (सिव्हील)	१००	२००	दोन तास	वस्तुनिष्ठ बहुपर्यायी
स्थापत्य अभियांत्रिकी पेपर क्र. २	०१९	इंग्रजी	बी.ई. (सिव्हील)	१००	२००	दोन तास	वस्तुनिष्ठ बहुपर्यायी

-: अभ्यासक्रम :-

Civil Engineering, Paper - I

Sr. No.	Topic
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.
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.

Civil Engineering, Paper –II

Sr. No.	
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.

दिनांक — १५/४/२०१७

अवर सचिव
महाराष्ट्र लोकसेवा आयोग

**महाराष्ट्र राजपत्रित तांत्रिक सेवा (मुख्य) स्पर्धा परीक्षा
अभियांत्रिकी सेवा (विद्युत), गट-अ व ब (मुख्य) परीक्षा
Maharashtra Gazetted Technical Services (Main) Competitive Examination
Engineering Services (Electrical), Gr. A & B (Main) Examination**

परीक्षेचे टप्पे :- लेखी परीक्षा - ४०० गुण,

मुलाखत - ५० गुण.

-: परीक्षा योजना :-

विषय	संकेतांक	दर्जा	माध्यम	प्रश्नसंख्या	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.

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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

अवर सचिव
महाराष्ट्र लोकसेवा आयोग

महाराष्ट्र राजपत्रित तांत्रिक सेवा (मुख्य) स्पर्धा परीक्षा
अभियांत्रिकी सेवा (यांत्रिकी), गट-अ व ब (मुख्य) परीक्षा

Maharashtra Gazetted Technical Services (Main) Competitive Examination
Engineering Services (Mechanical), Gr. A & B (Main) Examination

परीक्षेचे टप्पे:- लेखी परीक्षा— ४०० गुण

मुलाखत - ५० गुण

परीक्षा योजना

विषय	संकेतांक	प्रश्नसंख्या	गुण	दर्जा	माध्यम	कालावधी	प्रश्नपत्रिकेचे स्वरूप
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 bodies, 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.	<p>Power Plant Engineering</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>Diesel and gas turbine power plant – General layout, advantage and disadvantage component, performance of gas turbine power plant, combine heat power generation.</p>
7.	<p>Renewable Energy Sources</p> <p>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.</p> <p>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.</p>

Paper - II

Sr. No.	Topic
1)	<p>Strength of Materials</p> <p>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.</p>
2)	<p>Theory of Machines and Vibration</p> <p>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.</p> <p>Free and forced vibration of single degree of freedom systems, effect of damping , vibration isolation, resonance critical speeds of shafts.</p>
3)	<p>Design of Machine Elements</p> <p>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.</p>
4)	<p>Materials Technology</p> <p>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.</p>

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

महाराष्ट्र राजपत्रित तांत्रिक सेवा (मुख्य) स्पर्धा परीक्षा
कृषि सेवा (मुख्य) परीक्षा

Maharashtra Gazetted Technical Services (Main) Competitive Examination
Agriculture Services (Main) Examination

परीक्षेचे टप्पे :- लेखी परीक्षा - ४०० गुण

मुलाखत - ५० गुण

प्रश्नपत्रिकांची संख्या :- दोन (एक अनिवार्य व एक वैकल्पिक)

-: परीक्षा योजना :-

पेपर क्रमांक	विषय व संकेतांक	प्रश्नसंख्या	गुण	माध्यम	कालावधी	दर्जा	प्रश्नपत्रिकेचे स्वरूप
१ (अनिवार्य)	कृषि - विज्ञान (संकेतांक - ०१५)	१००	२००	इंग्रजी	एक तास	कृषि पदवी	वस्तुनिष्ठ बहुपर्यायी
२ (वैकल्पिक)	कृषि (संकेतांक - १०१) किंवा कृषि अभियांत्रिकी (संकेतांक - १०२)	१००	२००	इंग्रजी	एक तास	त्या - त्या विषयाची पदवी	वस्तुनिष्ठ बहुपर्यायी

वैकल्पिक विषय : कृषि (संकेतांक - १०१) अथवा कृषि अभियांत्रिकी (संकेतांक - १०२) या दोन विषयांपैकी कोणताही एक विषय निवडावा.

सविस्तर अभ्यासक्रम

Paper I (Compulsory)

AGRICULTURE SCIENCE (Code No. 015)

Standard : Degree in Agri. or Agri. Engineering

Total Marks : 200

Nature of Paper : Objective type

Total Questions: 100

Medium : English

Duration : 1 Hour

(1) AGRONOMY (MARKS : 80)

(I) Principles of Agronomy :-

Agronomy :

Its definition, Scope, and role of Agronomist in agriculture.

Classification of Crops :

Agriculture seasons in India and in Maharashtra. Factors affecting crop production.

Tillage :

Factors affecting tillage, type of tillage operations, tillage implements. Effects of tillage on soil and crop growth. Modern concepts of tillage.

