Annexure III

Syllabus

Paper I

Tamil Eligibility Test, General Studies and Aptitude and Mental Ability

Part A - தமிழ் மொழி தகுதித் தேர்வு
(பத்தாம் வகுப்பு தரம் – 100 கேள்விகள்)

குறியீடு: 501

அலகு I: இலக்கணம் (25 கேள்விகள்)

எழுத்து: பிரித்து எழுதுதல் – சேர்த்து எழுதுதல் – சந்திப்பிழை – குறில், நெடில் வேறுபாடு – லகர, ளகர, ழகர வேறுபாடு – னகர, 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, ஓரெழுத்து 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 மரூஉவை 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 பேஞ்சுது - 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) ரபுத் தமிழ்: திணை மரபு - உயர்திணை: அம்மா வந்தது – அம்மா வந்தாள்; அ·றிணை: 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.மீனாட்சி 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.ஜகந்நாதர், நாமக்கல் கவிஞர்.

குறிப்பு: அலகு VII-க்கான பாடத்திட்டம் பத்தாம் வகுப்பு வரையிலான (upto SSLC Standard) பாடப் புத்தகங்களை அடிப்படையாகக் கொண்டது.

Part B: General Studies (SSLC Standard – 75 Questions)

Unit I: General Science (5 Questions)

Nature of Universe - Measurement of physical quantities - General scientific laws in motion - force, pressure, and energy - Everyday application of the basic principles of mechanics, electricity, magnetism, light, sound, heat, and nuclear physics in our daily life; Elements and compounds, acids, bases, salts, petroleum products, fertilizers, pesticides, metallurgy, and food adulterants; main concepts of life science, classification of living organisms, evolution, genetics, physiology, nutrition, health and hygiene, human diseases; Environmental science; Latest inventions in science and technology; Current affairs.

Unit II: Geography (5 Questions)

Earth location - Physical features - Monsoon, rainfall, weather, and climate - Water resources - Rivers - Soil, Minerals, and Natural resources - Forest and Wildlife - Agriculture pattern; Transport - Communication; Population density and distribution in Tamil Nadu and India; Calamities - Disaster management - Environment - Climate change; 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 – 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, Thanthai Periyar, Jawaharlal Nehru, Rabindranath Tagore, Kamarajar, Mahatma Gandhi, Maulana Abul Kalam Azad, Rajaji, Subhash Chandra Bose, Muthulaksmi Ammaiyar, Muvalur Ramamirtham, and other National Leaders; Different modes of agitation of Tamil Nadu and movements; Characteristics of Indian Culture, Unity in Diversity - Race, Language, Custom; India as a secular state.

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 Lokayukta – Right to Information - Empowerment of Women - Consumer Protection Forums - Human Rights Charter; Political parties and political system in Tamil Nadu and 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 - Finance Commission - Resource sharing between Union and State Governments - Goods and Services Tax; Economic trends - 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; 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; Welfare schemes of Government; Current socio-economic issues; Current affairs.

Unit VI: History, Culture, Heritage, and Socio-Political Movements of 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-politico-economic affairs - Philosophical content in Thirukkural; Role of Tamil Nadu in freedom struggle - Early agitations against British Rule - Role of women in freedom struggle; Various Social reformers, Social reform movements and Social transformation of Tamil Nadu.

Part C: Aptitude and Mental Ability (SSLC Standard – 25 Questions)

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 – Subject Paper

1. Agriculture
(Diploma Standard)

Code: 431

Unit I: Agronomic Principles, Practices and Meteorology (30 Questions)

Agriculture – Definition – Branches of agriculture – Classification and status of major crops in Tamil Nadu. Factors affecting crop production. Cropping systems definitions - principles - intercropping - types, Principles and Practices of Agricultural Operations – Tillage definition and types - Intercultural Operations, Implements and Tools in Agriculture – Growth stages and yield prediction.

Meteorology – Agricultural Meteorology – Definition - Importance in Crop Production - Atmosphere – Components and its importance – Weather Parameters and their role in Crop Production. Rainfall – Spatial and Temporal Variability in Tamil Nadu across Seasons – Agro Climatic Zones of Tamil Nadu. Automatic weather stations and its components - Agroadvisory services.

Irrigation - water movement in soil – soil moisture constants – available soil moisture - effect of water stress on crop yield – water use efficiency – water requirement of major crops – critical stages of water requirement – irrigation scheduling – types and advantages – Irrigation methods – Micro irrigation – Flagship schemes and policies of Tamil Nadu - Irrigation water use efficiency – management of poor quality irrigation water - soil erosion due to water and control.

Weeds – definition and importance of weed control in crop production – classification of weeds – methods of weed management. Herbicide classification based on mode of action - method of application - common and new herbicides available in the market – weed control practices for major crops – parasitic, problematic and aquatic weed management - integrated weed management – concepts and practices.

Agronomic practices including climatic and soil requirement, land preparation – seeds and sowing – varieties – fertilizer management – irrigation – weed control – harvesting – Production technologies for cereals, millets, pulses, oilseeds, commercial crops, mulberry, forages and green manure crops.

Unit II: Farming system, Dry Farming and Agro-Forestry (10 Questions)

Integrated farming system – models and components – Schemes of Tamil Nadu. Cropping schemes – Crop calendar of operation of major crops - Dry Farming – Definition and Present Status in Tamil Nadu – Soils of Dry Farming Tracts and their limitation to Crop Production – Major Crops of Dry Land. Suitable Dry Land Technology for increased Crop Productivity – Pre-monsoon sowing – Conventional Crop Production Vs Alternate land Use in Dry Land – Drought and disaster effects and management – crop insurance schemes - Integrated Farming Systems in drylands. Erosion - Classification of Erosion – Soil moisture conservation practices – agronomical, physical and biological methods - Cultivation Practices – Water Harvest – Farm Ponds – Percolation Ponds –Weather aberrations and Contingent Crop Planning – Watershed development – definition and components. Land use classification – Role of Forests – Agroforestry – Definition and types – Social Forestry, Urban Forestry – Agroforestry Systems - Shifting Cultivation – Alley cropping – Wind Break and Shelter Belts – Agroforestry Practices – Teak, Casuarina, Ailanthus, Neem, Bamboo, and Acacia production and management practices.

Unit III: Soils and Fertility Management (30 Questions)

Definition of Soil – Its main components – Soils of Tamil Nadu. Soil physical, chemical and biological properties and their significance in crop production. Soil Micro Organisms - Importance of Organic Matter on Soil Properties. Acid, Saline and Alkaline Soils and their reclamation. Soil and water pollutants and management. Irrigation water – Qualities of irrigation water - Water testing. Soil Fertility – Major, Secondary and Minor Plant Nutrients. Soil Fertility evaluation, Soil sampling and testing and fertilizer recommendations – Soil health card. Fertilizers – Nitrogenous, Phosphatic and Potassic Fertilizers – Complex and Mixed Fertilizers, Efficient use of Fertilizers – fertilizer management in major crops. Identification and management of major and minor nutrient deficiency symptoms in plants.

Biostimulants – New age fertilizers – Crop Boosters - Remote sensing – GIS and GPS. Bio-Fertilizers – Groups of Bio-Fertilizers – Bacterial, Fungal, Algae and Azolla.

Unit IV: Horticultural Crop Cultivation Techniques (10 Questions)

Status of major horticultural crops in Tamil Nadu – Methods of propagation of major fruit crops - role of growth regulators – Soil and climate requirement - production technologies - nutrient and physiological disorders and its management - post-harvest technologies for Mango, Banana, Grapes, Papaya, Sapota, Guava, Citrus, Pomegranate, Ber, Annona, Amla, Apple, Pear, Avocado, Dragon fruit, Plum and Pineapple.

Importance of Vegetables – Nutritive Value - Methods of propagation of major vegetable crops - role of growth regulators – Types of Vegetable Garden: Kitchen Garden, Nutritional Garden, Truck Garden, Commercial Garden - Soil and climate requirement - production technologies - nutrient and physiological disorders and its management - post-harvest technologies for Tomato, Brinjal, Chillies, Bhendi, Onion, Cucurbits; Cauliflower, Cabbage, Turnip, potato, beetroot carrot, greens and perennials.

