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 स्वरुप
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, वाक्प्रचार 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, analitycal ability , problem solving, basic numeracy)
vi)	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.

Date :- 16/ 06/ 2021 **Under Secretary**
Place :- Mumbai **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.

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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 analysi**s**, 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 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 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 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.	**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.

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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

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

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**

-: परीक्षा योजना :-

पेपर क्रमांक व संकेतांक	विषय	प्रश्नसंख्या	गुण	माध्यम	कालावधी	दर्जा	प्रश्नपत्रिकेचे स्वरुप
१ (संकेतांक ५११)	कृषि – विषयक सामान्य ज्ञान	१००	२००	इंग्रजी	एक तास	कृषि पदवी	वस्तुनिष्ठ बहुपर्यायी
२ (संकेतांक ५१२)	कृषि विज्ञान व तंत्रज्ञान	१००	२००	इंग्रजी	एक तास	कृषि पदवी	वस्तुनिष्ठ बहुपर्यायी

नकारात्मक गुणदान -

१) प्रत्येक चुकीच्या उत्तराकरीता २५% किंवा १/४ एवढे गुण एकूण गुणांमधून वजा/ कमी करण्यात येतील.
२) एखाद्या प्रश्नाची एकापेक्षा अधिक उत्तरे दिली असल्यास अशा प्रश्नाचे उत्तर चुकीचे समजण्यात येऊन त्या प्रश्नाच्या उत्तराकरीता २५% किंवा १/४ एवढे गुण एकूण गुणांमधून वजा/कमी करण्यात येतील.
३) वरीलप्रमाणे कार्यपध्दतीचा अवलंब करताना एकूण अंतिम गुणांची बेरीज अपूर्णांकात आली तरीही ती अपूर्णांकातच राहील व पुढील कार्यवाही त्याच्या आधारे करण्यात येईल.
४) एखाद्या प्रश्नाचे उत्तर अनुत्तरित असेल तर, अशा प्रकरणी नकारात्मक गुणांची पध्दत लागू असणार नाही.

-: अभ्यासक्रम :-

Paper – I: General Agriculture

(1) Basics of Agriculture: (120 Marks)

Definition, meaning and its branches. Factors affecting crop production, Agro-Climatic Zones. Cropping Systems: Definition and types of cropping systems, Problems of dry land agriculture. Seed production, seed processing, seed village, Meteorology: weather parameters, crop-weather advisory, System of crop intensification. Organic farming. Major soil types of India and Maharashtra. Fertilizers. Integrated watershed management.

Food production and consumption trends in India. Food security and growing population. Reasons for grain surplus. National and International food policies. Production and procurement; Need for food security, NFSM and other food security related Government initiatives, impact of

Government procurement & distribution. Buffer stock – Objectives & Norms in India. Availability of food grains, per capita expenditure on food. Trends in poverty, public distribution system and below poverty line population, targeted public distribution system (PDS), policy implementation in context to globalization. Processing constraints. Relation of food production to national dietary guidelines and food consumption pattern. Food based dietary approaches to eliminate hunger; nutrient deficiency – micronutrient deficiency: protein energy, malnutrition or protein calorie malnutrition (PEM or PCM) and HRD in context of work capacity of women and children. Food grain productivity and food security.

Ecology and its relevance to man, natural resources, their sustainable management and conservation. Causes of climate change, Green House Gases (GHG), major GHG emitting countries, climate analysis, distinguish between adaptation and mitigation, climate change impact to agriculture and rural livelihood, carbon credit, IPCC, UNFCCC, CoP meetings, funding mechanisms for climate change projects, initiatives by Govt. of India, NAPCC, SAPCC, INDC. Present scenario of Indian agriculture and allied activities; recent trends, major challenges in agriculture. measures to enhance viability of agriculture; Factors of Production in agriculture; Agricultural finance and marketing. Impact of globalization on Indian agriculture and issues of food security; concept and types of farm management.

Concept of rural area. Structure of the Indian rural economy; Importance and role of the rural sector in India. Economic, social and demographic characteristics of the Indian rural economy, causes of rural backwardness, rural population in India, Occupational structure, farmers, agricultural Laborers, artisans, handicrafts, traders, forest dwellers/tribes and others in rural India, Trends of change in rural population and rural workforce, problems and conditions of rural labour.

Precision agriculture: concepts and techniques, Geo-informatics use in precision agriculture. Crop discrimination and yield monitoring, soil mapping; fertilizer recommendation using geospatial technologies. Spatial data and their management in GIS; remote sensing concepts and application in agriculture. Image processing and interpretation; global positioning system (GPS), crop simulation models and their uses, STCR approach for precision nutrient Management; Nanotechnology-concepts and techniques, nano-particles, nano-pesticides, nano-fertilizers, nano-sensors. Use of nanotechnology in seed, water, fertilizer, plant protection.