Seed :

Qualities of good seed, types of seed, seed testing and seed treatment, different methods of sowing, optimum plant population and geometry. Classification of Seeds.

Cropping systems :

Types of cropping systems, crop rotations, relay cropping.

Weeds :

Definition, methods of weed control, integrated weed management concept.

(II) Agriculture meteorology :

Definition of meteorology, weather and climate elements of weather. Temperature measurement, factors affecting temperature. Solar radiation, significance of solar radiation in agriculture. Factors affecting solar radiation, measurement of solar radiation. Atmosphere pressure its measurement, variation of pressure with height, hydrological cycle. Drought climatology, classification of draught, weather forecasting in agriculture, its classification, techniques of weather forecasting. Forecasting network in India.

(III) Irrigation water management :

Soil water: Sources of water, absorption and movement of water in soil, soil moisture constants, forms of soil water, factors affecting available soil moisture. Absorption of soil moisture by plant. Factors affecting absorption, evaporation, transpiration, consumptive use and effective rainfall.

Irrigation: Water requirement, irrigation requirement of crops, factors affecting water requirement, scheduling of irrigation - different approaches. Depth of irrigation, measurement of irrigation, water use efficiency.

Drainage : Importance of drainage, types of drainage. Effect of bad drainage on soil and crop growth.

(IV) Field crops**(a) Kharif crops including forages, cereals, millets and pulses:****Kharif crops :**

Their importance, Soil and climate requirement varieties, seed and sowing, manure and fertilizer application schedule, water and irrigation needs. Management of weeds and plant protection measures. Crop rotations and cropping systems, harvesting, yield and production potential, seed production.

1. **Cereals and Millets :** Rice, Sorghum, Pearl millet, Maize, Hill millets.
2. **Pulses :** Red gram, Greengram, Blackgram, Horsegram, Cowpea, Kidney bean and Dolichos.
3. **Oilseeds :** Groundnut, sesame, soybean, Castor, Sunflower, Niger.
4. **Fibre crops :** Cotton and Sannhemp.
5. **Commercial crops :** Turmeric and ginger.
6. **Forage crops:** Cowpea, Maize, Jowar, Napier, Rhodes, Paragrass, Subabhul, Shevari (Sesbania ogyptica), stylo, Cluster bean, Marvel, Dinanath, Anjan (Chenclarus ciliaris).
7. **Green manuring crops :** Sannhemp, Dhaincha, Glyricedia.

(b) Field crops (Rabi crops, including forage, oilseeds and commercial crops) :

Rabi Crops :

Their importance, history, distribution and production, growth pattern and critical stages, yield parameters and measures to improve the same. Soil and climatic requirements, varieties, seed and sowing nutritional requirement and manure and fertilizer application schedule, water and irrigation needs, management of weeds and plant protection measures. Crop rotations and cropping systems, harvesting, yield and production potential quality aspects and preparation for marketing, Agronomical practices for seed production. Agronomy of important crops of the region with special emphasis on hybrids.

1. **Cereals :** Wheat, Rabi Sorghum.
2. **Pulses :** Gram and Pea.
3. **Oilseeds :** Linseed, Rapeseed mustard, safflower, sunflower.
4. **Commercial crops :** Sugarcane, sugarbeat, potato.
5. **Forage crops :** Lucern, Berseem, Oat, Summer maize, Summer sorghum.
6. **Summer crops :** Rice, Groundnut, Greengram.

(V) Rainfed Agriculture :

Agroclimatic zones of Maharashtra, Techniques of soil and water conservation, moisture conservation, crop residue management, mulches, minimum tillage, zero tillage, harvesting and recycling of runoff water, Drought resistant crops, contingency planning .

(VI) Farming System and Sustainable Agriculture :

Definition, sustainable agriculture, resource management, components of farming system. Effect of preceding and associated crops.

(2) SOIL SCIENCE (MARKS : 40)

Definition of Soil; Weathering of rocks and minerals, physical and chemical properties of soil. Soil structure, definition, types and its importance in crop production. Soil texture, classes, ion exchange, soil solution, organic matter, soil moisture, Alkaline and Acid soils. Quality of irrigation water, soil survey. Soil fertility and soil productivity. Soil water movement, infiltration, Soil water movement percolation, evaporation and evapo transpiration, essential plant nutrients, organic manures, fertilizers, Integrated Nutrient Management. Eco-friendly farming, Nutrient management in problem soils, preparation of compost, vermicompost, Organic farming, its merits and demerits, mixed, Complex and Compound fertilizers, micro nutrients, liquid fertilizers, Bio-fertilizer, Soil pollution by agro-chemicals.

(3) AGRICULTURAL ENGINEERING (MARKS : 80)

(I) Farm Machinery and Power :

- (a) Sources of Farm Power - Human, animal and mechanical; I.C. engines- principles of operation and different working systems, I. C. engine cycles, terminology connected with engine power and working examples; Tractors- classification, factors affecting the tractor selection, tractor clutches and brakes; power transmission systems-gear trains, differential, final drives and power take off; trouble shootings and remedies; operating cost of tractors and implements; periodical care, repair and maintenance of tractors.
- (b) Tillage- Definition, functions, classification. Primary and secondary tillage implements, related terms and working examples; hitch systems of implements.
- (c) Seed cum fertilizer drill, metering mechanisms, planters, chaff cutters; harvesters and threshers; sickles, mowers, reapers, and combine.

(d) Plant protection equipment - types of sprayers and dusters, principles of operations; uses.

(II) Agricultural Process Engineering :

- (a) Changes occurring in food grains during storage; food grain storage structures; pre-cooling - definition and types; freezing- definition and types; Refrigeration-simple compression refrigeration system; cold storage- meaning and use.
- (b) Determination of moisture content-direct and indirect methods; Drying - principles and methods, types of dryers; factors affecting drying; pasteurization, sterilization, and evaporation.
- (c) Working principles of Agricultural viz. milk, grains and fruits, processing equipments, grinders, mill, graders, cleaners, Separators, seed / treaters.
- (d) Material handling equipments (excluding design) - belt, bucket and screw conveyor; packaging material for agricultural and horticultural produce.

(III) Soil and Water conservation, Watershed Management :

- (a) (i) Principles of watershed management - Watershed - Definition, surveying, leveling, types of survey, objects of surveying, survey instruments.
- (ii) Measurement of distances and area; chain and compass surveying; plane table surveying-radiation and intersection methods; leveling- collimation and rise and fall methods.
- (iii) Watershed characteristics, rainfall pattern, land use capability classification, runoff estimation of volume by rainfall infiltration method, peak rate of run off by rational formula.
- (iv) Soil and water conservation structures used in Maharashtra, Water harvesting, Farm pond.
- (b) Erosion control- biological and engineering measures; temporary and permanent gully control structures; contour bund, graded bund and bench terraces.
- (c) Principles of watershed management.

(IV) Micro Irrigation and Drainage Engineering :

Definition and Concept of micro - irrigation. types of micro irrigation. Design of micro irrigation system. Pump selection - calculation of head, discharge, losses and performance evaluation. Maintenance of pumps and irrigation system. Permeability and hydraulic conductivity of soils. Drainage coefficient, Design and layouts of surface and sub surface drainage system.

(V) Farm Structures :

- (a) Buildings materials - Bricks, cement, sand, mortar, concrete.
- (b) Location and management of farmstead.
- (c) Silo-pit and trench silo; Dairy barns- stanchion and loose housing barns; Poultry houses- wire floored, deep litter and cage house.
- (d) Farm fencing.
- (e) Green house technology-basic approach and scope in India, attributes of green house technology, green house types, materials for green house construction and covering.

PAPER II
AGRICULTURE (OPTIONAL)
(Code No. 101)

Standard : Degree in Agriculture
Medium : English
Nature of Paper : Objective type

Total Marks : 200
Total Questions: 100
Duration : 1 Hour

(1) AGRICULTURAL BOTANY (Marks : 40)

Morphology :

Floral organization and mechanism of pollination, Fertilization; Development of fruits and seeds.

Anatomy:

Cells and tissues - types and junctions.

Cytogenetics :

Cell structure, Mitosis, Meiosis, Chromosome morphology and structure, Gene-enzyme hypothesis, Molecular organisation - DNA, RNA, Genetic code, Protein synthesis, Regulation of gene action. Chromosomal aberration, Polyploidy types and uses. Mutation-macro and micro, chemical and Physiological mutagenesis. Linkage - sex linkage, Sex determination.

Genetics :

Mendelism and laws of inheritance. Mono, dia and tri-hybrid ratio, Gene interactions. Linkage and crossing over. Gene maps, Allelism, Pleiotropism, Penetrance and expressivity, Quantitative inheritance, Extra nuclear inheritance.

Plant Breeding :

Methods of breeding in self pollinated crops, Pure line and Mass selection, Hybridization, Pedigree selection, Bulk population, Back cross, Single seed descent, Multiple crossing, Bi-parental mating, Multilines; Methods of breeding in cross pollinated crops Mass selection, Line breeding, Recurrent selection, Synthetic varieties and Composite varieties. Methods of breeding in sexually propagated crops- Clonal selection and hybridization, New plant breeding tools viz. Tissue Culture, Protoplast Fusion, Somatic hybridization, chromosome multiplication and Genetic Engineering. Sterility and self incompatibility, and its utilization, Inbreeding, Heterosis and its exploitation. Seed production technology in self and cross pollinated crops. Seed certification and processing. Seed deterioration- causes and remedies. Seed legislation in India and quality seed.

Plant Physiology :

Osmotic qualities of cells and their relationship; Transpiration mechanism, Drought resistance and concept of xerophytism. Water use efficiency, photosynthesis mechanism and factors affecting photosynthesis, classification of plants on the basis of photosynthetic mechanism as C₃, C₄ and CAM plants. Photo-respiration, Respiration, respiratory drifts during storage and ripening of fruits and vegetables. Respiratory quotients of starchy, fatty, proteinaceous seeds - its importance. Plant nutrition, translocation of nutrients and photosynthesis and their partitioning, Metabolism of carbohydrates, proteins and fats, Source and sink relationship. Seed germination, dormancy and quiescence, growth and growth analysis related to yield. Photoperiodism, Vernalization Auxin, heteroauxin, growth regulators and inhibitors and their uses.

Social forestry :

Silviculture, Agro-forestry, their importance & scope.

Medicinal and Aromatic plants :

Cultivation, processing, Marketing and uses.

Environmental Science & Agro-ecology :

Agro-ecology - Definition, levels of organisation, relation with other sciences, **Environment** - Definition, components and factors. Ecological groups, Population dynamics, Community dynamics, **Pollution** - types, classification, causes and control measures, **Ecosystem** - Definition, concept and structures, **Agro-ecosystem** - Origin and evaluation, Domestication of plant and animals, Climatic risk, Natural resources & their conservation.

Plant Biotechnology :

Biotechnology – In-vitro culture techniques, Totipotency, Organogenesis. Embryogenesis, types of culture - single cell culture, suspension culture, micropropagation, shoot tip culture and meristem culture. Different stages and production of pathogen free plants. Anther and pollen culture and production of homozygous lines. Embryo culture, Ovule culture and In-vitro fertilization, somaclonal variation, its importance. Protoplast isolation, fusion, somatic, hybrids, cybrids, Techniques of gene transfer. Transgenic plants. Application of Biotechnology in Agriculture- Biopesticides, Biofertilizers, cryopreservation and secondary metabolites.

(2) PLANT PROTECTION (ENTOMOLOGY AND PLANT PATHOLOGY)

ENTOMOLOGY (MARKS : 20)

- A)** General morphology; anatomy and physiology of insects, Classification of insects. Economic importance of insects. Major insect pests of field and Horticultural crops of Maharashtra State, their occurrence, life history, damage and control measures. **Insecticides** - classification and formulations. Beneficial insects (Sericulture, Apiculture and Lac culture etc.)
- B)** Outbreaks of insects and their causes, Pest surveillance, ETL - concept & application, Store grain pests and methods of their control.
- C)** Appliances used in plant protection including HV, LV and ULV sprayers, Safe handling of pesticides, Antidotes for pesticide poisoning.
- D) Pest Management -**
Pest resistance, role of biotechnology in pest management.
- E) Study of non insect-pest:**
Importance of Sanitary and Phyto- Sanitary measures e.g. snail.
- F) Residual effect of insecticide -**
Its testing, national & international standards.
- G) Biological control of insect-pests -**
Definition, methods and scope. Important natural enemies & their host. IPM concept and recent trends in plant protection (Role of chemosterilants, attractants, repellents, pheromones and light traps in pest control)

PLANT PATHOLOGY (MARKS : 20)

- (A)** History and development of plant pathology, economic importance of plant diseases, Nature, position and structure of fungi, bacteria, viruses and mycoplasma, their methods of reproduction and nutrition.
- (B)** Broad classification of fungi and phytopathogenic bacteria. Studies and economic importance of peronosporales, Ustilaginales, Uredinales, Moniliales, Sporophyte, parasites, Symbiosis and their modifications, Polymorphism, Heteroecism, Physiologic specialization and heterothallism.
- (C)** Dissemination and transmission of fungi, bacteria, viruses, mycoplasma and nematodes, Phenomena of infection susceptibility, host reaction.
- (D)** Epidemiology and forecasting, Disease resistance.
- (E)** Symptomology, Flowering parasites, physiological disorders.

(F) Principles of plant diseases & its control, chemical, bio-control their formulation and doses.

(G) Symptoms causal organism, etiology and control measures of the following crop diseases -

Crop	Name of the disease
1) Cotton	Angular leaf spot, root rot, anthracnose, wilt.
2) Sorghum	Smut, Rust, leaf spots, ergot.
3) Groundnut	Tikka or leaf spot, Aspergillus blight/bud blight, rust.
4) Wheat	Rust, smut, leaf blight/spots.
5) Citrus	Dieback, tristeza, greening, nematodes, canker, gumosis.
6) Banana	Bunchy top, mosaic, fusarial wilt
7) Sugarcane	Red rot, smut, grassy shoot
8) Grape	Anthracnose, Downy mildew, powdery mildew
9) Chilli	Die back, mosaic, churda-murda
10) Turmeric	Leaf spot, rot
11) Ginger	Foot rot
12) Onion	Leaf blight, transit and storage diseases
13) Vegetables	Dumping ole, root knot, soft rot, mosaic
14) Paddy	Blight, blast
15) Pigeon-pea	Wilt, Stem canker
16) Greengram/ Blackgram	Powdery mildew.
17) Soyabean	Rust, Bacterial Leaf-spot
18) Sun-Flower	Rust, Powdery mildew
19) Flower crops	Downy mildew, Powdery mildew, Anthracnose, Root rots, wilt, leaf spots, rust, dieback, crown gall.
20) Potato	Brown rot, ring rot, scab, mosaic early and late blight
21) Linseed	Powdery mildew, Rust
22) Sunflower	Powdery mildew, Rust

(3) HORTICULTURE (MARKS : 40)

(A) Cultivation of fruits :

What is horticulture, its importance, scope and branches. Brief study of climate, soil, propagation, varieties, planting, manuring, irrigation, special horticultural practices (pruning, training, bending, notching and bahar treatment), harvesting and maturity indices of important fruit like mandarin, sweet orange, kagazi lime, mango, banana, grape, coconut, arecanut, cashew, papaya, guava, chiku (Sapota), fig, pomegranate, pineapple, ber (Jujube). Scope and importance of dry-land horticulture and crop suitable for dry-land or rain-fed conditions.

(B) Cultivation of vegetables :

Classification of vegetables and type of vegetable farming. Brief study of cultivation of vegetable viz. tomato, chilly, brinjal, peas and beans, cucumber, pumpkin, bitter- gourd, Okra, onion, potato, leafy vegetables and Cole crops.

(C) Cultivation of flowers :

Cultivation of important flower crops, Landscape gardening, its importance and scope. Protected cultivation of vegetables and flowers.

(D) Plant growth regulators & their uses.

(E) Post harvest management and processing :

Post harvest handling and management of important horticultural crops. Principles and methods of fruit and vegetable preservation. Importance and scope of fruit and vegetable preservation. Preparation of various products such as squash, syrup, jams, jelly, marmalade, pickles, ketchup, dehydration, canning of fruits and vegetables, Export-import of horticulture crops.

(4) AGRICULTURAL EXTENSION (MARKS : 30)

Rural Sociology and Community Development:

Meaning and scope of rural sociology and its importance in extension education, Characteristics of rural society, Poverty in rural area, Culture- Meaning, Characteristics, functions and cultural aspects, Rural social groups, Study of rural institutions i.e. family, caste, class, religion, gram panchayat, village schools, co-operative societies and other voluntary organisations, Meaning, necessity scope and Principles of community development, Panchayat-Raj system, Development of leadership, types (opinion & change agent), role, functions, identification and training of leaders, qualities essential for local leaders.

Principles of Extension Education and Educational Psychology :

Principles, Meaning, need, importance and scope of extension education, Philosophy and objectives of extension education, Meaning and scope of educational psychology, Principles of adult education, Basic psychological concepts - instincts, motives, drives, attitudes, intelligence, socialization, and personality development.

Extension teaching methods and aids :

Learning - it's meaning, teaching and learning process, creating effective learning situation, Communication process, elements of communication, mass and interpersonal communication, diffusion of innovations, innovation- decision process, innovativeness and adoption of innovations. Extension teaching methods, classification, purpose, characteristics, planning and use. Factors influencing the selection of extension teaching methods and aids. Relative effectiveness of extension teaching methods and aids. Emerging IT & Other technologies in the field of Agricultural extension.

Extension Administration and Programme Evaluation:

Extension administration- meaning, need and scope, Basic principles of administration, Organization - it's meaning, nature and technical problems of organizations, Programme - planning, meaning, purpose and steps in programme planning, Characteristics of sound programme and its implementation, Extension evaluation - necessity, methods and tools of data collection, measuring devices, Sampling techniques.

(5) AGRICULTURAL ECONOMICS (MARKS : 20)

Economics :

Meaning, definition, consumption, production, factors of productions. Concept of national income and employment, money, inflation.

Agricultural Economics :

Definition, scope and importance. Place of Agriculture in Indian economy, General problems of Agriculture in India, Food problem, population and employment problem, Land holding and productivity, Five year plans & Agricultural development, New Agricultural Policy & Strategy. Existing programmes & Schemes of Central / State Government.

Problems of Agricultural Marketing, regulated market :

Market Functions, Functionaries, Market channel, Market cost, margins, Role of FCI, STC, SWC / CWC, CCI, NAFED, Monopoly procurement of cotton in Agricultural marketing, Cooperative marketing - structures and function, Agriculture price structure - objective of price policy, Support price and price fixation, International trends in Agriculture, implications of GATT / WTO, Export - import of Agriculture commodities, Role of APEDA.

Agricultural credit :

Need, classification and agencies supplying agricultural credit policy, Role of Co-operative sector / Role of various Banks in Agriculture credit.

Farm management and production economics :

Types and systems of farming, principles used in farm management, Low cost, efficient, environment-friendly technology, Farm Cost, different types of cost, Production functions and their types, Farm planning and budgeting, Factor and product relationship, Farm records and accounting. Crop insurance.