Importance of flower crops – Methods of propagation of major flower crops - role of growth regulators – Soil and climate requirement - production technologies - nutrient and physiological disorders and its management - post-harvest technologies for Jasmine, Rose, Chrysanthemum, Marigold, Tuberose, Crossandra, Cockscomb.

Garden Design – Formal and Informal Gardens – Components of Garden – Lawns and Lawn Making - Study of Important Flowering Annuals, Flowering and Foliage Shrubs – Flowering and Foliage Trees – Creepers and Climbers – Cacti and Succulents – Indoor Plants and Indoor Decoration – Cut Flowers – Flower arrangement – Bonsai Culture and dry flower decoration.

Importance of aromatic and spices, medicinal and plantation crops – Methods of propagation - role of growth regulators – Soil and climate requirement - production technologies - nutrient and physiological disorders and its management - post-harvest technologies for Spices – Pepper, Cardamom, garlic, Clove, Nutmeg, Cinnamon, Allspice, Turmeric, Ginger, tamarind, Coriander and Fenugreek. Plantation Crops – Coffee, Tea, Coconut, Arecanut, Cashew, Cocoa and Rubber. Medicinal Crops – Coleus, Gloriosa, Ashwagandha, Senna, Keezhanelli, Agave, Thulasi and Achorus.

Tissue culture and micropropagation of horticultural crops – Totipotency – Regeneration – Callus culture – Somaclonal variation – hardening of tissue culture plants.

Unit V: Breeding and Seed Production (20 Questions)

Field Crops – Importance – Classification – Agricultural and Industrial – Chemical Composition of Economic Parts in the Crops & Cereals, Millets, Pulses, Oilseeds, Fibres, Sugar and Starch Crops. Plant Photosynthesis – Respiration – Translocation of Assimilates. Floral biology – Reproductive and Pollination System in Plants – Mechanisms of promoting Self Pollination and Cross Pollination in crop plants – Plant genetic resources – importance – collection – characterization and conservation. Selfing incompatibility and male sterility- application and limitation – male sterility classification – GMS, CMS, CGMS, EGMS, and gametocides.

Breeding Techniques for Self Pollinated Crops – Pure line selection – Mass Selection – Hybridization and Selection – Pedigree Method – Bulk Method – Rice, Black gram, Groundnut. Two and three line breeding in rice. Breeding Techniques for Cross Pollinated and Often Cross Pollinated Crops – Mass Selection, backcross method - Heterosis Breeding – Development of Hybrids. Inbred development.

Single Cross – Double Cross and Poly Cross – Use of Male Sterile lines for Hybrid Seed Production – Synthetics and composites for crops like Maize, Cumbu, Redgram, Cotton, sorghum, Castor, Sunflower, Coconut. Breeding Methods for vegetatively propagated crops – Clonal Selection – Hybridization and selection for crops like Sugarcane, Tapioca, Potato and fodder crops. Mutation in crop improvement – Polyploid in Crop Improvement – Inter Specific Hybridization. Importance and success stories. Geographical indications, PPV & FR Act and IPR.

Seed – Importance – Seed Quality Characteristics – Classes of Seed – Nucleus, Breeder, Foundation and Certified Seed – Guidelines for Seed Production – Multiplication Ratio – Seed Certification, general certification standards – Field Inspection and Certification – Seed Standards –Pollination and Role of Insects, Environmental and Edaphic Factors. Seed registration - Seed Production Techniques

for Varieties and Hybrid in Rice, Maize, millets, Pulses, Cotton, Oilseeds, fodder crops and Important Vegetables: Tomato, Brinjal, Chillies, Bhendi, Lablab, onion and Cucurbits. Harvesting, Processing, Treatment, Storage, Seed Health and Marketing.

Unit VI: Plant Protection Principles and Practices (30 Questions)

Insects - Definitions – Characters – Economic Classification – Sericulture – Rearing of Mulberry silk worms – Apiculture – Role of Bees in Crop Productivity – Hiving Bees and Apiary Management. Beneficial Insects – Insect Pollinators – Predators and Parasitoids. Pest – Definition – Categories of Pests – Pest outbreak – Pest Monitoring – Pest Surveillance – Forecasting – Economic Threshold Level – Economic Injury Level. Pest Management Components – Cultural, Physical, Mechanical, Legal and Integrated Methods – Use of Resistant Varieties, Biological Control – Parasitoids, Predator and Microbial Agents.

Pesticides – Groups, Classification, Mode of Action – Formulation and Uses, Principles of Pesticides application – Hazards in the use of Pesticides and Environmental Pollution – Safe Handling of Pesticides new and organic pesticides – Pesticide residue - Behavior modifying chemicals – Use of Pheromones in pest management and behavioral modifying chemicals; approach.

Damage symptoms - life cycle and Integrated management practices of insect and non insect pests of Rice, Millets, Cotton, Sugarcane, Pulses, Oilseeds, Brinjal, Tomato, Bhendi, Cucurbits, Crucifers, Moringa, Tapioca, Chillies, Onion, Coconut, Arecanut, Turmeric, Curry-leaf, Coffee, Tea, Cardamom, Pepper, Betelvine, Flower crops, Mango, Citrus, Banana, Grapes, sapota, Guava, Pomegranate, Pests of stored materials and their management.

Plant diseases – definition, Causes of plant diseases – Fungi, Bacteria, Viruses and Mycoplasma – Categories of plant diseases – Mode of spread – Environmental factors influencing diseases out breaks. Control exclusion – Eradication – Immunization – Protection – Cultural – Methods of Control– Bio control – Economics of the new technologies, Useful fungi – mushroom, cultivation of Oyster mushroom, Trichoderma – utility – Nematodes – Types – Symptoms – Management.

Fungicide – Characteristics – Major groups – Formulation and Applications – Phytotoxicity – Precautions in using fungicides – Antibiotics in plant disease management. Bio technology and its application in disease management – Assessment of crop diseases and losses – Plant Disease Control - Principles - Integrated Pest Management of major diseases caused by Fungi, Bacteria, Virus and Mycoplasma in Cereals, Pulses, Oilseeds, Cash crops – Fruits – Vegetables – Plantation crops – Spices – Flowers and their management.

Unit VII: Livestock, Poultry Management, Artificial Insemination and Calf Rearing (10 Questions)

Significance and role of livestock and poultry in Indian economy – Various systems of livestock production – extensive – semi intensive – intensive – mixed – Integrated farming systems – Manure management methods – Definition of breed – classification of indigenous, exotic cattle and buffaloes – Breed characteristics of Sindhi, Kangeyam and Umblacherry, Jersey, Holstein Fricsian, Murrah and Surti. Breeding – importance of cross breeding.

Artificial Insemination – merits and demerits – Housing management – farm site selection space requirement for calves, heifer, milch animal and work bullocks – Type and design of house. – Systems of housing – Single row system – Double row system – head to head and tail to tail – merits and demerits – Care and management of new born calf and heifers – Care and management of pregnant, lactating animals and work bullocks.

Milk – Definition – clean milk production – methods of milking – hand and machine milking – Processing of milk – cooling Pasteurization – Definition – Various methods – Low Temperature Long Time and High Temperature Short Time – advantages and disadvantages.

Nutrition – Definition – Ration – Balanced composition of concentrate feed for dairy animal, calf and work bullock – Requirement and importance of green fodder, carrying capacity and forage cycle.

Diseases – classification – Viral, bacterial and metabolic – General control and preventive measures. – Viral Diseases – Foot and mouth – Bacterial diseases – Anthrax, Haemorrhagic septicemia and Black quarter – Metabolic – Tympanites, Ketosis and Milk fever – Mastitis and its control – Zoonotic

diseases(Anthrax, Tuberculosis, Brucellosis and Rabies) – Prevention and control.

Sheep and Goat farming – classification of breeds of Indian and exotic origin – Systems of rearing – Housing management – Type design – Floor diagram – Space requirement for adult and young stock –Nutrition – common tree Fodder for small ruminants – Common ailments of sheep and goat – Sheep pox – Foot and Mouth – Blue Tongue – Enterotoxaemia – Ecto and Endo parasites Systems of poultry rearing – Backyard, Intensive systems; Nomenclature of commercial layers and broiler strains – Care and management of day old chicks – Brooder management. Systems of housing – Deep litter and cage systems – merits and demerits – Raised platform housing – Floor space requirement – litter management – care and management of layers and broilers.

Poultry Nutrition – composition of chick mash grower, layer, broiler starter and finisher mashes – Feed Conversion Ratio / dozen eggs or kilogram of meat. Classification of Poultry diseases – Viral – Bacterial – Protozoan – Causative organisms, symptoms, causes and prevention – Viral diseases – Ranikhet disease - Infectious bursal disease - Bacterial disease – E. coli – Coryza – Salmonellosis – Protozoan – Coccidiosis – Vitamin and mineral deficiencies – Schemes, Policies, Subsidies in Animal Husbandry by Tamil Nadu.

Unit VIII: Farm Machinery, Post Harvest Technology and Energy and Environment (10 Questions)

Thrashing Floor, drying floor. I.C. Engines – Types, Introduction – Preventive maintenance and minor repairs. Tractor – Different systems of a tractor – Hydraulic system – Clutch and Transmission system – Hitching of implements to Tractor – Power Tiller – and matching Implements. Seeders and planters. Plant Protection equipment –Harvesting machinery. Agricultural Pumps – Types of pumps – Custom hiring centre – e-vadagai.

Post Harvest losses in durable and Perishable crops – Moisture content – Methods of Determination – Drying – Sun Drying – Mechanical Drying – Merits and Demerits. Shelling and Decortication – Rubber Roll Sheller – Centrifugal Dehusker. Parboiling of Paddy – Merits and Demerits – Polishing – Milling of Corn and Pulses – Principles and Methods – Seed Treater – Types of Seed Treater. Storage of Grains and Seeds – Condition for safe storage – Value addition and suitable machineries for major food grains.

Energy Resources and Forms of Energy – Conventional and Non - Conventional Energy – Solar Energy – Merits and Limitations - Energy from Bio-Mass – Technologies – Classification and types of Bio-Gas Plants – Bio-Gas from Plant Wastes – Utilization of Bio-gas. Bio Fuel Plant – Gasifiers – Smokeless Chulas.

Ecology – Natural resources – Environmental Pollution and Management – Atmospheric Pollution – Particulate emission by industries and automobiles – Smog – Acid rain – Ozone hole – Global Warming – Causes, Effects and Control measures –Traditional farming methods – Eco-Safe technologies in agriculture.

Unit IX: Commercial Agriculture (20 Questions)

Bio-control agents - Role in pest and disease management – Categories of bio-control agents. Setting up a bio-control laboratory. Mass culture of tobacco caterpillar (*Spodoptera litura*) and gram pod borer (*Helicoverpa armigera*)- synthetic diet – mass production of SlNPV and HaNPV. Mass production of *Trichogramma* spp., *Chrysoperla*, coccinellid predators, *Trichoderma viride*, *Pseudomonas fluorescens* and Entomo-pathogenic nematodes

Biofertilizers – Microorganisms for crop nutrition – Types – Sources of good quality strains – Facilities – equipment – and raw materials required – Types and specification of carrier material – production of azospirillium, azotobacter, Glucano acetobacter, phosphate solubilizer, potash releasing microorganism, PGPR, azolla, BGA, PPFM, and AM fungi – Shelf life and storage of carrier and liquid based biofertilizers – constraints in mass production – storage and preservation – quality standard of commercial biofertilizers – quality control biofertilizer lab in Tamil Nadu.

Mushroom- Morphology: common edible mushrooms - Pleurotus, Calocybe - poisonous mushrooms - Laboratory techniques: sterilization - Media preparation, pure culture techniques, sub-culturing and storage. Spawn: types of spawn, mother spawn and bed spawn. Cultivation: Oyster mushroom, Milky

mushroom – Problems in cultivation: Biotic and abiotic disorders - Uses of mushroom: as food, nutraceutical and pharmaceutical values, composting coir-pith and other agro-wastes – Post harvest technology: methods of preservation and value addition.

Fruit and Vegetable processing – Equipments and Accessories used in processing – Preparation of Squash, Syrup, Cordial, Nectar, Ready to serve beverages – Fruit juice concentrate – Paste, Powder, Bar – Jam, Jelly, Marmalade and Candy, Preserve – Pickles – Oil, Salt and vinegar – Tomato products – Ketchup. Sauce, Puree and Paste – Canning of Fruit and Vegetables – Dehydrated Fruit and Vegetables and Re-hydration – Preservation by low temperature – cut-out analysis of canned Fruit and Vegetables – Evaluation of Frozen Fruit and Vegetables – Osmotic dehydration

Seed Production –Selection of field – Maintenance of genetic purity – Removal of offtypes – Isolation distance - Manual emasculation and Pollination - Hybrids – Single cross - double cross – Production of hybrid seed – Varieties – seed production - Use of gametocide – Merits and demerits of hybrids and varieties - Selfing, emasculation and crossing technique in Rice, millets, oilseeds, pulses, Cotton, Tomato, Bhendi – clonal multiplication – Cumbu napier – Seed registration – Field inspection and certification.

Harvesting – Physical and chemical indices – Extraction techniques – Seed processing – Use of cleaner, grader – Seed treatment – Seed packaging – Seed storage – Sanitation – Certification procedure.

Nursery Technology – preparation of land and seed treatment – Sowing and raising of rootstocks (Fruits and Flower Crops) – Application of Liquid Manure and plant protection of rootstock – Potting materials and Preparation of pot mixture – Potting of Rootstock and Hardening - Selection of Scion Plants and Grafting, Aftercare of Grafted Plants, Graft Separation and Hardening – Preparation of Cuttings of Ornamental Plants, Treating the Cuttings with growth regulators and Planting in Mist Chamber in Beds/Polybags, Potting of Rooted Cuttings and Hardening – Air Layering of Ornamental/Fruit Crops – Budding of Ornamental Plants (Rose) – Maintenance of Potted Plants – Packing and Marketing.

Organic composting - Nutrient potential of different organic manures – Preparation of FYM Compost – Composting methods - Preparation of enriched FYM – Coirpith composting – Sugarcane trash – Pressmud - Farm wastes and farm weeds - Parthenium composting – Determination of maturity indices of composts - Commercial utility of organic manures –Introduction to vermicompost – Types of Vermicompost - Materials for vermicomposting. Preliminary treatment of composting material – Small Scale vermicomposting – Large scale vermicomposting – Other types of vermicomposting – Requirements for vermicomposting – Bedding materials, container, pH, Moisture content, Temperature – Cover feed substrates - Selection of right type of worm species – Preparation of vermicompost beds – Collection of Vermicompost – Vermicompost efficiency – Transportation of live worms – Application of vermicompost

Unit X: Agricultural Extension Agricultural Economics and Digital Agriculture (30 Questions)

Rural Economics and Agricultural Economics – Meaning, importance and scope Sectors of Economy - Importance of agriculture in rural economy: Problems of rural economy – Population growth and its consequences. Agents of production: Land distribution – Size of land holding – Man-Land ratio - Subdivision and Fragmentation – Land reform – Ceiling on land holding, Tenurial reforms, Consolidation of land holdings

Co-operative farming and Bhoodhan movement – Success and failure. Rural labour: Meaning – Classification – Characteristics of rural labour – agricultural labour – Employment, wages and income - Minimum wages Act and other welfare measures.

Rural Banking and Finance: Meaning and Concept – Classification and purpose

Sources of finance – Institutional and non-institutional – Government, cooperatives, nationalized commercial banks, regional rural banks and land development banks, private money lenders and other traditional sources – Establishment of NABARD and its role, Multi-agency, Service area approach. Rural industries: Importance and their classification – Investment needs – Generation of employment.

Types of agro-industries – Rural industries project - Khadi and Village Industries

Problems of rural industries – Potentials for development of agro- industries from agricultural products and wastes – Sugarcane, Cotton seed, Banana sheath, Forestry products – Rural technologies – Technology gap – Economic and social constraints in the spread of technology. Study of important and recent rural development schemes.

Marketing and agricultural marketing – Concepts - definition and scope – Classification of Markets – Structure – Characteristics of agricultural commodities: Problems in grading and standardization. Marketing costs and marketing margins. Price spread. Advantages and problems.

Cooperative agricultural marketing societies and regulated markets – Role of National Agricultural Cooperative Marketing Federation and TANFED. Role of specialized agencies viz., Food Corporation of India, Central Warehousing Corporation, State Warehousing Corporation in marketing of agricultural commodities and CCI – Role of Regulator Markets – Agmark – e-NAM.

Price support programmes – Buffer stock operations – Role of Commission on Agricultural Costs and Prices – Price stabilization. Agmark grading and commercial grading – Marketing information and intelligence – Marketing of agricultural inputs viz., seeds, fertilizers, plant protection chemicals and implements.

Sociology – Rural Sociology – Characteristics of rural society. Rural Youth – Their needs and aspirations. Basic rural institutions and voluntary agencies. Leadership – Classification, Characteristics and their influence. Motivation – Methods of Motivation. Social change. Adoption – Meaning, Stages, Adopter categories and their characteristics. Extension methods – Classification – Individual contact - group contact and mass contact methods. Extension aids – Audio aids, Visual aids and Audio Visual aids. Print and Electronic media. Photography, new achievements in communication technology – Transfer of Technologies through demonstrations – Field day – Exhibition – Mass media.

Visit to a village – Identifying resources, conducting participatory rural appraisal (PRA), conducting SWOT (strengths, weaknesses, opportunities and threats) analysis and preparing action plan for village development.

Visiting farmers – Analysis of farm resources and studying the life style of farmers, earnings, enterprises, expenditure pattern, technical information seeking behavior and dissemination of technologies. Finding the factors of adoption of technologies.

Problem diagnosis study – visiting farmers' fields, identifying technical and frequent problems like soil, pest, disease, disorders and other problems in agriculture, obtaining solutions from known sources and providing them to the farmers.

Visiting agro service centers – Studying the business techniques, farmers approach, distribution pattern, dealership pattern, knowing different agro chemicals available in markets and their prices, gaining experience in solving the farmers problems in agro service centers .

Visiting daily vegetable wholesale markets – uzhavar sandhai - assessing the price fluctuation and preparing price trend calendar for different vegetables. Preparing line chart for maximum price of different vegetables grown in the district and identifying optimum sowing period for different vegetables.

Study the potentialities, prospects and to get clear knowledge about starting agro industries and food processing industries – PMFME – Schemes and policies of

Government of Tamil Nadu in Agriculture – Establishment – Farmers group – FPO – Role and Functions.

Application of computer in agriculture - Multimedia Presentation – power point - Internet and E- Mail – Online reporting system – Major Apps and Web Portals (Uzhavan app, Agris net portal,Tamil man valam and latest apps) for improving livelihood of farmers - Application of artificial intelligence and IoT in agriculture.

2. Automobile and Mechanical Engineering
(Diploma Standard)

Code: 512

Unit I: Basics of Mechanical Engineering (20 Questions)

Fluid mechanics : Properties of fluids –flow of fluids – types - Hydraulic systems – components - Reciprocating pumps - Centrifugal pump – Gear pumps and vane pumps - Thermal Engineering - Properties of Gases - Expansion of Gases - Air cycles – Otto and Diesel cycles- Fuels- Fuel characteristics –Octane number and Cetane number – Alcohol, LPG and CNG as fuel for IC engines - Lubricants- Viscosity, Flash point, Fire point and Pour point - Air compressors : single stage and multi stage air compressors- IC Engine performance – Refrigeration – vapour compression refrigeration system – refrigerants – air conditioning - types - applications.

Unit II: Mechanics of Materials (20 Questions)

Mechanical properties- strength, ductility, hardness, brittleness, fatigue and creep -endurance limit - Ferrous alloys -Non ferrous metals and alloys - Heat Treatment - Toughening –Normalising, annealing, hardening, case hardening –elastic and plastic deformation - Simple Stress and strain – Modulus of elasticity- Shear force, Torsion - Theory of simple bending, deflection.

Unit III: Production Technology (20 Questions)

Foundry- Patterns – Special casting techniques -Welding – Hot and Cold working – drawing, rolling and forging – powder metallurgy – processing of plastics – lathe work – planner – shaper – slotter – drilling machines – milling machines – grinding machines – broaching – boring and jig boring – Gears manufacturing – Metal finishing – press work – non conventional production processes - Semi automats – Automats.

Unit IV: Design of Machine Elements (20 Questions)

Engineering materials – Types - Factors affecting selection of materials, Preferred number, Factor of safety and allowable stress – Stresses: Tension, Compression, Shear, Crushing, Bending and torsion – Couplings, types, requirement of good couplings –Design of Joints and Fasteners – Design of shafts, keys– Classification of bearings, Design of bearings, Material used for bearings – Belt drives and gear drives.

Unit V: Computer Integrated Manufacturing (20 Questions)

CAD – Definition – geometric modeling – wire frame, surface and solid modeling –graphic standards – GKS, IGES, PHIGS and DXF. CAM – definition – Group Technology – Part families – Parts classification and coding – CAPP – types - CNC – definition – components of CNC – Part program – format – coordinate system –types of motion control – types of interpolation – G and M codes – sub program – canned cycles – FMS, AGV and Robotics.

Unit VI: Automobile Engines (20 Questions)

Principles of 2 stroke and 4 stroke engines - Valve timing and port timing diagrams – OHV and OHC - Engine block - Cylinder head - Piston - Connecting rod - Crank shaft - Camshaft - timing gears - Firing order - Carburation – MPFI - Diesel Engine - CRDI - Injectors types - Cooling system – Radiator – Expansion reservoir cooling system - Coolant types - Lubricating system - Full pressure lubrication system - Turbo Chargers – Pollutants – emission control systems in SI and CI engines – EGR, catalytic converter, PCV, DPF and SCR – Bharat Stage norms (BS IV and VI) - Maintenance and servicing - On Board Diagnostics (OBD).

Unit VII: Chassis and Transmission Systems (20 Questions)

Friction and Transmission of motion - Clutches – Gearboxes - Manual and Automatic - Universal joints – Axles – Live and dead axles - Constant velocity joints – Differential - Suspension System – Front independent suspension systems – Rear Suspension System – Leaf spring and Tandem axle suspension – air suspension - steering - types – Wheel Alignment – Power Steering – Types – Brakes – Braking efficiency – Air brake system – Hydraulic retarders - Anti-lock Braking Systems (ABS) - Tyres - Tubes - types – Tyre specification - Trouble shooting - Preventive Maintenance and servicing.

Unit VIII: Electrical Engineering and Electric Vehicles (20 Questions)

Units and symbols - AC and DC - Electro magnetism - EMF – alternators – starter motors- Battery: Lead acid battery –ignition system – coil and electronic ignition systems - Electronics - Transistor - Capacitor - Diodes - Rectifiers - circuit breakers, sensors - Electronic Control Unit (ECU).Electric Vehicle (EV) – Necessity – Range – Layout – Battery – Li based batteries – Hybrid EV – Mild, Series, Parallel and Smart hybrid – Battery charging – Types – Normal and Fast charging – Battery swapping techniques – Battery Management System (BMS) – Motor – Types – Brushless DC Motor (BLDC) – controller unit - e-vehicle policy – fuel cell vehicle.

Unit IX: Body Building Technology (20 Questions)

Terminology - classification of motor vehicle body for passenger transport, goods transport and cars - Chassis - Frame – types -Types of body construction – Aerodynamic body considerations - safety consideration – Active and Passive safety system - Seat belt and air bag – Advanced Driver Assistance System (ADAS) - NVH Level – Bus body construction - regulations - Goods vehicle construction – Truck classifications – special vehicles- Ergonomics of Driver seat design - Painting - Body repairing - maintenance and safety on painting.

Unit X: Transport Management (20 Questions)

Leadership - Morale – Motivation – Depreciation calculation using straight line method and sinking fund method – Material Management - ABC analysis. Goods Transport, Passenger transport, Operational Layout of service station and garages – Bus stand –Classification - Passenger transport organization and Administrative set up – Fare calculation and fare collection methods - Motor Vehicle act – Salient features - Road signals - Traffic signals - Permit - Registering vehicle - Fitness certificate – Insurance – Types of Policy – Certificate of Insurance - Accident claim. Costing in Road transport - Running Cost.

3. Civil Engineering

(Diploma Standard)

Code: 443

Unit I: Engineering Mechanics (20 Questions)

Direct Stresses and strains (Tensile and compressive) due to Axial forces – Deformation of elastic bar due to uni-axial force – Composite Sections – Modular ratio – Relationship between elastic constants - Shear force and bending moment diagrams for statically determinate beams - Geometrical properties of sections - Stresses in beams due to bending – Flexural rigidity – Strength equation - Stresses in shafts due to torsion – Pin jointed perfect frames with vertical loads on nodal points (method of joints only).

Unit II: Mechanics of Structure (15 Questions)

Deflection of cantilever and simply supported beams for point and uniformly distributed loads – Shear force and bending moment diagrams for statically indeterminate structures (Propped cantilever, Fixed Beams, continuous beams, Non-sway Portal frames) using Mohr's theorems and moment distribution method.

Euler's and Rankin's formula for columns – Effective length for different end conditions - Stresses due to eccentric loads – combined stresses due to direct loads and bending moments in rectangular sections – Conditions for No tension (Circular, square and rectangular) – Stability of earth retaining walls.

Unit III: Construction Materials & Construction Practice (25 Questions)

Bricks, Lime, Tiles (Athangudi Tiles), Cement, Fine Aggregate, Coarse Aggregate, Timber, Ply wood, Steel, Glass, Plastics, PVC, UPVC, Paints, Mortars, Concrete – M-sand, P-sand – Latest construction Materials and construction Chemicals - Different types, qualities, requirements, standard specifications, Admixtures for cement mortar and concrete – Green Building Materials, Usage of PPC, Flyash Bricks, Solar Panels, Hollow clay Bricks (Tiles).

Different types of Foundations (Buildings Ocean, Harbour and other ordinary works) Masonry, Floors, Roofs, Interior Works, False ceiling – Wall paneling – Wooden flooring

Precast Block(Under Ground metro, metro slabs) Doors and Windows, Weathering Course, Damp proof course, Plastering, Painting, Colour Washing, Specifications for different works – Maintenance of created(Ocean & Harbours) assets.

Heritage structures – Construction, Traditional Flooring - Athangudi Tiles – List of Heritage Buildings.

Unit IV: Transportation Engineering (25 Questions)

Roads – Different types – methods of formation of water bound macadam Road, bituminous and concrete roads – Hill roads – Requirements – Camber, gradient, super elevation, carriage way, pavements, drainage system, sight distance etc., Traffic Engineering Bridges – Classification of bridges – Site selection and alignment – Foundation, substructure and super-structure.

Sub-grade soil – Soil mass as a three phase system – Grain size classification - Atterberg limits – IS Classification of soils–Compaction – Shear strength - Road Arboriculture – Express Highways – Rapid Transport System.

Railways – Formation of Tracks – Rails – Ballasts – Sleepers – Characteristics of materials – Rail Joints.

Harbour and Ocean structures – Component parts.

Unit V: Hydraulics (15 Questions)

Measurement of pressure in liquids – Pressure distribution and total pressure on immersed surfaces – Types of flow (Laminar, turbulent, steady, unsteady, uniform, non- uniform) – Flow through pipes – Losses, Frictional losses – Hydraulic gradient and total energy lines. Bernoullis theorem – use of Orifice, Mouthpiece, Hydraulic Coefficient Cd, Cc, Cv Orifice meter and Venturimeters – Flow through channels – Chez's formula – Bazin's and manning's formula – Economical sections for open channels, Conditions for Maximum discharge - Pumps – Reciprocating pumps – Centrifugal pumps – Characteristics – Selection and choice for pump - Discharge – Power and efficiency, Ground water – Types of well – Test for yield of wells.

Unit VI: Surveying and Remote Sensing (20 Questions)

Types of Surveys –Chain surveying – Compass surveying – Levelling – Contour surveying – Theodalite surveying – Trignometrical levelling – Tacheometry – Field work – Simple problems. Curves, Global Positioning System (GPS), Remote sensing – Photogrammetric Surveying and Hydrographic Surveying,Total Station and Geographical Information System (GIS) – Fundamentals of Remote sensing, Photogrammetry – Image interpretation & Analysis.

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

Sources of water – Conveyance of water – Treatment of water – Quality of water – Tests on water – Distribution systems – Sewers – Collection and conveyance of sewage– Sewer Appurtenances – Drainage arrangements and Sanitary fittings in buildings – Effluent treatment plants - Treatment and disposal of sewage, Solid waste Management.

Environmental pollution Control - Air – water – Soil – Noise - Pollution Control.

Unit VIII: Estimating and Costing (20 Questions)

Systems of taking out quantities – Trade and Group systems – Material requirement for different items of works – Preparation of data for works – Report writing – Valuation of buildings and properties – Fixation of rents – Approximate estimates – Detailed estimate and Abstract estimate for buildings, wall, sump, septic tanks, compound wall, roads, Harbour – (Floating structures such as jetty, wharf groyne, Break water, quay wall), CMDA Rules and regulations – Buildings Bye laws.

Unit IX: Structural Engineering (20 Questions)

Reinforced cement concrete structure – Analysis and design of singly and Doubly reinforced rectangular and T-beam sections – Cantilever, simply supported, continuous beams – One way and two way slabs – Lintels and Sunshades – Staircases – Rectangular and Circular short Columns – Isolated column footings. (All designs by Limit State Method only) – Basics of Retrofitting (Roof slab, Column & Beam)

Steel structures – Design of Tension and compression members by L.S.M – Different forms of Tension members – Design strength of single Angle Tension member – Design of ties using single Angles and channel section – Design of simple Beams and welded connection by L.S.M – Web Design strength in Bending, Shear – Limiting deflection of Beam.

Unit X: Construction Management and Computer Applications (20 Questions)

Planning of a project – Factors to be considered – Project reports – Organization structure of construction departments – Construction planning – CPM and PERT networks – Contracts – Tenders and Tender documents – Bill- Supervision and Quality control – Safety measures in construction sites – Labour legislations - Banking practice – Cash flow diagrams - Financial Management.

Ethics in Engineering – Disaster Management – Types of Natural calamities – Causes – Preparedness – Response and Recovery.

Use of Computers – Application of CAD softwares – Project management softwares – Use of MS word, Excel, PowerPoint – Application of Design and Analysis softwares.

4. Civil Engineering and Architecture
(Diploma Standard)

Code: 509

Unit I: Engineering Mechanics (20 Questions)

Loads - Simple Stresses and Strain –Modulus of Elasticity / Elastic constants – Application of stress and strain in engineering field – Behaviour of ductile and brittle material –Shear Force and Bending Moment – Geometrical properties of sections – Centroid – Moment of Inertia – Stresses in Beams and Shafts – Stresses in Beams due to bending – Stresses in shafts due to torsion – Pin Jointed Frames.

Unit II: Construction Materials and Construction Practice (20 Questions)

Bricks, Lime, Tiles, Cement, Fine Aggregate, Coarse Aggregate, Timber, Ply wood, Steel, Glass, Plastics, PVC, UPVC, Paints, Mortars, Concrete, M-sand, P-sand – Latest construction Materials and Chemicals – Green Building Concepts & Materials - Usage of PPC, Flyash Bricks, Hollow clay Bricks, Solar Panels.

Different types of Foundations -Masonry, Floors, Roofs, Interior Works - False ceiling – Wall paneling – Wooden flooring

Precast Concrete Construction -Doors and Windows - Weathering Course - Damp proof course – Plastering - Painting. Conservation of Heritage Structures.

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

Sources of Water – Collections and Conveyance of Water – Quality of Water – Treatment of Water – Distribution System – Appurtenances and Maintenance of Water Lines – Collections and Conveyance of Sewage – Treatments and Disposal– Environmental Pollution and Control – Waste Water Treatment and Solid Waste Management – Land, Water & Air Pollution - Drainage arrangements and Sanitary fittings in Buildings – Environmental Impact Assessment (EIA) - Methodology – Conservation of Marsh Lands – Reclamation of Water Bodies.

Unit IV: Surveying and Remote Sensing (20 Questions)

Types of Surveys – Chain surveying – Compass surveying – Levelling – Contour surveying – Theodalite surveying – Trignometrical levelling – Tacheometry – Field work– Simple problems - Curves, Global Positioning System (GPS) - Photogrammetric Surveying and Hydrographic Surveying -Total Station and Geographical Information System (GIS) – Fundamentals of Remote sensing - Photogrammetry – Image interpretation & Analysis.

Unit V: Estimation, Costing & Valuation (20 Questions)

Estimates and its types – System of taking out quantities – Trade and Group systems - Stages of Detailed Estimate – Measurements & Material Requirement –Specification& Report Writing – Approximate Estimates – Areas and Volumes - Detailed Estimate – Data – Abstract Estimate- Valuation of Land and Buildings.

Unit VI: Structural Engineering (20 Questions)

Slope and Deflection of Beams – Propped Cantilevers – Fixed Beams – Arches – Continuous Beams – Theorem of Three Moments –Moment Distribution Method – Columns and Struts – Combined Bending and Direct Stresses – Earth Pressure and Retaining Walls.

Reinforced cement concrete structure – Working Stress Method - Analysis and design of singly and doubly reinforced rectangular and T-beam sections – Cantilever, simply supported, continuous beams – One way and two way slabs – Lintels and Sunshades – Staircases – Rectangular and Circular short Columns – Isolated column footings. (All designs by Limit State Method only). Steel structures – Design of simple beams by Limit state method – Types of welded connections.

Unit VII: Construction Management and Computer Applications (20 Questions)

Planning of a project – Factors to be considered – Project reports – Organization structure of construction departments – Construction planning – CPM and PERT networks – Contracts – Tenders and Tender documents – Bill- Supervision and Quality control – Arbitration.

Safety measures in construction sites – Labour legislations - Banking practice – Cash flow diagrams - Financial Management -Ethics.

Disaster Management – Types of Natural calamities – Causes – Preparedness – Response and Recovery. Use of Computers – Application of CAD softwares– Project management softwares – Use of MS word, Excel, PowerPoint – Application of Analysis and Design softwares.

Unit–VIII: Building Services (20 Questions)

Water Supply & Sewage Disposal, Mechanical Systems – Pumps & Motors, Electrical Systems – Generation & Distribution - Ventilation & Lighting - Air Conditioning – Principles, systems & applications - Vertical Transportation systems - Fire Hazards, Safety & Design Regulations - Acoustics – Building Management Systems – Renewable Energy – Rain water Harvesting – Storm Water Management.

Unit–IX: Town Planning and Transportation (20 Questions)

Town Planning Principles – Master Plan - Road and Street Planning – Parks & Open Spaces – Landscape Architecture – Historic and contemporary Landscape – Soft & Hard Landscaping – Indoor & Outdoor Plants - Housing – Economy, Society, Environment and Transport Policy and Planning – Tamil Nadu Combined Development Building Rules, 2019 (TNCDBR, 2019) – Barrier free Design.

Roads – Different types – methods of formation of water bound macadam Road, bituminous and concrete roads – Hill roads –Camber, gradient, super elevation, carriageway, pavements, drainage system, sight distance - Traffic Engineering- Bridges – Classifications – Site selection and alignment – Foundation, substructure and super- Structure.

Railways – Formation of Tracks – Rails – Ballasts – Sleepers – Characteristics of materials – Rail Joints.

Unit X (20 Questions)

Unit X(A): History & Theory of architecture History of Architecture

Prehistoric - Egyptian Architecture – Greek Architecture–Roman Architecture –Early Christian & Byzantine Architecture – Romanesque and Gothic Architecture – Renaissance Architecture. Indian Architecture – Indus Valley Civilization, Buddhist Architecture, Hindu Architecture – Islamic Architecture in India.

Modern Architecture, Postmodernism, Contemporary World Architecture- Philosophy and works of Post Modern Indian Architects.

Theory of Architecture

Definition of Architecture–Architecture as satisfying functional, aesthetic & psychological human needs- Anthropometrics. Elements of Architecture–Form, Space, Light, colour, etc.

Principles of Architecture – Proportion, Balance, Scale, Symmetry, etc.

Unit X(B): Hydraulics Engineering & Soil Mechanics

Soil mass as a three phase system – Grain size classification - Atterberg limits – Properties - IS Classification of soils–Compaction – Shear strength – Safe Bearing Capacity.

Measurement of pressure in liquids – Pressure distribution and total pressure on immersed surfaces – Types of flow (Laminar, turbulent, steady, unsteady, uniform, non- uniform) – Flow through pipes – Losses, Frictional losses – Hydraulic gradient and total energy lines - Bernoullis theorem – use of Orifice, Mouthpiece, Hydraulic Coefficient Cd, Cc, Cv Orifice meter and Venturi meters –Flow through channels – Chezy's formula – Bazin's and Manning's formula Economical sections for open channels -Conditions for Maximum discharge - Pumps – Reciprocating pumps – Centrifugal pumps – Characteristics – Selection and choice for pump - Discharge – Power and efficiency - Ground water – Types of well – Test for yield of wells.

5. Electronics Engineering / Electronics & Communication Engineering (Diploma Standard)

Code: 447

Unit I: Electronic Devices and Circuits (20 Questions)

PN junction Diode -Zener diode-Filters - Capacitor filter - Inductor filter - L section filter - Pi section and RC filter - Rectifier: Half Wave, Full Wave and Bridge Rectifier – Opto electronic devices - Photo diode, Photo transistor and Opto coupler - Bipolar junction transistor (BJT) – Biasing – Configuration – Common Emitter Amplifier - Field effect transistor (FET) - Uni junction transistor (UJT) – Feedback - Effects of negative feedback - Transistor amplifiers - RC coupled amplifier - Transistor oscillators – Barkhausen criterion – Hartley Oscillator – Colpitts Oscillator – RC Phase shift oscillator – SCR – DIAC –TRIAC - Clippers and Clamper - Voltage Multipliers – Astable, Monostable Multivibrator using Transistors and Schmitt Trigger using Transistors.

Unit II: Electrical Circuits and Instrumentation (10 Questions)

Ohm's law - Kirchhoff's current law and Kirchhoff's voltage law - Network theorems (DC Circuits only): Thevenin's theorem, Superposition theorem and Maximum power transfer theorem - A.C Circuits - Resonance – Transformer -Single phase and three phase supply - DC Generator - DC motor – Single phase induction motor – Three phase induction motor – Capacitor start induction motor – Stepper motor – Universal Motor – Transducers – CRO –Thermocouple - Resistance measurement: Wheatstone bridge – Measurement of Inductance: Maxwell's bridge – Measurement of Capacitance: Schering Bridge.

Unit III:

(A) Programming In C (5 Questions)

Structure of C program - Compiler, Linker - Low level and High level Programming language - C character set –Tokens – Constants – Key words – Variables – Data types - I/O statements - Operators: Arithmetic, Logical, Assignment, Relational, Increment, Decrement, Conditional, Bitwise and Special operators – Precedence and Associativity - Decision making, branching and looping statements - Arrays and Strings - Structure and Union - Function.

(B) Computer Hardware Servicing and Networking (15 Questions)

Mother board components – Memory Storage devices - I/O Devices and Interface - Maintenance and troubleshooting of desktops and laptops - Computer Network Devices and OSI Layers - 802.X and TCP/IP protocols.

Unit IV: Industrial Electronics (10 Questions)

Thyristor family: Insulated gate bipolar transistor (IGBT), MOSFET and GTO-Trigger Circuits - Converters - Single phase Half controlled ,fully controlled bridge converter with R load and RL load - importance of flywheel diode-Commutation: Natural commutation – Forced commutation – Choppers

– Inverters - SMPS, UPS - PROGRAMMABLE LOGIC CONTROLLER (PLC) – PLC functions- Building blocks of a Robot - Robot Sensor.

Unit V: Analog and Digital Electronics (20 Questions)

Operational amplifier (IC 741) Op-amp applications - Timer (IC 555) – applications – PLL (IC 565) - VCO (IC 566) - IC Voltage Regulators (78XX, 79XX, LM 723) - Number system - Basic Boolean laws - De-Morgan's theorems – Logic gates - Combinational circuits: Arithmetic circuits, Encoder and decoder, Multiplexer, Demultiplexer, Parity checker and generator - Sequential circuits: Flip flops, Counters, Shift registers - Analog to digital conversion using Successive approximation method, Ramp method and Dual slope method - Weighted Resistor D/A converter – R-2R Ladder D/A converter - Classification of memories.

Unit VI: Communication Engineering (40 Questions)

Networks – Filters (LPF, HPF, BPF) – Antennas – Propagation – Modulation – Amplitude modulation – AM transmitter, receiver – Frequency modulation – FM transmitter, receiver - Pulse modulation – Audio system: Microphone, loud speaker – Video system: Mono chrome TV, Color TV.

Unit VII: Analog and Digital Communication Systems (40 Questions)

Radar System – Telephone system: PSTN, ISDN – Digital communication – Digital codes - Optical communication – Satellite communication – Microwave communication – Mobile communication (Qualitative treatment only) – Satellite multiple access techniques.

Unit VIII: Microcontroller and Its Applications (10 Questions)

8051 microcontroller – Architecture – Instruction set – Addressing modes – Assembly Language Programmes – Peripherals of 8051 - I/O Ports – Timer/Counter - Serial communication – Interrupts - IC 8255 - Interfacing with 8051 - Advanced Microcontrollers - PIC microcontroller – Arduino - Raspberry pi - IoT.

Unit IX: Very Large Scale Integrated Circuit (10 Questions)

NMOS, CMOS logic - VLSI design process - VHDL code for combinational circuit - VHDL code for sequential circuit – PLDs: PROM, PLA, PAL, CPLD – FPGA - ASIC.

Unit X: Embedded System (20 Questions)

Harvard and Von-Neumann architectures - RISC and CISC Processors - ARM processor architecture – Instruction sets – LPC 2148 ARM Controller - System control functions - LPC 2148 Peripherals - Serial communication in LPC 2148 - Embedded OS and RTOS.

6. Fisheries Technology, Fisheries Science and Navigation Engineering (Diploma Standard)

Code: 589

Unit I: Fishery Biology (15 questions)

Classification of fishes - Morphometric and Meristic Characters - Length Weight Relationship - Food and Feeding Habits - Reproductive Biology - Fish Physiology - Developmental Biology of Fin Fishes, Shell fishes - Von Bertalanffy's Growth equation - growth parameters - mortality parameters.

Unit II: Inland and Marine fisheries (25 questions)

Capture fishery resource of India - Major riverine fisheries of India - Lake Fisheries - Reservoir Fisheries - Cold Water Fisheries - Pollution in Aquatic system - Principles of Marine Fisheries of Indian Coasts - Crustacean fishery resources - shrimps, lobsters - Molluscan resources - Gastropods, Bivalves - Sea weed Resources - Distribution of living organisms in the Sea - Aquatic Ecology.

Unit III: Nautical Technology (25 Questions)

Principles of seamanship - International regulations for preventing collision at sea - Compass - Navigational Charts - Mercator Projections - Buoyage System - International Code flag signals - Navigational lights – Fire fighting equipments – Storm Signals - Distress Signals - Life Saving Appliances - Life buoy - Life jackets - Life raft.

Unit IV: Fish Processing Technology (20 Questions)

Proximate composition of fish - Principles of fish spoilage - Rigor Mortis - Drying, Salt drying, Icing, Freezing, Canning, Fishery by products, Fish packaging technology.

Unit V: Aquaculture (25 Questions)

Site selection for fish culture - Types of ponds – Pumps - Aerators - Sluice - Monk - Canals - Types of dykes - composite fish culture - Plankton - Fertilization - Aqua feeds - Pond disinfection with lime - Water quality management - Disease control - Common fresh water and marine ornamental Fishes - Common Coastal Aquaculture and Mariculture practices

Unit VI: Oceanography and Meteorology (10 Questions)

Waves - Tides – Currents - El-Nino - Salinity - Tsunamis - Weather - Climate - humidity - Tropical Cyclones - Atmospheric pressure.

Unit VII: Fishing Gear and Craft Technology (25 Questions)

Classification of Fishing Gears - Fishing Gear Materials - Modern Fishing gears - Trawls, Gill, Nets, Longlines - Fishing Gear Accessories - Fishing Crafts of Indian Coast - mechanization of fishing crafts - Tonnage system - Stability of fishing vessels - Wooden boat construction - Steel boat construction – Fiberglass Reinforced Plastic (FRP) boat Construction - Dry docking - Boat building yards - Maintenance of fishing vessels

Unit VIII: Fishery Economics (10 Questions)

Basic Economic terminologies - Elasticity - Price, Income - Cost, returns - Marketing - Co-operatives - Socio economic Survey - economics of fish seed production, Fish production system - economics of marine capture fisheries.

Unit IX: Fisheries Resource Management and Administration (20 Questions)

Open Access Fisheries - Maximum Sustainable Yield (MSY) - Maximum Economic Yield (MEY), Fishing holidays, Mesh size regulations - Growth over fishing - Recruitment over fishing - Ecosystem approach for fisheries management – Exclusive Economic Zone (EEZ) - Marine fisheries regulations - Marine Fisheries Resource conservation

Unit X: Fisheries Mechanical, Electrical and Electronic Engineering (25 Questions)

Classification of Engines - Marine diesel Engines - parts of Internal Combustion (IC) engines - Fishing machineries - Net hauler, Winch - Fish processing machineries - Canning machineries - Refrigeration

machineries - Ice Making machineries.

Principles of electricity - Electro fishing - Batteries - Principles of Radio Transmission - RADAR - sound propagation in water - Fish finding Equipments - Echo Sounder - SONAR - Communication Equipment - Radio Telephone – Satellite Telephone.

7. Handloom Technology, Textile Technology and Textile Manufacture (Diploma Standard)

Code: 445

Unit I: Fibre Properties and Man-Made Fibre Spinning (15 Questions)

i) Definition of Textile Fibre, Properties required for an ideal Textile Fibre of textile fibres
ii) Classification of Textile fibres – vegetable, animal, mineral, regenerated and synthetic fibre
iii) Microscopic, physical and chemical test methods for fibre identification
iv) Physical, Chemical properties and uses of Vegetable fibres – Cotton, Jute, linen
v) Physical, Chemical properties and uses of Animal fibres – Wool, Silk
vi) Physical, Chemical properties and uses of Regenerated Cellulosic fibres – Viscose Rayon Uses of HT Rayon
vii) Physical, Chemical properties and uses of Synthetic fibres – Polyester, Nylon 6,6 and Acrylic
viii) Requirements of fibre forming polymers , Spinning of Polymers - Melt Spinning, Wet spinning, Dry spinning
ix) Post Spinning Operations – Drawing, Crimping, Heat setting and Texturisation

Unit II: Spun Yarn Formation (20 Questions)

i) Ginning – Objects and Principles – Types of Ginning machines
ii) Objectives / Principles of opening, cleaning and mixing / blending machines
iii) Blowroom, card – Objects and Principles
iv) Draw frame, comber preparatory, comber, speed frame – Objects and Principles
v) Ring spinning – Object and Principle
vi) Doubling : Ring doubling, Two for One Twister (TFO) – Objects and Principles
vii) Working principles and features of rotor,air jet, air vortex and compact spinning systems
viii) Yarn conditioning, reeling, bundling and baling

Unit III: Fabric Formation (25 Questions)

i) Objectives of weaving preparatory processes
ii) Winding : Drum, precision and pirn winding - Yarn clearers, tensioners, knotters and splicers
iii) Warping –Types of warping and Creels
iv) Sizing –Ingredients, Size recipes for cotton and its blends with polyester and viscose.
v) Principles of Drawing-in and Denting.
vi) Primary, Secondary and Auxiliary motions of loom, Loom timing diagram.
vii) Tappet, Dobby and Jacquard shedding,
viii) Drop Box and Terry mechanism, Features of semi-automatic loom and automatic loom.
ix) Principles of Shuttle-less Weft insertion systems – Projectile, Rapier, air jet and waterjet looms.
x) Fabric defects – causes and remedies

Unit IV: Textile Calculations (20 Questions)

i) Calculations of speed, draft, hank, production and efficiency in spinning machines.
ii) Production and efficiency calculations in Winding, Warping, Sizing and Weaving
iii) Yarn numbering system: Indirect count systems – English, Direct count systems – Tex and Denier.
iv) Conversion of yarn count from one system to other.
v) Resultant count of folded yarn, Average count
vi) Reed, heald and fabric cover calculations
vii) Ex. Mill price calculation of one Kg of yarn and One meter of fabric

Unit V: Fabric Structure (15 Questions)

i) Elements of woven fabric design – Design, draft and peg plan – Colour and weave effect
ii) Construction of Weaves - Plain weave and its derivatives, Twill weave and its derivatives, Sateen and Satin
iii) Crepe, Honey comb, Brighton honey comb, Mock-leno, Huck-a-back, Bedford cords, Welt, pique,
iv) Backed cloth,Double Cloth, Triple Cloth
v) Extra warp and Extra weft figuring
vi) Terry Pile: 3 pick, 4 pick terry weave - Velvets and Velveteens
vii) Gauze and Leno structures

Unit VI: Chemical Processing (20 Questions)

i) Singeing, Desizing, Scouring, Bleaching and Mercerization – Objectives, Machines and Methods
ii) Dyes and their Classifications - Direct, Reactive, Vat, Acid, Basic and Disperse dyes.
iii) Dyeing of cotton, silk, wool, polyester and blends
iv) Dyeing machines – Winch, Jigger, HTHP, Soft-flow dyeing machine
v) Styles of printing – Direct, Resist and Discharge.
vi) Printing Methods – Roller, Rotary Screen, Flat bed
vii) Mechanical and chemical finishing – calendering, anti-shrink, resin finish,water repellent finish, flame retardant finish, Anti-microbial and UV protective finish

Unit VII: Knitting, Garments & Modern Developments in Handlooms (20 Questions)

i) Knitting - Objects , Comparison between knitting and weaving – Comparison between knitted and woven fabrics
ii) Knitting elements and their functions – Terms and Definitions
iii) Basic weft knitted structures and their properties – Plain, Rib,Interlock and Purl.
iv) Basic warp knitted structures and their properties – Tricot, Lockknit and sharkskin
v) Garments – Grey fabric inspection - Standard Body measurements - Pattern making and grading
vi) Spreading, Cutting, Sewing and Merchandising
vii) Developments in Handlooms – Solid border weaving, multiple putta weaving, Electronic Jacquard for handlooms.

Unit VIII: Testing and Quality Control (20 Questions)

i) Definition – Mean, Median, Mode, SD, SEand CV %.
ii) Calculations related to test of significance and control charts.
iii) Sampling techniques – Objectives and types of sampling
iv) Humidity control – Standard Testing atmosphere, Measurement of Relative Humidity.
v) Measurement of fibre length, strength , fineness, maturity and trash
vi) Determination of yarn count – twist per unit length – Strength: CSP, RKM and Elongation
vii) Evenness, Imperfections and Hairiness
viii) Determination of fabric strength, stiffness, handle, drape, thickness, GSM
ix) Crease resistance, abrasion resistance, pilling resistance, air / water permeability, dimensional stability.
x) Determination of fastness to washing, rubbing, light.

Unit IX: Nonwovens, Technical Textiles and Handloom Fabrics (25 Questions)

i) Classification of Nonwovens - Mechanical, Thermal and Chemical bonded fabrics
ii) Technical Textiles – Medical textiles, sports textiles
iii) Geo textiles, Agro textiles
iv) Automotive textiles and protective textiles
v) Quality Particulars of Handloom fabrics – Sarees, dhotis, bedsheets, towels, lungies
vi) Traditional Handloom Sarees – Banaras, Kanchipuram, Arani and Sungudi

Unit X: Textile Mill Management (20 Questions)

i) Plant location, Lay out, material handling in textile mills
ii) Production, Planning & Control
iii) Inventory control and its tools : ABC Analysis, Economic Ordering Quantity
iv) Total Quality Management : 5S Concept, ISO 9000, ISO 14000 , SA 8000 Certifications
v) Human Resources Management – Selection, recruitment, training and placement
vi) Factories Act 1948
vii) Role of Bureau of Indian Standards (BIS), Apparel Export Promotion Council (AEPC), Handloom Export Promotion Council (HEPC), Weavers Service Centre (WSC) and Textile Committee
viii) Export Pricing methods – Free On Board (FOB), Cost Insurance Freight (CIF)
ix) Export Procedure - Letter of Credit (LC), Shipping Bill, Bill of Lading (BIL)
x) Pollution Control: Types - Air, Water, Noise; Characteristics of Effluent and Effluent treatment of Wet Processing industry.

8. Horticulture
(Diploma Standard)

Code: 432

Unit I: Basic Horticulture and Plant Propagation (30 Questions)

Horticulture – Definition, scope and importance, Division and classification of horticultural crops – Horticultural zones in India and Tamil Nadu – Cropping systems - Precision farming- Planting systems –HDP and UHDP- Irrigation systems – Nutrient application methods in horticultural crops – Weed management – Training and Pruning system– Special horticultural practices – Maturity indices – Harvesting methods, pre-cooling – Packaging - Storage of horticultural crops - Protected cultivation.

Propagation - Tools and implements - Media and Containers - Types of nursery beds - Seed

treatment - Sowing – Protray nursery-seedling production - Potting, depotting and repotting of plants - Methods of asexual propagation through cuttings, layering, grafting and budding - Plant propagation structures - Mist chamber and shade net – Hardening and maintenance – Polyhouse- Application Growth regulators in propagation – Nutrient management and plant protection measures – Record keeping and maintenance-nursery act and certification.

Unit II: Soil and Fertility, Irrigation and Weed Management (20 Questions)

Soil types- Physical and chemical properties- Soil organic matter and its importance- Essential nutrients for crop plants - Major, secondary and micro nutrients – Manures and fertilizers – Types of fertilizers – Straight, Complex, Compound, Mixed, Fortified, chelated and water soluble fertilizers and their reactions in soil. Soil fertility – INM practices– soil health card-Problem soils – Acid, saline and alkaline soils -Reclamation and management-Rootstocks for problem soils.

Irrigation – Sources of water for irrigation –Critical stages of water requirement – Irrigation scheduling and fertigation –Irrigation methods-water conservation methods.Study of weeds - methods of weed control–Herbicides for weed management in horticultural crops– Integrated weed management practices.

Unit III: Production Technology of Fruits and Vegetables (30 Questions)

Area, production and importance of fruit crops in Tamil Nadu – Major fruit producing districts in Tamil Nadu-Layout of orchard - Physical features in orchard - Study of cultural practices of Tropical fruits – Mango, Banana, Grapes, Papaya, Sapota, Guava, Acidlime, Jackfruit, Dragon fruit. Sub-tropical and temperate fruits – Pineapple, Avocado, Mandarin orange, Apple, Pear, Plum, Strawberry with reference to soil, climate, varieties / hybrids methods of propagation (rootstocks), nutrient, irrigation and weed management practices – Training and pruning –Growth regulators – Maturity standardsfor harvesting – Post-harvest handling of fruit crops – Yield – Grading – packing – Storage and value added products – HDP/UHDP- Top working, double working and rejuvenation of old orchard- Organic fruit production and certification- Good Agricultural Practices (GAP).

Dry land horticulture – Arid and semi arid zones in Tamil Nadu and India. Crops suitable for dry land production – Important varieties, climate and soil requirements, commercial propagation methods - Spacing and planting systems - Cropping systems and intercropping – Mulching – Management of nutrients, water, weeds and problem soils –Training and pruning - Use of plant growth regulators – Post-harvest handling of Aonla, custard apple, pomegranate, ber, jamun, manila tamarind and wood apple - Soil and moisture conservation methods – Anti-transpirants.

Area, Production and importance of vegetable cultivation in Tamil Nadu –Kitchen garden-roof garden-vertical garden– Truck garden and market garden –soil and climate requirement – varieties / hybrids – Seed rate – Sowing -nursery practices – Protray nursery – Transplanting – Manuring – Irrigation – Fertigation - Nutrient deficiency and their corrective measures - Use of growth regulators
- Special horticultural practices (training, staking, pruning) – Physiological disorders and corrective measures – Maturity indices - Harvesting – Grading, sorting – Packing and storage and yield for important vegetable crop; Tomato, Brinjal, Chillies, Bhendi, Onion, Bittergourd, Ridgegourd, Snake gourd, Pumpkin, Water melon, Musk melon, Ash gourd,Tapioca, Yams, Colocasia, Cabbage, Cauliflower, Radish, Carrot, Beet root, Amaranthus, Moringa, Potato, Cluster beans, Lab lab, Peas and Beans.

Unit IV: Production Technology of Flower Crops and Landscaping (30 Questions)

Importance of commercial flower crops – Area and production - Study of cultural practices of commercial loose flowers – Rose, Jasmine, Tuberose, Chrysanthemum, Marigold, Crossandra, Celosia, Nerium and Gomphrena. Floral concrete and pigment extraction from loose flowers - Protected structures for cut flower production – Study of cut flower production techniques of Rose, Carnation, Gerbera, Chrysanthemum, Orchids, