

Annexure III

Syllabus

Paper I

Tamil Eligibility Test, General Studies, Aptitude and Mental Ability

Part A – தமிழ் மொழி தகுதித் தேர்வு (பத்தாம் வகுப்பு தரம்)

Code: 503

அலகு I: இலக்கணம் (25 கேள்விகள்)

எழுத்து: பிரித்து எழுதுதல் – சேர்த்து எழுதுதல் – சந்திப்பிழை – குறில், நெடில் வேறுபாடு – லகர, ளகர, முகர வேறுபாடு – ணகர, ணகர வேறுபாடு – ரகர, றகர வேறுபாடு – இனவெழுத்துகள் அறிதல் – சுட்டு எழுத்துகள் – வினா எழுத்துகள் – ஒருமைப் பன்மை அறிதல்.

சொல்: வேர்ச்சொல் அறிதல் – வேர்ச்சொல்லில் இருந்து வினைமுற்று, வினையெச்சம், வினையாலணையும் பெயர், பெயரெச்சம் வகை அறிதல் – அயற்சொல் தமிழ்ச்சொல், எதிர்ச்சொல் வினைச்சொல் – எழுத்துப் பிழை, ஒற்றுப்பிழை அறிதல் – இரண்டு வினைச் சொற்களின் வேறுபாடு அறிதல்.

அலகு II: சொல்லகராதி (15 கேள்விகள்)

(i) எதிர்ச்சொல்லை எடுத்தெழுதுதல், ஒரெழுத்து ஒரு மொழி, உரிய பொருளைக் கண்டறிதல் – ஒருபொருள் தரும் பல சொற்கள், பொருந்தா சொல்லைக் கண்டறிதல், அகர வரிசைப்படி சொற்களைச் சீர்செய்தல்; ஒருபொருள் பன்மொழி – இருபொருள் குறிக்கும் சொற்கள் – பேச்சு வழக்கு, எழுத்து வழக்கு – சொல்லும் பொருளும் அறிதல் – ஒரு சொல்லிற்கு இணையான வேறு சொல் அறிதல்.

(ii) கோடிட்ட இடத்தில் சரியான சொல்லைத் தேர்ந்தெடுத்து எழுதுதல் – (எ.கா.) பள்ளிக்குச் சென்று கல்வி பயிலுதல் சிறப்பு (பயிலுதல், எழுதுதல்) – வானில் முகில் தோன்றினால் மழை பொழியும் (முகில், நட்சத்திரம்); பொருத்தமான பொருளைத் தெரிவு செய்தல் – (எ.கா.) ஊடகம் – தகவல் தொடர்புச் சாதனம் (செய்தி, தகவல் தொடர்புச் சாதனம்) – சமூகம் – மக்கள் குழு (மக்கள் குழு கூட்டம்); ஊர்ப் பெயர்களின் மரபுவை எழுதுக – (எ.கா) புதுச்சேரி – புதுவை, மன்னார்குடி – மன்னை, மயிலாப்பூர் – மயிலை; பிழை திருத்துக (எ.கா) ஒரு – ஓர் பேச்சு வழக்குச் சொற்களுக்கு இணையான தூய தமிழ்ச் சொற்களை இணைத்தல் – (எ.கா) வெத்தில – வெற்றிலை, நாக்காலி நாற்காலி.

(iii) பேச்சு வழக்குத் தொடர்களிலுள்ள பிழை திருத்தம் – (எ.கா.) நேத்து மழ பேஞ்சது – நேற்று மழை பெய்தது; சொற்களை இணைத்துப் புதிய சொல் உருவாக்குதல்: மற்றும், அல்லது. ஆல், பிறகு வரை, இதுவுமல்ல, இருப்பினும், எனினும், இதனால்; அடைப்புக்குள் உள்ள சொல்லைத் தகுந்த இடத்தில் சேர்த்தல் – (எனவே, ஏனெனில், ஆகையால், அதுபோல, அதனால், வரை, பின்பு) – (எ.கா) நான் காட்டிற்குச் சென்றேன். அதனால் புலியைப் பார்த்தேன் – மாலைநேரம் முடியும் வரை விளையாடுவேன். தேர்வு முடிந்த பின்பு சுற்றுலா செல்லலாம்; பொருள் தரும் ஓர் எழுத்து – (எ.கா) ஆ-பசு, ஈ-கொடு, தை-மாதம், தீ-நெருப்பு; பல பொருள் தரும் ஒரு சொல்லைக் கூறுக – (எ.கா) கமலம், கஞ்சம், முளரி, பங்கயம் இச்சொற்கள் தாமரையைக் குறிக்கும்.

அலகு III: எழுதும் திறன் (15 கேள்விகள்)

(i) சொற்களை ஒழுங்குபடுத்திச் சொற்றொடர் அமைத்தல் – தொடர் வகைகள் – செய்வினை, செயப்பாட்டு வினை – தன்வினை, பிறவினை – ஒருமைப் பன்மை பிழையறிந்து சரியான தொடரறிதல்.

(ii) மரபுத் தமிழ்: திணை மரபு – உயர்திணை: அம்மா வந்தது – அம்மா வந்தாள்: அஃறிணை: மாடுகள் நனைந்தது – மாடுகள் நனைந்தன; பால் மரபு: ஆண்பால்: அவன் வந்தது – அவன் வந்தான்; பெண்பால்: அவள் வந்தது – அவள் வந்தாள்; பலர் பால்: அவர்கள் வந்தார்கள் – அவர்கள் வந்தனர்; ஒன்றன் பால்: அது வந்தன – அது வந்தது; பலவின் பால்: பறவைகள் பறந்தனர் – பறவைகள் பறந்தன; காலம்: நேற்று மழை பெய்யும் – நேற்று மழை பெய்தது; நேற்று வருவேன் – நேற்று வந்தேன்; இளமைப் பெயர்: பசு – கன்று; ஆடு – குட்டி; ஒலிமரபு: நாய் கத்தியது – நாய் குரைத்தது; வினைமரபு: கூடைமுடை, சோறு உண்; தொகை மரபு: மக்கள் கூட்டம் – ஆட்டு மந்தை, நிறுத்தல் குறியீடுகள்: கால்புள்ளி, அரைப் புள்ளி, முக்கால் புள்ளி, முற்றுப் புள்ளி, வியப்புக் குறி, வினாக்குறி அமையும் இடங்கள்.

அலகு IV: கலைச் சொற்கள் (10 கேள்விகள்)

பல்துறை சார்ந்த கலைச் சொற்களை அதாவது அறிவியல், கல்வி, மருத்துவம், மேலாண்மை, சட்டம், புவியியல், தொழில்நுட்பம், ஊடகம், தகவல் தொழில்நுட்பம் உள்ளிட்ட பல்துறை சார்ந்த கலைச் சொல்லுக்கு நேரான தமிழ்ச் சொற்களை அறிந்திருக்க வேண்டும். (உதாரணம்: search engine – தேடு பொறி, வலசை – Migration, ஒவ்வாமை – Allergy, மரபணு – Gene, கடல் மைல் – Nautical Mile).

அலகு V: வாசித்தல் – புரிந்து கொள்ளும் திறன் (15 கேள்விகள்)

கொடுக்கப்பட்ட பத்தியிலிருந்து கேட்கப்பட்ட வினாக்களுக்கு சரியான விடையைத் தேர்ந்தெடுத்தல் – செய்தித்தாள் – தலையங்கம் – முகப்புச் செய்திகள் – அரசு சார்ந்த செய்திகள் – கட்டுரைகள் – இவற்றை வாசித்தல் – புரிந்து கொள்ளும் திறன் – உவமைத் தொடரின் பொருளறிதல் – மரபுத் தொடரின் பொருளறிதல் – பழமொழிகள் பொருளறிதல் – ஆவண உள்ளடக்கங்களைப் புரிந்து கொள்ளும் திறன்.

அலகு VI: எளிய மொழி பெயர்ப்பு (5 கேள்விகள்)

ஆங்கிலம் மற்றும் பிறமொழிச் சொற்களுக்கு இணையான தமிழ்ச் சொற்கள் அறிதல் வேண்டும் – பயன்பாட்டில் உள்ள ஆங்கிலச் சொற்களை மொழிபெயர்த்தல் வேண்டும் (சான்று: pendrive, printer, computer, keyboard) – ஆவணங்களின் தலைப்பு – கோப்புகள் – கடிதங்கள் – மனுக்கள் – மொழிபெயர்ப்பு புரிந்து கொள்ளுதல்.

அலகு VII: இலக்கியம், தமிழ் அறிஞர்களும், தமிழ்த்தொண்டும் (15 கேள்விகள்)

திருக்குறள் தொடர்பான செய்திகள் (இருபது அதிகாரங்கள் மட்டும்) ஒழுக்கமுடைமை, பொறையுடைமை, ஊக்கமுடைமை, விருந்தோம்பல், அறன் வலியுறுத்தல், ஈகை, பெரியாரைத் துணைக்கோடல், வினை செயல்வகை, அவையஞ்சாமை, கண்ணோட்டம், அன்புடைமை, கல்வி, நடுநிலைமை, கூடா ஒழுக்கம், கல்லாமை, செங்கோன்மை, பண்புடைமை, நட்பாராய்தல், புறங்கூறாமை, அருளுடைமை – மேற்கோள்கள் – அறநூல் தொடர்பான செய்திகள் (நாலடியார், நான்மணிக்கடிகை, பழமொழி நானூறு, முதுமொழிக்காஞ்சி, திரிகடுகம், இன்னாநாற்பது, சிறுபஞ்சமூலம், ஏலாதி, அவ்வையார் பாடல்கள்) – தமிழின் தொன்மை, சிறப்பு, திராவிட மொழிகள் தொடர்பான செய்திகள் – உ.வே.சாமிநாத ஐயர், தெ.பொ.யீனாட்சி சுந்தரம். சி.இலக்குவனார் தமிழ்ப்பணி தொடர்பான செய்திகள் – தேவநேய பாவாணர், அகரமுதலி, பாவலரேறு பெருஞ்சித்திரனார், ஜி.யு போப், வீரமாமுனிவர் தமிழ்த் தொண்டு தொடர்பான செய்திகள் – தமிழ்ச் சான்றோர் பற்றிய செய்திகள்: பாவேந்தர், டி.கே.சிதம்பரனாதர், தவத்திரு குன்றக்குடி அடிகளார், கண்ணதாசன், காயிதே மில்லத், தாரா பாரதி, வேலுநாச்சியார், பட்டுக்கோட்டைக் கல்யாணசுந்தரம், முடியரசன், தமிழ் ஒளி உருத்திரங்கண்ணனார், கி.வா.ஜகந்தாதர், நாமக்கல் கவிஞர்.

PART B: General Studies (Degree Standard)

UNIT I: General Science (5 Questions)

Scientific knowledge and scientific temper - Power of reasoning - Rote learning vs conceptual learning - Science as a tool to understand the past, present, and future; Nature of universe - General scientific laws – Mechanics - Properties of matter, force, motion, and energy - Everyday application of the basic principles of mechanics, electricity and magnetism, light, sound, heat, nuclear physics, laser, electronics, and communications; Elements and compounds, acids, bases, salts, petroleum products, fertilizers, pesticides; Main concepts of life science, classification of living organisms, evolution, genetics, physiology, nutrition, health and hygiene, human diseases; Environment and ecology; Latest inventions in science and technology; Current affairs.

UNIT II: Geography of India (5 Questions)

Location - Physical features - Monsoon, rainfall, weather and climate - Water resources - Rivers in India - Soil, Minerals and Natural Resources - Forest and Wildlife - Agricultural pattern; Transport – Communication; Social Geography – Population density and distribution - Racial, linguistic groups and major tribes; Natural calamity - Disaster management; Environmental pollution - Reasons and preventive measures - Climate change - Green energy; Geographical landmarks; Current affairs.

UNIT III: History, Culture of India, and Indian National Movement (10 Questions)

Indus Valley Civilization - Guptas, Delhi Sultans, Mughals, and Marathas - Age of Vijayanagaram and Bahmani Kingdoms - South Indian History; National Renaissance - Early uprising against British rule - Indian National Congress - Emergence of leaders – B.R.Ambedkar, Bhagat Singh, Bharathiar, V.O.Chidambaranar, Jawaharlal Nehru, Kamarajar, Mahatma Gandhi, Maulana Abul Kalam Azad, Thanthai Periyar, Rajaji, Subash Chandra Bose, Rabindranath Tagore, and others; Different modes of agitation: Growth of Satyagraha and Militant Movements; Communalism and Partition; Change and continuity in the socio-cultural history of India; Characteristics of Indian Culture, Unity in Diversity – Race, Language, Custom; India as a secular state, Social harmony; Prominent personalities in various spheres – Arts, Science, Literature and Philosophy.

UNIT IV: Indian Polity (15 Questions)

Constitution of India - Preamble to the Constitution - Salient features of the Constitution - Union, State and Union Territory - Citizenship, Fundamental Rights, Fundamental Duties, Directive Principles of State Policy - Union Executive, Union Legislature - State Executive, State Legislature - Local Governments, Panchayat Raj - Spirit of federalism: Centre - State relationships - Election - Judiciary in India – Rule of Law - Corruption in public life – Anti-corruption measures - Lokpal and Lok Ayukta - Right to Information - Empowerment of Women - Consumer Protection Forums, Human Rights Charter; Political parties and political system in India; Current affairs.

UNIT V: Indian Economy and Development Administration in Tamil Nadu (20 Questions)

Nature of Indian Economy – Five-year plan models - an assessment - Planning Commission and Niti Aayog; Sources of revenue - Reserve Bank of India - Fiscal Policy and Monetary Policy - Finance Commission - Resource sharing between Union and State Governments - Goods and Services Tax; Structure of Indian Economy and Employment Generation, Land Reforms and Agriculture - Application of Science and Technology in Agriculture - Industrial growth - Rural welfare oriented programmes - Social problems - Population, Education, Health, Employment, Poverty; Human Development Indicators in Tamil Nadu and a comparative assessment across the Country – Impact of social reform movements in the socio-economic development of Tamil Nadu - Political parties, and welfare schemes for various sections of people - Rationale behind the reservation policy, and access to the social resources - Economic trends in Tamil Nadu - Role and impact of social welfare schemes in the socio-economic development of Tamil Nadu - Social Justice and social harmony as the cornerstones of socio-economic development; Education and health systems in Tamil Nadu; Geography of Tamil Nadu and its impact on economic growth; Achievements of Tamil Nadu in various fields; e-Governance in Tamil Nadu; Public awareness and General administration - Welfare oriented Government schemes and their utility, Problems in public delivery systems; Current socio-economic issues; Current affairs.

UNIT VI: History, Culture, Heritage, and Socio-Political Movements in Tamil Nadu (20 Questions)

History of Tamil Society, related archaeological discoveries, Tamil literature from Sangam age till contemporary times - Thirukkural - Significance as a secular literature - Relevance to everyday life, Impact of Thirukkural on humanity, Thirukkural and universal values - Relevance to Socio-politicoeconomic affairs, Philosophical content in Thirukkural; Role of Tamil Nadu in freedom struggle - Early agitations against British Rule - Role of women in freedom struggle; Evolution of 19th and 20th century socio-political movements in Tamil Nadu - Justice Party, Growth of Rationalism - Self Respect Movement, Dravidian Movement, and principles underlying both these movements; Contributions of Thanthai Periyar and Perarignar Anna.

PART C: Aptitude and Mental Ability (SSLC STANDARD)

UNIT I: Aptitude (15 Questions)

Simplification - Percentage - Highest Common Factor (HCF) - Lowest Common Multiple (LCM) - Ratio and Proportion - Simple interest - Compound interest - Area - Volume - Time and Work.

UNIT II: Reasoning (10 Questions)

Logical reasoning - Puzzles - Dice - Visual reasoning - Alpha numeric reasoning - Number series.

Paper II

1. Agricultural, Mechanical, Automobile and Civil Engineering (Degree Standard)

Code: 562

Unit I: General Engineering (20 Questions)

Statics of Particles, Equilibrium of Rigid bodies, Properties of Surfaces and Solids, Centroid, Centre of Gravity, Dynamics of Particles, Friction in Machine Elements, Stress, Strain and Deformation of Solids, Theories of Failures, Design of Shafts and Couplings, Fluid statics, equations of continuity and momentum, Bernoulli's equation, Flow through pipes, head losses in pipes, bends, Pumps and its applications, Valves and Types, Iron Carbide Phase Diagram, ferrous and nonferrous alloys, Heat treatment of ferrous and non-ferrous metal, Engineering and commodity polymers, composites, nano-materials, Foundry Technology- Metal Forming Processes, Metal Joining processes, Manufacturing of Thermo Setting and Thermo Plastic Products, Inventory control - Economic Order Quantity (EOQ) - quantity discounts, ABC Analysis, Operations Research, Assignment Model, Critical Path Method (CPM) and Program Evaluation Review Technique (PERT), Queuing Models, Industrial Safety.

Unit II: Surveying and Hydrology (20 Questions)

Surveying – Instruments - Methods of surveying – Linear measurements - Computation of area – Triangulation, intersection, traversing, cross staff survey – Plane table survey – Earth work computation - Simpson's and trapezoidal rule - Levelling - Definition - Types of benchmarks - Different types of levels – Reduced level by rise and fall method and height of collimation method - Contouring – Profile surveying - Cross section survey - Use of Minor instruments - Theodolite survey - Total station - GPS survey. Hydrology – Measurement of rainfall, evaporation and infiltration – Estimation of runoff – Factors affecting runoff – Computation of volume of runoff and peak flow – Unit hydrograph - Occurrence and movement of ground water - ground water exploration techniques - hydraulics of wells, types of wells and their construction - Well drilling – Methods and machinery - Techniques for different formations - Well logging - Types of well screen - Design of well screens - Well development - Yield testing.

Unit III: Soil Erosion and Conservation (15 Questions)

Soil erosion – Types – Factors affecting erosion by water and wind - Stages of water erosion - Biological control measures and their suitability - Contour farming, strip cropping, mixed cropping, intercropping and mulching - Mechanical control measures and their suitability – Design and construction of contour bunds, graded bunds, terraces, contour stone walls, contour trenches, staggered trenches and diversion drain - Gully control structures - Drop spillway, chute spillway, pipe inlet spill way and check dams - Wind erosion – Types and control - Wind breaks and shelter belts - Dry farming techniques for improving crop production - Estimation of soil erosion - Universal Soil Loss Equation.

Unit IV: Watershed Development and Management (15 Questions)

Watershed – Concept, types and delineation - Land capability classification - Participatory Rural Appraisal Technique – Watershed development plan – Estimation of cost and benefits -Gully and ravine reclamation – In-situ & Ex-situ water harvesting, micro catchments – Ground water recharge - Artificial recharge techniques and methods - Farm pond and percolation pond – Selection of suitable soil and water conservation practices – Afforestation – Holistic planning - Watershed based rural development – Use of aerial photography and remote sensing in watershed management - Applications of Remote sensing and GIS in planning and development of watersheds including forest cover and water resources.

Unit V: Farm Irrigation, Structures and Drainage (30 Questions)

Irrigation - Sources – Soil- water- Plant relationship - Water requirement of crops – Measurement of irrigation water - Weirs and flumes - Methods of irrigation - Surface, Sprinkler, Rain gun and drip irrigation - Irrigation automation - Drip irrigation – Components and design - Wetting pattern - Filters and Fertigation tanks - Pump capacity - Operation and maintenance - Sprinkler irrigation - Components - Sprinkler performance - Hydraulic design of sprinkler systems - Duty and delta relationship – Irrigation scheduling - Irrigation efficiencies and their estimation - Pumps - Types, selection and installation - Design and construction of farm structures – Site selection – Quality – RCC - Foundation, basement and

superstructure – Types of roofs – building plan and estimation, requirements of farm house, threshing floor, drying floor, poultry house, dairy farm, rat proof go down and farm roads - Design features earthen dams and gravity dams - Water conveyance structures – Earthen channels and lined channels – Advantages of lining – materials of lining – Design of channel cross section – Crossing control structures – Road crossing structures – Culvert, inverted siphon aqueduct – Their uses - Underground pipe line system – Components and their functions – Structures for plant environment – Green houses, poly houses and shade nets – Construction and utilization - Soilless culture. Drainage - Causes of water logging and salt problem - Methods of drainage - Design of surface, sub-surface and vertical drainage systems - Improvement and utilization of poor quality water - Reclamation of saline and alkali soils.

Unit VI: Farm Power (20 Questions)

Sources of Farm Power- Construction and working of Spark Ignition (SI) and Compression Ignition (CI) engines- Thermodynamic principles of SI and CI engine - Two stroke and Four stroke engines - Turbo charging – Fuel injection systems, Ignition, Lubrication and Cooling systems, Speed governors, Electrical systems of Internal Combustion engines - Different types of tractors, bull dozers and power tillers - power transmission systems, Types of Clutches and Gearboxes, Differential, Final drive system, Braking system – types, constructional details and operation, Steering system - – types, constructional details and operation, Suspension system – types, constructional details, uses of hydraulic system in tractors, hitching system, three point linkage- tractor power outlets. Resistances to vehicle motion, vehicle performance characteristics, Operations using bull dozer, Types of wheels and tyres – Battery: types, constructional details and working principle. Tractor stability - mechanics of tractor implement combination, weight transfer - Ergonomic considerations in operation of tractors, Safety devices in tractors, Maintenance of tractors. Single phase induction motor - three phase power measurement methods- Power factor- Electrical pump sets - regulated DC power supply, DC machine, DC generator, DC motor, starter - torque and efficiency - Electronics in Agriculture - Semi -conductors, transistors, operational amplifiers – Digital electronics, counters, encoders, decoders, Digital to Analog and Analog to digital converter-Instrumentation - transducers - strain gauges, types and gauge factor - force measurement using strain gauges, Torque measurement, pressure measurement, flow measurement temperature measurement, thermocouples, speed measurement microprocessors, microcontrollers, PID controllers, PLC - Electric vehicles in Agriculture.

Unit VII: Farm Machinery (20 Questions)

Earth moving equipment - Back hoe with front end loader, Crawler excavator - Bull dozer - blades-shovels-soil digging machines-primary tillage implements-indigenous plough, Mould board plough, disc plough, chisel plough, sub soiler, methods of ploughing – secondary tillage implements-cultivators, harrows, rotary tillers, rotavator, land shaping machinery- laser leveller, ridger, bund former, raised bed former, puddler. Calculation of field capacity, field efficiency. Sowing and transplanting –seed drills, types - different types of metering mechanisms, planters, broadcasters and rice transplanters, pneumatic planters- intercultural implements - dryland weeders, wetland weeders, manual and power operated weeders - plant protection equipments – sprayers - types of sprayers - Drone sprayer - calibration of sprayer, types of nozzles, drift – harvesters - sickle, mower, cutter bar, reaper, binders, windrowers - threshers - principle of threshing, types of threshers, threshing drums, calculation of output capacity, combines, working principles, components of combine. Root crop harvesters, cotton harvesters, cotton strippers, sugarcane harvester, maize harvesters, vegetable and fruit harvesters, crop residue management machinery - cost estimation of farm machinery.

Unit VIII: Unit Operations in Food and Agricultural Processing (20 Questions)

Heat transfer principles – Conduction, convection and radiation - Types of heat exchangers - Unit operations – Evaporators - Types - Mechanical separation – Filtration – Sedimentation – Settling – Centrifugal separation – Cyclone separation - Size reduction – Mixing – Blending – emulsification - Food processing operations - Pasteurization – Sterilization – Canning - Retort processing - Extrusion processing of foods - Methods of drying of foods – Preservation of food by irradiation - Microwave and dielectric heating - Fats and oil processing – Extraction methods and equipment - Food packaging – Materials and characteristics – Suitability - Processing of milk and milk products, packaging of milk - Principles of refrigeration and applications in food industries – Cold storage of fruits and vegetables - Design aspects

Unit IX: Process Engineering of Agricultural and Horticultural crops (20 Questions)

Engineering properties of food materials – Moisture content – Methods of determination – Psychrometry - Drying – Thin layer and deep bed drying – Types of heat sources and types of dryers - Cleaning and grading – Principles – Separators – Efficiency – Performance index - Shelling and decortication – Seed processing and layout of seed processing units - Rice processing – Parboiling and dehushing of paddy – Machines used - Milling of corn, pulses and millets - Material handling equipments - Conveyors and elevators - Storage – Conditions for safe storage – Bag and bulk storage – Silo storage - Design aspects - Modified atmosphere storage – Storage structures - Equipment used for processing of horticultural crops – Preservation of fresh fruits and vegetables – Drying and dehydration – Processing of coffee, tea, rubber, cashew nut, coconut, oil palm, aromatic plants, flowers and spices.

Unit X: Renewable and Bioenergy (20 Questions)

Solar energy – Solar collectors – Air heaters - Solar dryers – Water heaters - Solar cold storage– Solar photovoltaic systems and applications- Solar PV pump, fencing - Wind energy - Suitable sites – Types of wind mills – Wind mill components – Applications – Performance of wind mills - Biomass resources – Agro residues – Characteristics - Conversion technologies – Biochemical conversion – Biogas plant – Types and selection, construction, operation and maintenance - Slurry handling - Thermochemical conversion – Stoves – Types - Improved stoves – Pyrolysis – Charcoal production – Gasification – Briquetting – Alternate renewable energy systems - Hydro power, Geothermal, ocean and hydrogen energy- Energy storage systems- Energy Conservation- Cogeneration - Energy plantation and environmental impact – Global warming – Clean development mechanism (CDM) and role of afforestation - Biofuels – Biodiesel feedstock, production and by-product utilization – Ethanol – Production and utilization – Emission - Standards and control.

2. Agriculture (Degree Standard)

Code: 491

Unit I: Importance of Agriculture (10 Questions)

Importance of Agriculture in Indian Economy and its sectoral relationship - Agricultural Development through five year plans in India and Tamil Nadu - Growth pattern of crops in India and Tamil Nadu in terms of area, production and productivity - Government Agricultural Policies – Agricultural development through NITI AAYOG – import and export – role of NSC, FCI and PDS - Sustainable Developmental Goals.

Unit II: Fundamentals of Crop Production (20 Questions)

Factors of Production - Agricultural seasons of India and Tamil Nadu - Cropping patterns in India and Tamil Nadu - package of practices of different crops – Agro-Climatic zones of India and Tamil Nadu and their features - Weather and Climate - Weather forecasting – Remote sensing and GIS application - Climate change and its impact – Minimal tillage practices – Stress mitigating technologies including microorganisms – Nanoparticles and their applications – Natural farming and Bio-inoculants – Organic certification and standards – Drone technology in Agriculture.

Unit III: Natural Resource Management (20 Questions)

Soil - Soil structure - Factors influencing soil structure - Physical and Chemical properties - Effect of nutrient availability and plant growth – Soil health - Problem soils and their management - Soil survey - its objectives and scope - Soil fertility and productivity – Soil testing – Chemistry of Macro and Micro Nutrient – Soil health - Integrated Nutrient Management - Dry farming - Rainfed agriculture - Conservation of soil and water - Watershed and waste land development. Land use pattern and planning - Size and distribution of holdings - types and systems of farming - Water resources development and management - Command area development - Ground water Development and Conjunctive use - Water use efficiency - Quality of irrigation water - Its effect in soil and crops - Management of poor quality water for crop growth.

Unit IV: Crop Management & Allied Agricultural Activities (24 Questions)

Cropping systems and integrated farming - Recycling of agricultural waste - Organic manures, green manures, bio fertilizers - Balanced usage - integrated nutrient management - Physiological disorders in

crop plants and their management - Plant growth regulators – Regulation of flowering – Classification of stresses – Physiological adaptation of crop plants for abiotic stress - Irrigation management of different crops, Mushroom cultivation, bee keeping, silkworm rearing etc., Energy in Agricultural production - Sources - Solar, wind, animal, biomass and biogas - Mechanization in agriculture - Tractors & tillers - Agricultural implements and Machineries and their usage - livestock and poultry rearing.

Unit V: Crop Improvement (26 Questions)

Principles of breeding - Breeding methods in self, cross and vegetatively propagated crops - Modern tools in crop improvement – Heterosis breeding and Hybrid seed production technologies – Synthetic and composites – Breeding for biotic, abiotic and quality traits. Latest varieties of major crops in Tamil Nadu – Variety release procedures - Application of bio technology in Agriculture - Tissue culture & its significance - Transgenic Plants - Marker assisted selection – Markers - mapping population - speed breeding - Plant Genetic Resources: Collection conservation and exchange-Crop varietal protection-PPV& FR authority and its role.

Unit VI: Seed Science and Technology (20 Questions)

Seeds - Importance of quality seeds in Agriculture – Nucleus, Breeder, foundation, certified and labelled seeds – Characterisation of good quality seeds - Seed certification techniques and processing in Tamil Nadu - Seed testing – Seed testing laboratories-ISTA standards for seed testing - seed village concept Seed Act - Seed coating and priming technologies - Seed enhancement technologies – Varietal deterioration of crops – causes and maintenance – Post harvest handling of seeds.

Unit VII: Crop Protection Principles and Practices (24 Questions)

Importance of pest, disease, nematodes and weed management in agriculture – categories of pests, diseases, nematodes and weeds - pest and disease surveillance and weather forecasting on pest and disease incidence - Symptoms of damages, biology and control measures of pest, disease and nematodes of major crops in Tamil Nadu - Integrated pest, disease and nematode management in crop production - Pesticides and their use in IPM – mode of action - Pattern - plant protection equipments and their use - Plant quarantine - Storage pests, disease and nematodes and their management - Importance of biological control in pest, disease and nematode management - Weeds - Major weeds and their control – Pollinators and their safety – Banned and Next generation agro-chemicals.

Unit VIII: Farm Business and Finance Management (20 Questions)

Farm business management - Principles of farm business management – Types and systems of farms-Classical Production Functions - Cost concepts - Management of resources - Farm Planning and budgeting - Investment analysis – Risk and uncertainties in Agriculture - Agricultural credit system in India - Multi credit delivery system - Role of nationalized banks, NABARD and Regional Rural Banks - Lead Bank Scheme - Service area approach - Scale of finance-Credit Worthiness-3Rs,5Cs and 7Ps of credit-Crop Insurance - Kisan Credit Cards (KCC) - Agricultural Insurance Company.

Unit IX: Agricultural Marketing and Market Intelligence (20 Questions)

Marketing - Agricultural marketing - Market structure – Marketing Efficiency - Price Spread-Market Integration-Market Risk-Speculation and hedging - Market Institutions- Warehouses and rural godowns - Agmark-Cooperatives - Commodity Boards – Agri business management – Farmer Producer Organisations and Agri-business incubation - Principles of Management-Entrepreneurship - Development - Forms of Business organizations - Agricultural Price Policy - CACPMSP - FRP- Procurement Price-Policies for agricultural development - Economic liberalization - WTO and its impact on agricultural export - IPR – APEDA – International trading in agricultural commodities - Importance of Agriculture in Indian economy - Land size and distribution of holdings and land use pattern in Tamil Nadu - Agriculture under Five Year Plans (FYPs) - Food Security - Public Distribution Systems (PDS) - Buffer Stock.

Unit X: Agricultural Extension: Principles and Methods (16 Questions)

Extension methods for transfer of technology - AV aids-Communication models - Use of ICT in transfer of technology-Diffusion and adoption- Pre and post independent rural development initiatives: key features, strength and weakness of individual programmes - Programme planning and evaluation methods- Rural sociology - key features of Indian rural system-value system-social change- rural migration. Role of women

in Agriculture – Social organisations and Non-Governmental organisations – Extensions / Agricultural Developmental programs by ICAR / Government –e-Agriculture and Digital Tools.

3. Agriculture, Chemistry, Zoology and Botany (Degree Standard)

Code: 518

Unit I: Agriculture and Its Principles (20 Questions)

Area, production and productivity of crops in India and Tamil Nadu - Government Agricultural Policies – Role of NSC, FCI and PDS - Agricultural seasons, cropping patterns and agro climatic zones of India and Tamil Nadu – Package of practices of different crops – Classification of stress and mitigating technologies - Nanoparticles and their applications – Natural farming - Organic certification and standards – Drone technology in Agriculture. Soil health - Problem soils and their management - Soil survey - Its objectives and scope – Soil fertility and productivity – Soil testing – Integrated Nutrient Management. Quality of irrigation water - Its effect in soil and crops – Chemistry of Macro and Micro Nutrient - Physiological disorders in crop plants and their management – Energy in Agricultural production - Sources-Solar, wind, animal, biomass and biogas – Agricultural implements and Machineries and their usage.

Unit II: Crop Improvement (25 Questions)

Principles of breeding - Breeding methods in self, cross and vegetatively propagated crops - Modern tools in crop improvement – Heterosis breeding and Hybrid seed production technologies – Synthetic and composites – Breeding for biotic, abiotic and quality traits. Latest varieties of major crops in Tamil Nadu – Variety release procedures - Application of biotechnology in Agriculture - Tissue culture & its significance – Transgenic Plants - Marker assisted selection – Markers - Plant Genetic Resources Collection conservation and exchange – Crop varietal protection - PPV& FR authority and its role. Seeds – Importance of quality seeds in Agriculture – Nucleus, Breeder, foundation, certified and labeled seeds – Characterisation of good quality seeds – Seed certification techniques and processing in Tamil Nadu - Seed testing – Seed testing laboratories - ISTA standards for seed testing - seed village concept. Seed Act - Seed coating and priming technologies – Seed enhancement technologies – Varietal deterioration of crops – causes and maintenance – Post harvest handling of seeds.

Unit III: Crop Protection Principles and Practices (25 Questions)

Importance of pest, disease, nematodes and weed management in agriculture – categories of pests, diseases, nematodes and weeds - Migratory pests – Pest and disease surveillance and weather forecasting on pest and disease incidence - Symptoms of damages, biology and control measures of pest, disease and nematodes of major crops in Tamil Nadu - Integrated pest, disease and nematode management in crop production - Pesticides and their use in IPM – mode of action – plant protection equipments and their use – Plant quarantine - Storage pests, disease and nematodes and their management - Importance of biological control in pest, disease and nematode management – Weeds - Major weeds and their control – Pollinators and their safety – Banned and next generation agro chemicals - Fumigation methods - Insecticide residue and MRL.

Unit IV: Farm Business Management and Economics (20 Questions)

Farm business management - Cost concepts - Management of resources - Farm Planning and budgeting - Investment analysis – Risk and uncertainties in Agriculture - Agricultural credit system in India - Multi credit delivery system - Role of nationalized banks, NABARD and Regional Rural Banks - Crop Insurance - Kisan Credit Cards (KCC) – Agricultural marketing – Market structure – Marketing Efficiency - Market Risk - Speculation and hedging - Market Institutions - Warehouses and rural go downs – Agmark - Cooperatives - Commodity Boards – Agri business management – Farmer Producer Organisations and Agri-business incubation - Agricultural Price Policy - CACPMSP – FRP - Procurement Price - Policies for agricultural development – International trading in agricultural commodities - Food Security - Public Distribution Systems (PDS) - Buffer Stock - Extension methods for transfer of technology – AV aids – Communication methods - Rural sociology- Social organisations and Non-Governmental organisations – Developmental programs by ICAR / Government – e-Agriculture and Digital Tools.

Unit V: Analytical Chemistry and Fertilizers (20 Questions)

Preparation of standard solutions – Indicators, Buffer solutions, Molarity, Normality – Principles of Volumetric Analysis - Different types of titrations – Gravimetric Analysis – Basic principles and instrumentation of column, TLC, Gas Chromatography and HPLC.

Preparation, properties and uses: Urea, Ammonium Nitrate – Calcium ammonium nitrate, ammonium phosphate and super phosphate

Unit VI: Carbohydrates and Amino Acids (15 Questions)

Carbohydrates: Classification, Sources, Preparation and reactions – Glucose, Fructose, Sucrose and lactose – Structure of glucose and fructose.

Amino Acids: Classification – Zwitter ion – peptide linkage – Structure of proteins

Unit VII: Systematic Botany (20 Questions)

General features, structure, reproduction and economic importance of Algae, Bryophytes, Pteridophytes and Gymnosperms. General characters, occurrence, mode of nutrition and reproduction of fungi. Harmful effects of fungi on plants. General symptoms and control measures of viral, bacterial and fungal diseases. Whittaker's five kingdom classification. Koch postulates. Disease cycle culture of microorganisms pure and batch culture. Morphological features and modifications of Leaves, Flower and Inflorescence, fruits, stem and root. Botanical nomenclature – rules and typification. ICNAFP. APG system of classification. Influence of biotic and abiotic factors on vegetation. Eco system and its components. Pollution types and its control measures. Natural Disaster Management. Biodiversity and its conservation.

Unit VIII: Developmental Botany (20 Questions)

Meristems and Tissues (Simple and Complex). Structure and development of Anther and Ovule. Double fertilization and Triple fusion seed – Structure, germination, viability and dormancy. Ultrastructure of prokaryotic and Eukaryotic cell. Morphology, types and functions of chromosomes. Mendelian genetics. Sex determination in plants. Absorption of water and minerals mineral nutrition in plants. Physiological role of growth regulators photosynthesis – Light and Dark reaction. Respiration – types, Kerb's and glycolysis, CAM pathway.

Unit IX: Non-Chordata and Chordata: (15 Questions)

Non-Chordata: General organization - Classification upto classes. Prochordata - Amphioxus. Chordata - General organization- outline classification upto class level. Symmetry and Coelom. Outline classification of insects - Morphology, mouthparts, and life cycle - Hormonal development - Social life in insects - Beneficial and harmful insects – Traps and their types in godown - Physical, chemical, biological and pheromone traps.

Unit X: Physiology and Biochemistry (20 Questions)

Biochemistry: Biomolecules - Structure and functions of carbohydrates, Proteins and lipids. Physiology: Digestion, Nutrition, balanced diet and assimilation. Composition of blood. Nerve impulses and conduction. Cell Biology: Cellular organelles - Structure and functions - DNA structure and function and replication. Immunology: Types of immunity, antigen and antibody- Vaccination. Genetics: Sex chromosomes - Genetic disorders. Developmental Biology: Gametogenesis - Fertilization. Environmental Biology: Ecosystem, structure and functions - Intra and inter specific association. Evolution: Theories of evolution - Mimicry in Evolution - Fossils and Human evolution.

4. Archaeology (PG Degree Standard)

Code: 420

Unit I: Cultural History of Tamil Nadu (14 Questions)

Primary Sources - Cultural History: Sangam Age, Post - Sangam Age, The Pallava, Pandya, Chola, Chera, Vijayanagara and Nayaka periods – Socio-Economic and Religious Life – Trade and Commerce – Science and Technology.

Unit II: History of Archaeology (16 Questions)

Development of Archaeology in the World: Archaeological Theories – Development of Archaeology in India: Indological Studies, William Jones, James Prinsep, Alexander Cunningham, John Marshall and

Mortimer Wheeler - Development in the Post-Independence Period: Archaeological Survey of India, Tamil Nadu State Department of Archaeology and University Departments - National Mission on Monuments and Antiquities (NMMA) – National Monument Authority (NMA)

Unit III: Field Archaeology (24 Questions)

Exploration Methods and Techniques - Excavation Methods and Techniques – Archaeological Stratigraphy – Marine Archaeology- Geoarchaeological Applications -Dating Methods: Absolute and Relative –Analysis of excavated materials– Scientific analysis – Documentation – Interpretation and Excavation Report Writing

Unit IV: Pre and Proto History of India (24 Questions)

Indian Prehistory - Geoarchaeology - Lower Palaeolithic, Middle Palaeolithic and Upper Palaeolithic Cultures - Mesolithic Culture – Neolithic Culture – Rock Art in India - Chalcolithic Cultures – Harappan Culture – Iron Age / Megalithic Culture - NBPW Culture. Archaeological Sites: Teri Sites, Adichanallur, Sivakalai, Mayiladumparai, Paiyampalli, Pattaraiperumpudur and Attirampakkam

Unit V: Epigraphy and Palaeography (30 Questions)

Epigraphy as a Source- History of Indian Epigraphy – Harappan Signs and Graffiti - Palaeography: Brahmi and Kharoshti Scripts – Asokan Inscriptions – History of Epigraphy in Tamil Nadu -Origin and Development of Tamizhi (Tamil - Brahmi), Vattezhuttu, Tamil and Grantha. Structure of stone and copper plate Inscriptions – Prasasti/Meikirti - Select Inscriptions: Pulimankombai, Mangulam, Jambai, Pugalur, Arachalur, Pulankurichi, Porpanaikottai, Manur, and Tirumukkudal – Select Copper Plates: Pallankoil, Kuram, Chinnamanur, Dalavaipuram, Esalam and Thiruvallangadu

Unit VI: Numismatics (10 Questions)

Numismatics as a source – Introduction to Currency System - Punch Marked Coins – Coins: Sangam Age, Roman, Satavahana, Gupta, Pallava, Pandya, Chola, Vijayanagara and Nayaka – Mint and Techniques

Unit VII: Art and Architecture (12 Questions)

Art and Architecture: Harappan, Buddhist, Mauryan, Satavahana, Gupta, Chalukya, Rashtrakuta, Hoysala, Vijayanagara and Nayaka- Art and Architecture: Chandelas and Odisha Architecture - Art and Architecture of Tamil Nadu: Pallava, Pandya, Chola, Vijayanagar, Nayaka and Secular Architecture.

Unit VIII: Iconography and Paintings (10 Questions)

Introduction to Iconography – Ancient Texts of Iconography – Mudras and Asanas- Buddhist and Jain Iconography, Saiva and Vaishnava Iconography - Chola Bronzes, Mural Painting: Pallava, Pandya, Chola, Vijayanagara and Nayaka.

Unit IX: Conservation and Heritage Management (20 Questions)

Classification of Cultural Properties: Tangible and Intangible – Concept and Methods of Conservation - Conservation: Prehistoric and Excavated Remains, Rock Cut Caves and Built Heritage – Preservation of Mural Paintings –Marshall's *Conservation Manual* (1923) - Introduction to Heritage Management - Indian Antiquarian Laws: Indian Treasure Trove Act 1878, Ancient Monuments Preservation Act 1904, The Ancient Monuments and Archaeological Sites and Remains Act 1958 - Heritage Education – World Heritage Monuments.

Unit X: Historical Archaeology (40 Questions)

Historical Archaeology – Ancient Ceramics of India - Excavated Sites in India: Sisupalgarh, Kausambi, Hastinapur, Ahichchatra, Nalanda, Taxila, Pataliputra, Vikramsila, Adam, Nagarjunakonda, Amaravati, Hampi, Pattanam(Musiri) - Sites of Tamil Nadu: Korkai, Mangudi, Alagankulam, Keeladi, Porunthal, Kaveripoompattinam, Vallam, Uraiyur, Karur, Kodumanal, Tirukkivilur, Kanchipuram, Vasavasamudram, Arikamedu and Gangaikondacholapuram

5. Archaeology / Epigraphy / Heritage Management and Museology (PG Diploma Standard)

Code: 421

Unit I: Cultural History of Tamil Nadu (20 Questions)

Primary Sources - Cultural History: Sangam Age, Post-Sangam Age, Pallava, Pandya, Chola, Chera, Vijayanagara and Nayaka periods – Socio-Economic and Religious Life.

Unit II: History of Archaeology (20 Questions)

Development of Archaeology in India: Indological Studies, William Jones, James Prinsep, Alexander Cunningham, John Marshall and Mortimer Wheeler - Developments in the Post-Independence Period; Archaeological Survey of India, Tamil Nadu State Department of Archaeology and University Departments.

Unit III: Field Archaeology (20 Questions)

Exploration Methods and Techniques - Excavation Methods and Techniques – Archaeological Stratigraphy – Dating Methods: Absolute and Relative – Analysis of excavated materials – Documentation - Excavation Report Writing.

Unit IV: Pre and Proto History of India (20 Questions)

Indian Prehistory - Lower Palaeolithic, Middle Palaeolithic and Upper Palaeolithic Cultures - Mesolithic Culture – Neolithic Culture – Rock Art in Tamil Nadu - Chalcolithic Cultures – Harappan Culture – Iron Age / Megalithic Culture.

Unit V: Epigraphy and Palaeography (30 Questions)

Epigraphy as a Source- History of Indian Epigraphy – Harappan Signs and Graffiti - Palaeography: Brahmi and Kharoshti Scripts – Asokan Inscriptions – History of Epigraphy in Tamil Nadu -Origin and Development of Tamizhi (Tamil -Brahmi) – Vattezhuttu, Tamil and Grantha - Structure of stone and copper plate Inscriptions – Prasasti/Meikirti - Select Inscriptions: Pulimankombai, Mangulam, Pulankurichi, Tirumukkudal – Select Copper Plates: Pallankoil, Esalam and Thiruvallangadu.

Unit VI: Numismatics (10 Questions)

Numismatics as a source – Introduction to Currency System - Punch Marked Coins – Coins: Sangam Age, Roman, Pallava, Pandya, Chola, Vijayanagara and Nayaka – Mint and Techniques.

Unit VII: Art and Architecture (20 Questions)

Art and Architecture: Harappan, Buddhist, Mauryan, Satavahana, Gupta, Chalukya, Rashtrakuta, Hoysala, Vijayanagara and Nayaka - Art and Architecture of Tamil Nadu: Pallava, Pandya, Chola, Vijayanagara, Nayaka and Secular Architecture.

Unit VIII: Iconography and Paintings (16 Questions)

Introduction to Iconography – Mudras and Asanas- Buddhist and Jain Iconography, Saiva and Vaishnava Iconography - Mural Paintings: Pallava, Pandya, Chola, Vijayanagara and Nayaka.

Unit IX: Conservation and Heritage Management (14 Questions)

Classification of Cultural Properties: Tangible and Intangible – Concept and Methods of Conservation – Conservation of Cultural Heritage - Marshall's *Conservation Manual* (1923) - Introduction to Heritage Management - The Ancient Monuments and Archaeological Sites and Remains Act 1958 - Heritage Education – World Heritage Monuments.

Unit X: Historical Archaeology (30 Questions)

Historical Archaeology – Ancient Ceramics of Tamil Nadu – Excavated Sites of Tamil Nadu: Korkai, Mangudi, Alagankulam, Keeladi, Porunthal, Kaveripoompattinam, Vallam, Uraiyur, Karur, Kodumanal, Arikamedu and Gangaikondacholapuram.

6. Architecture (Degree Standard)

Code: 401

Unit I: Introduction to Architecture (25 Questions)

Definition of Architecture - Integration of aesthetics and function. Elements of Architecture – Form, Space, light, colour, etc. Principles of Architecture – Proportion, Scale, balance, rhythm, symmetry, hierarchy, pattern and axis. Understanding of organization of form and space, volumetric study, architectural characteristics & style of buildings with examples. Understanding user circulation and spatial requirement for all types of buildings. Universal design principles and Barrier free environment. Functional aspects of architecture – site, structure, skin, circulation etc. Principles of composition and relationship between human activities and anthropometrics. Computer application in Architecture- Architectural graphics - Drawing & visualization tools – image editing, 2D & 3D modelling, 3D visualization.

Unit II: History of Architecture & Culture (20 Questions)

Historical development of Egyptian, West Asian, Greek & Roman Architecture with examples. Historical development of Buddhist Architecture with examples. Evolution of Hindu Temple Architecture – Dravidian and Indo-Aryan Periods- Outstanding examples of these periods. Historical development of Indo- Islamic Architecture – Delhi Sultanate, Provincial & Mughal styles with examples. Modern Architecture - development of theories, various philosophies & schools of thoughts, works of modern architects. Post Modern Architecture - various philosophies, works of postmodern architects. Architecture of India under Colonial rule. Post-independence architecture in India - works of Indian Architects. Contemporary World Architecture & recent trends

Unit III: Materials and Construction Techniques (25 Questions)

Properties, characteristics, strengths, manufacturing, components & applications of materials, construction methods and techniques, detailing for the following : Stone – Brick & Clay Products – Lime – Cement – Mortar – Timber – Concrete – Ferrous and Non-Ferrous Metals – Glass – Plastics – Asphalt, Sealants & Adhesives – Protective and Decorative Coatings – Surface finishing & flooring materials - Water Proofing and Damps Proofing Materials – Rural Building Materials(Bamboo, Soil, etc.). Building structural systems, prefabrication of building elements; principles of modular coordination-construction planning and equipment. Principles and design of disaster resistant structures. Temporary structures for rehabilitation. Specification – necessity, importance, types & classification – Specification writing - Estimation (Approximate & detailed) – Current trends. Advanced construction technologies - Construction systems & Practice

– Construction methods & equipments, Construction Technology for High-rise buildings, Construction management.

Unit IV: Building and Services – Current Development & New Trends (20 Questions)

Water Supply and sanitation systems: Sources, Quality, treatment methods and distribution systems of water - water requirements for firefighting systems and different building typologies – Primary and Secondary waste water treatments, Modern types of sewage treatment plants. Choice of pipe materials, fittings & fixtures - Systems of water supply and sewage disposal in all types of buildings. Water harvesting systems – Principles, planning and design of storm water drainage systems. Solid Waste – Methods of solid waste management - collection, transportation and disposal – Recycling and Reuse of Solid waste – MSW rules. Electrical installations in buildings- Single/three phase supply - Planning electrical wiring for building - Building safety and security systems- Building Management systems, Building automation. Lighting – Design, Installation & Application in buildings. Mechanical ventilation techniques: Air conditioning – Systems & Applications configuration, sizing & space requirements. Vertical transportation systems – Design criteria & installation of Elevators, Escalators & moving walkways. Fire safety and firefighting systems – requirements and norms, NBC guidelines. Architectural Acoustics – Fundamentals, Importance of shape volume, treatment of interior surfaces. Relevant National and state level legislations and guidelines.

Unit V: Human Settlements Planning (20 Questions)

Origin of Human settlements In India & the rest of the world – River valley civilizations (Indus Valley, Mesopotamia, Egyptian & Chinese) – Traditional planning principles in India – approaches & concepts – Classical & Medieval planning in Europe and India - Evolution of modern planning theory, concepts and

works of town planners - Planning models. Elements of Human settlements – functions & linkages, Structure & form. Types of plan like Regional plan, Perspective plan, Master plan, Zonal plan etc. URDPFI and RADPFI Guidelines, DCR,CRZ for coastal areas; JNNURM, AMRUT, Zoning regulations, SEZ, PUD,TOD; Contemporary Urban planning – Issues and Trends. National and state level government organizations -initiatives, schemes and projects.

Unit VI: Urban Studies – Urban Design, Urban Housing & Conservation (25 Questions)

Urban Design – need, aspects, scope & components of urban space – Indian Urbanism - Theorising & Reading urban space – Imageability & townscape elements, social aspects of urban space, gender & class – URDPFI guidelines. Urban Renewal, Redevelopment, Rehabilitation & Conservation, TDR. Urban Public spaces – Universal design, pedestrian friendly environment, streetscapes. Housing in the Indian Context, Socio-Economic aspects, Housing standards, Site Planning & Housing Design. Vernacular architecture of India and Heritage tourism; Smart city and Sustainable urban development. Conservation in India – Understanding the need & purpose, definition, Adaptive re- use, International agencies & their role – Policies & legislations, case studies – Conservation practice and Planning; National and state level government organizations – Initiatives, schemes and projects; Relevant National and state level legislations and guidelines

Unit VII: Environmental Studies, Site Planning & Landscape Ecology (25 Questions)

Environment, Ecosystems & Bio-diversity – Environmental Pollution, Human population & social issues with relation to the environment – Environmental laws in India. Site Planning – Introduction to basic terminologies, Methods of surveying, Instruments & Application, Levelling, Site Drawings, Importance of Site Analysis – On-site & off-site factors, Study of micro climate, Site Diagramming, Site Context, Site planning & Site layout principles. Topographical study and Contour Analysis. Introduction to Landscape Architecture – Elements of Landscape Design – plant material, water & landforms, Garden Design – Japanese, Italian Renaissance & Mughal, Site Planning – Organization of spaces – circulation, built form and open spaces, site planning and micro climate, site planning for neighborhood parks, children’s play area and campus development – Landscaping of Functional areas – Urban open spaces and principle of urban landscape – Street landscaping, landscape design for waterfront areas and functional areas in urban centers – green roofs and walls.

Unit VIII: Climatic Design & Energy Efficient Architecture (20 Questions)

Climate & Human comfort, Visual and Acoustical comfort in built environment. Solar Control, Heat flow through materials & building envelope design, Air movement patterns through natural & built forms, Design strategies for different climate types. Energy Efficiency – Importance & Significance, Passive Heating & Cooling techniques, case studies, day Lighting & Natural ventilation, Use of Renewable energy systems – Current & future trends. National and state level government organizations -initiatives, schemes and projects. Relevant National and state level legislations and guidelines.

Unit IX: Project Management and Current Trends (10 Questions)

Project Management – Introduction, Project programming & Critical path method, Cost model analysis, Programming evaluation review technique – PERT network - Project feasibility study - Facility Programming and Planning. Computerized Project Management, Current trends - various international and national agencies - Funding and implementation procedure.

Unit X: Professional Practice and Ethics (10 Questions)

Understanding the basic concepts and terminology in architectural practice -Architectural profession – Code of conduct & ethics and profession. Role of Architects in conceptualizing, design proposal until the execution procedure. Role of COA & IIA – Architect’s Services, Scale of fees, Architectural Competitions - Tender & Contracts – Legal aspects – Important Legislations & current trends.

7. Basics of Engineering (Degree Standard)

Code: 422

UNIT I: Mathematics (20 Questions)

Matrices: Eigen values – Eigen vectors of a real matrix - Cayley - Hamilton theorem - Similar and Orthogonal transformations - Reduction of a quadratic form to Canonical form by orthogonal transformation. Ordinary differential equations: Order and degree - Higher order linear ODE with constant coefficients - Method of undetermined coefficients - Method of variation of parameters - Cauchy's and Legendre's linear equations. Functions of several variables: Partial derivatives - Total derivatives - Euler's theorem - Implicit functions - Jacobians - Taylor's theorem - Maxima and Minima. Integration: Definite and indefinite Integrals - Techniques of integration using integration by parts and Trigonometric Integrals - Double Integrals - Change of order of integration - Volume Integrals. Vector Calculus: Vectors and scalars - Gradient and Directional derivatives - Divergence and Curl - Applications of Green's theorem, Gauss divergence theorem and Stoke's theorem. Complex variables: Analytic functions - Verification of Analyticity - Construction of Analytic functions - Conformal Mappings - Bilinear transformations. Complex Integration: Cauchy's integral theorem - Cauchy's fundamental theorem - Cauchy's residue theorem - Taylor's and Laurent's series - Contour integration (excluding poles on the real axis). Laplace transform: Existence of Laplace transform - Laplace transform of elementary functions- Properties - Laplace transform of Periodic functions - Inverse Laplace transform - Convolution theorem - Solution of linear second order ODE by Laplace transform technique.

UNIT II: Engineering Physics (25 Questions)

Mechanics: Newton's laws of motion – gravitation – work, energy and power - Properties of matter : Elasticity – moduli of elasticity - Sound : intensity level – reverberation – Ultrasonics : production, detection and applications - Thermal Physics : Thermal expansion - thermal stress - expansion joints - bimetallic strips - thermal conductivity- heat conductions in solids – flow of heat through compound media – Thermodynamics – Laws of thermodynamics – Carnot engine - Applied Optics : Interference – Young's double slit experiment - anti-reflection coatings - Diffraction - Lasers – principle and applications – CO₂ and Nd:YAG laser - semiconductor lasers – applications of Lasers – Optical fibres: classification (index & mode based) - principle and propagation of light in optical fibres - acceptance angle and numerical aperture - fibre optic communication system - Quantum Physics : Photoelectric effect– dual nature of matter and radiation – Heisenberg's uncertainty principle - Schrödinger's wave equation - Physics of Materials : Crystal structures – unit cell – packing factor – Superconductivity : Properties and applications - Magnetisation of matter: Magnetic dipole moment – atomic magnetic moments- magnetic permeability and susceptibility - Magnetic material classification : diamagnetism – paramagnetism – ferromagnetism – Semiconductors : Intrinsic Semiconductors – Energy band diagram – direct and indirect band gap - extrinsic semiconductors – Dielectric materials: Matter polarization and relative permittivity - dipole moment and polarization vector -polarization mechanisms: electronic, ionic, orientational, interfacial and total polarization- frequency dependence - dielectric strength and break-down in gases, liquids and solids.

UNIT III: Engineering Chemistry (25 Questions)

Fuel -Classification of fuels - Calorific value - Solid fuel - Liquid fuel - Gaseous fuel - Octane number - Cetane Number -Lubricants - Classification - Greases - Solid Lubricants. Water - Sources - Classifications - Softening process - Desalination - RO Method - Internal treatment - Treatment of Water for Municipal purposes. Plastics - High polymer - classification - Polymerization techniques - Thermoplastics - Thermosetting resins - examples. Rubber -"Types of Rubber - Vulcanisation - Properties- Unvulcanised and Vulcanised. Natural Rubber - Synthetic Rubber - examples. Refractories - Classification - Manufacture of Refractories - Magnesite - Silica - Zirconia -Chromite. Abrasives - Natural - Artificial-Abrasive paper & cloth. Corrosion: Dry and Wet corrosion - Factors affecting corrosion- Different types of corrosion. Productive coating - Hot dipping- metal cladding, electro deposition - Organic Coatings - Paints - Varnishes. Cement and lime- setting and hardening. Explosives- classifications - characteristics-requirements for good explosives- nitrocellulose- TNT- TNB-DNB-PETN-RDX. Alloys- purpose of making alloy- types of alloys- Ferrous alloys. Electrochemistry - conductors and non-conductors - Kohlrausch law - Electrochemical cell- reversible and irreversible cells - EMF - Concentration cell- polarization - over voltage, decomposition potential. Fuel Cells. Nano Chemistry-Basics- distinction between molecules, Nano materials and bulk materials. Size dependent properties and applications of Nano Materials.

UNIT IV: Basics of Computer Engineering (25 Questions)

Computer Organisation - CPU and Microprocessor [ALU, Control Unit and Bus Structure] - Data Storage [Primary, Secondary and Virtual] - Input and Output Devices.

System Software - Assembler - Compiler - Loader - Linker - Operating Systems.

Programming Languages - Classification of Programming Language, Algorithm, Flow chart, Pseudo code, High-Level Languages – Fundamental concepts of C Programming.

Basic Computer Networking - Network Components [Routers, Bridges, Gateways] - ISO-OSI Reference Model - LAN - WAN - Client-Server Architecture - Internet - World Wide Web.

Applications - Office Tools - Word processor - Spreadsheet - Power point - Introduction to Database concepts - E-mail - Browser.

IT Enabled Services - E-Governance - E-Commerce - Multimedia.

UNIT V: Basics of Civil and Mechanical Engineering (30 Questions)

Introduction to Engineering mechanics - Units and Dimensions - Laws of Mechanics - Coplanar Forces - Static Equilibrium of Rigid body - Moment of force - free body diagram - friction - laws of friction - sliding friction - wedge friction - Rolling resistance - Lader friction - Friction in screws - Screw jack -Belt friction - Properties of surfaces and solids - Centroids and centre of mass - line and areas - Rectangular, circular, triangular areas by integration - T-section, I- Section, Angle section, Hollow section - Area moment of inertia of plane areas - Parallel axis theorem – Perpendicular axis theorem, Polar moment of Inertia, Principle moment of Inertia Mass moment of inertia- Centroid of the simple solids - Dynamics of particle - Displacement, velocity and acceleration - Different types of motion - Rectilinear , Curvilinear and Projectile motions - Newton's II-law of motion - Work Energy equation - Impulse and momentum principles.

UNIT VI: Basics of Electrical and Electronics Engineering (30 Questions)

Ohm's law – Kirchoff's laws – Introduction to DC and AC circuits - single phase and three phase circuits – Power and Power factor, Unbalanced and Balanced loads, Operating principles of moving coil and moving iron instruments (voltmeters and ammeters) – wattmeters, multimeter, energy meters and megger, Construction and principle of operation: DC motors- DC generators-Transformers- Induction motors, Characteristics of PN junction diode - zener diode- half wave and full wave rectifiers - Bipolar junction transistor (CC,CE,CB configurations), SCR, Amplifiers- Operational amplifiers – Inverting and Non-inverting amplifiers, Binary number system- logic gates- Boolean algebra - Half and full adders- Flip-flops - registers and counters- A/D and D/A conversion, Types of analog and digital signals- Modulation and Demodulation(amplitude and frequency) Communication systems: Radio- TV- Fax- Microwave-Satellite and optical fibre.

UNIT VII: Principles of Management (15 Questions)

Management - Definition, Evolution of Management Philosophies, Types of Business, Environment Analysis - Planning- Types, Steps, Forecasting, MBO, MBE. Organizing – Departmentation, Line and Staff Authority, Delegation and Decentralization. Staffing - Manpower Planning, Recruitment and Selection, Training, Performance Appraisal. Directing – Theories of Motivation, Leadership Styles, Power and Politics, Change Management, Conflict Management, Communication in Business- Controlling Types, Control Techniques, Budgetary and Non-Budgetary Control.

UNIT VIII: Total Quality Management (15 Questions)

Quality – Definitions, Vision, Mission and Policy statements-Dimensions of Product and Service Quality- Contributions of Quality Gurus-Deming, Juran, Crosby, Masaaki Imai, Feigenbaum, Ishikawa. Costs of Quality- Continuous Process Improvement- PDCA, Quality Circle, 5S, Kaizen-Statistical Process Control (SPC), 7QC Tools, New Management Tools of Quality, Bench Marking, 6 sigma, Quality Function Deployment (QFD), POKAYOKE, Total Productive Maintenance (TPM), Business Process Reengineering (BPR), Quality Certifications.

UNIT IX: Environmental Science and Engineering (15 Questions)

Definition, scope and importance of environment – need for public awareness. Eco-system and Energy flow– ecological succession. Types of biodiversity: genetic, species and ecosystem diversity– values of biodiversity, India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ. Environmental pollution: Causes, Effects and Preventive measures of

Water, Soil, Air and Noise Pollutions. Solid, Hazardous and E-Waste management. Energy management and conservation, New Energy Sources - Need of new sources. Different types of new energy sources. Applications of- Hydrogen energy, Ocean energy resources, Tidal energy conversion. Concept, origin and power plants of geothermal energy. Sustainability and management - Development , GDP, Sustainability- concept, needs and challenges-economic, social and aspects of sustainability-from unsustainability to sustainability-millennium development goals, and protocols-Sustainable Development Goals-targets, indicators and intervention areas. Climate change- Global, Regional and local environmental issues and possible solutions. Concept of Carbon Credit - Carbon Footprint. Environmental management in industry- Material Life cycle assessment, Environmental Impact Assessment. Sustainable habitat: Green buildings, Green materials, Energy efficiency, Sustainable transports. Sustainable energy: Non-conventional Sources, Energy Cycles carbon cycle, emission and sequestration, Green Engineering: Sustainable urbanization- Socio-economical and technological change.

8. Business Administration PG Degree Standard

Code: 385

Unit I: Management Concepts (15 Questions)

The development of Management thought-Pre scientific management era – Human relation era – Social sciences era – Management sciences era. Definitions of Administration and Management – Basic Principles and Process of Management. Functions of Management: Planning, Organising, Staffing, Directing, Coordination and Controlling. Management by objectives – Process of MBO – Management by Exception.

Unit II: Managerial Economics (10 Questions)

Introduction to Economics; Nature and Scope of Managerial Economics – Significance in Decision - Making and Fundamental Concepts - Objectives of a Firm - Role of Economic Analysis in managerial decisions. The Concept of Profit. Nature and Measurement of Profits - Profit Maximization - Profit Planning and control – Profit Policies – Cost Volume Profit Analysis. National Income – Definition, Concepts and Various Methods of its Measurement– Inflation, Types and Causes - National Income and Economic Welfare-Business Cycles and Business Forecasting – Measuring Business Cycles Using Trend Analysis

Unit III: Organisational Behaviour (20 Questions)

Organisational Behaviour :Importance – Historical Development of Organisation Behaviour-Understanding Individual :Personality- Perception-Learning-Values-Attitude- Job Involvement – Organisational Commitment – Job Satisfaction – Emotions – Emotional Intelligence – Spiritual Quotient. Understanding groups: Meaning of group and group dynamics – Theories of Group Dynamics – Group Cohesiveness – Team Building- Management of change-Organisational Culture-Management of Conflict-Organizational Citizenship Behaviour.

Unit IV: Human Resource Management (20 Questions)

Functions of HRM – Managerial Functions and Operative functions – Organisation of HRM Department – Qualities and Qualification of HR Managers – HR Policies - Environmental influences of HRM – HRM Challenges – HRM Strategies. Recruitment and Selection- Job Analysis- Job Evaluation-Performance Appraisal-Training and Development-Quality of Working Life-e HRM

Unit V: Research Methodology and Statistics (10 Questions)

Research – Meaning – Types – Nature and scope of research – Review of Literature - Problem formulation – Statement of research Objective – Value and cost of information – Research Questions – Research Gap - Decision theory – Research process – Research designs – Experimental Research. Methods of data collection – Sampling – Measure of Central Tendency -Measure of Dispersion - Testing of Hypothesis – Correlations - Regression- Multivariate Analysis - Research Report

Unit VI: Operations Management (20 Questions)

Operations Management concept, objectives and types – Characteristics of Modern Operation Management – Differences between Services and Goods – Operation Strategy – Supply Chain Management – Warehousing and Supply Chain Strategies – Supply Chain Dynamics. Operations

Planning- Work study: Objectives, Procedures – Method Study and Motion Study - Work Measurement and Productivity. Total Productive Maintenance- Materials management and Purchase Management - Project management - Quality Control – Quality Movement – Continuous Improvement – Tools – Total Quality Management (TQM) concepts – ISO Quality Certification – Quality Assurance.

Unit VII: Marketing Management (50 Questions)

Marketing – Definition – Importance – Concepts in Marketing, Marketing Concepts – Traditional and Modern Concepts – Marketing Environment, Marketing Strategies – Kinds of Marketing Strategies – Marketing Mix Concept – Marketing Research and Information – Objectives and Process. Consumerism – Problems of consumer protection – Developments in Consumer Protection in India - Government and Marketing – Neo Marketing Trends – e-Marketing – Tele-marketing – Green Marketing – Event Marketing – Viral Marketing – Direct Marketing- Ethics in Marketing & Advertisement.

Unit VIII: Management Information System & E-Commerce (20 Questions)

Data, Information, Intelligence, Information Technology, Information System, Functional Information Systems, DSS, EIS, KMS, GIS, International Information System-Data Base Management System- Role of information management in ERP, e-governance, Data Mining, Business Intelligence, Pervasive Computing, Cloud computing, CMM. Electronic Commerce: Technical Components of E-Commerce Functions of E-Commerce - Advantages and disadvantages of E- Commerce -Electronic Commerce and Electronic Business - Electronic Commerce Technology - Building the E-Business application - Avoiding legal issues- Web strategy: Attracting and retaining visitors - Search Engines and Portals- Cyber service - Online Banking.

Unit IX: Accounts and Auditing (10 Questions)

Basic Accounting concepts - Kinds of Accounts. Double Entry Book Keeping - Journal and Ledger Accounts- Subsidiary books- Trial balance - Errors – Types of errors - Rectification of errors – Bank reconciliation statement – Manufacturing - Trading - Profit & Loss Account - Balance sheet. – Accounting for non-trading Institutions-Income & Expenditure Account-Receipts and Payment Accounts and Balance sheet – Accounting for depreciation – methods of depreciation –Preparation of accounts from incomplete records. Auditing – Origin – Objectives – Types - qualities of an Auditor - Audit programmes - verification and valuation of Assets and Liabilities. Investigation-objectives of investigation - Audit of computerized-Accounts - electronic auditing

Unit X: Financial Management (25 Questions)

Finance Functions – Nature And Scope – Evolution Of Finance Function – Its New Role in The Contemporary Scenario – Goals Of Finance Function – Maximising Profit Vs Wealth – Cost – Risk – Return- Trade Off – Concept Of Time Value Of Money – Future Value and Present Value and The Basic Valuation Model - Sources Of Short Term Financing – The Management Of Working Capital -Cash Management Strategies - Receivables Management- Sources of Long Term Finance - Cost Of Capital and Capital Structure - Economic Value Added (EVA)-Risk and Uncertainty - Risk Management- Return on Investment.

9. Chemistry (Degree Standard)

Code:430

UNIT I: Physical Chemistry (35 Questions)

(a) Chemical Thermodynamics: (25 Questions) Terminology – Systems and surroundings - First Law of thermodynamics - C_p and C_v relation - Hess's law of constant heat summation - Kirchoff's equation - extensive and intensive properties- second law of thermodynamics - entropy and entropy as a measure of probability - Free energy and Chemical equilibria - variation of free energy with temperature and pressure - Gibb's and Helmholtz equation – Heterogeneous equilibria and Le Chatlier principle.

(b) Solid State Chemistry: (10 Questions) Crystalline and amorphous solids - unit Cell - Miller Indices – symmetry elements in crystals (cubic system only)- Bragg's equation - radius ratio's and packing in crystals- determination of crystal structures by Bragg's method – structure of NaCl, Wurzite , TiO_2 and spinels.

UNIT II: (30 Questions)

(c) Chemical Kinetics: (15 Questions) Rate laws - rate constant - order and molecularity of reactions - I, II, III, and zero order reactions – concept of Arrhenius theory - Collision theory and Transition state theory -catalysis.

(d) Electrochemistry: (15 Questions) **Conductance in electrolytic solution, specific and molar conductance** - Ostwald's dilution law - Kohlraush's law - Debye Huckel theory- Types of reversible electrodes - Nernst equation - reference electrode and standard hydrogen electrode - computation of cell e.m.f. -calculations of thermodynamic quantities of cell reactions (ΔG , ΔH , ΔS and K) Determination of pH and pKa of acids by potentiometric methods.

UNIT III: (12 Questions)

(e) Analytical chemistry and Instrumental methods:

Principle, instrumentation and applications of UV- Visible, IR, Raman, NMR, Mass, GCMS and Atomic Absorption spectroscopy.

UNIT IV: (20 Questions)

Inorganic Chemistry

(f) Periodic classification: (14 Questions) Classification based on electronic configuration – periodic properties - atomic and ionic radii, ionisation potential, electron affinity and electronegativity - various scales - Trends along periods and groups.

(g) Chemical bond: (3 Questions) Lattice energy - VSEPR Theory and its applications - partial ionic character from electronegativity - Fajan's Rule.

(h) Compounds of Boron: (3 Questions) Electron deficient nature of boron compounds - preparation and properties of halides and nitrides of boron - diborane - Borazine, silicones and structures of silicates

UNIT V: (20 Questions)

(i) Lanthanides and Actinides: (7 Questions) Position in the periodic table, occurrence, electronic configuration, oxidation state - lanthanide contraction - magnetic properties and complexation behaviour - comparison of lanthanides and actinides.

(j) Nuclear Chemistry: (13 Questions) Radio activity - detection and measurement – Half-life period - nuclear stability, - n/p ratio - isotopes, isobars and isotones -nuclear reactions - spallation - nuclear fission and fusion - stellar energy Uses of nuclear energy - nuclear power projects in India - Applications of radioactive isotopes in industries, medicine and agriculture.

UNIT VI: (20 Questions)

(k) Co-ordination Chemistry: (10 Questions) Nomenclature – theories of co-ordination compounds- Werner, valence bond, crystal field theories - Effective atomic number – isomerism.

(l) Analytical Chemistry: (10 Questions) Principles of volumetric analysis - different types of titrations- Gravimetric analysis – Basic principles - Separation and purification techniques

UNIT VII: (25 Questions)

Organic Chemistry:

(m) Nature of Bonding: (18 Questions) Hybridisation (sp , sp^2 and sp^3) and Geometry of molecules - cleavage of bonds - homolytic and heterolytic fission of carbon – carbon bonds - Reaction intermediates - free radicals, carbocations and carbanions - their stability.

(n) Types of reactions: (7 Questions) Nucleophilic, electrophilic, free radicals, addition, elimination, substitution, oxidation and reduction reactions.

UNIT VIII : (18 Questions)

(o) Electron displacement effects: (8 Questions) Inductive, inductometric, electromeric, mesomeric, resonance, hyperconjugation and steric effects.

(p) Stereochemistry: (10 Questions)

Optical isomerism and Geometrical isomerism - chirality - optical isomerism of lactic and tartaric acid - Racemisation – Resolution-asymmetric synthesis - Walden inversion - cis and trans isomerism of maleic and fumaric acids-R-S-Notations - conformational analysis of cyclohexane

UNIT IX : (5 Questions)

(q) Carbohydrates: Classification, sources, preparation and reactions - Glucose, Fructose, Sucrose and lactose- structure of glucose and fructose.

(r) Amino acids – Classification - Zwitter ion - peptide linkage - structure of proteins - structure and functions of DNA and RNA

(s) Hormones and vitamins - Classifications, sources and functions

UNIT X : (15 Questions)

(t) Pharmaceutical Chemistry: (10 Questions) Terminology-pharmacology, pharmacotherapies, toxicology, chemotherapy, classification and nomenclature of drugs, sources of drugs, Assay of drugs by biological, chemical and immunological methods, physiological effects of functional groups of drugs - Different types of drugs like analgesics, antibiotics, antiseptics, disinfectants, anaesthetics, antacids, antimalarial antidepressants, antipsychotic and sedatives.

(u) Nano Chemistry: (5 Questions)

Definition – types of nano materials – Nano drugs and their delivery- Applications of nano materials in medicine

10. Civil Engineering (Degree Standard)

Code: 398

Unit I: Building Materials and Construction Practices (20 Questions)

Properties and testing of engineering materials-brick, stones, M-sand, aggregates, cement, timber, recycled and modern materials-glass, plastic FRP, ceramic- concrete – properties and testing - mix design-admixtures, Self-compacting concrete steel construction practice-stone masonry, brick masonry ,R.C.C. and block masonry – construction equipment - building bye-laws and development regulations practiced in Tamil Nadu - Provisions for fire safety, lighting and ventilation- Acoustics.

Unit II: Engineering Survey (15 Questions)

Survey - Chain- Compass - Plane table - levelling - Theodolite- computation of area and volume-L.S. and C.S. – Contour - Traversing – traverse adjustment- -Heights and Distances - Tacheometry and Triangulation - total station and GPS and Remote sensing techniques for surveying.

Unit III: Engineering Mechanics and Strength of Materials (20 Questions)

Forces- types-laws - centre of gravity-moment of inertia-friction-Stresses and strains -Thermal stress - elastic constants - Beams - Bending moment and shear force in beams - Theory of simple bending - deflection of beams - torsion - Combined stresses – stresses on inclined planes - Principal stresses and principal planes - Theories of Failure – Analysis of plane trusses.

Unit IV: Structural Analysis (20 Questions)

Indeterminate beams - Stiffness and flexibility methods of structural analysis - Slope deflection - Moment Distribution method – Arches and suspension cables - Theory of columns - moving loads and influence lines – Matrix method- Stability of retaining walls – plastic theory- Seismic analysis of high rise building

Unit V: Geotechnical Engineering (25 Questions)

Formation of soils - types of soils - classification of soils for engineering practice - Field identification of soils - Physical properties and testing of soils - Three phase diagram - permeability characteristics of soils - stress distribution in soils - Theory of consolidation, shear strength parameters of soils –

stabilization of soil -Compaction of soils- Stability analysis of slope - Soil exploration - Soil sampling techniques – SPT -Borelog profile - shallow foundations - Terzaghi's bearing capacity theory - Pile foundation –pile load test- Group action of piles - settlement of foundations- Ground Improvement techniques.

Unit VI: Environmental Engineering and Pollution Control (15 Questions)

Sources of water - Water Demand -- Characteristics and analysis of water – hydraulics for conveyance and transmission - water borne diseases – Functional design of water treatment plant – desalination plant- water distribution system – pipe network analysis- characteristics and composition of sewage - Planning and design of sewerage system - sewer appurtenances - Pumping of sewage - sewage treatment and disposal - Design of storm water drain- plumbing system in high rise building - industrial waste treatment - solid waste management – Air and Noise pollution control – E-Waste management.

Unit VII: Design of Reinforced Concrete, Prestressed Concrete and Steel Structures (30 Questions)

Design of concrete members - limit state and working stress design concepts - design of slabs - one way, two way and flat slabs - Design of singly and doubly reinforced sections and flanged sections -design of columns and footings – pre- stressing - systems and methods- post tensioning slabs - Design of pre-stressed members for flexure.

Design of tension and compression members - Design of bolted and welded connections design of members of truss - designs of columns and bases - design of beams, plate girders and gantry girder- design of liquid storage structures –elevated and underground- design of retaining wall.

Unit VIII: Hydraulics and Water Resources Engineering (20 Questions)

Hydrostatics-applications of Bernoulli equation – losses in pipes - flow measurement in channels - open channel flow- types of pumps and characteristics - Applications of Momentum equation, Kinematics of flow. Water resources in Tamil Nadu - Water resource planning - Master plan for water management - flood control – Runoff estimation – hydrograph – flood routing - Soil plant water relationship - Water requirement for crops - Irrigation methods – Design of alluvial canal and design of headworks. Water logging and land reclamation - cross drainage works.

Unit IX: Urban and Transportation Engineering (20 Questions)

Urbanization trend and impact - Slum clearance and slum improvement programmes - Different modes of transport and their characteristics. Geometric design of highways. – Pavement materials and testing – alternate pavement materials- modified binders - Design and Construction of bituminous and concrete roads – pavement distress and evaluation - Maintenance of roads – Railways - Components of permanent way - Signalling, Interlocking and train control - drainage in roads and railways. Airport planning - Components of Airport - Site selection – Runways – Planning of terminal buildings Harbours & Ports - Layout of a harbour - Docks - Breakwaters.

Unit X: Project Management and Estimation (15 Questions)

Construction management - Construction planning - Scheduling and monitoring - Cost control, Quality control and inspection - Network analysis - CPM and PERT -methods of project management - Resources planning and resource management - Types of estimates - Preparation of technical specifications and tender documents – e-tender - Building valuation - law relating to contracts and arbitration.

11. Computer Science, Information Technology, Electrical, Electronics and Communication Engineering (Degree Standard)

Code: 554

Unit I: Programming In C, Python and Object Oriented Programming (20 Questions)

C Programming:

Data Types – Expressions – Input / Output Operations – Decision Making and Branching Statements – Looping Statements – Arrays – Initialization – Declaration – One dimensional and Two dimensional

arrays. String – string operations – String Arrays. Simple programs – sorting – searching – matrix operations – Function – Definition of function – Declaration of function – Pass by value – Pass by reference – Recursion – Pointers – Definition – Initialization – Pointers arithmetic - Pointers and arrays – structure data type – structure definition – Structure declaration – Structure within a structure – Union – Programs using structures and Unions – Storage classes, Pre-processor directives - File Handling

Python Programming:

Python Interpreter and Interactive Mode-Data types-Statements- Expressions-Boolean Values and Operators-Strings-Arrays of Numbers- Lists-Tuples-Dictionaries-Functions-File Reading and Writing

Object Oriented Programming:

C++ Programming features – Data Abstraction – Encapsulation – Class – Object – constructors – static members – constant members – member functions – pointers – references – Role of this pointer – Storage classes – function as arguments – String Handling – Copy Constructor – Polymorphism – compile time and run time polymorphisms – Function overloading – operators overloading – dynamic memory allocation – Nested classes – Inheritance – virtual functions. Abstract class – Exception handling – Standard libraries – Generic Programming – templates – class template – function template – STL - containers – iterators – function adaptors – allocators – Parameterizing the class – File handling concepts.

Unit II: Data Structures and Algorithms (20 Questions)

List ADT – array based implementation – linked list implementation – singly linked lists – circularly linked lists – doubly-linked lists – applications of lists – Polynomial Manipulation – All operation (Insertion, Deletion, Merge, Traversal) – Stack ADT – Evaluating arithmetic expressions – other applications – Queue ADT – circular queue implementation – Double ended Queues – Priority Queues - application of queues – Trees: Binary Tree - Binary Search Tree-Tree Traversals –Operations- AVL Tree-Splay Tree-Red Black Tree- Binary Heap- Skew Heap- Leftist Heap - Binomial Heap-Fibonacci Heap- Sorting algorithms: Insertion sort – Selection sort – Shell sort – Bubble sort – Quick sort – Merge sort – Radix sort – Heap Sort - Searching: Linear search – Binary Search - Hashing: Hash Functions – Separate Chaining – Open Addressing – Rehashing – Extendible Hashing – Graph Algorithms: Minimum Spanning Tree – Shortest Path Algorithms - Graph Traversals -Directed Acyclic Graph- Topological Ordering-All Pair Shortest Path Algorithms- Floyd Warshall algorithm- Bellman Ford Algorithm-Network Flow Algorithms- Ford Fulkerson Algorithm-Amortized Analysis of Algorithms - Algorithm Analysis: Asymptotic Analysis-Solving Recurrence Equations-Algorithm Design Techniques- Greedy Algorithms-Dynamic Programming-Divide and Conquer.

Unit III: Digital Logic and Computer Architecture (20 Questions)

Boolean Algebra and Logic Gates – Combinational Logic – Sequential logic Functional Units of a Digital Computer - Arithmetic operations : Addition and Subtraction – Binary Multiplication – Binary Division – Floating Point Numbers – Addressing Modes - Instruction Set Architecture – RISC and CISC Architectures CPU Performance Metrics - Data path and Control – Hazards: Structural, Data and Control Hazards – Dynamic Scheduling – Speculation – ILP and Thread Level Parallelism – Memory Hierarchy – Cache Memories – Virtual Memory – Associative memories – Accessing I/O devices Interrupts - Direct Memory Access – Multicore Architectures – Open MP – MPI – Cache coherence policies – GPU architectures and programming.

Unit IV: Database Management Systems (20 Questions)

INTRODUCTION TO DBMS – File Systems Organization – Sequential, Pointer, Indexed, Direct – Purpose of Database System – Database System Terminologies – Database Characteristics – Data models – Types of data models – Components of DBMS – Relational Algebra. LOGICAL DATABASE DESIGN: Relational DBMS – Codd's Rule – Entity – Relationship model – Extended ER Normalization – Functional Dependencies, Anomaly – 1 NF to 5 NF – Domain Key Normal Form – Denormalization. SQL & QUERY OPTIMIZATION – SQL Standards – Data types – Database Objects – DDL – DML – DCL – TCL – Embedded SQL – Static vs Dynamic SQL – QUERY OPTIMIZATION: Query Processing and Optimization – Heuristics and Cost Estimates in Query Optimization – TRANSACTION PROCESSING AND CONCURRENCY CONTROL – Introduction – Properties of Transaction – Serializability – Concurrency Control – Locking Mechanisms – Two Phase Commit Protocol – Dead lock – TRENDS IN DATABASE TECHNOLOGY – RAID – File Organization –

Organization of Records in Files – Indexing and Hashing – Ordered Indices – B+ tree Index Files – B tree Index Files – Static Hashing – Dynamic Hashing – Object Oriented Database Management Systems-Object Oriented Relational Database management Systems

Unit V: Operating Systems and Cloud Technologies (20 Questions)

OPERATING SYSTEMS OVERVIEW – Computer System Overview – Basic Elements, Instruction Execution, Interrupts, Memory Hierarchy, Cache Memory, Direct Memory Access, Multiprocessor and Multicore Organization. Operating system overview – objectives and functions, Evolution of Operating System – Computer System Organization – Operating System Structure and Operations –System Calls, System Programs, OS Generation and System Boot – PROCESS MANAGEMENT – Processes – Process Concepts, Process Scheduling, Operations on Processes, Interprocess Communication; Threads – Overview, Multicore Programming, Multithreading Models; Windows 7 – Thread and SMP Management. Process Synchronization – Critical Section Problem, Mutex Locks, Semaphores, Monitors; CPU Scheduling and Deadlocks – STORAGE MANAGEMENT – Main Memory – Contiguous Memory – Allocation, Segmentation, Paging, 32 and 64 bit architecture Examples; Virtual Memory – Demand Paging, Page Replacement, Allocation, Thrashing; Allocating Kernel Memory, OS Examples – I/O SYSTEMS – Mass Storage Structure – Overview, Disk Scheduling and Management; File System Storage – File Concepts, Directory and Disk Structure, Sharing and Protection; File System Implementation – File System Structure, Directory Structure, Allocation Methods, Free space Management; I/O Systems.

Cloud Technologies: Cloud Characteristics-Cloud Service and Deployment Models-Virtualization-Virtual Machines-Server, Network and Storage Virtualization-Hypervisor-Cloud Security Requirements-Threats: Malicious Attacks-Events and Alerts- Security Information and Event Management - Hadoop –Map Reduce Technique.

Unit VI: Software Engineering (20 Questions)

Software Process and Project Management:

Introduction to Software Engineering, Software Process, Perspective and Specialized Process Models - Software Project Management: Estimation – LOC and FP Based Estimation, COCOMO Model – Project Scheduling – Scheduling, Earned Value Analysis – Risk Management – Introduction to Agility - Agile Process - Extreme Programming - XP Process - REQUIREMENTS ANALYSIS AND SPECIFICATION – Software Requirement: Functional and Non – functional, User requirements, System requirement, Software Requirements - Document – Requirement Engineering Process : feasibility Studies, Requirements elicitation and analysis, requirements validation, requirements management – Classical analysis: Structured system Analysis, Petri Nets – Data Dictionary - SOFTWARE DESIGN –Design process design Concepts – Design Model – Design Heuristic –Architectural Design – Architectural styles, architectural Design, Architectural mapping using dataflow – User Interface Design: Interface Analysis, Interface design – Component level Design: Designing Class based components, Traditional Components –TESTING AND IMPLEMENTATION –Software testing fundamental – Internal and external views of Testing – white box testing – basis path testing - control structure testing – black box testing – Regression Testing – Unit Testing – Integration Testing – Validation Testing – System Testing and Debugging – Software Implementation Techniques : Coding practices – Refactoring –PROJECT MANAGEMENT –Cost Estimation – FP Based, LOC Based, Make /Buy Decision, COCOMO II – Planning – Project Plan, Planning Process, RFP Risk Management – Identification, Projection, RMMM – Scheduling and Tracking – Relationship between people and effort, Task Set & Network, Scheduling, EVA – Process and Project Metrics - DEVOPS Essentials - Build Model Using MAVEN - Building DEVOPS using Azure.

Unit VII: Web Technology (20 Questions)

SCRIPTING LANGUAGES –Web page designing using HTML, Scripting basics – Client side and server side scripting. Java Script – Object, names, literals, operators and expressions – statements and features – events – windows –documents – frames –date types –built-in functions – Browser object model – Verifying forms – HTML5 – CSS3 – HTML 5 canvas – Web site creation using tools – Event Handling- PHP Scripting - JAVA PROGRAMMING – Features of java – Data types, variables and arrays – Operators – Control statements – Classes and Methods – Inheritance. Packages and Interfaces – Exception Handling – Multithreaded Programming – Input / Output – files – Utility Classes – Strong Handling – JDBC – JDBC Overview –JDBC implementation – Connection class – Statements – Catching Database Results, handling database Queries. Networking –Inet Address class – URL class – TCP sockets – UDP sockets, Java

Beans –RMI – APPLETs – Java applets – Life Cycle of an Applet – Adding Images to an Applet – Adding Sound to an Applet – Passing Parameters to an Applet - Event Handling. Introducing AWT: Working with Windows Graphics and Text. Using AWT Controls, Layout Managers and Menus. Servlet – life cycle of a servlet. The Servlet API, Handling HTTP Request and Response, Using Cookies, Session Tracking - MVC Architecture – Nodejs - Events – Listeners – Timers - Callbacks – Handling Data - Implementing HTTP Service in Nodejs – NOSQL – MongoDB – Frameworks – SPRING – MERN – MEAN – Flutter

Unit VIII: Computer Networks and Security (20 Questions)

NETWORKING FUNDAMENTALS & LINK LAYER –Building a network- requirements – Layering and protocols – Internet Architecture – Network software – Performance; Link layer Services – Framing – Error Detection – Flow control – MEDIA ACCESS & INTERNETWORKING – Media access control- Ethernet (802.3) – wireless LANs -802.11 – Bluetooth – switching and bridging – Basic Internetworking (IP, CIDR, ARP, DHCP, ICMP)- ROUTING – Routing (RIP, OSPF, metrics) – Switch basics – Global Internet (Areas, BGP, IPv6), Multicast – addresses – multicast routing (DVMRP, PIM) - TRANSPORT LAYER – Overview of Transport layer – UDP- Reliable byte stream (TCP) – Connection management – Flow control – Retransmission – TCP Congestion control – Congestion avoidance (DECbit, RED) – QoS – Application requirements – APPLICATION LAYER - Traditional applications - Electronic Mail (SMTP, POP3, IMAP, MIME) HTTP –Web Services - DNS –SNMP – Mobile Computing – Mobile Computing Vs. wireless Networking – Mobile Computing Application – Characteristics of Mobile Computing – Structure of Mobile Computing Applications. MAC Protocols – Wireless MAC Issues – Fixed Assignment Schemes – Random Assignment Schemes – Reservation Based Schemes –MOBILE INTERNET PROTOCOL AND TRANSPORT LAYER – Overview of Mobile IP- Features of Mobile IP- Key Mechanism in Mobile IP – Route Optimization. Overview of TCP/ IP – Architecture of TCP/ IP – adaptation of TCP Window – Improvement in TCP Performance – MOBILE AD-HOC NETWORKS – Ad- Hoc Basic Concepts – Characteristics – Applications – Design Issues – Routing – Essential of Traditional Routing Protocols – Popular Routing Protocols – Vehicular AdHoc networks (VANET)- MANET Vs VANET – Security – Cryptographic Algorithms – Caesar Cipher – Hill Cipher – Vignere cipher – LFSR Sequences – Number Theory –GCD –Chinese Remainder Theorem – Fermat's Theorem and Euler's Theorem – Symmetric key Cryptography – DES – AES Algorithms – Public key algorithms – RSA – Diffe–Hellman Algorithm – ElGamal System – Elliptic Key Cryptography – Digital Signatures – Digital Certificates – Hashing – MD5 – SHA1 – Key Management – Kerberos –PKI –IP Security – Email Security – SSL – SET –OS Security – Database Security.

Unit IX: Microprocessor and Embedded Systems (20 Questions)

8085 Architecture, Instruction set, addressing modes, Assembly language programming, Interrupts, timing diagrams, memory and I/O interfacing; 8086 Architecture, Instruction set, addressing modes, minimum and maximum mode configuration, assembler directives, assembly language programming, interrupts; 8051 Architecture, Special Function Registers (SFRs) instruction set, addressing modes, assembly language programming, I/O ports, Timers/counters, interrupts and serial communication.

Embedded System design process, Embedded processors – ARM Processor – Architecture, ARM Instruction sets – Addressing Modes – Pipelining – Embedded C Programming – Looping Structures – Register Allocation – Function calls – Pointer aliasing – Structure arrangement – bit fields – unaligned data and endianness – inline functions and inline assembly – portability issues. Profiling and cycle counting – instruction scheduling – optimized primitives. Multiple tasks and processes – Context switching – Scheduling policies – Interprocess communication mechanisms – Exception and interrupt handling – Performance issues. Meeting real time constraints – Multi-state systems and function sequences – Embedded software development tools – Emulators and debuggers.

Unit X: Electrical, Electronics and its Applications (20 Questions)

Ohm's Law - Kirchhoff's Laws – Solution of DC circuits with Independent sources only (Steady state), AC Fundamentals: Waveforms, Average value, RMS Value, Impedance, Instantaneous Power, Real Power, Reactive Power and Apparent Power, Power Factor – Steady State Analysis of RL, RC and RLC Circuits- three phase circuits.

Magnetic Circuits– DC Machines: Construction, Working Principle, Types and Applications of DC Generator and Motor, EMF and Torque equation. AC Machines: Construction, Working and Applications of Transformer, Three phase Alternator, Synchronous motor, Single and Three Phase Induction Motor, stepper motor, servo motor and BLDC motor.

Operation and Characteristics of electronic devices: PN Junction Diodes, Zener Diode, BJT, JFET, IGBT and MOSFET– Voltage regulators - Operational Amplifiers - 555 timer IC based astable and monostable multivibrator.

Solenoids, electro-pneumatic systems, proximity sensors, limit switches, piezoelectric, Hall Effect, photo sensors, Strain gauge, LVDT, piezo electric crystals, differential pressure transducer, optical and digital transducers, Smart sensors, Thermal Imagers.

Moving Coil and Moving Iron Instruments, Power Measurement, Energy Meter, Instrument Transformers - CT and PT, Multimeter- DSO- Data Acquisition Systems – A/D and D/A Converters –Data Transmission Systems – smart meters.

Single and Three Phase AC to DC Converters – uncontrolled and controlled rectifiers– Switched Mode Power Supplies – buck, boost and buck-boost converter topologies –switching losses – Inverters – Single and Three Phase Inverters – Voltage control –Pulse Width Modulation techniques – harmonic elimination techniques – Uninterrupted Power Supplies- Batteries – types and characteristics.

12. Criminology, Forensic Science, Psychology and Philosophy (Degree Standard)

Code:571

Unit I: Sociology and Psychology of Crime (20 Questions)

Anomie – Merton and Durkheim, Culture Conflict, Sub-culture theories. Theory of Imitation – Gabriel Tarde, Differential Association Theory, Drift and Neutralisation Theory, Translation Criminology, on-set and Influence of Drugs and Alcohol on children behavior. Vagrant and Truant children – Legal controls. Victimless crimes: Alcoholism, Drug Addiction, Beggary, Commercial Sex, Suicide, Delinquency. Anti-social Behavior.

Unit II: Family centered & Community Influences - Crimes against children and women under Indian Law (20 Questions)

Dowry, domestic violence, child abuse – Physical, Social, Sexual, Emotional and Neglect. Inter-religion and Inter-caste tensions and conflicts. Honour killing, Hate crimes and Blasphemy. Fundamental Rights under constitution of India. Rights of person in custody. The protection of Human Rights Act, Protection of Children from Sexual Offences Act (POCSO). The Immoral Trafficking Prevention Act, 1956 (Amended 2006) – Child Marriage Act.

Unit III: Women and Juvenile Institutions with relevant legislations and International Guidelines (20 Questions)

Women Institutions: Vigilance Home, Protective Home children in conflict with law; children and vulnerability. Juvenile Justice Board, Child Welfare Committee, Observation Homes, Juvenile Justice (Care and Protection of children) Act, 2015. Juvenile Homes, Special Homes, Fit institutions, Juvenile Aftercare Services, Juvenile Police Unit, Probation of Offenders Act and Parole. 3-R's Rehabilitation of punishment, Reformation and Reintegration. United Nations Standard Minimum Rules for Juvenile Justice (Beijing Rules) and United Nations (Riyadh) Guidelines. Convention of the Rights of the Children, Prevention of Delinquency.

Unit IV: Crime Prevention and Victim Assistance (20 Questions)

Crime prevention; Primary, Secondary and Tertiary. Neighborhood involvement, Situational crime prevention, crime prevention through Environmental Design and Defensible space. United Nation Declaration of Basic principles of Justice for victims of Crime and Abuse of power, 1985. Impact of victimization – Physical, financial and psychological resilience, post – traumatic stress, growth, anger and aggression management, Repeat victimization, routine activities theory, life style exposure. Restitution and Restorative Justice.

Unit V: Forensic Science and Toxicology (20 Questions)

Forensic Science – Definition – Physical evidences – their classification and significance – Locard's Principle of Exchange

Toxicology – classification and mode of action of poisons – narcotic drugs – alcoholic beverages – Isolation and Identification of poisons, drugs and alcohol.

Drugs: Pharmacological actions, therapeutic uses and screening tests of the following drugs- opium alkaloids-morphine, heroin, antibiotics synthetic analgesics phenothiazines, meprobamate, diazepam pethidine, methadone barbiturates stimulants tranquilizers amphetamines, imipramines hallucinogens cannabinoids, LSD hypnosis and sedatives antipyretics, analgesic, antiseptics and disinfectants - Alcohol manufacture of ethyl alcohol and liquors constituents of liquors estimation of alcohol contents in liquors denaturation, denaturants, industrial alcohol and power alcohol.

Definition of poisons - Mode of action of poisons - Extraction and purification of poisons in toxicological analysis - Volatile poisons – metallic poisons - non-volatile organic poisons - water soluble compounds - protein precipitation methods. Estimation of the following poisons Carbon monoxide, cyanide, formaldehyde, methanol, chloral, chloroform, phenols, cresols, phosphorus and amphetamines Signs and symptoms of H₂SO₄, HNO₃, CO₂, H₂ S poisoning. Analytical methods for the estimation of ethyl alcohol. Metallic poison-signs, symptoms of arsenic, mercury, lead and copper - Reinch test - Marsch Berzelius and Gutzeit tests volumetric, colorimetric and instrumental methods of analysis of the above metals. Pesticides & Insecticides Definition - general properties poisonous nature - detection & isolation.

Unit VI: Forensic Biology (20 Questions)

Examination of biological fluids - blood, semen and saliva stains – forensic characterization of the above stains – stain patterns of blood - Examination of fibres, hair, bones, teeth and skull – Fundamentals of DNA Typing. Forensic Anthropology - Anthropometry and its uses - Biochemical and Molecular Techniques: Blood and its composition – WBC, RBC and Platelets. Blood clotting, Blood grouping - Antigens and Immunoglobins – Classes and functions. Collection and Preservation of Biological fluids [Blood, Semen and Saliva] - Isolation of DNA from blood sample, and DNA Typing - Ethnobotany – Ethno Medicinal Plant, Narcotic Plant

Unit VII: Introduction to Psychology (20 Questions)

Psychology – Branches - Biological Bases of Behaviour – Brain, Nervous System – Heredity – Environment – Developmental Stages – Childhood - Adolescence – Adulthood – Attention – Kinds of Attention – Perception – Illusion – Consciousness – Sleeping – Consciousness altering drugs – Memory – Memory Models - Types of memory – Forgetting – Thinking – Intelligence – Theories of Intelligence - Emotional Intelligence – Intelligent Quotient (IQ) - Creativity – Theories of Creativity – Motivation – Drives – Classification of Motivation - Motives – Affiliation – Aggression – Emotion – Biological Basis – Theories of Emotions.

Unit VIII: Health, Social and Wellbeing Psychology (20 Questions)

Health Psychology – Behavioural and Psychological correlates of illness – Stress and coping – Managing Stress – Personality – Types of Personality – Projective Techniques – Adjustment – Models of Adjustment - Mental Disorders – Abnormality – Diagnosis – Diagnostic and Statistical Manual of Mental Disorders (DSM) – International Classification of Diseases (ICD) – Anxiety Disorder – Mood Disorder – Dissociative and Somatoform disorders – Schizophrenia, Psychotherapies – Mental Hygiene - Yoga and Meditation – Social Behaviour – Prejudice – Social Influence – Prosocial Behaviour – Group – Group Behaviour – Inter group relation.

Unit IX: Indian Philosophy (20 Questions)

Heterodox: Carvaka – Epistemology, Metaphysics and Ethics; Jainism – Bondage and liberation, Triratna and Pancharama Vratas, Sects of Jainism – Svetambara and Digambara; Buddhism – Four noble truths, Eight fold path, Sects of Buddhism – Hinayana and Mahayana.

Orthodox: Nyaya – Theory of knowledge; Vaisheshika – Theory of Atomism; Samkhya – Theory of Evolution, Theory of Causation; Yoga – Astanga Yoga; Purva Mimamsa – Theory of Knowledge; Vedanta – Advaita – Maya, Brahman & concept of liberation; Visistadvaita – world, God and liberation; Dvaita – Doctrine of Panchabedha.

Unit X: Logic and Ethics (20 Questions)

- a Logic: Nature and classification of Terms and Propositions, Laws of Thought, Square of Opposition, Obversion & Conversion – Rules of Categorical Syllogism with fallacies; Mixed Syllogism – Hypothetical, Disjunctive and Dilemma. Difference between Deduction and Induction, Problems of Induction Stages of Scientific Induction, Characteristics of Hypothesis, Observation and Experiment.

- b Ethics: Rna – Rta; Karma; Purusharthas; Varnashrama Dharma; Ethics of Buddhism, Jainism and Bhagavad Gita.
Hedonism, Utilitarianism of Bentham and J.S. Mill, Intuitionism of Butler, Kant's Categorical Imperative, Bradley's – My Station and its Duties.

13. Dairy Science, Dairy Technology, Food Technology, Food Processing (Degree Standard)

Code: 579

Unit I: Dairy Science (20 Questions)

Status of Indian dairy industry- Operation flood program - Anand pattern - Milking systems – clean milk production - Milk composition and factors affecting composition of milk - Nutritive value - Platform tests, Adulteration of raw milk - Milk procurement and pricing policy - Operation and maintenance of primary milk co-operative society (PMCS) – milk analysers, estimation of milk fat and SNF –Chilling of raw milk and BMC operation - Milk transportation and surveillance system, Raw milk - FSSAI specifications.

UNIT II: Processing of Fluid Milk (20 Questions)

Unit Operations in Dairy Processing Plant: Homogenisation - Standardization of milk – Pearson square and algebraic methods - Thermal processing of milk - Defects in market milk - Manufacture of special milk: toned, double toned, reconstituted, recombined, flavoured, homogenized, vitaminised and acidophilus milk –Storage of raw milk and Processed milk. Manufacture of sterilized milk: UHT-Cleaning and Sanitation – CIP System - Distribution systems for market milk - Effect of heat processing on nutritive value.

UNIT III: Fat Rich Dairy Products (20 Questions)

Cream: Definition & Legal standards, efficiency of cream separation and factors affecting Cream separation – control off at percentage in cream - Neutralization, standardization, pasteurization and cooling of cream - Preparation and properties of different types of cream – sterilized cream, frozen cream - Factors affecting quality of cream - ripening of cream - Packaging, storage and distribution - defects in cream and prevention.

Butter: Theory of churning, legal standards - Technology of butter manufacture: batch and continuous methods - Over run in butter; control of fat loss in buttermilk - packaging and storage – transportation - defects in butter - rheology of butter - uses of butter. Care and maintenance of cream separator, coolers, vacreator, factory butter churn and continuous butter making machine. Special butter and related products: Manufacture, packaging, storage and properties of whey butter, flavoured butter, whipped butter, renovated butter/fractionated and polyunsaturated milk fat products, vegetable oil- blended products and low-fat spreads - Manufacture, packaging, storage and characteristics of margarine of different types.

Ghee and butter oil: Methods of ghee making: batch and industrial processes - innovations in ghee production - procedure, packaging and preservation of ghee – utilization of substandard milk –Composition of ghee and changes during manufacture - fat constants. Manufacture of butter oil - packaging and storage.

Unit IV: Ice-cream and Frozen Desserts (20 Questions)

Definition - classification - composition and standards of ice cream and other frozen desserts - calculation and figuring of ice cream mix and yield -Stabilizers and emulsifiers – classification, properties and role in quality of ice cream - Thermodynamics of freezing and calculation of refrigeration loads - Types of freezers - refrigeration control/instrumentation - Hygiene, cleaning and sanitation of ice cream plant - Effect of process treatments on the physico-chemical properties of ice-cream mixes and ice cream - Processing and freezing of ice-cream mix and control of over run - Packaging, hardening, storage and transportation of ice-cream - Defects in ice cream, causes and prevention.

Unit V: Traditional Indian Dairy Products and Fermented Dairy Products (25 Questions)

Khoa and Khoa based sweets: Peda, Burfi, Kalakhand, Gulabjamun and Milk cake - Compositional profile and manufacture process. Rabri and Basundi:Channa and Channa based sweets: Rasogolla, Rasomalai, Sandesh, Paneer. Chakkaand Shrikhand – Misti Dahi–Kheer, Payasam and kulfi.Bio preservative principles in enhancing the shelf-life of indigenous milk products –packaging.

Preparation of Dahi, Yogurt, Lassi, Buttermilk.Cheese Technology - Definition - standards and classification of cheese - Action of rennet on milk in relation to cheese making -Manufacture of different

varieties of cheese: Cheddar, Swiss, Mozzarella, Gouda and Cottage Cheese - Enzyme Modified Cheese (EMC) – flavourings - Application of membrane processing in cheese manufacture - Factors affecting yield of cheese – Packaging - storage and distribution of cheese –Accelerate ripening of cheese. Manufacture of processed cheese and cheese spread - Mechanization and automation in cheese processing.

Unit VI: Condensed and Dried Milks (15 Questions)

Condensed Milk: Definition and legal standards - Condensed milk, sweetened condensed milk and evaporated milk - manufacturing techniques - Recombined sweetened condensed milk - Grading and quality of raw milk for condensed and evaporated milk, physico-chemical changes taking place during manufacture of condensed milk - heat stability of milk and condensed milk and role of stabilizers in the stability of condensed milk - defects in condensed milk, causes and prevention.

Dried Milk: Grading and quality of raw milk for dried milks - Manufacture of whole milk powder (WMP), skim milk powder (SMP), and heat classified powders - composition of dried milks, recovery of milk powders- manufacture of infant foods, malted milk foods and other formulated dried products - Cheese spread powder, ice cream powder, cream powder, butter powder, whey powder.

Unit VII: Dairy Chemistry (20 Questions)

Milk Sampling Techniques from different sources for Chemical Analysis - Chemistry of Lactose, Significance of lactose in milk and milk products - Estimation of lactose in milk - Chemistry of Proteins- General description, amino acid contents of milk proteins, caseins, lactalbumins, lactoglobulins, other proteins in milk, physical and chemical properties of milk proteins, separation of milk proteins - Estimation of proteins in milk - Chemistry of Milk Lipids - General description, classification, distribution of lipids in milk, composition of milk, milk fat constants, phospholipids, unsaponifiable matter, milk fat hydrolysis, milk fat oxidation, hydrogenation of fat - Mineral constituents of milk.

Unit VIII: Microbiology of Milk and Milk products (20 Questions)

Common microbes in milk and their significance, Microflora of mastitis milk, Sources of microbial contamination of raw milk during collection, transport and storage; Microbial changes in raw milk during long storage, Microbiological grading of raw milk; Microbiological aspects of processing techniques - bacteriophage, thermization, pasteurization, sterilization, boiling, UHT and non-thermal processes including membrane filtration; Role of psychrotrophic, mesophilic, thermophilic and thermotolerant bacteria in spoilage of processed milks, their sources and prevention; Microbiological quality of dairy products - fat rich, frozen, concentrated, dried milks, fermented, and indigenous dairy products; Legal standards; Sources of contamination and factors affecting microbial quality of these products during processing, storage and distribution; Microbiological defects associated with milk products and their control; Food poisoning; infections and their public health significance; Sources of pathogens and their prevention.

Environmentally transmitted microbial pathogens (*Salmonella*, *E. coli*, *Campylobacter*, *Yersinia* etc.) and viruses (enteric and respiratory); indicator microorganisms - total and faecal coliforms, faecal streptococci, bacteriophage etc; Biofouling and biofilms; microbial toxicants and bio-organic pollutants; Current trends in cleaning and sanitization of dairy equipment; Enumeration of composite microflora in milk and dairy products - aerobic & anaerobic; Quality requirements of water for dairy plant operations.

Principles of quality and safety functions in dairy processing unit; FSSAI - regulations and guidelines; ISO standards; principles of QMS and HACCP, SAFE, GMP, SSOP, FSMS, personnel hygiene and food handling in dairy industry; Bio-safety concepts - Sampling plan as per International council for microbiological standards for foods (ICMSF); Guidelines and specifications for different dairy foods as recommended by ICMSF, CODEX.

Unit IX: Dairy Process Engineering (20 Questions)

Canning, dehydration, freezing, freeze drying, fermentation, microwave, irradiation and chemical additives- Aseptic preservation, hurdle technology, hydrostatic pressure technology and microwave processing- Use of non-thermal technologies (microfiltration, bacteriophage, ultra high voltage electric fields, pulse electric fields, high pressure processing, irradiation, thermosonication), alternate-thermal technologies (ohmic heating, dielectric heating, infrared and induction heating).

Refrigeration – principles - refrigeration effect – coefficient of performance – units of refrigeration - vapour compression system-different types Refrigeration components – compressor, condensers, evaporators,

expansion device – types, construction, principle and working- Refrigerants – properties – classification, nomenclature – comparison and advantages – alternate refrigerants – Azeotropes - vapour absorption system- Electrolux refrigerator –construction and principles -Cooling load estimation.

Fuels: Renewable energy sources:- Operation and maintenance of different types of boilers - Properties of steam - Use of steam tables and Mollier charts, Analysis of energy input in steam generation and heat gain insteam consumption. Steam generators - Introduction to Indian Boiler Regulation Act. Boiler Draught - Air Compressors.

Unit X: Dairy Process Equipment Design and Automation (20 Questions)

Principles and design of shell and its component, stresses from local load and thermal gradient, mountings and accessories - Principles and design of fermenter vessel and design problems - Hazards and safety considerations - Principles and design of agitators and separators. Heat exchangers - Principles and design of shell and tube heat exchanger - plate heat exchanger - scraped surface heat exchanger - tubular heat exchanger - sterilizer and retort - single effect and multiple effect evaporators- rising film and falling film evaporators. Design of crystallizer, centrifugal separator, freezing equipment- Types of freezers – Principles and design of ice-cream freezers and refrigerated display system - Principles and design of tray dryer, tunnel dryer, vacuum dryer, spray dryer and freeze dryer- Principles and design of screw conveyor, bucket elevator and pneumatic conveyor - Principles and design of extruders - Cold and hot extruder design, single and twin screw extruder.

Machines for filling of liquid and wet products - to predetermined level and predetermined volume- filling of dry solids- by count- volume-weight - methods of wrapping and bagging -Form, fill and seal machines- various forms of packaging – Cartoning systems – Printing and Labelling – Container handling. CAS and MAP, shrink and cling packaging, vacuum and gas packaging - Aseptic packaging, Active packaging, Smart packaging, intelligent packaging - Retort packaging, principles, application.

Dairy plant automation –principles- role of programmable Logic controller (PLC) and Supervisory control and Data Acquisition (SCADA)-automation tools-sensors-flow meters-actuators-and robotic system.

14. Electrical, Electronics and Communication Engineering (Degree Standard)

Code: 514

Unit I: Circuit Theory, Signals and Systems (20 Questions)

Circuit analysis: Kirchoff's laws, Nodal and Mesh analysis, Network Theorems: Superposition, Thevenin, Norton, Miller and Reciprocity. Sinusoidal steady state analysis: phasors, complex power, maximum power transfer. Time and frequency domain analysis of linear circuits: RL, RC and RLC circuits, solution of network equations using Laplace transform. Linear 2-port network parameters, Star-Delta transformation. Three Phase Circuits – Star-delta transformation - Real and reactive power - power factor Characteristics and classifications of Continuous and Discrete Time signals - CT signal analysis - Fourier Series, Fourier Transform and Laplace Transform. Sampling theorem, Discrete Time signal analysis - DTFT and Z-Transform. CT and DT systems - Impulse response and convolution, Frequency response, Transform domain analysis using FT, LT - Recursive and non-recursive systems.

Unit II: Analog and Digital Electronics (20 Questions)

Semiconductor Devices: PN Diode, Zener, LED, Photo diodes, Transistors, FET and their applications. Rectifier circuits, Voltage regulators, Biasing circuits, Small signal amplifiers, Frequency response, Multistage amplifiers, Coupling methods, Large signal amplifiers, Push, pull amplifiers, Feedback amplifiers, Oscillators, Operational amplifiers and its applications, Precision rectifiers, Multivibrators, Schmitt triggers, Voltage Controlled Oscillator, 555 Timer.

Number representations: Binary, Integer and Floating point numbers, Boolean algebra, Minimization of functions using Boolean identities and Karnaugh map. Digital logic gate families (DTL,TTL,ECL,MOS,CMOS), Logic gates, Simplification of Logic Functions, Design of Combinational circuits, Sequential logic circuits, latch, Flipflops, Counters, Registers, multiplexers and demultiplexers, Memories(ROM,PLA and FPGA).

Unit III: Electromagnetic Theory (20 Questions)

Coulomb's Law-Electric Field Intensity-Electric Flux Density-Gauss's Law- Divergence - Electric Field and Potential due to Point, Line, Plane and Spherical Charge Distributions - Effect of Dielectric Medium -

Capacitance of Simple Configurations- Magnetic Circuits- Magnetomotive force - Reluctance-Faraday's laws-Lenz's law-Biot-Savart's law - Ampere's law - Fleming's Left and Right Hand Rule-Lorentz force - Inductance - Self and Mutual Inductance-Dot Convention-Coupled Circuits
Maxwell's equations, Poynting vector. Plane waves and properties: Reflection and refraction, Polarization, Phase and group velocity, Propagation through various media, Skin depth. Transmission lines: Equations, Characteristic impedance, Impedance matching, Impedance transformation.

Unit IV: Electrical Machines (20 Questions)

D.C. Machines - Construction, Excitation methods - Armature Reaction and Commutation - Characteristics and Performance Analysis - Generators and Motors - Starting, Speed Control and braking - Testing - Losses and Efficiency. Transformers – Types - Construction and Operation – Testing - Equivalent Circuits - Losses and Efficiency - All day efficiency - Regulation - Parallel Operation - Three Phase Transformers - Auto-transformer. Induction Machines - Construction, Principle of operation - Rotating Magnetic Field - Performance, Torque-Speed Characteristics, No-load and Blocked Rotor tests, Equivalent Circuit, - Starting, Speed Control and braking. Single Phase Induction Motors - Linear Induction Motors - Hysteresis Motors - Reluctance Motors. Synchronous Machines – Construction - Operating characteristics and Performance analysis - Efficiency and Voltage regulation - Parallel operation - V and inverted V curves of synchronous motors - Power factor improvement - permanent magnet synchronous motor - Permanent magnet brushless dc motor - stepper motor.

Unit V: Control Systems (20 Questions)

Mathematical Modelling of Physical Systems - Transfer Function - Block Diagrams and Signal Flow Graphs and their Reduction using Mason's Rule - Time Domain and Frequency Domain Analysis of Linear Time Invariant (LTI) System - Errors for Different Type of Inputs and Stability Criteria for Feedback Systems - Stability Analysis Using Routh-Hurwitz Array - Nyquist Plot and Bode Plot - Root Locus - Gain and Phase Margin - Basic Concepts of Compensator Design - PI, PD and PID Controllers - State Variable formulation - state transition matrix - Eigen values and Eigen vectors - free and forced responses of Time Invariant systems - controllability and observability.

Unit VI: Power Systems (20 Questions)

Single Line Diagram of Power System - Per Unit Quantities - Power Generation Types - Hydro, Thermal and Nuclear Stations - Pumped storage plants - Cogeneration - Economic and operating factors - Modelling and performance characteristics of Power transmission lines and Cables - Mechanical Design of Transmission Lines – Sag - Insulators - Z_{BUS} and Y_{BUS} formulation - Load flow studies - Shunt and Series Compensation - Symmetrical and Unsymmetrical Fault Analysis - Transient and Steady - State Stability of Power Systems - Equal Area Criterion - Voltage and Frequency Control-Power System Transients - Power System Protection - Circuit Breakers - Relays classification of protection schemes -overcurrent, distance, differential and carrier - Equipment protection - transformer, generator, motor, busbars and transmission line – earthing and lightning protection - AC and DC Distribution – deregulation - energy conservation and energy auditing

Unit VII: Measurements and Instrumentation (20 Questions)

Units and Standards - Static and Dynamic Characteristics - Types of Errors - Error Analysis -Measurement of Current, Voltage, Power, Power-factor and Energy - Indicating instruments - Measurement of Resistance, Inductance, Capacitance and Frequency - Bridge Measurements - Instrument Transformers - Electronic Measuring Instruments - Multi meters - True RMS meter - Spectrum Analyzer -Power Quality Analyser - Recording Instruments-X-Y Recorder - Magnetic Recorders - Digital Data Recorder – Oscilloscopes – DSO - LED and LCD Display –Sensors and Transducers and their applications to the Measurement of Non-Electrical Quantities like Temperature Pressure, Flow-rate, Displacement, Acceleration, Noise level, Fire and smoke deduction - Data Acquisition Systems – A/D and D/A Converters - Data Transmission Systems - PLC -smart meters.

Unit VIII: Digital Processors, Communication and Networks (20 Questions)

Architecture of 8085, 8086 and 8051 – Instruction Sets – Assembly Language Programming – Interfacing for memory and I/O: 8255 Programmable Peripheral Interface – 8253 Programmable Timer Interface – 8279 Programmable Keyboard and Display Interface – 8257 Direct Memory Access Interface - Embedded processors (ARM and PIC basics only). Classification of Signals and systems – Properties of

Discrete Fourier Transforms - FFT Computation – FIR Filters – IIR Filters: Butterworth Filters – Chebyshev Filters.

Analog and Digital Communication Systems: AM/FM Modulation and Demodulation, ASK, FSK, PSK, PCM – Adaptive Delta Modulation – FDM and TDM – OSI MODEL, TCP/IP reference model, Data link layer, Medium Access Control, Network layer.

Unit IX: Power Electronics and Drives (20 Questions)

Static and dynamic behaviour of Power Semiconductor devices - Power Diode, DIAC, SCR, TRIAC, GTO, MOSFET and IGBT - Single and Three Phase AC to DC Converters - uncontrolled and controlled rectifiers - performance parameters - Switched Mode Power Supplies - buck, boost and buck-boost converter topologies - Switching losses – Inverters - Single and Three Phase Inverters - Voltage control - Pulse Width Modulation techniques - harmonic elimination techniques – AC voltage controllers- Uninterrupted Power Supplies - Electrical drives - motor load dynamics - load torque characteristics - Speed Control of DC Drives - Converter/Chopper fed dc motor drives - Speed control of AC drives - induction motor drives - stator voltage control and V/f control - synchronous motor drives -V/f control, self control, margin angle control and power factor control

Unit X: Renewable Energy Sources, Storage Devices and Utilisation of Electrical Energy (20 Questions)

Renewable Energy – Sources and Features - Solar Radiation Spectrum - Radiation Measurement - Solar Photovoltaic Cell – principle of operation –types - MPPT – Microhydel - Operating principle - Wind Energy – components - wind power turbine types - MPPT- Site Selection - Types of Wind Generators - smart grid - Electric vehicles - V2G and G2V - Fuel Cells - Batteries - types and characteristics - Super Capacitors Electrical wiring – illumination - design of lighting schemes - air conditioning system

15. Environmental and Chemical Engineering (PG Degree Standard)

Code: 393

Unit I: Environmental Policy, Environmental Legislations and Environmental Impact Assessment (25 Questions)

National Environment Policy - International Conventions and Obligations, International treaties of Environment-Water (P&C) Act, 1974 as amended - Air (P&C) Act, 1981 as amended - Environmental Protection Act, 1986 with amendments and Rules and Notifications made under Environmental (Protection) Act, 1986 for the management of hazardous waste, solid waste, e-waste, bio-medical waste, plastic waste, C & D wastes, battery waste etc., EIA - Notification, Methodology, models, Environmental Monitoring and Management Plan, Public consultations as per EIA Notification.

Unit II: Environmental Chemistry and Environmental Microbiology (15 Questions)

Chemical mass balance – Emission calculations – Green Chemistry principles –Aquatic Chemistry - Atmospheric Chemistry and Soil chemistry – Representative sample collection techniques- Field and lab analysis - Wet and Instrumentation Methods - Chemical speciation, Classification and Characteristics of microorganisms - Microorganisms in wastewater and air - Applications of microorganisms in wastewater treatment and soil remediation.

Unit III: Principles & Design of Physico-Chemical treatment of Wastewater (20 Questions)

Water Quality criteria and indices - Wastewater characteristics - Unit operations - Principles and design of screens, grit chamber, skimming tanks - Flow equalisation and neutralisation - Aeration and gas transfer mechanisms – Sedimentation -Types of settling – analysis and Design of Sedimentation tanks - Process and design of filtration systems - Adsorption, ion exchange, electro-coagulation, Electrodialysis, reverse osmosis – RO reject Management - Disinfection.

Unit IV: Principles and Design of Biological Treatment of Waste water (25 Questions)

Types of Reactors - Mass Balance Analysis - Reaction and Reaction rates - Suspended growth process - Role of microorganism - Growth kinetics, oxidation, modelling, mCRT, F/M Ratio, Bio kinetic coefficients - Design of activated sludge process, Plug flow Reactor, Aerated lagoon - Oxygen Requirement, transfer of

oxygen, Equipments- Secondary clarifier, Sludge Volume Index, Sludge production, Operation and maintenance, Attached growth process - Trickling filter - process, substrate removal, classification, design, NRC, Rankine's and Eccenfelder equation - Rotating Biological contactors - UASB - Sludge digestion - sludge management – Advanced Biological Treatment – SBR, MBR, ANSBR.

Unit V: Air and Noise pollution Control (15 Questions)

Sources and Effects– Classification-Photochemical reactions, Atmospheric Stability-Lapse Rates, Inversions, Plume Behaviour -Pollutant Dispersion, Emission Standards and Air Quality Standards, Air Quality Index, Methods of Pollutant Sampling and Measurement, Continuous emission and Air Quality monitoring. Control Methods for Particulate Emissions, Black carbon and Gaseous Pollutants; Indoor Air Pollution, Automobile Pollution-Emission Norms and Control Techniques, Source apportionment studies, Noise Pollution – Source – Effects – Standards - Measurement and Control Measures - Industrial Noise Measurement and control.

Unit VI: Solid and Hazardous Waste Management (25 Questions)

Sources, generation rate, classification and characteristics - source segregation and storage - methods of collection - transportation - route optimisation – treatment –Incineration, Pyrolysis, Composting, MBT and Landfilling, Bioremediation ,Bioaccumulations - disposal – Coprocess - Centralised and de-centralised processing - Landfill design and operation - Dumpsite rehabilitation, Management of hazardous waste, biomedical waste, plastic waste, construction and demolition wastes and E waste - Resource recovery, recycle, reuse and product development from waste.

Unit VII: Statistical Approach and Modelling of Environmental Systems (15 Questions)

Principles of Environmental modelling, Statistical approach, model building, environmental models, Data Sampling – Distributions – Inference - Estimation – Hypothesis Testing, Calibration, Validation, and Sensitivity Analysis. Types of air quality models-dispersion and emission models, chemical and ecological models, Pollutant and nutrient dynamics. Operational control of wastewater treatment processes, microbial dynamics calculations, Surface and ground water Modeling.

Unit VIII: Industrial Pollution Prevention and Cleaner Production Technologies (25 Questions)

Industrial Manufacturing process description, Wastewater Characteristics, Source reduction, Treatment and disposal, key issues emerging contamination and pollution control measures for highly polluting industries such as Paper and Pulp, Sugar, Distillery, Chemical plants - Metal finishing, Iron and Steel, fertilizer, Meat packing, Poultry plant - Automobile - Thermal power plants, Cement Plants, Textile dying, Tanneries, Pharmaceutical, pesticides, petroleum refinery and petrochemicals - Integrated Waste Management for zero discharge, Cleaner production process including process modification, raw material substitution - Recycle and reuse of waste.

Unit IX: Environmental Safety and Risk Assessment (15 Questions)

Health and Safety systems in work places. Hierarchy of control measures for occupational health risks. Accident, causes, mechanical and electrical hazards and preventive steps. Role of personal protective equipment and the selection criteria. Significance of human factors in the establishment emergency preparedness. Qualitative and quantitative risk assessment- Hazard identification and control, Hazard assessment, Overall risk contours for different failure scenarios – disaster management plan – Safety measures design in process operations. Ergonomics effects on humans. Inspections and audits, safety policies, EHS issues.

Unit X: Sustainable Development, Environmental Management and Economics and Global, Regional and Local Environmental Issues (20 Questions)

Sustainable Development Principles - International Conventions and treaties-Sustainable Development Goals and Indicators, Environmental Management Systems – ISO 14001, 19000 - Environmental Auditing – Ecolabelling- Life cycle Assessment-Design for Environment, Economics of pollution prevention - Cost Benefit Analysis - Circular economy - Economic instruments for environmental protection - Pollutant tax and emission trading - Natural resource economics, Green building concepts.

16. Environmental Science, Biology and Chemistry
(PG Degree Standard)

Code: 557

Unit I: Introduction to Environment (30 Questions)

Environment: Components – Segments – Atmosphere: Troposphere – Stratosphere – Mesosphere – Thermosphere – Lithosphere: Crust – Mantle – Core – Hydrosphere: Fresh water and saline water – Biosphere – Ecology: Autecology – Synecology – Ecosystem: Structure and Function – Energy Flow – Food Chain – Food web – Ecological pyramids – Biogeochemical cycles (C, N, P, S and water) - Ecological successions: Primary and Secondary succession – Ecological interactions: Symbiosis - Commensalism – Mutualism - Proto-cooperation – Amensalism – Predation – Parasitism – Natural resources: Classification-renewable and non-renewable - Status and challenges. Water resources: Types – Availability – Issues - Conflicts over water. Soil and mineral resources - Mineral exploitation and Environmental impacts; Forest resources. Energy resources: Conventional and Non-conventional energy - Sustainable development: Sustainable Development Goals (SDGs)

Unit II: Environmental Pollution and Management (30 Questions)

Pollution – Pollutant – Contamination – Contaminant - Point and non-point sources. Air pollution: Sources - Primary and secondary pollutants - Criteria pollutants – VOCs – PAN - PAHs - POPs - Acid rain – Smog – Oxidizing - Reducing. Air Pollution dispersion models: Looping – Coning – Lofting – Trapping - Indoor air pollution – Effects. Control Measures: Scrubbers – Wet – Dry – Venturi – Filter – Bag filters – Dehumidifier- Electrostatic precipitators (ESP) – Flue Gas Desulfurization (FGD). Cyclonic separators – Catalytic converter. Noise pollution: Sources – Effects – Control measures. Water pollution: Sources – Effects – Eutrophication – Biomagnification – Bioaccumulation – Control Measure – Waste water treatments – Primary – Secondary – Tertiary – Common Effluent Treatment Plant (CETP) – Sewage Treatment Plant (STP) – Constructed Wetlands. Soil pollution: Sources – Effects – Control measure – Bioremediation – Microbial remediation – Phytoremediation - Heavy Metal Pollution – Hg - Cr – As – Se – Cd - Pb - Sources – Effects - Thermal and Radioactive pollution - Municipal solid waste - Hazardous waste – Biomedical waste – Effects - Control measures – Incineration – Pyrolysis - Gasification – Composting – Ecotoxicology: Toxicant – Toxicity – Acute – Subacute – Chronic - Dose descriptor – LD50 – LC50 – NOAEL- Dose response relationship- Fate of Chemical in environment: Insecticides Fungicides – Herbicides – Fertilizers – PCB - Dioxins. Land degradation- deforestation- desertification – urbanization- Ozone layer depletion – Greenhouse Gases and Climate change – Meteorological indicators - Remote Sensing and GIS for environmental Management – National river conservation plan – Carbon sequestration and carbon credits.

Unit III: Environmental Legislation, Policies and Standards (25 Questions)

Introduction to environmental laws - Constitutional provisions- Article 48A, Article 51A (g) – Article 21- Major Indian Environmental Legislations: Water Act - Air Act - Environment Protection Act – Environmental Protection Rules - Noise Pollution Rules – Biodiversity Act - Plastic and Solid waste management Rules – National Green Tribunal Act – Bio Medical Waste Management Rules – The E- Waste Management Rules – Hazardous and Other Wastes(Management and Transboundary Movement) Rules- Environmental Impact Assessment Notification – Coastal Regulation Zone Notification. Central Pollution Control Board (CPCB) - Environmental standards – Drinking water standards (IS 10500:2012)- Discharge of Industrial Effluents into inland – Public sewers – Irrigation – Marine – Standards for sewage treatment plants – Designated best use water quality criteria. National Ambient Air Quality standards – Noise standards - National Green Tribunal – Environmental Impact Assessment: Screening- Scoping- Public consultation – Methodologies – Environmental management plan- ISO 14000 series – Life cycle assessment – Occupational health and safety: Preventive measures – Health screening measures.

Unit IV: Instrumentation and It's Applications (30 Questions)

Basic Principles, Instrumentation and applications of Ultraviolet-visible (UV-vis.) spectroscopy; Beer-Lambert's law, solution preparation and small molecules analysis and Flow Injection analyzer - Fourier Transformer Infrared spectroscopy (FT-IR): sample preparation - functional group analysis, Flame spectrometry, Atomic Absorption Spectroscopy (AAS), Inductively Coupled Plasma - Mass Spectrometry (ICP-MS), Inductively Coupled Plasma Emission spectroscopy (ICP-OES), Fluorimetry – Chemiluminescence's Detector system, X-ray fluorescence spectroscopy (XFS), Microscopy techniques: (fundamentals only) Optical microscopy, Scanning Electron Microscopy (SEM). Transmission Electron

Microscopy (TEM).

Chromatographic Techniques: Basic Principles, Instrumentation and applications of chromatography – Paper chromatography, Thin layer chromatography (TLC), High-performance Liquid chromatography (HPLC) and Gas chromatography (GC), Gas-Chromatography with Mass Spectrometry (GC-MS).

Electrochemical Techniques: Basic Principles, Instrumentation and application of conductometry, potentiometry – Ion selective meter – Voltammetry – Turbidimetry and nephelometry, Elemental analyzer, TOC analyzer, Portable Gas analysis, ambient air quality H₂S, CO₂, SO₂, NO₂, NH₃, O₃, HC Particulate analysis, Stack monitoring, Volatile organic Carbon (VOC).

Unit V: Analytical chemistry (30 Questions)

Titrimetric Analysis: Classification of reaction in titrimetric analysis – Standard Solutions – Normality, Molarity and Molality - concentration units – Primary and Secondary standard – neutralization indicators – self indicators and external indicators- acid base titrations – precipitation titrations – redox titrations.

Principles of gravimetric analysis – choice of precipitants and condition of precipitation, specific and selective precipitants – Dimethyl glyoxime (DMG), cupferron, phenolphthalein, salicylaldehyde, ethylene diamine – Co-precipitation and post precipitation.

Sampling techniques and procedure for solids, effluent, water and air - Physical evaluation of water; color, odour and turbidity. Chemical examination of water; alkalinity, Total Dissolved Solids (TDS), turbidity and total hardness. Determination of carbonates, bicarbonates, sulphates, chlorides, nitrates, phosphate, fluorides – sodium, potassium, SAR, iron, manganese, cadmium, chromium, lead, mercury and arsenic – oil and grease. Biological evaluation of water; dissolved oxygen, biological oxygen demand, chemical oxygen demand - organic pollutant and microbiological analysis.

Unit VI: Environmental Biology (10 Questions)

Physiology: Water relations of plants, Ion Transport, photosynthesis, Photolysis of water, Carbon fixation in C₃-C₄ cycles, Biological Nitrogen fixation, Stress physiology (Biotic and Abiotic), Photochemical reactions, Oxidative Phosphorylation. Biodiversity - Biodiversity and its distribution; Levels and types; Hotspots; Biodiversity loss - Threats to biodiversity - In-situ and ex-situ conservation approaches - Biosphere reserves – MAB program - Pollution indicator organisms and adaptive mechanisms in invertebrates, fishes, amphibians, reptiles and birds. Biophysics: Laws of Thermodynamics, Energy transduction in biological systems. Migration of fishes, birds and mammals. Endangered and extinct species - current status – IUCN Red list category.

Unit VII: Biochemistry Aspects of Pollution (10 Questions)

Introduction to Pollution and Biochemistry: Disruption of Biochemical Pathways by Pollutants. Carcinogens and Environmental Pollution: Definition and Types of Carcinogens, Mechanisms of Carcinogenesis - Oxidative Stress, Common Environmental Carcinogens. Biochemical Markers for Carcinogenesis: Asbestos Toxicity - Heavy metal toxicity: Lead, Cadmium, Mercury, Arsenic and their Biochemical Effects - Mechanisms of Toxicity: Free Radicals, Oxidative Stress, Antioxidants. Role of Blood Tests in Detecting Pollutant Exposure: Effect of pollutants on human health. Pathways for Detoxification: Phase I and Phase II Detoxification.

Unit VIII: Environmental Microbiology (15 Questions)

Environmentally transmitted Microbial Pathogens (*Mycobacterium tuberculosis*, *Streptococcus pyogenes*, *Salmonella typhi*, *E.coli*, *Vibrio cholerae*, *Clostridium botulinum*), Viruses (Enteric and Respiratory), Indicator Microorganisms – Total and Faecal Coliforms, Faecal Streptococci. Biofouling and Biofilms; Microbial toxicants (Tetanus toxin, Botulinum toxin), Aflatoxin, Waste water treatment (Aerobic and anaerobic) – Waste conversion using microorganisms - Biofertilizer – Important plant diseases caused by Bacteria, Mycoplasma, Virus, Fungi and Nematodes – Biocontrol agents – Integrated pest management. Microbial Biotechnology – Fermentation technology – fermentation as a biochemical process – Bioconversion: Production of Alcoholic beverages, Antibiotics, Amino acids, Vitamins and Organic Acids – Single Cell Protein production (SCP).

Unit IX: Marine Environment (15 Questions)

Fundamentals of marine biology: Physical chemical properties of seawater-Chemical Properties-Vertical stratification- horizontal stratification of marine ecosystem-Marine Ecosystems: coastal; pelagic; and estuaries; deep sea; coral reefs; mangroves; sea grass meadows. Microorganisms; invertebrates;

vertebrates; marine plants; Turtles seabirds and marine mammals. Marine protected areas; conservation strategies; IUCN categories. Human Impacts, disaster and its management: sea ranching; Artificial reef. Marine Pollution and management: point and non-point source pollution; oil pollution; plastic pollution; microplastic pollution; heavy metal pollution; nutrient pollution, pesticide pollution; PHC pollutions, thermal pollution, nuclear pollution ballast waters and its impact.

Unit X: Biostatistics (5 Questions)

Biostatistics: Sampling techniques, Central Values (Mean, Mode, Median), Dispersion: absolute relative probability: Binomial Properties, Problems, Fitting Positions, Normal, Skewness, Kurtosis, Correlations and Regressions - Simple Linear Testing – large sample. T-test, Chi square Test – Two-way ANOVA Experimental Design – Principles. CRD, RBD, LSD, Missing Plots – Figurative Representation (Bar diagram, Pie chart etc.).

17. Evaluation and Applied Research (PG Degree Standard)

Code: 607

Unit I: Economics (20 Questions)

Indian Economy– Economic Growth and Development: Concepts, distinction between the two, and contemporary measures (GDP vs. GVA, HDI, Gender–related Development Index, Multidimensional Poverty Index) – National Income Accounting: Concepts of GDP, GNP, NNP, NDP, Per Capita Income, methods of calculation, and recent estimates – Planning in India: Evolution from the Planning Commission to the role and functions of NITI Aayog; transition from central planning to indicative planning and cooperative federalism – Inclusive Growth: Concept, issues, strategies, and the role of social welfare schemes and government programs – Sustainable Development: Concepts, relevance of Sustainable Development Goals (SDGs), climate finance, and environmental policies – Sectoral Trends and Structural Changes – Agricultural – growth and development – green revolution – Industry – Industrial Policy changes and their effects on growth. Role of Public Sector –(disinvestment, privatization) and MSMEs – problems, government support – Investment Models: Public–Private Participation (PPP), National Infrastructure Pipeline (NIP), and National Monetisation Pipeline (NMP) – Infrastructure: Focus on new–age infrastructure (energy, transport, logistics, digital and National Bank for Financing Infrastructure and Development (NaBFID) – FDI: Trends, policy liberalization, and "Make in India" initiatives.

Service Sector: Types of services, changing sectoral contributions, and the role of IT/ITES. Labour: Skilled, semi–skilled, and unskilled labour dynamics; integration of e–Shram portal and new labour codes/laws. Human Development: Concepts, trends, issues, health – Public Health, National Health Mission, education, drinking water and sanitation, housing, nutrition, and social sector initiatives – Employment, Unemployment, and Underemployment: Concepts, measurement (Labour Force Participation Rate, Worker Population Ratio), and recent trends (Periodic Labour Force Survey data). Employment in organized and unorganized sectors (informalization of the workforce). Strategies for Employment Generation and skill development programs (PMKVY). Poverty: Concepts, measurement (Tendulkar and Rangarajan committees), trends, and poverty alleviation programs (MGNREGA) – Fiscal Policy and Budgeting: Union Budget, recent trends, fiscal consolidation path. FRBM Act (Fiscal Responsibility and Budget Management Act) and its review/current status. Taxation: Goods and Service Tax (GST), tax administration reforms, and fiscal federalism (role of the Finance Commission). Parallel economy in India (Black Money). Inflation and Definition: trends, estimates, consequences, and remedies. Wholesale Price Index (WPI) vs. Consumer Price Index (CPI) as primary inflation measures (focus on CPI for policy) – Monetary Policy and Banking: RBI (functions, autonomy debate) and the Monetary Policy Committee (MPC) framework for inflation targeting. Monetary policy tools (Repo, Reverse Repo, CRR, SLR, MSF, OMO, MCLR, etc.). Banking Sector Reforms – Non–Performing Assets (NPAs) resolution (IBC, Bad Bank concept – NARCL), Public Sector Bank consolidation/recapitalization, and financial inclusion initiatives. Digitalization of Finance: Unified Payments Interface (UPI), Payment Banks, Small Finance Banks, and FinTech developments – External Sector and Global Linkages – India's Foreign Trade – Composition, direction, and recent changes in trade policy – trade agreements (FTAs). Balance of Payments (BoP): Current and Capital Account components, change rate management (fixed vs. flexible, NEER/REER). Global Financial Crisis: Impact on India and lessons learned. International Economic Organizations: India and WTO requirements (subsidies, IPR issues like TRIPS, TRIMS, GATS), IMF, World Bank, BRICS.

Unit II: Econometrics (20 Questions)

Definition and methodology of Econometrics. Data types and Structure: Cross-section, time-series, and panel data. Definition and Measurement of variables – Measurement scales of variables – Ratio, interval, ordinal, and nominal scales. Correlation: Simple and multiple correlation – Karl Pearson's correlation coefficient and Spearman's rank correlation coefficient. Regression Analysis (Simple and Multiple): Ordinary Least Squares (OLS) Principle and Properties of regression coefficients (Gauss–Markov theorem and BLUE – Best Linear Unbiased Estimators) – Coefficient of Determination – R^2 and adjusted R^2 Assumptions of Classical Linear Regression Model (CLRM): linearity, exogeneity, homoscedasticity, no-autocorrelation and normality of errors. Functional Forms of regression models: Log-linear – double-log, Semi-Log models – Elasticity and Growth Rate computations. Violation of Assumption of CLRM: Heteroscedasticity, Multicollinearity, Autocorrelation – Definition consequences and Remedial Measures. Dummy Variables and Qualitative Response Regression Models: Linear Probability Model (LPM), Logit and Probit Models – Binary, ordinal and Multinomial – Odds ratios and Marginal effects – Interaction effects – cautions of using dummy variables – Dummy variable trap. Basics of Time-Series Analysis and Forecasting: Time-Series Decomposition – Components of Time series data – Stationarity of Time Series data – Tests of Stationarity – Unit Root Test – Dickey–Fuller (DF) and Augmented Dickey–Fuller (ADF) test, Phillips–Perron (PP) test – Methods of time series forecasting : AR, MA, ARMA, and ARIMA models – Box–Jenkins Methodology (identification, estimation, diagnostic checking and forecasting). Simultaneous Equation models: Methods of Indirect Least Squares model and Two Stage Least Squares. Panel Data Models: Fixed effect model and Random affect model.

Unit III: Statistics (20 Questions)

Compilation and Tabulation of data Collected – Classification – Types of Classification – Formulation of discrete and continuous frequency distribution (uni-variate and Bi- variate). Pictorial Representation of data: Bar diagrams – Pie diagrams – Histogram – Ogives and Lawrence Curve Measures of Location – Mean, Median, Mode, Harmonic Mean and Geometric Mean – Quartiles – Measures of variation: Range, Quartile deviation, Mean deviation, Variance and Standard deviation. Coefficient of variation, skewness and Kurtosis. (All the calculation of measures are for both grouped and ungrouped data) – Moments (raw and central) – outlier detection. Probability and Distribution: Introduction to probability: Random Experiments, Sample Space and events, Definition of probability. Classical, Empirical and Axiomatic approach to probability; Addition and Multiplication Theorem, Conditional probability and Baye's Theorem. Random Variables and Distribution function – Mathematical Expectation and conditional Expectation. Convergence in Probability – Weak Law of large Numbers and strong law of large Number – Central limit Theorem – Discrete distributions: Binomial, Poisson. Continuous Distributions: Normal Distribution Chi-Square, t and F distributions and their properties.

Application of Statistical Methods – Sampling Theory: Introduction to the theory of Sampling: Sampling designs – Simple Random Sampling with and without replacement – Systematic, Stratified, Ratio and Regression Sampling methods – Determination of sample size – Sampling and non – sampling errors – Cluster sampling, Purposive Sampling Quota Sampling. Testing of Hypothesis: Introduction to Testing of Hypothesis: Simple, Null and Alternative hypotheses, composite hypothesis, two kinds of Errors – Degrees of freedom – Critical Region – One-tailed and Two-tailed tests – P-Value – Confidence Intervals –Power function. Testing of significance using chi-square, t and F tests. (simple problems) – Non-Parametric Tests ANOVA – One way and Two way classifications. Application of Statistical Methods through MS-Excel – Language : Over view of MS-Excel: Construction of charts and diagrams – Sorting – Filtering – Removing duplicates – Calculation of Measures of Central tendency, Measures of dispersion, correlation Regression and curve fitting using – Excel. Linear Programming Problem: Graphical Methods – Travelling Salesman Problem – Assignment Problem – Simplex Methods.

Unit IV: Mathematics (20 Questions)

Algebra: Groups – Sub groups – Permutation groups – Normal subgroups and Quotient groups – Homomorphisms – Automorphisms – Cayley's Theorem.

Rings: Rings – Sub rings – Integral Domain – Field – Homomorphisms – Ideals and Quotient Rings.

Linear Algebra: Vector Spaces – Basic Concepts – Linear Transformations – Linear Independent and Bases – Inner Product Spaces.

ODE: ODE with constant coefficients – ODE with variable coefficients – Higher order ODE's.

PDE: First order PDE – Second order PDE – Elliptic – Parabolic and Hyperbolic PDE's.

Real Analysis: Properties of monotonic functions – Functions of bounded variations – Total variations –

Additive property of total variation – Total variation on $[a,x]$ as a function of x – Continuous functions of bounded variations – Infinite Series: Absolute and conditional convergence – Dirichlet's test and Abel's test Rearrangement of series – Riemann's theorem on conditionally convergent series.

Complex Analysis: Differentiability and Cauchy–Riemann Equations – Harmonic Functions – Power Series as an Analytic Function – Complex Integrations – Cauchy Integral Formula – Morera's Theorem – Existence of Harmonic Conjugate – Taylor's Theorem – Conformal mappings.

Functional Analysis: Metric Spaces and continuous functions – Normed Spaces – Convergence, completeness and Baire's Theorem – Bounded Linear Maps on Banach Spaces – Bounded Operators on Hilbert Spaces.

Topological Spaces: Basis for a Topology – The Product Topology – The Metric Topology – Connected Spaces – Connected Subspaces of the Real Line Components – Urysohn's lemma.

Measure Theory: Measure on the Real Line – Measurable Functions – Measure Spaces – Convergence.

Unit V: Business Administration (20 Questions)

Management – Concept and Foundations of Management – Managerial Functions – Decision making and Models – Authority and Responsibilities – Business ethics – Organizational behaviour concept – Leadership and power – Organizational Climate and Culture – Groups Dynamics in organization – HRM – Functions – Job Analysis – Job Evaluation – Recruitment and Selection – Training and Development – Performance appraisal and 360 degree feedback – Promotion and Transfer – Compensation – HR Audit – Organizational Misbehaviour – Current trends and issues in HRM – Quality of work life balance – Conflicts in organization – Fundamentals of operations management – Production Planning – Capacity Planning – Plant Layout and Design – Morden Production concept – JIT, Kaizen, Japanese 5's framework – Quality Management – TQM – Six Sigma – Resources Optimization Modals – PERT – CPM – Linear Programming Modals – Nature and Scope of Financial Management – Finance Function – Sources of Finance – Financing Decision – Risk Management – Cost of Capital and Capital Structure – Investment Decisions – Valuation Concepts and Valuation of Securities – Capital Budgeting – Working Capital Management – Dividend Decisions – Cost functions – Break even analysis – Marketing Management – Scope and Evolution – Marketing Strategy Formulation and Components of Marketing Plants – Segmenting and Targeting the Market – Product Positioning and Differentiating of the Market – Analysing Competition and Consumer Market – Consumer Behaviour – Industrial buyer Behaviour – Marketing Research – Product and Pricing Strategy – Marketing Channels – CRM (Customer Relationship Management) Process – Customer Satisfaction – Rural Marketing – Basics of Business Law and Labour Law – Vision and Mission – Nature and Scope of Strategic Management – Strategic Indent– Process of Strategic Planning and Implementation – SWOC (Strength, Weakness Opportunity and Challenge) Analysis – BCG Matrix – Balanced Score Card – Business Analytics and Visualisation – Block Chain Technologies – ERP and MIS (Enterprise Resource Planning and Management Information System) Supply Chain Concept – Business Intelligence – E–Business and E–Commerce – AI in Management.

Unit VI: Sociology and Social Work (20 Questions)

Sociology: Meaning, Nature and Scope of Social Thought. Auguste Comte: Law of Human Progress. Hierarchy of the Sciences. Social Statics and Dynamics, Positivism. Herbert Spencer: Theory of Evolution, Types of Society, Organic Analogy. G. F. Tonnies: Gemeinschaft and Gesellschaft and Public Opinion– Emile Durkheim: Social Facts, Rules of Sociological Methods, Division of Labour, Theory of Suicide, Religion and Society. Structuralism: Claude Levi Strauss – Structural Anthropology – Binary Opposition, Bronislaw Malinowski–Bio–cultural functionalism. Structural–Functionalism: A.R. Radcliffe– Brown – Study of Social Relationship as Integrated Social System–Karl Marx: Historical Materialism, Mode of Production, Surplus Value, Class Struggle, Alienation– Max Weber: Social Action, Ideal Type, Authority, Bureaucracy, Protestant Ethic and the Spirit of capitalism. Vilfredo Pareto: Logical and non–logical Action, Circulation of Elites. George Simmel: Formal Sociology. Social Types. Philosophy of Money. Karl Manheim: Sociology of Knowledge.

Definition of Scientific Research: Science and Its Characteristics. Features, Purpose, and Assumptions of Scientific Method. Steps in Scientific Method. Applicability of Scientific Method to the Study of Social Phenomena. Theory – research relationship (Induction, deduction and abduction). Philosophy of Social sciences: Ontology: Objectivism, Constructivism, Realism, Idealism; Epistemology: Positivism, Interpretivism, Critical Epistemologies, Standpoint Theory; Axiology: Values In Research, Ethics, Reflexivity, Positionality –Paradigms: Positive, Interpretive, Critical, Feminist, Postcolonial, Queer–Ethics in Social Research – informed consent, confidentiality, anonymity, digital research ethics– Quantitative

Methods and Survey Research –Nature, Scope and limitations of quantitative research methods– Qualitative Research – Case study – Ethnography – Phenomenology – Ethnomethodology – Grounded. Mixed Method Research Design – Types – Triangulation Method. Sociometry, Survey techniques, participant observation – In – depth interviews, life histories, oral narratives –Focus group discussions – Field notes, thick description, reflexive journals – Measurement and Scaling Techniques: Need for Scales, Problems of Scaling, Methods of Scale Construction –Content analysis, Thematic analysis, Narrative analysis, Interpretative Phenomenological Analysis (IPA),Descriptive Phenomenological Analysis (DPA) Discourse analysis–Mixed Method–data analysis – Secondary Data Analysis – Strategies for data integration –Introduction to data analysis software – SPSS, Nvivo, ATLAS.ti

Social Work: Concept, objectives, Definition, Principles –methods, values and Historical development of Social Work in UK, USA and India. Professional Social Work vs Voluntary Social Work. Social Work Practice in Community, Industry, Hospital, School, correctional institution and rehabilitation institutes. Social Work administration: Meaning, purpose, functions. Social Welfare administration in National, State and local level. Social Agency: Types and Models of NGOs. Social Policy: Need, Evolution, Constitutional base. Policy and programme for Women, Children, Youth, Aged, Handicapped , SC, ST and OBC. Fundamental Rights, Directive principles of State policy. NITI Aayog. PRA and PLA. Project Evaluation: Identification and Formulation. Project appraisal methods, Project Evaluation tools. Community Impact assessment, Vulnerability Assessment and SDGs Assessment.

Unit VII: Anthropology (20 Questions)

Anthropology: Introduction–Origin and History; Meaning, Definitions and Uniqueness; Scope–Utility and Branches; Relationship with other disciplines–Archaeology, History, Sociology, Psychology, Economics and Politics; Foundations of Society and Culture–Definitions, Elements and Characteristics, Social Institutions and Organizations– Marriage, Family, Descent and Kinship; Rite–de–Passages, Magic and Religious organization, Economic and Political organization; Emergence and Dispersal of Homo sapiens– Out of Africa Theory; Stages of Human Evolution; Peopling and People of India; Practicing Anthropology– Applied, Advocacy and Public Anthropology.

Indian Culture and Civilization: Palaeolithic, Neolithic, Megalithic and Indus Valley Harrappan and Lothal cultures; Demographic profile of India–Ethnic and Linguistic elements in the Indian population and their distribution; Concept of Tribe, Scheduled Tribes–Tribal cultures of India, Brief Ethnographic details of Tribes of Tamil Nadu, Problems of the tribal communities, Tribal Development and Administration; Community, Caste, Scheduled Caste and Minorities–Caste–system in India: Structure and characteristics, theories of origin of caste, Dominant caste. Indian village: Social stratification and Indian village as a social system, Peasant cultures – Folk–Urban Continuum; Cultural change in Indian Society: Sanskritization, Westernization, Modernization; Egalitarianism, Cultural relativism, Multiculturalism, Enculturation, Acculturation; Post Modernism and Globalization; Constitutional safe guards for STs/SCs, Role of Anthropology in Tribal, Rural and Urban development. Status of Women and Gender issues in India and Tamil Nadu.

Anthropological Research Methodology–Qualitative, Quantitative and Mixed Methodology–Empirical and Scientific Research; Research Methodology, Method and Techniques, methods, methodology; Fieldwork and Ethnography; Tools of data collection–Participant observation, Interview, Schedules, Case study, Genealogy, Transect–walk, Social mapping, etc.

Unit VIII: Agricultural, Resource and Environmental Economics (20 Questions)

Economic Theory

Microeconomics – Consumer Behaviour and Markets: Theory of Consumer Behaviour: Utility theory (cardinal/ordinal), Gossen's first and second laws– utility measurement, indifference curve analysis, Consumer Surplus. Demand and Supply: Demand and supply functions, factors affecting demand and supply, elasticity of demand and supply (price, income, cross–price elasticity). Market Structures: Types of Market Structures: Perfect Competition, Monopoly, Monopolistic Competition, and Oligopoly (including modern topics like game theory basics in oligopoly). Price Determination: Price determination under different market structures. Macroeconomics – National Income Concepts and measurement – circular flow of income.

Agricultural Marketing, Prices and international trade: Producer surplus– Marketable and Marketed surplus, Price spread– marketing cost and marketing margin, Marketing Efficiency. Market integration, Marketing Intelligence. Institutions and Policies : Institutions: APMC Act and recent reforms, e–NAM, Regulated Markets, Cooperatives, Commodity Boards, warehouses– SWCs and CWCs, Contract

Farming, Farmers' Markets (Uzhavar Santhais), Farmers Producers Organizations (FPOs). Price Policies: Commission on Agricultural Costs and Prices (CACP), Agricultural Prices– Minimum Support Price, State Administered Prices, Procurement Price, and price support programs/policies. PDS, TPDS, buffer stock operations. Trade Theory: Theory of absolute and comparative advantage. Trade Policy: Terms of Trade and Instruments of Trade Policy; Tariffs and Non–tariff barriers, Balance of Trade vs. Balance of Payments.

Rural Finance

Rural Indebtedness. Sources of finance– Financial institutions– Cooperatives, Commercial Banks, and Regional Rural Banks (RRBs), Priority Sector Lending: Differential Rate of Interest Scheme. Lead Bank Scheme, Higher financial institutions– NABARD and RBI, District Credit Plan. Financial Management– Discounted and undiscounted measures – Financial statements and ratio analysis. Partial and complete budgeting Micro–Financing: Role of MFIs, NGOs, and Self–Help Groups (SHGs). Financial Inclusion. Relief measure of rural indebtedness – Nationalisation of banks. Risk and Insurance: Risk in agriculture and different Crop Insurance Schemes

Production Economics: Types and forms of production functions. Returns to scale vs. Economies of scale. Classical production function, production relationships, Cost Concepts: Fixed Cost (TFC), Variable Cost (TVC), Total Cost (TC), Average Cost (AFC, AVC, ATC), and Marginal Cost (MC). Cost of cultivation vs. Cost of Production. Efficiency Measures: Technical Efficiency, Economic Efficiency, and Allocative Efficiency.

Natural Resource Economics

Concepts and Classification: Concepts, classification (exhaustible, renewable, recyclable), and problems of Natural Resource Economics. Economy–Environment Interaction: Fundamental interactions and the concept of a circular economy. Resource Scarcity: Resource scarcity definitions (absolute, relative), Limits to Growth debate, measuring and mitigating natural resource scarcity, scarcity indices, and Malthusian vs. Ricardian Scarcity. Optimal Resource Management: Theory of optimal extraction of exhaustible (Hotelling's rule) and renewable resources (e.g., fisheries models, forestry models). Property Rights and Management: Issues in natural resource management; private property, common property, and open access resources (Tragedy of the Commons). Collective action in common property resource management (Elinor Ostrom's principles). Spatial Planning: Land use planning; optimal management of land, water, forests, and fisheries. Technology: Resource mapping; modern applications of GIS (Geographic Information Systems) and Remote Sensing in resource management.

Environmental Economics

Environmental Problems and Quality: Economics of the environment; Externalities– theory of externality (Pigouvian taxes/subsidies, Coase theorem). Pollution: Sources and types of pollution (air, water, solid waste, land degradation); environmental and economic impacts. Pollution Control: Economics of pollution control; efficient reduction in environmental pollution (Marginal Abatement Cost). Regulation: Environmental regulation; economic instruments (e.g., cap–and–trade, pollution taxes, subsidies) and indirect instruments (command and control policies, performance standards).Legislation: Environmental legislations in India.

Unit IX: Public Administration (20 Questions)

Public Administration: Definition, Meaning, Scope and Significance – Public Administration Principles and Practices – Evolution of Present Status of the Discipline – Dichotomy – Public vs Private Administration – Approaches to the Study of Public Administration: Kautilya, Tiruvalluvar, F.W.Taylor, Luthur Gulick and Urwick – Comparative Public Administration – Development Administration – New Public Administration – New Public Management – Personnel Administration – Principles of Organization and Administration – Classical theories – Human Relation theories – Modern theories of Administration – Administrative Responsibility and Ethics .

Public Financial Administration: Budgetary process and accountability – Types of Budget – Resource Mobilization, Tax Administrations and Financial Control – Union – State financial relations in India – Good Governance: Social welfare schemes in Tamil Nadu, Women Empowerment schemes in Tamil Nadu, Health care Policy in Tamil Nadu – E. Governance : ICT application in government – IT parks in Tamil Nadu – District administration: e–governance in Districts, THAI scheme, Pudhuvazhvu Scheme – Special Economic Zones – Panchayat Raj: Rural Development Programmes in Tamil Nadu, Environmental Protection in Tamil Nadu – Administrative Reforms in India – Urban Governance: Urban Local Bodies in

Unit X: Research Methodology (20 Questions)

Research Methods: Research Problems – Formulation, Conditions and Considerations – Meaning, Categories, and Operationalization – Variables: Meaning, Types, and Measurement – Review of literature: Scope and Purpose of literature review, Processes and sources of reviewing the literature – Types of reviews – narrative, systematic, scoping, meta – analysis, critical, meta – synthesis – Quantitative Methods and Survey Research – Nature, Scope and limitations of quantitative research methods – Qualitative Research Design: Need for Research Design, Features. Types: Exploratory, Descriptive, Explanatory, Experimental, Evaluative, and Action – Sources of Data: Primary and Secondary Data – Sampling: Introduction to the theory of sampling; Probability and non-probability methods – sampling and non-sampling errors – Hypothesis: Functions, Conditions for a Valid Hypothesis, Formulation of Hypothesis, Forms of Hypothesis, Hypothesis Testing: Simple, Null and alternative hypotheses, composite hypothesis – Tools of quantitative data collection– structured, unstructured – open ended and closed ended questions– Qualitative data collection– interview guide– questionnaire– Rule of translation of interview schedule and questionnaire– rule of translation and back translation– Pilot study–Methods of Data Collection: Interview– Secondary Data collection – Observation Methods: Direct Personal Observation (participant and non-participant observation).Mechanical/Electronic Devices (e.g., cameras, sensors, GPS)– Other Contemporary Methods: Case Studies, Experiments, Projective Techniques, and Delphi– Reliability and validity of data – limitations of data collection method (errors in data collection) Technique Data analysis – Organizing, Analysing, and Summarizing quantitative data, Editing–Coding, Classification, Tabulation, Interpretation– Report writing– Format, Footnotes, Figures,– Reference Material: References/Bibliography: A comprehensive list of all sources cited, following a consistent citation style (e.g., APA, MLA). Appendices: Supplementary materials like raw data, sample questionnaires, detailed maps, or complex tables. Evaluation Criteria for a Good Report: Objectivity and lack of bias. Logical structure and clear, formal language. Reliability and validity of data and findings. Proper documentation and ethical considerations (e.g., informed consent, confidentiality).

18. Financial and Cost Accountancy (Intermediate Standard)

Code: 433

Unit I: Accounting (10 Questions)

- Accounting Standards (old) 2,10,12 and 16
- Accounting for Cooperative Societies
- Branch and Departmental Accounts (including foreign branches)
- Accounting for non-profit organizations and incomplete records
- Computerized Accounting System

Unit II: Auditing (20 Questions)

- Nature and scope and significance of auditing
- Audit Engagement, Audit Programme, Audit working papers, Audit note book audit evidence and audit report
- Internal check, internal control and internal audit– industry specific
- Auditing of difference types of undertaking– education, hospitals, cooperative societies, trusts, municipalities

Unit III: Financial Management (30 Questions)

- Meaning–objectives –scope of financial management
- Tools for Financial Analysis– Ratio, Cash flow analysis
- Analysis and Interpretation of Financial Statements
- Investment decisions–ARR, Pay back, NPV,IRR,PI
- Cost of Capital Structure and Leverages
- Working Capital Management – Financing – Cash, Inventory, Receivables and Payables

Unit IV: Direct Taxation (10 Questions)

- a) Heads of Income and Computation of Total Income under various heads
- b) TDS/TCS/Advance Tax
- c) Taxation as applicable to Government undertaking and Cooperative Societies.

Unit V: Indirect Taxation (30 Questions)

- a) Canons of Taxation
- b) Goods and Services Tax(GST)
 - 1. CGST-SGST-IGST- Cess
 - 2. Registration – Supply – Time of Supply – Value of Supply – Place of Supply – Input tax credit – Reverse Charge Mechanism (RCM) – Payment of Taxes.
- c) Filing of GST periodic returns

Unit VI: Commercial Law, Industrial Law & Company Law (20 Questions)

- a) Indian Contract Act
- b) Sale of Goods Act
- c) Negotiable Instrument Act
- d) Factories Act, Payment of Gratuity Act
- e) Employees Provident Fund Act 1952
- f) Employees State Insurance Act 1948
- g) Payment of Bonus Act 1965, Minimum Wages Act 1948
- h) Tamil Nadu Tender Transparency Act, 1998

Unit VII: Cost Accounting: Prime Cost and Overheads (20 Questions)

- a) Material Cost
 - a. Purchase procedures, ledgers and forms (MRN, GRN etc.)
 - b. Inventory levels management
 - c. Stores ledger under FIFO, Weighted average, retail price
 - d. Physical stock taking and inventory reconciliation
 - e. Wastage and shortage
- b) Labour
 - a. Remuneration methods
 - b. Measuring production and productivity
 - c. Incentive Schemes: Halsey, Rowan, Taylor
 - d. Labour Turnover
- c) Overhead
 - a. Cost grouping, allocation and apportionment
 - b. Treatment of under and over absorption
 - c. Machine hour rate computation

Unit VIII: Cost Accounting: Book Keeping and Methods (15 Questions)

- a) Costing accounting records, Ledgers, Cost statements
- b) Items excluded from cost and normal and abnormal, terms/cost
- c) Integral accounts
- d) Reconciliation of cost accounting records with financial accounts
- e) Process, job, contract, and Batch costing
- f) Service costing: hospital, transport, hotel etc.

Unit IX: Cost Accounting: Techniques (15 Questions)

- a) Marginal costing
 - a. CVP analysis
 - b. Break even point and Margin of safety
 - c. Break even chart
 - d. Cost indifference point
 - e. Key factor analysis

- b) Standard costing and variance analysis
 - a. Material
 - b. Labour
 - c. Variable Overheads
 - d. Fixed Overheads
 - e. Sales variances
 - f. Sales margin variances

Unit X: Budget and Budgetary Control (30 Questions)

- a) Concepts, Types of Budgets
- b) Budgetary Control Vs Standard Costing
- c) Advantages and Limitations
- d) Preparation of Various Budgets
- e) Zero Base Budgeting

**19. Geology
(PG Degree Standard)**

Code: 395

Unit I: General Geology and Geomorphology (20 Questions)

Origin, Evolution, Age and Interior of the Earth - Principles of geodesy – Rock cycle – Isostasy - Continental drift, Seafloor spreading, Plate tectonics - Paleomagnetism and its application for determining paleoposition of continents – Orogeny and Epeirogeny – Volcanoes and earthquakes – Effects and causes – Seismic Hazard zonation of India - Tectonic deformation and seismicity in the Extra Peninsular, Indogangetic plains and Peninsular India - Applications of geomorphology in mineral prospecting and coastal studies - Weathering – processes and products - Geomorphic cycles and their interpretation - Morphology and its relation to structures and lithology - geomorphic landforms formed by action of rivers, wind, glaciers, waves and groundwater - Features of ocean floor - continental shelf, slope and rise - concepts of landscape evolution, major geomorphic features of India – coastal, peninsular and extra peninsular - Classification of shorelines and their evolution - submarine canyons, Geosynclines and Island arcs.

Unit II: Stratigraphy (20 Questions)

Principles of stratigraphy - Code of stratigraphic nomenclature of India - lithostratigraphy – biostratigraphy – chronostratigraphy – magnetostratigraphy, sequence stratigraphy - Principles of stratigraphic correlation; Indian stratigraphy and economic importance - Cratons of India – Dharwar, Bastar, Singhbhum, Aravalli and Bundelkhand Cratons - Proterozoic mobile belts – Eastern Ghats Mobile Belt, Southern Granulite Terrain, Central Indian Tectonic Zone, Aravalli – Delhi Belt, North Singhbhum Mobile Belt - Proterozoic sedimentary basins – Cuddapah, Delhi, Vindhyan, Kurnool and Kaladgi - Phanerozoic stratigraphy – Paleozoic - Spiti, Kashmir and Kumaon - Mesozoic - Spiti, Kutch, Narmada Valley and Tiruchirapalli erstwhile Trichinopoly - Gondwana Supergroup, Deccan Traps - Cenozoic Assam, Bengal basins, Garhwal-Shimla Himalayas – Siwaliks - boundary problems in Indian stratigraphy Precambrian-Cambrian boundary - Permian-Triassic boundary - Cretaceous-Paleogene (K-Pg) formerly Cretaceous-Tertiary (K-T) boundary - Paleogene-Neogene and Neogene-Quaternary boundary.

Unit III: Paleontology (20 Questions)

Fossil record and geological time scale - modes of preservation of fossils and concept of taphonomy – Body and ichno-fossils, species concept, organic evolution, Ediacara Fauna - morphology and time range of Graptolites, Trilobites, Brachiopods, Lamellibranchs, Gastropods, Cephalopods, Echinoids and Corals - Evolutionary trends in Trilobites, Gastropods, Cephalopods; and Graptolites - Micropaleontology – methods of preparation of microfossils, morphology of microfossil groups (Foraminifera, Ostracoda), Fossil spores and pollen - Application of micropaleontology in oil exploration - Gondwana plant fossils and their age and climate significance - Vertebrate life through ages, evolution in Proboscidea, Equidae and Hominidae - Dinosaurs – their classification and extinction - Applications of paleontological data in stratigraphy, paleoecology, and paleoclimatology - Mass Extinctions.

Unit IV: Structural Geology (10 Questions)

Mechanical principles of rocks – Strain markers in deformed rocks - Mohr's circle – V rules and outcrop patterns – Stereographic Projections of structural elements - Mechanics and causes of folding and faulting - Classification of folds and faults - Recognition of folds and faults in the field - Joints – Cleavage and Schistosity types and origin – Secondary lineation - Types of unconformity and their recognition in the field – Introduction to Petrofabric analysis – Tectonites, their classification and geological significance.

Unit V: Mineralogy and Crystallography (25 Questions)

Definition, Classification and elements of minerals and Crystallography – Optical, Electrical and Magnetic Properties of minerals - Physical, chemical and optical properties of Quartz, Feldspars, Feldspathoids, Pyroxene, Amphibole, Olivine, Garnet, Mica, Zeolites and Carbonate groups - Stereographic and Gnomonic projections of natural crystals of normal classes. 14 Bravais lattices and their derivation - Derivation of 32 classes of symmetry - Elements of X-ray crystallography - Napier's theorem - Equations of a normal - Bragg's law - X-ray diffraction method - Identification of minerals from X-ray diffractogram – Concept of optical mineralogy – Identification of minerals using petrological microscope.

Unit VI: Igneous and Metamorphic Petrology (25 Questions)

Classification of Igneous rocks: Mineralogical, Chemical and IUGS classification – Structures and textures - Petrography and petrogenesis of Granites, Alkaline rocks, Anorthosites, Carbonatites, Dolerites, Ultramafics - Study of binary and ternary system of crystallisation - Bowen's reaction series - Diversity of Igneous rocks – variation diagrams - Crystallisation of Basaltic magma - Metamorphism – Agents and kinds of metamorphism – classification of metamorphic Rocks – Textures and Structures – Different grades and depth Zones – Metamorphic facies – Metamorphic differentiation – Thermal – Clastic and Regional Metamorphism – Origin of Eclogites – Charnockitisation – Granitisation – Metasomatism.

Unit VII: Sedimentology (20 Questions)

Sedimentary depositional environments – Important clastic and non-clastic rocks – Heavy minerals and Provenance – Tectonics and Sedimentation – Sedimentary Basins of India – Paleocurrents and Basin Analysis - Classification of sedimentary rocks - sedimentary textures grains size, roundness, sphericity, shape and fabric - grain size analysis - sediment transport and deposition - sedimentary structures Penecontemporaneous deformation structure and biogenic structures - principles and application of paleocurrent analysis - composition and significance of different types of sedimentary rocks Sandstone, Limestone, Banded Iron Formation, Mudstone and Conglomerate - carbonate diagenesis and dolomitisation - sedimentary environments and facies-facies models - fluvial, glacial, deltaic, siliciclastic shallow and deep marine environments - carbonate platforms – types and facies models; sedimentation in major tectonic settings; Application of sequence stratigraphy in basin analysis.

Unit VIII: Economic Geology (25 Questions)

Classification of mineral deposits – Process of formation of mineral deposits - Magmatic, Hydrothermal, Sedimentary, Metamorphic, Sublimation, Evaporation, Oxidation and Supergene enrichment - Metallogenic Epochs and provinces of India - Introduction of ore microscopy – Physical and optical properties of ore minerals – Textures and microstructures of ores – Controls of ore Localisation – Fluid inclusion in ore mineral assemblages – Origin, Occurrences, Indian distribution and uses of the following ores - Iron, Manganese, Copper, Lead, Zinc, Aluminium, Chromium, Gold, Barite, Graphite, Asbestos and Silica, Uranium, Thorium and Industrial Minerals. Origin of coal and petroleum - Physical and Chemical Properties of coal and petroleum – Deposits of coal and Petroleum in India – Distribution of Gondwana and Tertiary coal fields of India. Gas hydrates and Coal bed methane, Petroliferous basins of India – Lignite deposits in India – Strategic, Critical and essential minerals – National mineral policy 2019 – Conservation and Utilization of mineral resources.

Unit IX: Hydrogeology (15 Questions)

Occurrence of groundwater - Aquifers - Major Basins and Drainage systems of Tamil Nadu - Groundwater flow - Darcy's Law - Hydraulic conductivity and Hydrological parameters - Transmissibility, Permeability - Specific yield and retention - Hydrogeological characters of different types of rocks - Rock water interaction - Types of wells - Drilling methods and methods of construction, Design and development and Well logging methods - Pumping test methods - Estimates of groundwater potential and recharge - Managed Aquifer

recharge – Rainwater Harvesting techniques and methods - Aquifer recharge methods - Seawater intrusion - Study and methods - Electrical methods of groundwater exploration - Tracer – Isotope techniques.

Unit X: Applied Geology (20 Questions)

Geophysical methods of prospecting – Electrical, Magnetic, Gravity and Seismic – Radioactive methods – Geochemical classification of elements and anomaly – Geochemical cycle – Geochemical prospecting – Engineering properties of Rocks – Geological investigations pertaining to Dams, Reservoirs, Tunnels, Bridges and Roads – Rock sampling techniques – Ore reserve estimation and UNFC. Mining Methods: Surface and Sub surface – Coal and Alluvial – Prominent mines and mineral legislations of India – Environmental impacts (EIA) due to mining and mineral processing – Role of Geologist in mining industries. Natural Hazards - Floods, Landslides, Earthquakes and Tsunami – Causes and Mitigation. Renewable and non renewable resources. Applications of Remote sensing - GIS and GPS in Geological studies.

20. Horticulture (UG Degree Standard)

Code: 493

Unit I: Fundamentals of Horticulture (15 Questions)

Scope and importance – State, National and Global scenario of horticultural crops – Area and production – Import and export – Nutritive value and Medicinal value of horticultural crops – Horticultural zones of Tamil Nadu and India – National and regional agencies involved in promotion of horticultural industry in India (NHB, APEDA, Commodity Boards and Government schemes) – Classification of horticultural crops – Factors limiting horticultural crop production – Role of season – Soil and climate requirements - Physical and chemical properties of soil - Climatic factors – Light, temperature, photoperiod, relative humidity, rainfall, altitude, microclimate - Kitchen gardening - Nutrition gardening – Truck gardening – Market gardening - Vegetable forcing - Protected and precision horticulture – Hydroponics, Aeroponics – Nutrient Film Technique – Vertical farming - Horticulture therapy.

Unit II: Growth and Development of Horticultural Crops (15 Questions)

Important phases of growth and development - Bearing habits – Classification of horticultural crops based on life cycle – Annual, biennial perennial (woody and herbaceous perennials) – Fruitfulness and unfruitfulness - External and internal factors associated with unfruitfulness – Physiology of flowering, fruit set, ripening and senescence – Fruitdrop - Causes and control measures - Plant growth regulators – Functions and role in horticultural crops - Bud dormancy – Dormancy breaking – Parthenocarpy – Parthenogenesis – Polyembryony – Stenospermocarpy – Vivipary - Apomixis.

Unit III: Propagation of Horticultural Crops (15 Questions)

Propagation – Definition – Establishment of nursery – Site selection - Tools and implements propagation structures - Mist chamber, phytotron - Humidifiers – Greenhouse – Glasshouse – Polyhouse - Shade net, glass house, poly tunnels, cold frames and hotbeds, pit nursery - Media and containers – Soil sterilization - Sexual propagation – Merits and demerits – Crops propagated through seeds - Seed viability, longevity, dormancy, germination – Pre-sowing treatment – stratification, scarification, seed priming, seed pelleting, seed invigoration, seedling vigour – Raised seed bed and pro-tray nursery – Asexual propagation – Merits and demerits – Methods of vegetative propagation – Identification of plus trees – Mother block, scion bank – Clonal nursery – Chimeras - Cutting – Layering – Grafting, budding types – Anatomical and physiological basis of grafting – Stock scion relationship, graft compatibility Budwood selection and certification – Top working and after care - Propagation through specialized plant parts (bulbs, tubers, offsets, runners, suckers, slip, crown, rhizomes, corms) – Quality management and nursery certification – Micro propagation – Application – infrastructure requirements – Types of media – Stages of micro propagation – Micro grafting – *in vitro* propagation of important horticultural crops.

Unit IV: Management Techniques for Horticultural Crops (15 Questions)

Planning – Layout and management of orchards – Fencing – Wind breaks and shelter beds – Spacing – Planting system – Physical and chemical properties – Soil reaction – acid, saline and alkaline soils – Soil fertility - Essential elements – Functions - Organic manures and inorganic fertilizers, Water soluble

fertilizers - Bio-fertilizers, vermicomposting - Applications and management – Nutrient deficiencies and corrective measures - Physiological disorders and remedies – Irrigation, micro irrigation and maintenance – Critical stages of water requirement – Effect of water stress on crop yield – Anti-transpirants – management of irrigation water quality - Conventional and micro irrigation – Fertigation - Mulching – Sod culture – Weed management – Application growth regulators – Training and pruning principles and methods - Rejuvenation of senile and old orchards – Cropping systems - Cover cropping - Multitier cropping – Intercropping – Special horticultural techniques (pinching, thinning, disbudding, blanching, smudging, notching, ringing) - Principles of organic horticulture – GAP and GMP.

Unit V: Production Technology of Fruit Crops (30 Questions)

Scope and importance of fruit crops - Composition and uses - Origin and distribution – Species – Season - Climate and soil requirement – Varieties and hybrids – Propagation techniques - Planting systems and planting density including High density planting (HDP) and ultra high-density planting (UHDP) – spacing – Water and nutrient management – Fertigation - Weed management - Canopy management - Training and pruning – Intercultural practices - Off season production - Special horticultural techniques – Use of plant growth regulators – Maturity indices - Harvest and yield – Nutrient deficiencies and physiological disorders and its corrective measures and management of important pest and diseases of important fruit crops :- Mango, Banana, Acidlime, Sweet orange, Mandarin, Grapes, Papaya, Guava, Sapota, Pineapple, Jackfruit, Pomegranate, Aonla, Annona, Ber, Sweet tamarind, Jamun, Fig, Apple, Pear, Plum, Peach, Strawberry, Litchi, Avocado, Carrisa, West Indian Cherry, Date Palm, Phalsa, Bael, Wood apple, Rose apple, Bread fruit, Bilimbi, Durian, Carambola, Mangosteen, Loquat, Passion fruit, Rambutan, Pumelo, Grape fruit, Cherries, Currants, Apriocot, Perssimon, Olive, Pecanut, Chestnut, Hazelnut, Kiwi, Pistachionut, macadamianut, Walnut and Almond and minor tropical, arid and temperate fruit crops.

Unit VI: Production Technology of Vegetable Crops (30 Questions)

Scope and importance of vegetable crops - Composition and uses - Origin and distribution – Area and production - Soil and climatic requirements - Varieties and hybrids – Propagation methods - Seed rate – Sowing and nursery practises – Containerized seedling production - Season – Planting methods – Water, nutrient and weed management – Fertigation – Training for vegetables – Intercultural practices - Maturity indices – Harvest and yield – Nutrient deficiencies and physiological disorder and its corrective measures of important vegetable crops: Tomato, Brinjal, Chilli and Capsicum (Sweet Pepper), Bendi, Leguminous vegetables (Beans, Peas, Cluster beans, Cowpea, Dolichos bean); Bulbous vegetables (Onion, Garlic); Tuber crops - (Potato, Tapioca, Sweet potato, Elephant foot yam, Dioscorea, Chinese potato, Colacassia); Cucurbitaceous vegetables (Cucumber, Bitter gourd, Snake gourd, Ridge gourd, Ash gourd, Musk melon, Water melon, Pumpkin) - Cruciferous vegetables (Cabbage, Cauliflower, Knol khol, Brussels sprout, Sprouting broccoli and Chinese Cabbage); Root vegetables (Carrot, Radish, Beetroot, Turnip) - Leafy vegetables (Spinach, Lettuce, Palak, Amaranthus, Agathi and Asparagus) – Perennial vegetables (Drumstick, Coccinea) – Protected cultivation of vegetable crops - Precision farming of important vegetable crops and seed production.

Unit VII: Floriculture & Landscape Gardening (30 Questions)

Scope and importance of flower crops production - Uses - Origin and distribution – Area and production - Climate and soil requirement - Species and varieties - Propagation, season - Spacing and planting methods - Irrigation, nutrient management – Fertigation – Weed management - Training and pruning – Intercultural operations – Special horticultural techniques – Growth regulators – Off season production - Maturity indices – Harvest and yield and management of important pest and diseases for important loose flower crops: Jasmine, Rose, Tuberose, Chrysanthemum, Marigold, Nerium, Ixora and Crossandra - Cut flowers - Rose, Carnation, Anthurium, Orchid, Liliun and Gerbera – Cutfoliage and fillers. Principles of Landscape designing – Styles of gardening - Types of gardening viz., Hindu, English, Mughal, Japanese, Persian, Italian, French gardening Garden components – Trees foliage flowering and avenue trees – Burlapping – Shrubs -Hedge and edge plants – Flowering annuals creepers and Climbers - Cacti and succulents Lawn – Types of grasses – Layout, planting and maintenance of lawn –Indoor plants and interior scaping – Garden adornments - Principles and styles of flower arrangements – Bonsai styles and culture – Industrial, Institutional, Public and Private landscaping - Special types of gardening –Kokedama, tray, terrarium, roof and vertical gardening – Computer Aided Designs for Landscaping – AUTOCAD garden design.

Unit VIII: Production Technology of Spices and Plantation Crops (20 Questions)

Scope and Importance of spices and plantation crops - Composition and uses - Origin and distribution – Area and production – Climate and soil requirements - Species and varieties - Season, seed rate / Vegetative propagation methods – Spacing - Planting systems – High density planting (HDP) – Ultra High Density Planting (UHDP) - Irrigation and nutrient management – Fertigation - Weed management – Training and pruning – Cropping systems – Multitier cropping – Cover cropping – Inter cropping - Growth regulators – Mulching - Shade trees and canopy regulation – Maturity indices, harvest, yield and management of important pests and diseases - Processing methods of important plantation and spice crops: Major spices, seed spices, tree spices, herbal spices and minor spices - Black Pepper, Cardamom, Turmeric, Ginger, Curry leaf, Clove, Nutmeg, Cinnamon, Coriander, Fenugreek, Cumin, Tamarind, Allspice and Vanilla – Plantation crops - Tea, Coffee, Rubber, Cocoa, Coconut, Oilpalm, Cashew, Palmyrah and Arecanut.

Unit IX: Production Technology of Medicinal and Aromatic Crops (10 Questions)

Scope and importance of medicinal and aromatic crops - Composition and uses - Origin and distribution – Area and Production - *Ex situ* and *in situ* conservation – Classification of medicinal and aromatic crops – Constraints in medicinal plants cultivation - Climate and soil – Varieties – Propagation - Nursery practices - Planting methods - Cropping systems – Manures and Fertilizers – Irrigation – Intercultural operations – Harvest indices – Harvest and yield - Management of important pests and diseases - Production systems - Contract farming – Good Agricultural Practices (GAP) – Good Cultivation Practices (GCP) – Good Manufacturing Practices (GMP) - Organic production and certification – Classification and distillation methods of essential oils – Secondary metabolite production - Value addition - Organisational support for promotion of medicinal and aromatic crops - Medicinal crops: Senna, Periwinkle, Glory lily, Aswagandha, Medicinal coleus and Solanum, Sweet flag, Aloe, Isabgol, *Phyllanthus*, *Stevia*, Opium poppy. Aromatic crops: Lemon grass, Citronella, Vetiver, Ocimum, Davana, Mint, Geranium, Patchouli and Eucalyptus.

Unit X: Post-Harvest Technology of Horticultural Crops (20 Questions)

Importance of Post-harvest handling in horticultural crops – Maturity indices – Postharvest handling methods – Ripening chambers – Washing – Grading - Waxing – Grades and standards – Methods of packing - Types of containers and their advantages and disadvantages – Storage - Principles and methods of refrigerated storage - Storage methods - Pre-cooling - Controlled Atmospheric Storage (CAS), Modified Atmospheric Storage (MAS) – Low pressure storage and cold chain concept - Importance and scope of processing industries in India - General principles of fruit and vegetable preservation like canning, dehydration, freezing, fermentation - Use of chemicals (preservatives) and irradiation – Good Manufacturing Practices (GMP) – Food safety and quality control.

21. Industrial Safety and Health (Degree Standard)

Code: 515

Unit I: Chemical Technology, Chemical Process Calculations, Thermodynamics, Fluid Mechanics and Mechanical Operations (20 questions)

Fertilizers, Cement, Glass, Ceramic and Refractories, Oils, Soaps and Detergents, Pulp and paper, Dyes, sugar, leather and rubber, polymer, pharmaceutical and food industries.

Properties of gases, liquids and solids, Humidity and saturation, Gas laws, Material balance involving recycle, by-pass and purge systems with and without chemical reactions and Energy balances. Material and Energy balance with reactions, Gibbs Phase rule.

Thermodynamics and its applications, thermodynamic functions, compressibility factors, entropy, Chemical Reaction Equilibrium.

Fluid Statics, Newtonian and Non-Newtonian fluids, Equation of continuity, Navier Stroke equation, Friction Factor, Dimensional analysis, Flow through pipes, flow through fixed and fluidized beds, flow meters.

Laws of size Reduction, Mixing and agitation, Filtration, Sedimentation and Conveying of solids. Materials of construction for chemical Industries - Polymeric and composite materials, Nano and biomaterials. Corrosion - prevention and control.

Unit II: Heat Transfer, Mass Transfer, Chemical Reaction Engineering and Process Design, Instrumentation and Control (20 questions)

Modes of Heat transfer, Heat transfer with phase change, heat transfer coefficient. Design of heat exchangers - Double pipe, Shell and Tube. Evaporators - Single and Multiple effect.

Fick's Laws, Diffusion, Mass Transfer Coefficient and theories of Mass Transfer, Momentum, Heat and Mass transfer analogies, Inter phase Mass transfer operations, HTU, NTU and HETP concepts, Design of equipment - Distillation, Extraction, Absorption, Drying. Crystallization and Membrane separation processes.

Reaction rates - homogeneous and heterogeneous reactions, single and multiple reactions in ideal reactors. Residence time distribution. Design of reactors - Isothermal and non-isothermal fixed bed reactors and fluidized bed reactors. Kinetics of heterogeneous catalytic reactions. Diffusion effects in catalysis- rate and performance equations, Catalyst deactivation.

Numerical solutions of linear and non-linear algebraic equations, solution of initial and boundary values, Integration of Simpson rule. Solution of partial differential equations. Eigen value problems - Theorem for Eigen values and Eigen functions.

Sensitivity analysis, Constrained and unconstrained NLP, Newton's method, Quasi-Newton's method, Cost estimation, Plant utilities, pinch technology, Laplace transformation, application to solve ODEs. Open-loop systems, first order systems, first order systems in series, second order systems and their dynamics; transportation lag. Closed loop control systems, feed-back control systems, BODE diagram, stability criterion, frequency response.

Unit III: Environmental Engineering, Occupational Safety and Health in Chemical Industry, Mechanics of Machinery and Management in Textile Industry (20 questions)

Air, Water, Soil pollution and Noise control. Wastewater treatment by various methods: Chemical, biochemical and advanced oxidation process. Industrial hygiene, occupational safety & health in chemical industries, Industrial safety principles, plant layout, chemical hazards identification and classification, Safety in operations and processes, fire safety, hazard identification techniques, disposal of hazardous and toxic wastes, onsite and offsite emergency preparedness plan, safety audit, work permit system, roles and responsibilities of safety officers and welfare officers, occupational diseases.

Kohlberg's theory - Gilligan's theory - Safety and Risk - Assessment, Risk Benefit Analysis and Reducing Risk, Respect for Authority, Collective Bargaining, Confidentiality, Conflicts of Interest, Occupational Crime, Professional Rights, Employee Rights. Intellectual Property Rights (IPR).

Drive transmission, clutches and brakes in textile machinery, design of machine elements - cams, cone drums, drafting rollers; calculations - sley eccentricity, beat-up force; application of industrial engineering in garment industry; costing of yarn, fabric and garment; maintenance of light, temperature and humidity, and ergonomic aspects in textile industry, interpretation of financial statements; investment appraisal techniques; application of TQM tools.

Unit IV: Textile Manufacturing (20 questions)

Classification and identification of fibres; structure and properties of fibres; Production of synthetic fibres - raw materials, wet, dry, melt, dry-jet spinning.

Objectives, principle of working and calculations - ginning, blow room, carding, draw frame, comber preparatory, comber, roving frame, ring frame, ring doubling, TFO, rotor, air-jet, air-vortex, friction, core and wrap spinning machines; helical geometry and packing density of yarn, yarn contraction, yarn twist vs. strength, structure-property relations of yarns.

Objectives, principle of working and calculations - winding, warping, sizing; principle of fabric formation in shuttle looms, rapier, air-jet, and projectile looms; Basic woven fabric structures and its derivatives; Pierce geometry of plain woven fabrics, structure-property relationship of fabrics.

Objectives, principle of working and calculations - circular, flat and warp knitting; basic weft and warp knitted structures; production of nonwovens - needle punch, spun lace, spun bond and melt blown. Safety measures in fibre, yarn and fabric manufacturing industry.

Unit V: Chemical Processing of Textiles and Quality Assurance (20 questions)

Objectives and principles of desizing, singeing, scouring, bleaching and mercerizing machines; dyeing of different types of fibres, yarns and fabrics and the machines used; types and methods of printing; colour

and fastness measurement.

Principles and methods for shrink-proof, raising and calendaring, crease resistance, water-proof, water-repellent, flame retardant, soil release, UV resistance, anti-microbial, anti-static, softening, stiffening, elastomeric, self-cleaning finishes; eco-friendly processing, eco standards and eco labels, characteristics of effluent and effluent treatment.

Measurement of length, strength, fineness, maturity and trash of the cotton fibres; measurement of count, twist, strength and elongation, unevenness, imperfections and hairiness of the yarn; determination of construction parameters, tensile, tear, and bursting strength, air permeability, bending, drape, crease and wrinkle recovery, thickness, pilling and abrasion resistance and shrinkage of the fabrics; yarn defects analysis – diagram, spectrogram, Variance-length curve; fabric defects analysis.

Garment manufacturing – pattern making, marker planning, spreading, cutting, sewing and finishing; types of stitches and seams; garment inspection; fibre, yarn and fabric requirement for industrial, automotive, geo, agro, medical, protective and sports textiles.

Safety measures in chemical processing industry.

Unit VI: Electrical Engineering (20 questions)

Circuit elements – Kirchoff's Laws – Mesh and Nodal Analysis – Network Theorems and Applications for DC and AC circuits: Thevenin's Theorem, Norton's Theorem, Superposition Theorem, Maximum Power Transfer Theorem. Three phase Circuits, Star – delta transformation.

Coulomb's Law, Gauss's Law, Magnetic Circuits – Magnetomotive force- Reluctance – Faraday's laws – Lenz's law – Biot – Savart's law – Ampere's law – Fleming's left and Right Hand Rule - Lorentz force – Inductance – Self and Mutual Inductance – Dot Convention – Coupled Circuits.

D.C, Machines, Generators and Motors – Starting, Speed Control and braking – Testing Losses and Efficiency. Transformers – Types – Construction and Operation – Testing. Induction Machines Starting, Speed Control and braking Synchronous Machines, permanent magnet brushless DC motor, stepper motors

Circuit Breakers- protection; transformer, generator, motor, bus bars and transmission line – AC and DC Distribution – deregulation- energy conservation and energy auditing.

Unit VII: Measurements, Control Systems and Power Electronics (20 questions)

Measurement of Current, Voltage, Power, Power factor; Energy – Indicating instruments – Multi meters, Transducers and their applications to the Measurement of Non-Electrical Quantities like Temperature, Pressure, Flow-rate, Displacement, Acceleration, Noise level- Data Acquisition Systems – A/D and D/A converters – Data Transmission Systems – PLC – smart meters.

Control systems; Mathematical Modelling of Physical Systems, Transfer function, block diagram, signal flow graph and the reduction, PI, PD and PID Controllers –state. Semiconductor Devices

Power Semiconductor devices – single and Three Phase AC to DC Converters, Speed Control of DC Drives speed control of AC drives, induction motor drives.

Unit VIII: Electrical Power Generation and Thermal Engineering (20 questions)

Power Generation Types – Hydro, Thermal and Nuclear Stations, Co- generation, Renewable Energy, Solar energy, Wind Energy, smart grid – electric vehicles – V2G and G2V – Fuel cells – Batteries – types and characteristics – Super Capacitors.

Thermal engineering - basic concepts, Zeroth, First and Second laws of thermodynamics, thermodynamic system and processes, Emissions and Controls. I.C. Engines Refrigeration and air-conditioning: Vapour refrigeration cycle, heat pumps, gas refrigeration. Heat exchanger performance.

Unit IX: Mechanical Engineering (20 questions)

Properties of Surfaces and Solids, Centre of Gravity, Gears and Gear Trains, Fly Wheels and Governors, Balancing of Rotating and Reciprocating Masses, Friction in Machine Elements, Force Analysis, mechanisms for Vibration Control. Stress, Strain and Deformation of Solids, Fundamentals of Design for Strength and Stiffness of Machine Members, Spur Gears and Parallel Axis Helical Gears, Bevel Gears, Worm Gears and Crossed Helical Gears. Fluid properties, Bernoulli's equation, Pelton wheel, Francis and Kaplan turbines - pumps and its applications - Valves and Types

Production Flow Analysis, Industrial Robotics, lean manufacturing. Work study - Techniques, Method study - ABC Analysis material handling systems, Management theory and practice, planning - Decision making, Organising, staffing, Motivation, Leadership, controlling, control techniques, Industrial Safety - Standards – OSHA.

Unit X: Production Engineering (20 questions)

Constitution of alloys and phase diagrams, heat treatment of ferrous and non-ferrous metal, surface modification techniques, powder metallurgy, non-metallic materials, mechanical properties and testing, crystal defects and strengthening mechanisms, Engineering ceramics, Engineering and commodity polymers, composites, nano-materials. Foundry Technology- Sheet Metal Operation welding defects, Casting, Welding Inspection (NDT), Machinability machine tools - CNC machine tools. Limits, Fits and Tolerance, Computer Aided Inspection, Machine vision, Measurement of power, flow and temperature. Statistical quality control, control charts, acceptance sampling, reliability, TQM, 5S, ISO standards. Fundamentals of Computer Graphics, Geometric Modeling, Production Planning and Control, Computer Aided Process Planning, Cellular Manufacturing, Flexible Manufacturing System and Automated Guided Vehicle System.

22. Library and Information Science (Degree Standard)

Code: 594

Unit I: Library and Society (20 Questions)

Library as a Social Institution; Impact of Libraries on Social, Political, Economical, and Cultural aspects, Community Engaged Librarianship, Laws of Library Science, History and development of Library movement in India.

- (i) Types of Libraries – Public, Academic and Special Libraries; Librarianship, Professional Ethics.
- (ii) Library Legislation; Public Library Act; Delivery of Books and News papers (Public Library) Act; Right to Information (RTI) Act and Digital Delivery mandates. Intellectual Property Rights – Copyright Act. Creative Commons and Open Licensing.
- (iii) Library associations and Professional bodies – United Nations Educational Scientific and Cultural Organization(UNESCO), International Federation of Library Association, (IFLA), American Library Association (ALA); Chartered Institute of Library and Information Professionals (CILIP); Indian Library Association(ILA); Indian Association of the Teachers of Library and Information Science (IATLIS).
- (iv) Role of government agencies in library development – Rajaram Mohanrai Library Foundation(RRRLF) ; University Grant Commission – Information and Library Network (INFLIBNET), National Digital Library of India(NDLI).

Unit II: Library Management (20 Questions)

- (i) Management – Concept; Definition; School of Thoughts – Functions of Management; (POSDCORB); Library Authority and Committees.
- (ii) Library Sections and Routines – Collection development Policy: Issues- Selection, Acquisition; Technical, Maintenance, Circulation, Reference and Periodical, Preservation and Conservation of Library resources.
- (iii) Human Resource Management – Job Analysis, Job Description, Recruitment, Selection, Training, performance Appraisal, Motivation, etc.
- (iv) Financial Management – Budget – Types, Sources of income to various types of libraries, Physical facilities – Building and equipments ; Green Library
- (v) Library Records - Statistics; Reports

Unit III: Information Processing (Library Classification) (20 Questions)

- (i) Library Classification – Concept; Definition; Need and Purpose.
- (ii) Library Classification – Various Schemes of classification – Colon Classification; Dewey Decimal Classification; Universal Decimal Classification and Library of Congress Classification.
- (iii) Structure of knowledge – Modes of Formation of Subject, - Canons and Laws
- (iv) Facet and Facet analysis – Fundamental categories (PMEST); Analytico- Synthetic approach, metadata-driven ontologies & RDA-aligned approaches.
- (v) Notation –Types; Characteristics and Functions. Call number and structure.

Unit IV: Information Processing (Library Cataloguing) (20 Questions)

- (i) Library Cataloguing – Concept; Definition; Need, Purpose and Functions.
- (ii) Library Catalogue – Types – Physical forms and Inner forms - Alphabetical, Classified, and Alphabetico - Classified; Trade catalogue.
- (iii) Cataloguing Standards – ISBDs; Cataloguing Codes – Classified Catalogue Code of Ranganathan, Anglo-American Cataloguing Rules.
- (iv) International Standards – MARC – CCF; UNIMARC; MARC21; Metadata ,Dublin core, RDA, BIBFRAME.
- (v) Subject Headings – Sears' List of Subject Headings, Library of Congress Subject Headings (LCSH), Centralised, Co-Operative Cataloguing and Union Cataloguing.

Unit V: Information Sources (20 Questions)

- (i) Information Sources – Types, Documentary and Non Documentary – primary, secondary, and tertiary; Print Vs. Electronic resources.
- (ii) Reference Sources: Dictionaries, Encyclopedias, Indexing and Abstracting Sources, Directories, Biographical Sources; Geographical Sources.
- (iii) Electronic Information Sources – E-Books, E-Journals, Databases, Theses and Dissertation; Bibliographic, Indexing and Abstracting, Citation and Full-text data bases.
- (iv) Open Access Resources and Commercial Resources – Discipline oriented sources – Medline; INSPEC; etc; UGC - e- Sodhsindhu, ONOS, Sodhganga.
- (v) Evaluation of Information sources - Print and Web Resources; Multimedia; Open Access Resources.

Unit VI: Information Services (20 Questions)

- (i) Information Services - Types: Ready reference and Long range reference services; User education; Information literacy.
- (ii) Literature search – Bibliography compilation and Bibliographical services.
- (iii) Current Awareness Service (CAS), Selective Dissemination of Information (SDI), Rich Site Summary (RSS), E-Alert & Web based Services, Artificial Intelligence-driven services, Makerspace.
- (iv) Indexing and Abstracting services; Referral Service, Reprography service.
- (v) Translation and other specialized services, Library services for Differently Abled People data services, Mobile Services.

Unit VII: Computer and Computer Applications (20 Questions)

- (i) Computer – Definition; Characteristics; Classification of Computers Hardware – Generations; Input and Output Devices; Secondary Storage Devices; Tele communication – Concept and Components.
- (ii) Computer Software – Meaning; Types – System Software and Application Software; Operating System – Single user vs. Multi-user; Open Sources vs Proprietary.
- (iii) Database – Concept; Database Management System (DBMS) – Concepts; Functions.
- (iv) Library Automation - Need and Purpose; Areas of library automation; Library automation software packages – Proprietary vs Open.
- (v) Web Technology – Browser, Search Engine, Protocol, Integrated Services Digital Network (ISDN), Semantic web.

Unit VIII: Resource Sharing and Networking (20 Questions)

- (i) Resource sharing – Concept, Definition, Need, Purpose; Digital Inter-library loan (ILL).
- (ii) Library Co-operation – Concept, Definition, Need and Purpose.
- (iii) Computer Networks – Types – LAN, WAN, MAN; Internet and Intranet.
- (iv) Library Networks – Concept, Need, Functions.
- (v) Library Network System – International, Online Computer Library Center (OCLC), World cat; National – INFLIBNET, DELNET.

Unit IX: Information System (20 Questions)

- (i) Information System – Concept, Characteristics and Functions.
- (ii) Information System, Types – International, National; Subject – Mission Oriented; National Knowledge Commission; National Mission on Libraries.

- (iii) Information Systems – International - United Nations Educational, Scientific and Cultural Organization (UNESCO), International Nuclear Information System (INIS), International System for Agricultural Science and Technology (AGRIS), Information Service in Physics, Electro technology and Control (INSPEC), Open Access Infrastructure for Research in Europe (OpenAIRE); National - National Institute of Science Communication and Information Resources (CSIR-NIScPR) , National Information System in Science and Technology (NISSAT) - Defence Scientific Information & Documentation Centre (DESIDOC).
- (iv) Library Consortia – Trends, Functions; University Grant Commission UGC – e-sodhsindhu, *One Nation One Subscription (ONOS)* Council of Scientific and Industrial Research (CSIR) Consortium.
- (v) Open Access movement; Open Access System. Open Licensing, Creative Commons.

Unit X: Digital Library and Information Communication Technology Applications (20 Questions)

- (i) Digital Library – Concept, Definitions, Characteristics, Theoretical framework, Merits and Demerits. Digital Library Management – Design, Architecture, Standards.
- (ii) Digital Library Initiatives – Initiatives in India; Open Archives Initiatives. National Digital Library of India (NDLI), Shodhganga, India stat.
- (iii) Metadata – Definition, Standards, Metadata Harvesting. Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH), Interoperability with global harvesters (CORE, Europeana).
- (iv) Digital Library – Building process – Digitization; Software and Hardware; Institutional repositories.
- (v) Library Security Technologies – CCTV, SMARTCARD, Barcode, QR Code, Radio Frequency Identification (RFID), Biometrics, Emerging Trends in Library Services.

23. Mechanical, Production and Manufacturing Engineering (Degree Standard)

Code: 399

Unit I: Mechanics, Kinetics and Dynamics (18 Questions)

Statics of Particles, Equilibrium of Rigid bodies, Mechanism of Deformable Bodies, Properties of Surfaces and Solids, Centroid, Centre of Gravity, Dynamics of Particles, Elements of Rigid Body Dynamics, Basics of Mechanisms, Kinematics of mechanisms, gyroscope, Gears and Gear Trains, Fly Wheels and Governors, Balancing of Rotating and Reciprocating Masses, Friction in Machine Elements, Force Analysis, Balancing, Single Degree Free Vibration, Forced Vibration, mechanisms for Vibration Control, Effect of Damping, Vibration Isolation, Resonance, Critical Speed of Shaft.

Unit II: Strength of Materials and Design (20 Questions)

Stress, Strain and Deformation of Solids, Combined Stresses, Theories of Failures, Transverse Loading on Beams, Stresses in Beams, Torsion, Deflection of Beams, Energy Principles, Thin Cylinders and Thick Cylinders, Spherical Shells, Fundamentals of Design for Strength and Stiffness of Machine Members, Design of Shafts and Couplings, Design for Static and Dynamic Loading, Design of Fasteners and Welded Joints, Reverted Joints, Design of Springs, Design of Bearings, Design of Flywheels, Design of Transmission Systems for Flexible Elements, Spur Gears and Parallel Axis Helical Gears, Bevel Gears, Worm Gears and Crossed Helical Gears, Design of single and two stage speed reducers, Design of cam, Clutches and Brakes, Design of Piston and Connecting Rods.

Unit III: Fluid Mechanics and Turbo Machinery (20 Questions)

Fluid properties, fluid statics, manometry, buoyancy, control volume analysis of mass, momentum and energy, fluid acceleration, differential equations of continuity and momentum, Bernoulli's equation, Dimensional Analysis, viscous flow of incompressible fluids, boundary layer, elementary turbulent flow, flow through pipes, head losses in pipes, bends. Turbomachinery: Pelton wheel, Francis and Kaplan turbines - impulse and reaction principles – velocity diagrams, pumps and its applications-Valves and Types - Theory of Jet Propulsion- Pulse Jet – Ram Jet Engines, Online Continuous Flow Monitoring System.

Unit IV: Thermal Engineering and Thermodynamics (30 Questions)

Basic concepts, Zeroth, First and Second laws of thermodynamics, thermodynamic system and processes, Carnot cycle. irreversibility and availability, behaviour of ideal and real gases, thermodynamic relations, properties of pure substances, calculation of work and heat in ideal processes, analysis of thermodynamic

cycles related to energy conversion, Fuel and combustion, Fuels Characteristics, Emissions and Controls, Testing of IC Engine-Renewable sources of Energy.

Power Engineering: Steam Tables, Rankine, Brayton cycles with regeneration and reheat. I.C. Engines: air-standard Otto, Diesel cycles. Refrigeration and air-conditioning: Vapour refrigeration cycle, heat pumps, gas refrigeration, Reverse Brayton cycle; moist air: psychometric chart, basic psychometric processes.

Unit V: Heat and mass Transfer (25 Questions)

Modes of heat transfer - one dimensional heat conduction, resistance concept, electrical analogy, unsteady heat conduction, fins dimensionless parameters in free and forced convective heat transfer, various correlations for heat transfer in flow over flat plates and through pipes, thermal boundary layer, effect of turbulence, radiative heat transfer, black and grey surfaces, shape factors, network analysis; heat exchanger performance, LMTD and NTU methods.

Basic Concepts of Mass transfer, Diffusion Mass Transfer, Fick's Law of Diffusion Steady state Molecular diffusion, Convective Mass Transfer, Momentum, Heat and Mass Transfer Analogy, Convective Mass Transfer Correlations, Radiative Heat Transfer.

Unit VI: Materials Science and Metallurgy (25 Questions)

Constitution of alloys and phase diagrams, Iron – Iron Carbide Phase Diagram - steels, cast iron, phase transformations- diffusion-TTT diagram, ferrous and nonferrous alloys, heat treatment of ferrous and non-ferrous metal, surface modification techniques, powder metallurgy, non-metallic materials, mechanical properties and testing, crystal defects and strengthening mechanisms, conducting and semi conducting materials, magnetic and dielectric materials, Engineering ceramics, Engineering and commodity polymers, composites, nano-materials.

Unit VII: Production Technology (22 Questions)

Foundry Technology- types of pattern, cores, moulding and casting methods, Solidification, design of castings, defects, Melting Furnaces, Hot and Cold working, Metal Forming Processes - types, Defects and Remedies, Sheet Metal Operation, metal joining processes, types and design of weldment, welding metallurgy, welding defects, Casting, Welding Inspection (NDT), Manufacturing of Thermo Setting and Thermo Plastic Products, Metal cutting, Cutting Tool Nomenclature, Machinability machine tools - center lathe, drilling, milling, grinding, gear cutting and broaching, Machining Time Calculation, unconventional machining processes, Micro Manufacturing, CNC machine tools, Manual Part Programming - Machining and Turning Centre.

Unit VIII: Metrology and Quality Control (15 Questions)

Limits, Fits and Tolerance, Linear and angular measurements, Interferometry, laser interferometers - Types, Computer Aided Inspection, Basic concept of CMM - Types of CMM, Machine vision, Form measurement-Straightness- Flatness, Roundness, Surface finish measurement, contact and non-contact method, Measurement of power, flow and temperature. Statistical quality control, control charts, acceptance sampling, reliability, TQM, 5S, ISO standards.

Unit IX: CAD / CAM / CIM / FEA (13 Questions)

Fundamentals of Computer Graphics, Geometric Modeling, Visual Realism, Assembly of Parts, CAD Standards, Fundamentals of CIM, Production Planning and Control, Computer Aided Process Planning, Cellular Manufacturing, Flexible Manufacturing System and Automated Guided Vehicle System, Group Technology, Production Flow Analysis, Industrial Robotics, Additive Manufacturing, Just in Time(JIT), lean manufacturing, One Dimensional Problems in FEA, Two Dimensional Scalar Variable Problems, Two dimensional vector variable problems, Isometric Parametric Formulation.

Unit X: Industrial Engineering and Management (12 Questions)

Work study - Techniques, Method study and work measurements - objectives - basic procedure, machine loading and scheduling, product sequencing, inventory control - E O Q - quantity discounts, ABC Analysis material handling systems, operations research, Linear Programming, simplex method, Transportation model, Assignment model CPM and PERT, Queuing Models. Management theory and practice, planning - Decision making, Organising, staffing, Motivation, Leadership, controlling, control techniques, Industrial Safety - Standards – OSHA.

24. Pharmacy, Clinical Pharmacology and Micro Biology Degree Standard

Code: 516

Unit I: (20 Questions)

1) Historical background and development of profession of pharmacy: History of profession of Pharmacy in India in relation to pharmacy education, industry and organization, Pharmacy as a career, Pharmacopoeias: Introduction to IP, BP, USP and Extra Pharmacopoeia.

2) Calculations:

Posology: Pediatric Dose calculations based on age, body weight and surface area.

Pharmaceutical calculations: Percentage solutions, Alligation, Proof spirit and isotonic solutions based on freezing point and molecular weight.

3) Unit Operations: Size reduction, Size separation, Mixing, Filtration, Centrifugation, Evaporation, Drying, Distillation, Heat transfer, Tablet Compression and Tablet coating.

4) Coarse Dispersion:

Suspension, interfacial properties of suspended particles, settling in suspensions, formulation of flocculated and deflocculated suspension. Emulsions and theories of emulsification, micro emulsion and multiple emulsion, stability of emulsions, preservation of emulsions, rheological properties of emulsions and emulsion formation by HLB method.

5) Pre-formulation studies: Introduction to pre-formulation, goals and objectives, study of physicochemical characteristics of drug substances

a. Physical Properties: Crystal & amorphous form, particle size distribution and determination, shape, flow properties, derived properties, solubility profile (Pka, pH, Partition co-efficient) Polymorphism.

b. Chemical properties: Hydrolysis, Oxidation, reduction racemisation, polymerisation.

BCS classification of drugs and its significant

Application of preformulation considerations in the development of solid, liquid oral and parenteral dosage forms and its impact on stability of dosage forms.

6) Pharmaceutical Excipients – Used in Liquid, Semisolids and Solid dosage forms.

7) Quality Control Tests of the following formulations: Oral Solid dosage forms, Semi solids, Oral Liquid dosage forms, Parenteral, Ophthalmic preparation and Pharmaceutical Aerosols.

8) Cosmetics: Formulation and preparation of the following cosmetics preparations- Lipsticks, Shampoos, Cold Cream, Vanishing Cream, Tooth Paste, Hair Dyes, Sunscreens.

9) Packaging Material Sciences: Materials used for packaging of Pharmaceutical products, factors influencing choice of containers, legal and official requirement for containers, Quality control tests for containers and rubber closures.

10) Bio availability and Bioequivalence: Definitions and objectives of Bioavailability, absolute and relative bioavailability, measurement of bioavailability, in-vitro drug dissolution models, in-vitro-in-vivo correlations, bioequivalence studies, methods to enhance dissolution rates and bioavailability of poorly soluble drugs.

Unit II: (15 Questions)

1) Pharmacokinetics: Definition and introduction of Pharmacokinetics, Compartment models, Non-compartment models, Physiological models, One compartment open model

a) Intravenous Injection (bolus)

b) Intravenous infusion

c) Extra vascular administrations.

Pharmacokinetic parameters – Elimination rate constant (K_E), Half life ($t_{1/2}$), Volume of distribution (V_d), Area under curve (AUC), Absorption rate constant (K_a), Total body clearance (CL_t) and Renal Clearance (CL_R) – definitions, methods of elimination, understanding of their significance and application.

2) Good manufacturing practices (GMP)

3) Good Laboratory Practices (GLP): Organisation and personnel, Facilities, equipment, Testing facilities operation, Test and control articles, Protocol for conduct of a Nonclinical Laboratory Study, Records and reports, Disqualification of Testing facilities.

4) Warehousing: Good Warehousing practice, Materials Management.

5) Quality management systems: Quality management and certification: concept of quality, Total Quality Management, Quality by Design (QbD), Six Sigma concept, Out Of Specifications (OOS), Change control, Introduction to ISO 9000 series of quality system standards, ISO 14000, NABL.

6) Over the counter (OTC) Sales: Introduction and sale of over the counter and Rational use of common over the counter medications.

7) Drug Store Management and Inventory Control: Organisation of Drug Store, types of materials stocked and storage conditions. Purchase and inventory control: Principles, Purchase procedures, Purchase order, Procurement and stocking, Economic order quantity, Reorder quantity level and methods used for the analysis of the drug expenditure.

8) Novel Drug Delivery Systems: Ocular Drug Delivery Systems, Transdermal Drug Delivery Systems, Implantable Newer Drug Delivery Systems, Targeted Drug Delivery and Controlled Drug Delivery Systems.

9) Blood products and Plasma Substitutes: Collection, Processing and Storage of whole human blood, dried human plasma, plasma Substitutes

10) Fermentation methods and general requirements, study of media, equipments, sterilization methods, aeration process, stirring. Large scale production fermenter design and its various controls. Study of the production of – Penicillins, Citric acid, Vitamin B12, Glutamic acid, Griseofulvin.

Unit III: (15 Questions)

General Microbiology & Immunology

1. Morphology, classification and identification of Bacteria, Virus, Fungus & Parasite
2. Normal microbial flora & Bacterial genetics
3. Culture Media & Equipments in Microbiology Laboratory
4. Sterilization and disinfection
5. Testing of Sterilization & disinfection including sterility testing of pharmaceutical products.
6. Bio Safety in Microbiology Laboratory
7. Cultivation of Bacteria
8. Structures, Cells and functions of Immune system
9. The complement system
10. Antigen-Antibody reactions
11. Hypersensitivity
12. Tumour Immunity & Immuno Haematology
13. Immuno Prophylaxis against infectious Diseases
14. Immunotherapy

Unit IV: (20 Questions)

Clinical & Applied Microbiology

1. C.N.S infections
2. Respiratory Infections
3. Urinary Tract Infections
4. Gastro intestinal Infections
5. Genital Tract Infections
6. Congenital Infections
7. Infections of Eye, Ear & Skin
8. Infections of Cardio vascular System
9. Pyrexia of Unknown Origin (P.U.O)
10. Zoonotic Infections
11. Collection, Transport and Disposal of Specimens
12. Environmental Microbiology (Food, Water, Milk and Air)
13. Microbial Control – anti microbial susceptibility testing
14. Microbiological Assays for Standardisation of Antibiotics and Vitamins
15. Bio medical waste management
16. Emerging and reemerging infections – Bio Terrorism
17. Advanced Molecular Techniques in Relation to Diagnosis of Infectious diseases & Basic molecular biology related to infections
18. Anti microbial resistance and antibiotic policy
19. Newer Vaccines
20. Quality Control, Audit and Accreditation of Standard Microbiology Laboratory.

Unit V: (15 Questions)

1. Atomic structure and valency, Radioactivity, Radio isotopes and Pharmaceutical applications of Radio Pharmaceuticals, hazards and precautions.
2. Sources of impurities in Pharmaceutical substances: Limit test as per I.P; Fundamentals of volumetric Analysis. Errors: Sources, types, methods of minimizing errors, Accuracy, Precision, significant figures.
3. A systematic study of inorganic compounds for their preparation, assay and use which includes Gastrointestinal agents, Topical agents and Dental products.
4. Preparation and use of Chemical reagents and Volumetric Solutions as per Pharmacopeia in Pharmaceutical Analysis.

Unit VI: (25 Questions)

1. Principles and Pharmacopoeial Assay Procedures involving Non-aqueous Titration, Redox, Diazotization, complexometric methods, electrometric titration, gravimetric analysis.
2. Chromatography – Thin Layer Chromatography (TLC), Column, Paper, Gas Chromatography (GC), Ion exchange, High Performance Liquid Chromatography (HPLC), High Performance Thin Layer Chromatography (HPTLC), Gel electrophoresis.
3. Theory, principle, instrumentation and applications of colorimetry, UV-Visible Spectrophotometry, Spectrofluorimetry, Nepheloturbidometry, Infra-Red (IR), Mass, Nuclear Magnetic Resonance (NMR), Radio Immuno Assay (RIA), Polarimetry, Refractometry, Thermal method of analysis – Thermo Gravimetric Analysis (TGA), Differential Scanning Calorimetry (DSC), Differential Thermal Analysis (DTA), Atomic absorption spectroscopy.
4. ICH guidelines – Calibration and validation, calibration of electronic balance, UV spectrophotometer, IR spectrophotometer, Fluorimeter, High Performance Liquid Chromatography (HPLC), Gas Chromatography (GC), Flame photometer.

Unit VII: (20 Questions)

1) General Pharmacology

Sources of drugs, Routes of drug administration, Dosage formulations, Pharmacokinetics, Pharmacodynamics - Good Clinical Practice- Patient compliance, and self medication, Placebo medicines and pharmacoconomics.

Discovery and development of drugs - Preclinical studies in animals - Clinical trials - Official regulatory guidelines.

Orphan drugs, Pharmacovigilance – Pharmacogenetics - Adverse drug reactions and monitoring - Clinical importance of drug interactions (both pharmacokinetic and pharmacodynamic interactions with special reference to antimicrobials, NSAIDs and cardiovascular drugs).

2) Drugs Acting on Nervous System – Central Nervous System

General anaesthetics and Pre anaesthetic medication – Antiepileptics – Sedatives and Hypnotics – Alcohols and disulfiram – Psychopharmacological drugs (Anti-Psychotics, Anti-depressants, anti-anxiety agents, anti-manic and hallucinogens) – CNS Stimulants – Neurodegenerative disorders – Deaddiction – Drugs of abuse, drug tolerance and drug dependence.

3) Peripheral Nervous System & Autonomic Nervous System

Neurohumoral transmission in Autonomic nervous system, Para Sympathomimetics, Parasympatholytics, Sympathomimetics, Sympatholytics, neuromuscular blocking agents, Skeletal muscle relaxants (peripheral), Local anaesthetic agents, Drugs used in Myasthenia gravis and glaucoma.

4) Cardiovascular Drugs

Drugs used in congestive heart failure, Anti-hypertensive drugs, Anti-Anginal Drugs, Anti-arrhythmic drugs, Hypolipidemic Drugs, Drugs used in the therapy of shock.

5) Drugs Acting on Hemopoietic and Renal System

Haematinics - Coagulants & Anticoagulants – Fibrinolytics & Antifibrinolytics – Antiplatelets– Diuretics.

Unit VIII: (20 Questions)

1) Drugs Acting on the Gastro Intestinal System

Anti-ulcer agents, Drugs for constipation and diarrhea, appetite stimulants and Suppressants, Digestants and carminatives, Emetics and anti-emetics.

2) Drugs Acting on Endocrine System

Anterior pituitary Hormones - Thyroid Hormones – Corticosteroids - Insulin & Oral Hypo glycaemic drugs
- Male & Female sex Hormones - Oral contraceptives - Uterine stimulants & relaxants.

3) Immunopharmacology & Autacoids

Cell and biochemical mediators involved in allergy, immuno modulation and inflammation, hypersensitivity reactions - therapeutic agents for allergy, asthma and COPD - NSAIDs & DMARDs & gout – Antihistamines
- Serotonin agonists & Antagonists.

4) Chemotherapy

General Principles of Chemotherapy, Sulfonamides and co-trimoxazole, Anti-biotics: Penicillins, Cephalosporins, Chloramphenicol, macrolides, Quinolones and fluoroquinolones, tetracycline and amino glycosides, Anti-tubercular agents, Anti-leprotic agents, Anti-fungal agents, Anti-viral drugs, Anthelmintics, Anti-malarial drugs, Anti-amoebic agents, Urinary tract infection and sexually transmitted diseases, Chemotherapy of malignancy.

5) Bio-Assay

Principles and applications of Bio-assay, types of bio-assay, bio-assay of insulin, oxytocin, Vasopressin, ACTH, d-tubocurarine, digitalis, histamine and 5HT.

6) Miscellaneous

Vaccines - Dermatological preparations - Chelating Agents.

Unit IX: (20 Questions)

1. Alphabetical, Morphological, Taxonomical, Chemical and Pharmacological classification of crude drugs.
2. Adulteration and evaluation of drugs of natural origin. WHO guidelines for the assessment of herbal drugs.
3. General introduction, composition, chemistry and chemical classification, general methods of extraction and analysis, bio-sources, therapeutic uses and commercial application of following secondary metabolites.
 - a. Alkaloids - Vinca, Rauwolfia, Belladonna, Opium
 - b. Steroids, Cardiac Glycosides and Triterpenoids - Liquorice, Dioscorea, Digitalis
 - c. Glycosides - Senna, Aloes
 - d. Tannins - Black & Pale catechu
 - e. Volatile oils - Mentha, Clove, Cinnamon, Fennel, Coriander
 - f. Resins - Benzoin, Ginger, Asafoetida, Colophony
4. Isolation, Identification and Analysis of following phytoconstituents
 - (i) Terpenoids- Menthol, Citral, Artemisin
 - (ii) Glycosides -Glycyrrhetic acid, Rutin
 - (iii) Alkaloids - Atropine, Quinine, Reserpine, Caffeine
 - (iv) Resins - Podophyllotoxin, Curcumin
5. Homeopathy: Introduction, Basic principles, Preparation and evaluation of Various Dosage forms of homeopathy system of medicine
6. Marine Drugs: Novel Medicinal agent from marine sources.
7. Herbal Cosmetics: Sources and description of raw material of herbal origin used via, fixed oils, waxes, gums, colours, perfumes, protective agents, bleaching agents, antioxidants in product such as skin care, hair care and oral hygiene products.

Unit X: (30 Questions)

1. The Drugs and Cosmetics Act, 1940 (As Amended from time to time)
2. The Drugs Rules 1945 (As Amended from time to time)
3. The Cosmetics Rules, 2020 (As Amended from time to time)
4. The Medical Devices Rules, 2017 (As Amended from time to time)
5. The New Drugs and Clinical Trials (NDCT) rules, 2019 (As Amended from time to time)
6. The Drugs (Price Control) Order 2013 (As Amended from time to time)
7. The Pharmacy Act, 1948 (As Amended from time to time)
8. The Drugs and Magic Remedies (Objectionable Advertisement) Act, 1954 and Rules, 1955 (As Amended from time to time)
9. The Narcotic Drugs and Psychotropic substances Act and Rules, 1985 (As Amended from time to time)

25. Physics, Chemistry, Biology, Computer Science and Forensic Science (PG Degree Standard)

Code: 575

Unit I: Fundamentals of Physics (20 Questions)

Impulse - Impact - Laws of Impact - Loss of Kinetic theory - Motion of two interacting bodies - Reduced mass - Rigid body dynamics. **Relativity:** Postulates of Special theory of relativity - Mass Energy Equivalence. **Space Physics:** Escape Velocity - Orbital Velocity - Geo Stationary Orbits and Satellite Communication - Remote Sensing.

Basic ideas of Interference, Diffraction and Polarisation - Principle of LASER and its applications - Coupling Schemes - Zeeman effect - Paschen Back effect - Rotation, Vibration and Rotation -Vibration Spectra - Frank Condon principle - Laws of thermodynamics - Entropy - Thermodynamic potentials - Maxwell's equations and its applications, Gibb's phase rule - Phase transition -Vanderwaal's equation of State.

Crystal Classes and Systems - 2D, 3D Lattices - Lattice heat capacity - X-rays - X-ray diffraction - Superconductivity - Super Conductors, Different types of magnetic materials - Binding energy -Propagation of electromagnetic waves in non conducting and conducting medium - Reflection and refraction at a plane interface between dielectrics - Radiation from a localised source. -Fourier transform infrared, Raman, NMR and ESR spectroscopy- Principle, technique and applications

Unit II: Electronics (20 Questions)

Ampere's circuital law and its application - theory of Ballistic Galvanometer - Potentiometer - measurement of current, voltage and resistance. Semiconductor diode and transistor - Optoelectronic devices - Photo diode, Photo transistor, LDR, LED, LCD, Special Semi conductor devices - JFET, MOSFET, UJT- Operational amplifier -Characteristics and applications - 555 timer. Logic gates -Half and Full adder and subtractors-Karnaugh map -NAND - NOR networks - flipflops -counters and shift registers- Active Filters- Analog to digital and digital to analog converter.

Modulation and demodulation techniques - Principle of radio communication - AM and FM transmission - RADAR Principle- Television transmission and reception - Propagation of Light in an Optical fibre. ECG and EEG techniques - Basic ideas of CT and MRI Scan.

Unit III: General Chemistry (20 Questions)

Reaction Kinetics: Rate laws - rate constant - order and molecularity of reactions - I, II, III, and zero order reactions - concept of Arrhenius theory - Collision theory and Transition state theory -catalysis.

Acids and Bases: Bronsted and Lewis acids and bases - pH and pKa acid - base concept in non - aqueous media - HSAB concept - Buffer Solutions. Redox Reactions: Oxidation numbers, Redox potential, Electro chemical series - application of EMF measurements -Redox indicators.

Structure and Bonding: Electronic configuration of atoms, periodic properties of elements, Ionic radii, ionization potential electron affinity, electro negativity, concept of Hybridization, molecular orbitals and electronic configuration of homo nuclear and hetero nuclear diatomic molecules, shapes of polyatomic molecules. Types of chemical bond (weak and strong) inter molecular forces, structure of simple and covalent bonds- covalent character in ionic bond and partial ionic character - lattice energy.

Organic Reaction Mechanism: SN1, SN2 mechanisms - addition substitution, elimination and rearrangements -free radical mechanism - aromatic substitution -and stability of reactive intermediate (Carbocations, Carbanion's free radicals, nitrates and benzynes) - Polar effects - Hammett's equation and its modification.

Stereochemistry: Optical and geometric isomerism E. Z and R.S notation's IUPAC Nomenclature of simple organic and inorganic compounds.

Unit IV: Chemical and Instrumental Analysis (20 Questions)

Titrimetric Analysis: Classification of reaction in titrimetric analysis - Standard Solutions - Normality, Molarity and Molality - concentration units - Primary and Secondary standard - neutralization indicators - self indicators and external indicators- acid base titrations - precipitation titrations - redox titrations.

Qualitative Analysis: Semimicroqualitative analysis of cations like Se, Te, W, Mo, Ce, Th, Zr, V, Ca, Ba, Ni, and Mg.

Basic Principles, Instrumentation and applications of Ultraviolet-visible (UV-vis.) spectroscopy; Beer-Lambert's law, solution preparation and small molecules analysis and Flow Injection analyzer-Nuclear Magnetic spectroscopy (NMR), small molecule analysis. Flame spectrometry, Atomic Absorption Spectroscopy (AAS), Inductively Coupled Plasma -Mass Spectrometry (ICP-MS), Inductively Coupled

Plasma Emission spectroscopy, Fluorimetry-Chemiluminescence's Detector system, X-ray fluorescence spectroscopy (XFS),

Chromatographic Techniques: Basic Principles of chromatography, Instrumentation and application of chromatography - Paper, thin layer chromatography (TLC), High-performance Liquid chromatography (HPLC) and Gas chromatography (GC), Gas-Chromatography with Mass Spectrometer (GC-MS), Liquid Chromatography with Mass spectrometry (LC-MS).

Unit V: Zoology (20 Questions)

Salient features of Invertebrata and Vertebrata - Structural Organization of animal cell - Types of Muscle - Blood and its composition- grouping - Blood cells - Structure of sperm and Egg. Human genetics - Pedigree analysis - Karyotyping - Chromosome structure and functions - Beneficial and harmful insects - Exploiting insects olfaction in forensic studies - Ants, blowflies and beetles in forensic investigation. Anthropology scope - Basic concepts, types - Applied and developmental Anthropology - Forensic anthropology and criminal investigations. DNA finger printing technology in forensic investigations. Chemistry of Biomolecules - Types of carbohydrates, proteins and lipids. Metabolism of Bio molecules - Nucleic acids - Types, Structure and functions of DNA & RNA, Enzymes - Properties - Marker enzymes - Classes and function of Hormones - Pheromones. Theories of Origin of life.

Unit VI: Botany (20 Questions)

Plant Diversity: Salient features and economic importance of Algae, Fungi, Lichens, Bryophytes, Pteridophytes, Gymnosperms and Angiosperms.

Cell Biology: Cell Organelles and its functions. Cell cycle, Cell division, Tissuesystem and secondary growth

Plant pathology: Bacterial, fungal and viral diseases of plants.

Embryology: Micro sporogenesis, Megasporogenesis, Polyembryony, Doublefertilization.

Genetics: Mendelism, Linkage, crossing-over, chromosome mapping.

Plant adaptations: Hydrophytes, Xerophytes, Mesophytes, Epiphytes, Halophytes and Mangrove vegetation. Biodiversity conservation methods.

DNA profiling: Genetic code, Mutation and DNA polymorphism, Recombinant DNA technology.

Isolation of DNA: Agarose Gel Electrophoresis, PCR, DNA Sequencing, RAPD, RFLP, DNA Finger printing, STR Typing.

Isolation of Proteins: SDS-PAGE, RIA, ELISA, FISH. Ames test, Comet Assay.

Microbiology: Microscope and its types. Histology and Staining techniques. Microbial culture and preservation techniques. Host-parasite interaction, Microbial diseases, Bioterrorism and Biohazards.

Unit VII: Computer Fundamentals and Applications (20 Questions)

Computer Peripherals-Operating System Fundamentals- File Systems & Management -Processors – Memory Devices - Network Fundamentals- Word Processing- Spread Sheets- Power Point Presentation- Database Fundamentals - Web Fundamentals - Browsers-Hypertext Markup Language (HTML) - Java Script- Web pages - Internet- Cloud Services- AIFundamentals and its Applications- Cyber Security - Authentication - Firewalls-E-Commerce Applications- Data Protection- Messaging Tools -Mail Services - Internet of Things (IoT).

Unit VIII: Fundamentals of Forensic Science and Crime Scene Investigation (20 Questions)

Forensic science - Definition- Organisation and functions of Forensic laboratory- Foot and tire Impressions: Walking pattern- Finger prints: principles, patterns,classification - Identification of tool marks- Firearms, bullet and cartridge case identification,Pellets and Wads - Fire and Arson - Explosives;classification- Combustion, detonation and explosion- Military and Industrial Explosives - Physical evidence,classification and significance- Crime scene examinations- Documentation-recognition,collection,preservation of transportation for laboratory examinations- Fundamentals of Crime Scene Photography.

Unit IX: Advanced Forensic Techniques in Documents, Toxicological and Bio-Evidence (20 Questions)

Questioned documents: Identification of Hand writing, Typed and Forged signatures - Broken glass: glass fractions, direction of force - Forensic examination of soil and paints, polygraph and voice identification- Toxicology: classification, mode of action of poison - Narcotic drugs,alcoholic beverages- Examination of biological fluids: blood,seminal,vaginal and saliva stains-Examination of fibres,hair,bones,nail,teeth, tissues and skull.

Unit X: Criminology, Penology and Victimology (20 Questions)

Concept of Crime - Nature and its Scope - Typology and Patterns of Crime - Schools of Criminology - Causation of Crime- Theories of Crime: Psychological, Sociological and Tentative- Crime and Economic Conditions - Media , Race and Crime- Organised Crimes - White Collar Crimes - Cyber Crimes - Sexual Offenders - Green and Environmental Criminology - Alcoholism , Drug Addiction and Crime - Crimes of the powerful - Methods and Counting Crime - Crime Statistics - Punishment: Theories, Forms of Punishment and Judicial Sentencing - Capital Punishment - Criminal Law Courts - Prisons - Parole - Juvenile Delinquency - Crime Prevention - Victimology: Branches of Victimology - Restorative Justice - Risk and Protective factors - Formal and Informal responses to victimisation - Victims: Victimisation Cycle - Stages, Effects and Theories of Victimisation

26. Statistics and Mathematics (PG Degree Standard)

Code: 506

Unit I: Probability and Distribution Theory (25 Questions)

Random variables and Distribution function, Distribution function of a random vector – Mathematical expectation and conditional expectation

Chebychev's inequality – Convergence in probability – Convergence in distributions – Weak and Strong laws of large numbers – Central limit theorems (Lindeberg-Levy, Liapunov's)

Introduction to distributions:

Discrete distributions: Negative binomial and Hyper geometric distributions

Continuous distributions: Cauchy, Beta, Gamma, Weibull and Log-Normal.

Sampling distributions: Non central t, F and Chi-square distributions and their properties – Bivariate Binomial, Poisson Normal and their properties.

Unit II: Estimation Theory and Testing of Hypotheses (25 Questions)

Introduction to estimation theory and properties of estimators.

Theorems and inequalities: Cramer – Rao inequality, Batacharya inequality, Rao – Blackwell, Neyman – Fisher factorization theorems with examples.

Methods of estimation: Method of moments, Maximum likelihood, Minimum Chi-Square and method of least squares, Bayesian estimation – Introduction - Point and interval estimation and Bayes estimator under squared error loss function.

Introduction to testing of hypotheses: Basic concepts – More powerful Test - Neyman – Pearson lemma: UMP and unbiased tests – MLR property and its uses for construction of UMP tests.

Non-Parametric tests: Run test, Median test, Mann-Whitney test, Wilcoxon test, Kolmogoro-Smirnov test (one and two sample test procedures), Kruskal-Wallis test and SPRT test

Unit III: Regression analysis (20 Questions)

Introduction to linear regression model – Simple and multiple regression models: Description of data model – Estimation and testing of hypotheses on regression coefficients – Adequacy measures – Predicted values and standard error – Evaluation of fit – Analysis of residuals.

Multicollinearity and its effects on inference and forecasting – Selection of variables – Forward selection procedure (step-wise method).

Introduction to Generalized Linear Models: Components of GLM – Logistic regression model- Classification in two population, Fitting and interpretation.

Unit IV: Sampling Theory and Design of Experiments (25 Questions)

Ratio and Regression estimators, estimation under double sampling – Cluster sampling – Two stage sampling – Sampling and Non sampling errors.

Contrasts: Linear and orthogonal contrasts – Linear models: Fixed, random.

Principles of experimental designs – Construction and analysis of 2^3 and 3^2 fractional experiments – Partial and complete confounding – BIBD - PBIBD (Two Associates only) - Youden Square design.

Unit V: Statistical Quality Control and Time series (15 Questions)

Acceptance sampling: Sampling inspection – AOQL, LTPD, Producers' and consumers' risks – Single, double, sampling plans for attributes and variables – OC, ASN, ATI and AOQ curves. Six sigma –

Overview and implementation.

Time series – Components, uses – Determination of trend by Method of moving averages, fitting of first and second order degree, seasonal indices and the estimate of the variance for random components, autoregressive, moving averages and ARIMA models.

Unit VI: Machine Learning Techniques through R and Python Languages (10 Questions)

Overview of R language – Defining the R project – Objects and data structures – Graphics using R language – Calculation of measures of central tendency, dispersion, correlation and fitting of regression lines (Linear and logistic).

Overview of Python Language – Regular expressions – Scientific libraries: Numpy, Scipy, Matplotlib and Pandas.

Machine Learning: Supervised learning – Classification (KNN and Naïve Bayes) and Regression (Linear and Logistic) techniques – Unsupervised learning (Clustering methods).

Unit VII: Algebra and Functional Analysis (20 questions)

Algebra: Groups – Subgroups – Normal subgroups – homomorphisms – Isomorphism – Cayley's theorem – Cauchy's theorem – Sylow's theorem – Finite abelian groups – Rings – Euclidean rings – Polynomial rings – Polynomial over the rational field – Polynomials over Commutative rings – Division rings – Frobenius theorem.

Field: Finite fields – Wedderburn's theorem, Extension Fields.

Functional Analysis: Fundamentals of normed Linear spaces, bounded Linear maps on Banach spaces, open mapping theorem, Bounded operators of Hilbert spaces.

Unit VIII: Real and Complex Analysis (20 questions)

Limit, Continuity, types of discontinuities, infinite limits, function of bounded variation, metric spaces. Riemann Integral – Fundamental theorem of calculus – mean value theorem. Riemann Stieltjes Integral.

Complex Analysis: Local properties of analytic functions – Removable singularities Taylor's theorem – Zeros and poles, local mapping – maximum principle – Harmonic functions – power series expansions – Weierstrass theorem – Taylor's series, Laurents series.

Unit IX: Differential Equations (20 questions)

Linear differential equations of higher order – Linear dependence and Wronskian basic theory – solutions in power series – Introduction to second order linear equations with ordinary points. Legendre equations and Legendre polynomial, Second order equations with regular singular points, Bessel equations. Partial differential equations; first order, Complete Integral, General Integral, Singular Integral, Compatible systems of first order equation, Charpit's method.

Unit X: Differential Geometry (20 questions)

Curves, analytic representation, arc length, tangent, osculating plane, Curvature, torsion, formula of Frenet, Contact, natural equations, helices, involutes and evolutes, Elementary theory of surfaces – Analytic representation – first & second fundamental forms, normal – tangent form, developable surfaces, Euler's theorem, Dupin's indicatrices – Conjugate directions, Triply orthogonal system of surface.

27. Statistics, Mathematics and Economics (Degree Standard)

Code: 504

Unit I: Algebra and Differential Calculus (20 Questions)

Theory of Equations: Relations between roots and Coefficients – Complex roots – Irrational roots – Related roots – Transformations of equations – Reciprocal equations.

Matrix Theory: Symmetric – Skew Symmetric – Hermitian – Skew Hermitian – Orthogonal and Unitary Matrices – Rank of a matrix – Consistency and solutions of Linear Equations – Cayley Hamilton Theorem – Eigen values and Eigen Vectors.

Differential Calculus: nth derivative – Leibnitz's theorem and its applications – Partial differentiation – Maxima and Minima of functions of two independent variables.

Unit II: Integral Calculus and Differential Equations (20 Questions)

Integral Calculus: Methods of integration – Properties of definite integrals – Reduction formulae – Double Integrals – triple integrals – Applications to area, surface and volume – simple problems.

First order but of higher degree equations – solvable for p , solvable for x , solvable for y – simple problems.

Second order differential equations with constant coefficients with particular integrals for e^{ax} , x^m , $\cos mx$, $\sin mx$, $e^{ax} \cos mx$, $e^{ax} \sin mx$ – simple problems.

Partial Differential equations: Formation of partial differential equations by eliminating arbitrary constants and arbitrary functions – First order P.D.E. – complete integral – Singular integral – general integral – standard types $f(p,q) = 0$, $f(z,p,q) = 0$, $f(x,y,p,q)=0$, Clairaut's form and Lagrange's equations – simple problems.

Unit III: Vector Calculus and Operations Research (25 Questions)

Vector Differentiation: Gradient, divergence, curl, directional derivative, unit normal to a surface.

Vector Integration: line, surface and volume integrals – Applications of Gauss, Stokes and Green's Theorems – simple problems.

Linear programming: Formulation – graphical solution – simplex method – Big-M method – Transportation problem – Assignment problem.

PERT and CPM: project network diagram – Critical path – PERT computations.

Inventory models: Basic concepts – EOQ models (i) Uniform demand rate infinite production rate with no shortages models (ii) Uniform demand rate with finite production rate with no shortages models.

Unit IV: Descriptive Statistics and Fitting of Simple equations (20 questions)

Introduction to Statistics, Uses, scope and limitations - Collection, Classification and Tabulation of data - Diagrammatic and Graphical representations of Data – Measures of location, dispersion, skewness and kurtosis – Bivariate data- Scatter diagram – Correlation, Partial correlation and regression – Fitting of Linear and quadratic equations by the method of least squares.

Unit V: Probability and Statistical Inference (25 questions)

Introduction to Probability - Addition, Multiplication and Baye's Theorems and simple applications. Random variables and Expectation– Univariate Probability distributions – Binomial, Poisson, Geometric, exponential and normal distributions (Mean & Variance). Sampling Techniques – Simple Random Sampling – Stratified and Cluster (Single Stage) - Estimation – Properties, Point Estimation by the method MLE. Tests of Hypothesis – Important terminology – Test procedures for large and small samples (z , t , Chi-square, F).

Unit VI: Time Series, Index Numbers and Statistical computing using MS-Excel (20 Questions)

Time series – Components – Determination of Trend (Moving Average, Linear Trend by LSE) - Index Numbers – Construction of Simple, weighted Cost of living index numbers.

Statistical Computing using MS-Excel: Introduction to MS-Excel – MS-Excel Options using Excel Shortcuts – Link the Data in Rows, Columns and Sheet - Functions: Logical Functions -Math and Statistical Functions – Regular Charts-Plotting Density Function and Distribution Function.

Unit VII: Micro Economics (15 Questions)

(a) Definition, Scope and Importance of Micro Economics – Law of Demand – Elasticity of Demand – Utility Analysis – Consumer Surplus.

(b) Production Function – Factors of Production – Producer's Surplus – Economies of scale – Cost and Revenue curves in the Short-run and Long-run – Welfare Criteria – Adam Smith, Bentham, Marshall, Pigou and Kaldor.

Unit VIII: Macro Economics (15 Questions)

Definition, Nature and Scope of Macro Economics – Circular flow of Income in an Open Economy – National Income Accounting – Definition – Concepts: GNP, NNP, GDP, NDP, Personal Income, Per Disposable Income & Personal Savings, Per Capita Income – Keynesian Psychological Law of Consumption – Investment function – Marginal Efficiency of Capital – Multiplier – Accelerator.

Inflation – Deflation – CPI – WPI – Phases of Trade cycle.

Unit IX: Stabilisation Policies (20 Questions)

(a) Monetary Policy: Barter System – Demand for and supply of money – Functions of money, Functions of Central and Commercial Banks – Money Multiplier – Monetary Policy Instruments – SLR, CRR, OMO & LAF – Functions of Money Market – Capital Market.

(b) Fiscal Policy: Taxation – Types of Taxes – Canons of Taxation – Public Expenditure – Causes and Growth – Types of Public Expenditure – Public Debt – Internal and External Public Debt - Budget – Deficit and deficit financing – FRBM (Fiscal Regulation and Budgetary Management) – Fiscal Federalism.

Unit X: Indian Economy: (20 Questions)

(a) Agriculture: Contribution of the Agriculture sector to National Income and Employment – Agriculture Price Policies – Agriculture Statistics – Modern Technology in Agriculture Statistics – Agriculture Finance and Marketing.

(b) Industry: Contribution of the Industrial Sector to National Income and Employment – MSME and Large Scale Industries – Industrial Policy Resolutions – Industrial finance.

(c) Service Sector: Contribution of the Services Sector to National Income and Employment –Transport, Communication and IT Sectors.

(d) Economics of Planning: Five Year Plans – Planning Commission – Finance Commission – NITI Aayog – Government Welfare and Employment Generation Programmes.

(e) Population: Demographic transition and Demographic Statistics – Poverty Alleviation Programmes.

28. Town Planning, Civil Engineering and Architecture (Degree Standard)

Code: 560

Unit I: Introduction to Planning - Theory and Techniques (20 Questions)

Planning System in India, Regional Plan, Master Plan, Structure Plan, Detailed Development Plans, City Corporate Plan and Smart City Plan - Concept of Region, Types of Region, Techniques of Regional Analysis. Multi-level Planning - Process of evolution of human settlement planning - Simulation models, Gravity analysis, Lowry model, Threshold analysis, Multivariate analysis – Optimization and economic analysis methods in project formulation and implementation.

Unit II: Urban Sociology, Economics, Geography and Environment - Theories and Applications (20 Questions)

Ecological processes and structures in Indian Cities - Social Change & Economic Development - Agglomeration economics - Economics of scale, Multiplier effect concept, scope, limitation - Basic and non-basic activities of economics base, methods of base identification - Land-use determinants, Locational Dynamics of urban Land-use - Spatial organization of Urban settlements - City-region, Urban Sprawl and Fringe - Urbanization in India and Tamil Nadu with reference to settlements and population distribution. Environmental Impact Assessment Practice in India - Types, Conceptual Approach and Phases of EIA – Environmental Concepts – Sustainable Planning – Eco Cities, Compact Cities, Smart growth, Sponge city.

Unit III: Remote Sensing, G.I.S. and Current Trends in Planning (20 Questions)

Basics of Remote Sensing and GIS. - Classification of spatial and non - spatial data application in planning - spatial data layers - Coding schemes – Digitization of spatial data – Editing spatial data usable for the given planning problem – Land use Suitability Analysis, Land use Modeling, Existing Land use Preparation using Mobiles, Satellite Imageries, Aerial Photographs, Drones in Physical Planning. Emerging Concepts of sustainable urban development, E – Governance, HRIDAY, Rurban Mission, AMRUT, Public private partnership, Local bodies and urban finance. Land Pooling concept, Transfer of Development Right, Accommodation Reservation, Formulation of Re-development and Urban Expansion Plans - Local Area Plans, Town Planning Schemes - Special Economic Zone, Value Capture Finance Policy Framework – Swiss Challenge Model, Industrial Corridor, Coastal Zone Management Plan, Planned Unit Development.

Unit IV: Physical Infrastructure and Legislation (20 Questions)

Implication of Urban Form and Size on Services Highway classification - Traffic and Transportation Survey - Para Transit modes – Private transport – Urban Transportation Planning Process – Trip Generation –

Trip Distribution – Modal Split – Trip Assignment, Congestion pricing, Non Motorized Transport, Transit Oriented Development, Bus Rapid Transit System, Unified Transport Authority. Tamil Nadu Urban Local Bodies Act, 1996 and Tamil Nadu Urban Local Bodies Rules, 2023. 73rd and 74th Constitutional Amendment Act (CAA) and their implications on planning and development. Town and Country Planning Act of Tamil Nadu 1971, Tamil Nadu Combined Development and Building Rules 2019, Urban and Regional Development Plans Formulation and Implementation (URDPFI) and Rural Area Development Plans Formulation and Implementation (RADPFI).

Unit V: Design of Reinforced Concrete, Pre stressed Concrete and Steel Structures (20 Questions)

Design of concrete members - limit state and working stress design concepts - design of slabs - one way, two way and flat slabs - Design of singly and doubly reinforced sections and flanged sections - design of columns and footings – pre- stressing - systems and methods- post tensioning slabs - Design of pre-stressed members for flexure.

Design of tension and compression members - Design of bolted and welded connections design of members of truss - designs of columns and bases - design of beams, plate girders and gantry girder- design of liquid storage structures –elevated and underground- design of retaining wall.

Unit VI: Environmental Engineering and Pollution Control (20 Questions)

Sources of water - Water Demand -- Characteristics and analysis of water – hydraulics for conveyance and transmission - water borne diseases – Functional design of water treatment plant – desalination plant- water distribution system – pipe network analysis- characteristics and composition of sewage - Planning and design of sewerage system - sewer appurtenances - Pumping of sewage - sewage treatment and disposal - Design of storm water drain- plumbing system in high rise building - industrial waste treatment - solid waste management – Air and Noise pollution control – E-Waste management.

Unit VII: Urban and Transportation Engineering (20 Questions)

Urbanization trend and impact - Slum clearance and slum improvement programmes - Different modes of transport and their characteristics. Geometric design of highways. – Pavement materials and testing – alternate pavement materials- modified binders - Design and Construction of bituminous and concrete roads – pavement distress and evaluation - Maintenance of roads – Railways - Components of permanent way - Signalling, Interlocking and train control - drainage in roads and railways. Airport planning - Components of Airport - Site selection – Runways – Planning of terminal buildings Harbours & Ports - Layout of a harbour - Docks - Breakwaters.

Unit VIII: Introduction to Architecture (20 Questions)

Definition of Architecture - Integration of aesthetics and function. Elements of Architecture – Form, Space, light, colour, etc. Principles of Architecture – Proportion, Scale, balance, rhythm, symmetry, hierarchy, pattern and axis. Understanding of organization of form and space, volumetric study, architectural characteristics & style of buildings with examples. Understanding user circulation and spatial requirement for all types of buildings. Universal design principles and Barrier free environment. Functional aspects of architecture – site, structure, skin, circulation etc. Principles of composition and relationship between human activities and anthropometrics. Modern Architecture - various philosophies, works of postmodern architects. Architecture of India under Colonial rule. Post-independence architecture in India - works of Indian Architects. Contemporary World Architecture & recent trends. Building Rules and Regulations, National Building Code.

Unit IX: Site Planning, Climatic Design and Energy Efficient Architecture (20 Questions)

Site Planning – Introduction to basic terminologies, Methods of surveying, Instruments & Application, Levelling, Site Drawings, Importance of Site Analysis – On-site & off-site factors, Study of micro climate, Site Diagramming, Site Context, Site planning & Site layout principles. Organization of spaces – circulation, built form and open spaces, site planning and micro climate, site planning for neighborhood parks, children’s play area and campus development – Landscaping of Functional areas – Urban open spaces and principle of urban landscape – Street landscaping, landscape design for waterfront areas and functional areas in urban centers – green roofs and walls. Climate & Human comfort, Visual and Acoustical comfort in built environment. Solar Control, Heat flow through materials & building envelope design, Air movement patterns through natural & built forms, Design strategies for different climate types. Energy

Efficiency – Importance & Significance, Passive Heating & Cooling techniques, case studies, day Lighting & Natural ventilation, Use of Renewable energy systems – Current & future trends. National and state level government organizations -initiatives, schemes and projects. Relevant National and state level legislations and guidelines.

Unit X: Human Settlements Planning and Urban Studies (20 Questions)

Origin of Human settlements In India & the rest of the world – River valley civilizations (Indus Valley, Mesopotamia, Egyptian & Chinese) – Traditional planning principles in India – approaches & concepts – Classical & Medieval planning in Europe and India - Evolution of modern planning theory, concepts and works of town planners; Contemporary Urban planning – Issues and Trends. Urban Design – need, aspects, scope & components of urban space – Indian Urbanism - Theorising & Reading urban space – Imageability & townscape elements, social aspects of urban space, gender & class. Urban Public spaces – Universal design, pedestrian friendly environment, streetscapes. Conservation in India – Understanding the need & purpose, definition, Adaptive re-use, International agencies & their role – Policies & legislations, case studies – Conservation practice and Planning.

29. Translation (Descriptive Type) (Degree Standard)

Code: 462

Translation of the following from English to Tamil:

- (a) State Acts, Bills, Ordinances, Rules and Notifications made thereunder. (145 Marks)
- (b) Central Acts, Ordinances, Rules and Notifications made thereunder. (105 Marks)
- (c) Legal Terms / Legal Maxims. (50 Marks)

30. Travel and Tourism (Degree Standard)

Code: 597

Unit I: Principles and Practices of Tourism (20 Questions)

Introduction to Tourism – Meaning and Scope, Concept, Components and types of Tourism - Evolution of Tourism in India and Tamil Nadu – Travel Motivation – Early History, Ancient Civilisation, Travel Through Ages – Emerging Trends – Ministry of Tourism, Government of India – Government of Tamil Nadu, Department of Tourism and Organisation Structure – Tourism Statistics.

Unit II: Tourism Products of India (30 Questions)

Unique features of Tourism Products – Tourist attractions – Hills, Beaches, Mountains, Flora and Fauna, Major wildlife Sanctuaries and National Parks, Water Bodies, Backwater – Land, Air, Water Based adventure activities.

Forts, Palaces, Museums, Temples, Churches, Mosque and other religious worship Places – UNESCO World Heritage Sites, Tamil Nadu Heritage Sites and Architectural features.

Fairs and Festivals, Folk Dances, Dance, Music, Arts and Crafts – Culinary Tourism – Major Tourist Circuits of India and Tamil Nadu.

Unit III: Transport (20 Questions)

History and Development – Land – Water and Air – Growth of Road Transport – Indian Road Network – Major Rail Network of India – Types of Rail Tours in India – Water Transport – Cruise Ships – Ferries – Hovercraft – River and Canal Boats – Boat Houses - Air Industry, Airlines in India, Functions, Present policies – Air Charters.

Unit IV: Accommodation Operations (20 Questions)

Origin and growth of Hotels – Types and Classification of Accommodation, Hotels on the basis of Size, Location, Facilities, Plan, Service and Ownership – Allied Catering Services – Supplementary

Accommodation – House Keeping – Safety Measures – Front Office Management – Booking Procedures – Types of Food and Beverage Outlets and Promotions.

Unit V: Tourism Marketing and Promotions (25 Questions)

Unique features of Tourism Marketing – Market Segmentation – Marketing mix – Tourists behavior – Distribution channel and its characteristics – Market research – Market forecast – Destination Life Cycle – Marketing Promotions – Tools of Promotion – E-Marketing, Digital Marketing – Domestic and International Travel Marts – Branding of Tourism Products – “Incredible India” Campaign – “Where Stories Never End” Tamil Nadu Campaign – International and National Tourism Day – Swachh Bharat Abhiyan and other Schemes.

Unit VI: Tourism Policy and Planning (15 Questions)

Need and Objectives of Tourism Policy – John Sargent Committee – L.K.Jha Committee (Adhoc Committee), 1963 - National Tourism Policy, 1982 - Yunus Committee, 1988 – Ancient Monuments Preservation Act, 1904 – Ancient Monuments and Archaeological Site and Remains Act, 1958 – Tourism Finance Corporation of India – National Action Plan on Tourism, 1992 – National Tourism Policy, 2002, 2023 – Tourism in Five Year Plans – Tamil Nadu Tourism Policy, 2023 – Guidelines and regulations – PPP (Public Private Partnership).

Unit VII: Functions of Travel Agency and Tour Operation (20 Questions)

Setting up of Travel Agency and Registration, Role and Types - Tour Operation Procedures – Tour Package – Itinerary Preparation – Tour Costing – Travel Formalities – Travel Documents, Passport, VISA, Health Regulations, Travel Insurance, Customs Clearance, Foreign Exchange formalities – Baggage Rules.

Unit VIII: Tourism Geography (25 Questions)

Physical Geography of India – Sub Continent - Climate - River System – Mountains – Plains – Political Geography of India – World Traffic Conference Area, TCA1, TCA2, and TCA3 Three Letter City Codes, Countries, Capitals and Currencies - World Time Zones, GMT – India Time Zone.

Unit IX: Tourism Organisations (15 Questions)

Organisations and Functions of WTO (World Tourism Organisation), ICAO (International Civil Aviation Organisation), IATA (International Air Transport Association), PATA (Pacific Asia Travel Association), TAAI (Travel Agents Association of India), IH&RA (International Hotel and Restaurant Association), SIHRA (South Indian Hotel and Restaurant Association), FHRAI (Federation of Hotel and Restaurant Association of India), FICCI (Federation of Indian Chamber’s of Commerce and Industry), SICCI (South India Chamber of Commerce and Industry), TFCI (Tourism Finance Corporation of India), SEPC (Services Export Promotion Council), IATO (Indian Association of Tour Operators), NTAC (National Tourism Advisory Council), FAITH (Federation of Association in Indian Tourism and Hospitality), ATOAI (Adventure Tour Operators Association of India), RTSOI (Responsible Tourism Society of India) and GTTAA (Global Tourism Travel Agents Association of India).

Unit X: Impact of Tourism (10 Questions)

Positive and Negative – Socio-Cultural and Economic Impacts – Physical and Environment Impacts - Earth Summits – SDGs (Sustainable Development Goals).

31. Visual Communication (Degree Standard)

Code: 477

Unit I: History of Photography (20 Questions)

Evolution and invention of photography and the camera - Basic principles of photography-Camera parts and its functions- Photography as a medium of Art and Science-Photography in 19th and early 20th century- Technological innovations - Transition to digital age – Digital evolutions in Photography- Contemporary and future trends.

Unit II: Basics of Photography and Techniques (20 Questions)

Camera anatomy – Parts (Lens, Body, Flash Light, View finder). Lens – Normal, Wide, Telephoto, Macro. Depth of Field

Depth of Focus, Mounts: E-mount, A-Mount, PL-mount- Block lenses and Zoom Lenses, Focal length Aberrations.

Exposure – Bracketing – Exposure triangle – (Aperture, Shutter,ISO) Over Exposure, Under Exposure – Toe & Shoulder region- Histogram – False colour – TTL meter - HDR.

Sensors – Human eye – Pixel – Resolution, Image formation – Electronic shutter, Focal plane shutter.

Shutter - Types – Mirrorless – Portrait Wildlife, Sports, Candid.

Mode– Portrait, Shutter, Manual, G Mode, Aerial, Mobile, 360° Geo tag Remote Sensing, Infrared.

Flash – Types - On-cam flash, High speed sync, TTL, Ring, Umbrella, Wireless – Flash sync.

Colour Space – Colour Temperature- RGB, CMYK – Sharpness – Contrast, Brightness- White Balance.

Light Source– Indoor, Outdoor, Flash, LED, White Balance.

Unit III: Visual Aesthetics (20 Questions)

Basic concepts of visualisation in Photography - Understanding of Indian and western visual aesthetics- Principles of Composition: Rule of Third, Lead in lines, Diagonal. Framing, Depth of field, Cropping, Aspect ratio etc., - Modern concepts of digital photography- designing Visual communication and photography as a means of expression - understanding of visual practices and contemporary transformations. Angles and Shots.

Unit IV: Photo Journalism (20 Questions)

Objectivity – Truth, Timeliness, News value. Visual appeal - Publicity, Propaganda, Framing, Revelation, Rhetoric, Image manipulation, Distortion, Captioning and content creation. Documentation – Archival, Stock Photography. Eye tracking – Simplification. Limiting focus, de-cluttering. Pictorials – Gendered image, Epitome, Un obtrusiveness, Hyper photography, Proxemics, Copyright, manipulation.

Unit V: Camera (20 Questions)

Camera - Types –SLR, TLR, DSLR and Mirrorless –Aspect ratio

Recording Formats – Memory Cards (SD, Micro SD, CF card (compact flash) – Speed, Memory, XQD card.

Unit VI: Equipments (20 Questions)

Filter – ND, Polarizer, UV, Colour Conversion Effects Filters, Gels, Modifiers – Gobos, Patterns.

Tripods – Monopods – Gorilla Stand – Rings. Reflectors – Diffusers

Lights – Flash light, Umbrella Light, Wireless Light, Natural Lights,

Batteries & Power supply – Battery grips – External Battery packs, Cables.

Unit VII: Lighting Techniques (20 Questions)

Lighting - Types – Natural and Artificial – (Sunlight, flash, LED...) – Visible spectrum – Wavelength - Hard light – Soft light, Portrait, Sports, Product (Table – Top), Candid, Flash Photography – Event – Hard Light – Soft Light – Diffuser – Back Light – Types of: Ambient, Fluorescence, Reflector, soft box– Rembrandt – Chiaroscuro, Noton, Butterfly, Split, Rim, Flat.

Colour temperature– Kelvin – 3 Point lighting Contrast, ratio (High key, low key)

Colours – Tint, shades, Tone – Saturation, Brightness, Primary & secondary (RGB & CMYK) colours – White Balance, Black Balance.

Unit VIII: Post – Processing and Editing (20 Questions)

Introduction to Adobe Photoshop - Software interface and cutting tool, Repair and retouching (crop tool, frame tool, Eye dropper tool, Healing brush, clone stamp tool, Erase tool, Dodge tool, pen tool, layers, blending modes) , File formats RAW and JPEG .

Adobe light room : Software interface, tagging photos, processing, creating preset, exporting pictures, colour management, Resolution and pixels for printing image, cropping, resizing Noise Reduction, HDR Dynamic Range, Curve adjustment, panoramas and composites, Raw processing.

STORAGE: RAM, Graphics processing, Raid storage, Memory cards, External hard drive, USB flash drive, Solid

State Drive (SSD), Hard Disk Drive (HDD), SD, Micro SD card, Cloud backup, Metadata, Keywords and Tags.

Unit IX: Social Media: (20 Questions)

Highlight industry events and exhibitions -incorporate visual storytelling - through captions / end notes engage with interactive posts, Plan and automate posts, Visibility and exposure, networking and community building feedback, Copyright and unauthorized use protecting your work, Algorithmic challenge, Instagram, fumble, Behance Pinterest, Facebook, You tube, flickr.

Unit X: Professional Practices: (20 Questions)

Building a photography profile - Copyright Act(1957) - copyright infringement - Social Media usage - Unauthorized sharing - Misuse of reposting - infringement -Protecting the ownership; Water marking, Reverse image search - Fair use policy - Popular photo agencies: AP, Getty images, Magnum, istock etc. - Business of photography.