(6) ANIMAL HUSBANDRY AND DAIRYING (Marks : 20)

(6-A) Animal Husbandry (MARKS : 10)

1) Breeds : Economic importance of live-stock in India. Classification of breeds of cattle and buffalo, sheep, goat, poultry and exotic breeds.

ii) Farming & Management :

Management different systems of housing, identification, exercises, grooming, dehorning, shearing, trimming of hoof, castration, wallowing, brooding, Farming -goat for meat broiler farming, layer farming, quail farming, duck farming, dairy farming, sheep farming, hatchery management.

iii) Breeding :

Principles of genetics, selection, methods of selection, factors affecting the selection, mating system, traits of economic importance in breeding of all species. Breeding goat, sheep and poultry for meat wool and eggs. Use of exotic breed for augmentation of production under different, Agro-ecological zones.

iv) Reproduction :

Anatomy and physiology of reproductive system of cattle (male & female). Artificial insemination- importance, methods of semen collection, dilution, preservation and transportation, Insemination of animals. Multiple Ovulation and Embryo Transfer Technology (MOET).

v) Nutrition :

Principle of nutrition. Chief constituents of animal and body plant. Digestion and absorption of nutrients in ruminants and non-ruminants. Classification and Composition of feeds, digestion, absorption and metabolism of food nutrients, bio-energetics. Functions of nutrients in animal body. Feeding standards, computation of ration for different ages and for different production functions. Thumb rules of livestock feeding. Utilization of non-conventional feeds. Macro and micro-minerals, vitamins and its role in animal nutrition. Complete feed. A Principles of raising important fodder and grasses. Complete feed preservation. Grass land management and grazing practices. Improving poor quality roughage, UROMOL, UMMB, Quality control of feed. Feed additives- probiotics, enzymes and its importance in nutrition.

(6-B) Dairying (MARKS : 10)

i) Milk and milk product : Production and utilization of milk in India. Milk secretion and its endocrinology. Mammary gland development, theories of milk secretion. Major milk constituents, composition of milk of different species. Factors affecting quality and quantity of milk. Clean hygienic milk production, collection, transportation and Processing of milk - Pasteurization, homogenisation, sterilization and cooling of milk. Important milk products - Dahi, butter, ghee, khoa, channa and ice-cream. Marketing of milk products.

ii) Legal standard and quality control tests : Aseptic packaging of milk and milk products. Detection of common adulterants, Nutritive value of milk. Role of National Dairy Development Board, Indian Dairy Corporation and Public & Cooperative sectors. Dairy in the progress of dairy industry.

(7) FOOD SCIENCE (Marks: 10)

Principles and methods of food preservation, Raw material in food processing, Composition and nutritive value, Unit operations in food processing, Industrial processing of fruits, vegetable, cereal grain, oil seeds, milk and dairy products. Meat and meat products, Eggs and poultry products, Food processing and nutritional quality, Chemistry and technology of fats and oil, Spoilage of foods, Food infections and food toxications, Microbial standards for foods, Toxic constituents in foods, Food quality control, adulterations and Government regulations, Quality attributes of food analysis, Recent development in storage of perishable commodities and food packaging. Food stability and properties of the packaging materials, Food additives, Food colours (natural and synthetic), Food flavours, Food descolourations and rancidities, Food residues and by-products, New food products and development, Food - transportation, marketing and economics.

PAPER II

AGRICULTURAL ENGINEERING (OPTIONAL)

(Code No. 102)

Standard : Degree in Agricultural Engineering

Total Marks : 200

Medium : English

Total Questions : 100

Nature of Paper : Objective type

Duration : 1 Hours

(1) FARM POWER AND FARM MACHINERY (MARKS : 40)

Farm Power :

Human, animal and electric Power, classification of engines, Otto cycles, diesel cycle, two stroke cycle operation, four stroke cycle operation, engine parts, valve types, operation and timing, combustion of hydrocarbon fuels, Carburetors and fuel supply, fuel injection systems for diesel engines, engine governing, air-cleaner, ignition systems, engine performance characteristics, engine trouble shooting.

Agricultural Tractors:

Classification of tractors, power tillers, clutches and brakes, transmission, differential, final drive, power take off, hydraulic system, three point linkage, steering mechanism, tracks and pneumatic tyres, repairs and maintenance of tractors, tractor performance test, cost estimation of tractor power for different operations.

Tillage Machinery :

Soil tillage, forces acting on tillage tools, mechanism of tillage, draft measurement, dynamometer and strain gauge, forces acting on mould board plough, draft of plough, effects of various parameters on draft of ploughs, adjustment of disk ploughs, wet land puddlers, disk harrows, clod crushers, cultivators, hoes, sugarcane earthing up equipment, rotavators, levellers, scrapers, bund former, hitching of drag type implements, hitching of mounted implements.

Planting and Harvesting Machinery :

Types of seed drills & planters, mechanism of seed drills, seed metering devices, furrow openers, ferti-seed drill, ammonia applicator, sugarcane planter, potato planter, paddy transplanter, design of seed drills and planters.

Harvesting methods, types of sickles, threshers, mowers, reapers, binders, forage harvesters, sugarcane harvester, potato digger shaker, Groundnut digger shaker, cotton picker, principles of combine harvesters, Horticultural tools & implements.

Plant Protection Appliances :

Types of sprayers, parts of sprayer-pumps, nozzles and their types, flow rates and spray patterns, factors affecting droplet size, agitation of spray materials, sprayers with hydraulic pumps, air pumps, gaseous energy sprayers and centrifugal energy sprayers, air lane sprayers, types of dusters, parts of duster, repairs and maintenance of sprayers and dusters.

(2) AGRICULTURAL PROCESS ENGINEERING (MARKS : 40)**Drying of Farm Crops :**

Importance and need for drying, moisture content and its measurement, equilibrium moisture content, Drying theory of grains, moisture migration and prevention of moisture accumulation, types of dryers and their operations for grains & Horticultural crops, Psychrometry.

Handling of Agricultural Materials :

Physical, mechanical, rheological, thermal and aerodynamic properties of agricultural materials, material handling equipment namely belt conveyors, screw conveyors, bucket elevators, pneumatic conveyors.

Processing of Agricultural & Horticultural Products :

Importance and need of processing, processing operation- cleaning, sorting and grading etc., principles and operation of air screen, cleaner, specific gravity separator, spiral separator, disk separator and pneumatic separator, size reduction mechanism, size reducing machines, fineness of modules and uniformity index, mixing process analysis, plant layout and cost analysis, food grain storage structures, flow process chart.

Dairy and Food Engineering:

Unit operations in food processing, mass and energy balance, fluid flow, heat transfer and heat exchangers, application of steam in dairy, pasteurisation, refrigeration, separation, evaporation, homogenization, drying and dehydration of food, dairy plant layout and plant sanitation, disposal of dairy plant wastes, Cutting, Blanching, slicing, Principles & techniques of fruit & vegetable preservation, pre-cooling, cold storage, freezing, concentration, dehydration, modified atmospheric storage, packaging .

(3) ELECTRICAL AND OTHER ENERGY SOURCES (MARKS : 20)**Electricity :**

Farm electrical motors-care and maintenance, equipment for the farm-shop, electric fence, feed processing equipment, electrical safety devices, single phase transformer types, construction and testing.

Solar Energy :

Principles of solar energy, collection, flat plate collectors, solar concentrators, different types of solar dryers and cooker, utilization of solar energy for grain drying, air-conditioning and water heating, solar pump, photo-voltaic water pumping system.

Wind Energy:

Wind structure and measurements, wind energy maps and site selection, types of wind mills, their structures and transmission, rotors-pump- generator and control equipment, irrigation planning with wind mills.

Biomass Energy :

Biomass fermentation, different types of bio-gas plants, site selection, design and construction technique of bio-gas plants, utilisation of bio-gas for burners, lamps and I. C. engines.

(4) FARM STRUCTURES (MARKS : 10)

Engineering Properties of materials of construction, Load bearing capacity of Soil and designing of foundation, types of foundations & its function, Plinth, Types of Walls, Types of Roofs and Roof Trusses, King Post, Queen Post, Steel Trusses etc., Flooring types, Doors and Windows and their types, Construction of Farm Roads, Farm Fences, Preparation of Plans for common Agricultural Structures and cost estimation, Green house-Types-materials-designs-principles.

(5) SOIL AND WATER CONSERVATION ENGINEERING (MARKS : 60)

Hydrology:

Hydrologic cycle, precipitation, its types and occurrence, measurement of precipitation, analysis of precipitation data, methods of determining the average depth of precipitation, relation between amount, intensity, frequency and distribution.

Runoff, factors affecting runoff, estimation of runoff rate and runoff volume, development of runoff hydrographs, basic hydrograph, unit hydrograph theory, hydrograph analysis.

Sedimentation :

Sediment, sediment movement and deposition, estimation of bed load and suspended load, measures for sediment control.

Soil Erosion:

Erosivity of rainfall, estimating erosivity from rainfall data, application of erosivity index, erodibility of soil, gully erosion and its control, estimation of soil loss in erosion, universal soil loss equation and its utility, erosion control structures, contour and graded bunds, terraces and broad base terraces. Design and estimates for permanent gully control structures, nala bunding structures, nala training work, design of grass-waterways.

Watershed Management :

Concept of watershed, Delineation of watershed, land use planning, control of erosion by land & crop management practices, control of stream bank erosion, types of flood, Flood control, economics of flood control; erosion control structures in arable & non-arable lands, hydrologic studies in watershed, morphological characteristics of watershed, farm ponds, selection of site for farm ponds, design, estimation and construction of farm ponds and percolation tanks, rainwater harvesting techniques, drought analysis and its application .

(6) IRRIGATION AND DRAINAGE ENGINEERING (MARKS : 30)

Fluid Mechanics :

Pressure and its measurement, types of flow and basic equations of flow, hydraulic and energy gradient line, discharge through orifices and mouth pieces, flow in open channel and pipes, weirs and notches, measurement of flow in open channel and pipes, head calculations, HP requirement.

Irrigation Methods:

Design of various types of irrigation methods for surface irrigation such as borders, ridges, furrows, basins etc., design of sprinkler and drip irrigation, design of lift irrigation schemes, selection of pumps and their installation, repairs and maintenance.

Canal Irrigation:

Terms used in canal irrigation systems, soil irrigability classes, canal water distribution, irrigation scheduling, cross drainage works, various structures on canal and distribution of irrigation water.

Drainage Engineering :

Drainage design criteria, soil permeability, drain-able porosity and its measurement, drainage coefficient and its estimation, methods of surface and subsurface drainage, design of surface and subsurface drainage, design of gravel envelope. Reclamation of saline & alkaline soils.

Ground Water Hydrology :

Occurrence and distribution of ground water, ground water movements, aquifers, Darcey's law, hydraulic conductivity, transmissivity, co-efficient of storage, steady and unsteady flow of water into wells, types of wells, well log, well drilling methods, development of wells, well testing, recuperation test of wells, GIS & its application.

Land Development :

Principles of land levelling and grading, cut fill ratios for various types of soils, methods of land levelling and grading, preparation of plans & estimate and execution of levelling and grading works, land development machinery.

दिनांक — ७/०२/२०१७

अवर सचिव
महाराष्ट्र लोकसेवा आयोग

महाराष्ट्र राजपत्रित तांत्रिक सेवा (मुख्य) स्पर्धा परीक्षा
वन सेवा (मुख्य) परीक्षा

Maharashtra Gazetted Technical Services (Main) Competitive Examination
Forest Services (Main) Examination

परीक्षेचे टप्पे :- लेखी परीक्षा - ४०० गुण

मुलाखत - ५० गुण

प्रश्नपत्रिकांची संख्या :- दोन

-: परीक्षा योजना :-

पेपर क्रमांक व संकेतांक	प्रश्नसंख्या	गुण	माध्यम	दर्जा	कालावधी	प्रश्नपत्रिकेचे स्वरूप
१ General Studies (037)	१००	२००	मराठी व इंग्रजी	पदवी	एक तास	वस्तुनिष्ठ बहुपर्यायी
२ General Science & Nature Conservation (038)	१००	२००	इंग्रजी	पदवी	एक तास	वस्तुनिष्ठ बहुपर्यायी

-: अभ्यासक्रम :-

Paper I- पेपर क्रमांक १-

Sr. No.	General Studies
1.	History of India with emphasis on that of Maharashtra
2.	Physical, Social and Economic Geography of India and the World, Emphasis on that of Maharashtra
3.	Indian polity and Governance. Constitution and Political System, Rural and Urban local self Government
4	Economic and Social Development

पेपर क्रमांक-२

पेपर क्रमांक-२ Paper – II

General Science & Nature Conservation

Sr. No	Topics	
1)	General Science (Physics, Chemistry, Botany, Zoology)	
2)	Nature Conservation	
2.1	1	Soils: - Physical, chemical and biological properties. Processes and factors of soil formation. Mineral and organic constituents of soil and their role in maintaining soil productivity. Soil profile. Problem soils and their reclamation.
	2	Soil and moisture conservation:- Causes of soil erosion, method of control, role of forest, characteristics of and steps in Watershed Management.
2.2	1	Eco Systems: - Types, food chain, food web, ecological pyramids, energy flow, biogeochemical cycle of carbon and nitrogen.
	2	Manures and Fertilizers:- Types, organic – inorganic.
	3	Diseases and pests of plants and animals.
	4	Pesticides and insecticides.
	5	Injurious plants and weeds.
2.3	1	Environmental Pollution:- Types, control, bio-indicators, endangered species, endemism.
	2	Environmental problems related to quarrying and mining.
	3	Greenhouse effect, Carbon trading, Climate Change.
2.4	1	Important wild animals of India.
	2	Breeds of cattle, Economics of fodder and pasture of grassland management.
2.5	1	Important indigenous trees species of India, exotic plants, plants as a source of forest products such as food, fibre, fuel wood, timber, non-timber, forest produce/minor forest produce. Medicinal plants, Energy plantations, Mangroves, Forest based industries.
	2	Factors effecting growth and distribution of plants. Forest types of India.
2.6	1	National parks and Sanctuaries, World heritage sites.
	2	Social forestry, Joint Forest Management, Agro forestry.
	3	Indian forest policy, Indian Forest Act, Wild Life Protection Act, Forest Conservation Act, 1980.
	4	National and International Organization working for nature conservation.
2.7	1	Use of aerial photographs, thematic maps. Satellite imageries, Principle and application of GIS.
	2	Biodiversity, causes of loss of biodiversity, importance of biodiversity conservation.
	3	Plants breeding, tissue culture. Tribal's and forests. Important tribes of India.

दिनांक – १/१०/२०१५

अवर सचिव
महाराष्ट्र लोकसेवा आयोग