(2) Land Related Laws (10 Marks)

Maharashtra Land Revenue Code: Definition and terminologies of agriculture, classification of land occupancies, responsibilities and duties of Revenue Officer, Title of State in lands and public roads. Use of lands for agriculture and non- agriculture, encroachment of land. Land revenue, revenue surveys, Assessment and settlement of land revenue, land within the sides of villages. Boundary and boundary works, Lands records, Records of rights, procedures of Revenue Officers.

Maharashtra Tenancy and Agricultural Land Acts, 1948: Concept of tenancy, right of tenants, Tiller's Day, Termination of tenancy, deemed tenancy, Personal cultivation, condition of purchase of agriculture land in Maharashtra, Sale of tenanted land, Confiscation powers of revenue officers.

Essential Commodities Act 1955: Essential commodities act in relation to cotton, sugarcane, food grains, milk and meat, Right to Fair compensation and transparency in land acquisition. Rehabilitation and resettlement Act, 2013.

(3) Agriculture Related Acts (10 Marks)

Scope, benefits coverage and limitations; and subsequent amendments etc. of following Acts in Agriculture and allied sectors:

Agriculture pest and disease act (1950) : Prevention of food adulteration act (1954), Food production order (1956), Indian seeds act (1966), Vegetable oil product Act (1967), Insecticides Act (1968), Agriculture Produce Market Act (1972), Meat Food Products Order (1973), Vegetable Oil product (standard of quality) order (1975), Indian veterinary council act (1984), Consumer protection act (1986), Indian fisheries act (1897), Central agricultural universities act (1992), Destructive insects and pests (Amendment and Validation) act (1992), The Protection of plant varieties and farmers' rights Act (2001), Biodiversity act (2002), Agricultural employees protection Act (2002), Right to information act (2005), Food Safety and Standards Act (2006),National Food Security Act (2013), Model agricultural produce and livestock marketing (Promotion & Facilitation) act, (2017), The-State/UT agricultural produce & livestock contract farming and services (Promotion & Facilitation) act (2018), Food safety and standards Act, 2006 (FSSA), Food safety and Standards authority of India (FSSAI).

(4) Agricultural Schemes (10 Marks)

Agricultural Schemes: PM-Kisan Scheme, Pradhan mantri kisan mandhan yojana (PMKMY), Pradhan mantri fasal bima yojana (PMFBY), Kisan credit card (KCC) scheme.

Rural Development Schemes: Pradhan mantri gram sadak yojana (PMGSY), Mission antyodaya, National social assistance programme (NSAP), Deen dayal antyodaya yojana (DDAY) and MGNREGA.

Other Schemes: National agriculture market (eNAM), National mission for sustainable agriculture (NMSA), Pradhan mantri krishi sinchayee yojana (PMKSY), Paramparagat krishi vikas yojana (PKVY), APEDA.

(5) Agricultural Related General Knowledge and Current Affairs (50 Marks)

Current Affairs in agriculture especially focus on cropping patterns, Irrigation, storage, transport and marketing of agricultural produce, Farm subsidies. Minimum support price (MSP), FRP for Sugarcane. Public distribution system, food security, Food processing & land reforms. Disaster management.

Highlights of agriculture in current union budgets, economic survey, facts and figures in various reports like livestock census, NABARD reports, Economic survey, Current statistical data about area, production and productivity of agricultural, horticultural crops, forest in country and Maharashtra; Currently released technologies/ varieties/products/ breeds of livestock animals etc. by ICAR, National Research Centers, Directorates and SAU's with special reference to Maharashtra. Recent schemes, rules and regulations, norms, Recent farm laws etc. formulated by the government of India and Government of Maharashtra and their impact. Recent facts and figures about agricultural exports and imports.

Recent advancement in agricultural research, ICAR Institutional changes/ updates. States/ National / International awards, fellowships in agriculture and food.

Paper – II: Agricultural Science and Technology

(1) Agriculture (128 Marks)

1.1 Agronomy

Tillage and tilth, Seeds and sowing. Crop density and geometry, Soil Management, Plant ideotypes, Crop adaptation and its distribution.

Earth atmosphere, Atmospheric weather variables; Nature and properties of solar radiation, types, solar constant, depletion of solar radiation, net radiation, albedo; Atmospheric temperature, temperature inversion, lapse rate, daily and seasonal variations of temperature, vertical profile of temperature, Energy balance of earth; Precipitation process, types and classification; Atmospheric humidity, concept of saturation, vapor pressure, process of condensation, formation of dew, fog, mist, frost, cloud; Artificial rainmaking. Monsoon- mechanism and importance in Indian agriculture, Weather hazards and extreme weather conditions, Modifications of crop microclimate, climatic normals for crop. Weather forecasting – types, Climate change, climatic variability, global warming, causes of climate change and its impact. Conservation Agriculture.

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices, Intercropping, pest and disease management and yield of *Kharif, Rabi and* Summer field crops.

Weed classification, harmful and beneficial effects on ecosystem, Reproduction and dissemination of weeds. Herbicide classification, concept of adjuvant, surfactant, herbicide formulation and their use. Introduction to mode of action of herbicides and selectivity. Allelopathy and its application for weed management. Bio-herbicides and their application in agriculture. Herbicide mixture, Herbicide compatibility, Integrated weed management, Herbicide Resistance and management.

Rainfed agriculture, types, Problems and prospects of *rainfed* agriculture; Drought: types, Crop adaptation and mitigation to drought; Crop management in rainfed areas, Contingent crop planning for aberrant weather conditions.

Farming system concept, its types, Farming system components and their maintenance, Cropping system and pattern, multiple cropping system, crop rotation and principles, Efficient cropping systems, Allied enterprises, Tools for determining production and efficiencies in cropping and farming system; Sustainable agriculture, indicators of sustainability, adaptation and mitigation, conservation agriculture strategies, HEIA, LEIA and LEISA and its techniques for sustainability, Integrated farming system, objectives and characteristics, components of IFS, Site specific IFS model for different agro-climatic zones, Resource cycling and flow of energy in different farming system.

Organic farming and its principles, Organic ecosystem concepts; Organic nutrient resources and its fortification; Restrictions to nutrient use in organic farming; Choice of crops and varieties in organic farming; Fundamentals of insect, pest, disease and weed management under organic mode of production; Operational structure of NPOP; Certification process and standards of organic farming; Processing, marketing and export potential of organic products.

1.2 Agricultural Botany

Floral biology and modes of reproduction, cell components and cell division, structure and replication of genetic material, structural changes in chromosome, mutation breeding, gene function and gene regulation, linkages and its estimation, Mendelian principles of heredity, gene interaction, cytoplasmic inheritance, objectives of plant breeding, heterosis and its exploitation, methods of breeding in self pollinated and cross pollinated and asexually propagated crops, self in-compatibility and male sterility, new plant breeding tools, breeding for biotic and abiotic and

	quality traits, seed production technology in self pollinated and cross pollinated crops, procedure of seed certification, diffusion and osmosis, transpiration and stomatal physiology, photosynthesis, respiration, metabolism of carbohydrates, lipids and nucleic acid, plant growth regulators, its uses and physiological role, Cultivation and processing of aromatic and medicinal plants, Agro-ecology, pollution, agro- ecosystem, types of *In-vitro* cultures, advantages and limitations of *In-vitro* culture, stages of micropropagation and its genesis, organogenesis, axillary bud proliferation, somatic embryogenesis and synthetic seed, cell suspension cultures, somaclonal variation, physical, chemical and *Agrobacterium* mediated gene transfer methods, marker assisted selection in crop improvement, secondary metabolites, cryopreservation.
1.3	**Soil Science and Agricultural Chemistry** Soil as a natural body, soil genesis, components of soil, weathering of rocks and minerals, factors of soil formation. Physical, Chemical and Biological properties of soil. Soil survey and soil taxonomy, Land capability classification. soil microorganisms, soil and water pollution, soil quality and health, Reclamation and management of problem soils, Remote sensing and GIS in diagnosis and management of problem soils. Bioremediation of soils, Organic manures, essential plant nutrients and their role. Integrated nutrient management, Chemical fertilizers. Soil fertility and nutrition, Different approaches of soil fertility evaluation. Soil testing methods for available nutrients, critical level of different nutrients, Plant analysis methods, Nutrient use efficiency
1.4	**Animal Husbandry and Diary Science** Breeds: Economic importance of live-stock in India. Classification of breeds of cattle, buffalo, sheep, goat and poultry; Farming and Management: Daily routine practices on livestock farm, Different livestock farming; Breeding: Principles of genetics, selection, systems of breeding livestock for its economic use. Reproduction : Anatomy and physiology of reproductive system of cattle. Artificial insemination. Multiple Ovulation and Embryo Transfer Technology (MOET). Nutrition : Principles of nutrition, Chief constituents of animal body Digestion, absorption and metabolism of various nutrients in ruminants and non-ruminants. Classification and composition of feeds. Role of various nutrients in normal physiology and growth of livestock. Feeding standards, computation of ration for different ages and for different production functions. Thumb rules of livestock feeding. Utilization of non-conventional feeds. Complete feeds. Feed and fodder preservation. Grass land management and grazing practices. Improving poor quality roughage, UROMOL, UMMB. Feed additives and supplements. Cultivation of fodder crops and trees. Milk and Milk Product: Production and utilization of milk in India. 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. Important milk products - concentrated, coagulated, fermented, frozen and dried products. Aseptic packing of milk and milk products. Detection of common adulterants. Nutritive value of milk. Role of Government and NGOs in the progress of dairy industry.
1.5	**Agricultural Economics** Meaning, definitions, Basic concepts of Economics. Methods of Economic Investigation, Economic laws, Micro and Macro economics Meaning, Laws of returns, Cost concepts, Elasticity of Demand and Supply. Definitions and types of credit, Classification of Credit analysis. Sources of agricultural finance, Financing institutions in India. Agricultural Cooperation in India. Agricultural marketing, market structure, marketing mix and market segmentation. Classification of agricultural markets. Producer's and Consumer's Surplus of agri-commodities.

	Market integration, marketing efficiency, marketing costs, margins and price spread, Role of Govt. in agricultural marketing, Risk in marketing. Agricultural prices and policy. Trade, GATT and WTO, Crop Insurance. Factors determining types and size of farms. Principles of farm management, concept of production. Introduction of Statistics and its applications in Agriculture, Classification and graphical representation of data, Dispersion, Probability, probability distribution – Binomial. Use of production function in decision-making on a farm. Correlation and Regression, Sampling – Simple, Random Sampling, Testing of hypothesis, Statistical test- t, F, Z and Chi-square, Basic principles of design of experiments.
1.6	**Agricultural Extension** Objectives, philosophy, principles and evolution of extension systems in India; Extension Education process and approaches; Extension Teaching Methods and Audio-Visual Aids; Programme Planning - Meaning, principles, steps, monitoring & evaluation; Training: Types, Training institutes in India. Extension administration and management: concept, principles, functions and differences; Agriculture journalism; Emerging Trends in agricultural extension such as Private extension, e-extension, cyber extension, market-led extension, farmer-led extension. Communication: Meaning, elements, models & barriers; Diffusion and adoption of innovation; Innovation decision process, adopter categories. Rural sociology concepts such as social groups, social values and attitudes, cultural concepts, social stratification, social institutions, social control, social change, social rural leadership etc. and their importance in agricultural extension. Dimensions of psychology: domains of behaviour, intelligence, teaching-learning process, perception, motivation, attitude, personality etc. Rural Development: Concept, objectives and genesis. Community Development: principles & philosophy. Extension administration and management: principles, functions & differences. Personality Development: Concept and Process; Group Dynamics, Team building, body language, conflict management, time management and public speaking. Entrepreneurship: Entrepreneur-Meaning, types, characteristics; Entrepreneurship-Concept, Process, Government schemes & incentives; SWOT analysis, Project-Formulation & financial analysis; Entrepreneurship skills-leadership, organizational, managerial & problem-solving.
1.7	**Agricultural Entomology** General morphology; anatomy and physiology of insects. Classification of insects. Insect ecology. Economic importance of insects. Major insects and 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, Lac culture etc.). Outbreak of insects and their causes. Pest surveillance, ETL – concept and application. Store grain pests and methods of their control. Appliances used in plant protection. Safe handling of pesticides. Antidotes for pesticide poisoning. Pest Management: Pest resistance, role of biotechnology in pest management. Study of non-insect and pest: Importance of sanitary and phytosanitary measures e.g. snail. Residual effect of insecticides: Its testing, national and international standards. Biological control of insect and pests: Definition, method and scope. Important natural enemies and their host. IPM concept and recent trends in plant protection. Role of Chemosterilants, attractants, repellents, pheromones and light traps in pest control.
1.8	**Plant Pathology** 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. Broad classification of fungi and phytopathogenic bacteria. Studies and economic importance of pernosporales, Ustilaginales, Uredinales, Moniliales, Sporophyte, parasites. Symbiosis and their modifications. Polymorphism, Heteroecism, Physiologic specialization and herrothallism. Dissemination and transmission of fungi, bacteria, viruses, mycoplasma and nematodes. Phenomena of infection susceptibility host reaction. Epidemiology and forecasting.

	Disease resistance. Symptomology, Flowering parasites, physiological disorders. Principles of plant diseases and its control, chemical, bio-control their formulation and doses. Symptoms and causal organism, etiology and control measures of crop diseases. Major diseases of field and Horticultural crops of Maharashtra state. Introduction, history, scope and importance of Agricultural Microbiology. Role of microbes in soil fertility and crop production. Role of Carbon, Nitrogen, Phosphorus and Sulphur cycles in agriculture. Biological nitrogen fixation, symbiotic-asymbiotic association. Role of Azolla, blue green algae and mycorrhiza in agriculture. Techniques in silage, bio-fertilizers, bio-pesticides, bio-fuel production and biodegradation of agro-waste. Mushrooms: edible and poisonous types, nutritive values, cultivation and production techniques of different mushrooms.
(2)	**Agricultural Engineering (16 Marks)**
2.1	**Irrigation and Drainage Engineering** Water Resources of India and Maharashtra, Irrigation scheduling criteria and methods, Quality of irrigation water, Soil-Water–Plant relationship, Water requirement of different Agronomic crops. Evaporation, Transpiration, Evapo-transpiration, Potential-evapotranspiration, effective rainfall and consumptive use of water. Water Use efficiency, Irrigation Efficiencies. Crop water management techniques in problematic areas. Aquifer and its types; classification of wells, artificial groundwater recharge techniques; water lifting devices; classification of pumps, component parts of centrifugal pumps, priming, pump selection, installation, effect of speed on capacity, head and power, effect of change of impeller dimensions on performance characteristics; propeller pumps, mixed flow pumps, deep well turbine pump and submersible pump. Water logging – causes and impacts, drainage, objectives of drainage, Surface drainage coefficient, subsurface drainage, hydraulic conductivity, drainable porosity, water table, Design of subsurface drainage system, drainage pipes, drain envelope, Vertical drainage. Bio-drainage, mole drains, conjunctive use of fresh and saline waters. Basic concepts of command area – definition, Description of components of irrigation canal system, crop water requirement, duty and delta, specific discharge of canal, Canal seepage and lining of canal, diversion head works and canal head regulators, hydraulic jumps, cross drainage works, canal falls, irrigation structures on distributary.
2.2	**Soil & Water Conservation Engineering** Surveying, classification and basic principles, chain surveying, cross staff and compass surveying, plane table surveying, leveling, contouring, computation of area and volume. Introduction of soil mechanics, physical and index properties of soil, seepage analysis, shear strength, compaction, consolidation of soil, active and passive earth pressures, stability of slope. Hydrological cycle, hyetograph, intensity-duration-frequency relationship, hydrological process, evaporation, runoff, hydrograph and its types. Soil erosion- introduction, causes, types of soil erosion, water erosion, soil loss estimation with components of USLE, water erosion, control measures, gully - ravines reclamation, wind erosion, principles mechanics and types of soil movement. Sedimentation. Water harvesting techniques- classification, farm ponds, temporary and permanent gully control measures- design and stability analysis.

2.3	**Farm Power and Machinery** Sources of farm power: Human, animal, mechanical, electrical, solar, wind power and farm mechanization. Principle of operation of Internal Combustion (IC) engine: IC engine types, components of IC engine, working principles of two stroke and four stroke engine, engine terminology. IC engine systems: Air cleaner, fuel and fuel supply system, cooling system, and lubrication system of tractor. Tractor: Tractor types and their selection, operating cost of tractor and attached implements. Primary tillage implements - Mould board (MB) plough, disc plough, rotavator. Secondary tillage implements-Harrows and cultivators. Implements for inter-culturing operations: Hand tools and hoes, tractor drawn intercultural equipments. Seed drills and planters: Sowing methods, seed drill, components of seed drill, fluted seed metering mechanism, types of furrow openers, calibration of seed drill and seed cum fertilizer drill, Planters, functions, seed metering device in planter. Plant protection equipments: Types of sprayers, classification of spraying techniques and dusting machines. Harvesting and threshing machinery: Harvesting and threshing machinery, harvesting methods, mower and combine harvester.
2.4	**Agricultural Process Engineering** Introduction, Unit operations of grain processing. Cleaning and grading, aspiration, scalping. Screens and sieves-Types, classification, Air screen cleaner- and capacity, effectiveness of screens. Various types of separators- specific gravity, magnetic, disc, spiral, pneumatic, inclined draper, velvet roll, colour sorters, cyclone. Size reduction: principle, Bond's law, Kick's law, Rittinger's law, procedure (crushing, impact, cutting and shearing), Size reduction machinery: Jaw crusher, Hammer mill, Plate mill, Ball mill. Sieve analysis and particle size. Drying: moisture content; Free, bound and equilibrium moisture content, isotherm, hysteresis effect, EMC determination. Psychrometric chart and its use in drying, Drying principles and theory, Thin layer and deep bed drying analysis, Falling rate and constant rate drying periods, maximum and decreasing drying rate period. Drying equations, Mass and energy balance. Methods of drying, types of grain dryers. Milling of paddy, Type of rice milling machinery. Modern rice milling – unit operations and machines. Parboiling of paddy – importance and methods. milling of maize- methods and processed products, milling of wheat operations and machineries. Processing of sorghum and millets. Milling of pulses-Unit operation, methods and machines. Processing of oilseeds- Unit operations. Mechanical expression and solvent extraction methods. Mixing: Theory of mixing of solids and pastes, Mixing index, types of mixers for solids, liquid foods and pastes. Material handling equipment. Types of conveyors: Belt, roller, chain and screw. Pneumatic conveying. Bucket Elevator. Cranes & hoists. Trucks (refrigerated/ unrefrigerated), Aero dynamics properties of agricultural products, drag coefficients, terminal velocity. Rheological properties; force, deformation, stress, strain, elastic, plastic and viscous behaviour, Newtonian and Non-Newtonian liquid, Visco-elasticity, Newtonian and Non-Newtonian fluid, Pseudo-plastic, Dilatant, Thixotropic, Rheopectic and Bingham Plastic Foods. Electrical properties.
2.5	**Unconventional Energy Sources and Electrical Engineering** Concept and limitation of Renewable Energy Sources (RES), criteria for assessing the potential of RES, Classification of RES. Solar, Heat, Geothermal, Biomass, ocean energy sources. Comparison of Renewable Energy Sources With non-Renewable Energy Sources. Energy available from Sun. Solar radiation data. Solar energy conversion heat through Flat plate and concentrating collector. Principle of natural and forced convection drying system, Solar Photo voltaics: P-n junctions. Solar cell. PV systems. Energy available from wind. General formula, Lift and drage. Basis of wind energy conversion. working principle of wind power plant .Bio-energy:

	Pyrolysis of biomass to produce solid, liquid and gaseous fuels. Biomass Gasification. Types of gasifiers, various types of biomass cook stoves for rural energy needs. Biogas: types of biogas plants, biogas generation, factor affecting biogas generation and usages, design consideration, advantages and disadvantage of bio-gas spent slurry.
2.6	**Farm Structures** Planning and layout of farmstead. Scope, importance and need for environmental control, physiological reaction of livestock environmental factors, environmental control systems and their design, control of temperature, humidity and other air constituents by ventilation and other methods, Livestock production facilities, BIS Standards for dairy, piggery, poultry and other farm structures. Design, construction and cost estimation of farm structures; animal shelters, compost pit, fodder silo, fencing and implement sheds, barn for cows, buffalo, poultry, etc. Causes of spoilage, Water activity for low and high moisture food and its limits for storage, Moisture and temperature changes in grain bins; Traditional storage structures and their improvements, Improved storage structures (CAP, hermetic storage, Pusa bin, RCC ring bins), Bag storage structures, Shallow and Deep bin. Rural living and development, rural roads, their construction cost and repair and maintenance. Protected cultivation: Components of green house, perspective, Types of green houses, polyhouses /shed nets, Cladding materials, greenhouse effect, light, temperature, relative humidity, carbon dioxide enrichment, Design and construction of green houses. Greenhouse heating – necessity, components, methods, design of heating system. Root media – types – soil and soil less media, composition, estimation, preparation and disinfection, bed preparation. Planting techniques in green house cultivation. Economic analysis.
(3)	**Horticulture (16 Marks)**
	Cultivation of tropical, subtropical and temperate fruits and vegetable crops, plantation crops, spices and condiments, flower crops, potato and tuber crops, dry land horticultural crops and medicinal and aromatic crops. Breeding of fruit, plantation, vegetable, tuber, spices and ornamental crops. Principles of plant breeding, genetics and cytogenetics. Seed production of vegetable, tuber, spices and ornamental crops. Plant propagation and nursery management. Weed management in horticultural crops. Orchard and estate management. Precision farming and protected cultivation of Horticultural crops. Fundamentals of horticulture. Ornamental horticulture and principles of landscape architecture. Growth and development. Introduction to agroforestry. Post-harvest management and processing of horticultural crops.
(4)	**Agricultural Biotechnology (10 Marks)**
	Scope, importance, history and branches of biotechnology: Defination, concepts, chronology and scientific contribution ,Plant and Agricultural biotechnology: tissue culture, concept and applications, Environmental , Industrial biotechnology basic concepts, various techniques and industrial applications, Nano-biotechnology: Nano-particles, nano-fertilizers and applications and future aspects of nano-biotechnology, Recombinant DNA: Introduction, Definition, requirements and evolution, tools in recombinant DNA technology, Molecular markers : Introduction and types- biochemical, morphological and molecular, DNA sequencing: Introduction, Maxam-Gilbert method, Sanger's method and automated sequencing. Genetic transformation: Field, Forest, Horticultural crops, Transgenics development and present status. Bioinformatics: Introduction, scope and importance, Biological databases. Biosafety guidelines: Definition, Biosafety concerns, Biosafety regulatory framework, Agencies and their role, Molecular techniques principles and applications: Southern, Northern, Western blotting, ELISA, PCR.

(5) Agricultural Food Technology (16 Marks)

5.1 Food microbiology

Importance and significance of microbes in food science. Spoilage of cereal and cereal products, Milk and milk products, Meat and meat products, Poultry and eggs, Fish and other sea foods, Fruits and vegetables and canned foods, Sugar and sugar products and salts and spices. Importance, role in fermented foods, organisms involved, beneficial effects, Food borne intoxications and infections, types of food involved, toxicity and symptoms, Types of fermentations; Alcoholic beverages: types, production and quality, Microbial cell products *i.e.* Mushroom, SCP, Baker's yeast, blue green algae and spirulina, Permitted and non-permitted food additives, Microbial standards of fresh and processed foods.

5.2 Food chemistry

Development and History of food chemistry. Introduction of food chemistry, biochemistry and its scope. Food based nutrients: {Carbohydrates, Proteins, Lipids, Vitamins, and Minerals} and its analytical techniques. Formulation of diets, recommended dietary allowances (RDA) for adult and child. Role of food chemist. Moisture in foods, Chemistry of food flavor, Nutraceuticals in food, Food pigments present in animal and plants kingdoms. Food product sampling plan: Sample collection and preparation for analysis. Food based different chromatographic techniques. Role of enzymes for the preparation of food products in co-relation with food industry. Classification of protein isolation and purification. Quantitative and qualitative analysis of food products. Calculation of basal metabolic rate (BMR). Calculation of body mass index (BMI). Nutritional labeling of food products. Role of various national and international agencies in field of human nutrition

5.3 Methods of processing

Minimal processing techniques for food, thermal Processing techniques: High Temperature Short Time Processing, Extrusion, Ultra high temperature, Drying, Dehydration, Evaporation, Concentration, Pasteurization, Sterilization. Low temperature preservation, Dehydro freezing, Lyophilization. Non-thermal processing: High pressure processing, Pulse electric field, Ultrasound, Pulse light, Ultraviolet light, Irradiation, Cold plasma processing, Ultrasonication, Ozone processing, Supercritical fluid extraction.

(6) Agriculture Business Management (06 Marks)

6.1 Agricultural Finance and Insurance

Agricultural Finance – meaning, definition, nature and scope. Agricultural Credit - meaning, Definition, importance and classification based on various criteria.

Credit Analysis - 3 R's of Credit; 5 C's of Credit; and 7 P's of Credit; Repayment Plans.

Financial Statements – meaning, types and uses, Ratio Analysis - current ratio, intermediate ratio, net capital ratio, acid-test ratio, debt-equity ratio, operating ratio, fixed ratio and gross ratio.

Time Value of Money / Principle of Time Comparison – meaning and importance Compounding and Discounting.

History of agriculture financing in India. Nationalization of banks – meaning, it's impact and objectives;

Scale of finance and security for loans. Banking schemes for agricultural finance – Differential Rate of Interest (DIR) Scheme – origin and features; Kisan Credit Card Scheme – origin, objectives and features. Financial inclusion – Jan DhanYojana, financial literacy and business correspondent model. NPAs in agricultural lending: applicability of the SARFESI Act in agricultural lending.

	Financing Agencies: RBI – activities and functions; NABARD – genesis, objectives and functions; AFC – functions; ADB and World Bank – origin and functions; IMF, IFC and IDA. Deposit Insurance and Credit Guarantee Corporation of India (DICGC) – origin and functions. Insurance – meaning and definition. Crop Insurance Scheme – origin, meaning, importance and advantages of crop insurance, Comprehensive Crop Insurance Scheme (CCIS), National Agricultural Insurance Scheme (NAIS), Modified National Agricultural Insurance Scheme (MNAIS), and Weather based Crop Insurance and Fasal BimaYojana and Unified Package Insurance Scheme (UPIS). Assessment of crop losses, determination of compensation, limitations in application and estimation of crop yields. Livestock insurance – origin, meaning and importance and it's schemes.
6.2	**Food Business Management** Introduction to food, food business and it's management, Types and classification of Foods, Food Business, Institutions involved in Food preparation, Marketing and Exporting. Present status of food industry in India – Current market size and future potential – Key drivers for growth. Recent advances in food processing, Quality management in food industry- Food Safety and standards (ISO and Codex). Food traceability. Food preservation methods - Food Packaging and Labelling - Improved food grain storage structures. Logistics management at different stages of marketing the food products. Food business environment and policy. IPR in Food Industry, Entrepreneurship opportunities in food business. Food Economics and Policy, Innovation in food business at domestic and international, Food Business Marketing. Successful business organizations. Food business Environment & Policy, Government, Regulations/Guidelines for food sector. Food Waste management. Food Retailing, Formats of Food Service Industry, Policies related to Food Processing and Markets, Institutions enabling food processing sector viz. Agmark, HACCP, ECOMARK. Food Safety and Standards Authority of India.
6.3	**Agribusiness Project Management** Meaning and definition of project, general features of projects, importance and objectives of project analysis. Categories of projects based on various criteria. Project cycle, stages of project cycle – conception, formulation, appraisal, implementation, monitoring and evaluation. Criteria for appraising projects – ex-ante and ex-post evaluation. Differences between economic and financial analysis in project evaluation. Costs and benefits of agribusiness projects, comparing costs and benefits of agribusiness projects. Externalities – meaning and definition, positive externalities, negative externalities and internalization of externalities, divergence between social costs and benefits of a project. Undiscounted measures of project worth – Accounting Rate of Return (ARR), ranking by inspection, payback period, proceeds per rupee of outlay and average annual proceeds per rupee of outlay. Time value of money - compounding and discounting, choice of discount rate. Discounted cash flow measures of project appraisal – Net Present Worth (NPW), Benefit-Cost Ratio (BCR) and Internal Rate of Return (IRR). Risk and uncertainty. Sensitivity analysis, general kinds of sensitivity analyses, social cost benefit analysis, and rationale for social cost benefit analysis. Project management – meaning, importance and triple constraint. Project management structures - functional organization, project organization and matrix organization - meaning, advantages and disadvantages. Project Rating Index (PRI), Work Breakdown Structure (WBS) and Responsibility Assignment Matrix (RAM / RACI). Network analysis – CPM and PERT. Project financing - sources of financing a project. Business incubators - definition, types and their benefits. Project control - monitoring time performance (Gnatt Charts, Control Charts), performance index and per cent complete index. Project audit and project closure.

(7) Fisheries Science (04 Marks)	
	National and global scenario of aquaculture production. Types and systems of aquaculture. Candidate species for aquaculture. Important live food organisms. Ornamental fish trade. Induced breeding and seed production of commercially important species. Use of therapeutics in aquaculture. Fish diseases and management. Marine and inland fishery resources of India. Current production and production potential. Exports of fish and fishery products. Commercially important fish and shellfish resources. Important crafts and gears used in India. Maximum Sustainable yield and Maximum Economic Yield. Water quality parameters. Environmental amelioratives. Marine mammals, aquatic reptiles, amphibians and birds species of India relevant to fisheries. State fishes of India. GIS and remote sensing in marine capture fishery. Integrated Coastal Zone Management (ICZM). Climate change and fisheries. Disaster management in fisheries. Marine parks and sanctuaries. Conservation programmes for endangered species. Concept of HACCP in fisheries. Different methods of fish preservation and processing. Freezing and packaging technology. Certification system for fish & fishery products. Fish by products and value-added products. Organizational set up of fisheries administration at the Centre and state. Coastal Aquaculture Authority of India and fisheries Institutes in India.
(8) **Home Science (04 marks)**	
8.1	**Food science and human nutrition:** Food groups, Food processing methods, Nutritive value Requirement, functions, sources and deficiency diseases of nutrients; Community Nutrition: National and International programme for improving the nutritional status of community; Determinants of human growth and development, Genetic basis, Stages of human life span, Components/domains of human development, Children with special needs.
8.2	**Resource management and consumer science** Consumer and Market: Consumer Rights, Consumer Markets, Buying Process and Buying Decisions; Financial Security: Types of Family Income, Saving: Avenues and Advantages, Investment: Types, Budget for Money Management
8.3	**Textile and apparel designing** Classification of Textile fiber, Fiber production in India, General properties of different textile fibers, Uses of different textile fibers, Care of clothes of different textile fibers
8.4	**Women in agriculture** Role of women in agricultural and allied sectors, National policy for the empowerment of women- goal and objectives, decision making

दिनांक - ११/०२/२०२२

अवर सचिव
महाराष्ट्र लोकसेवा आयोग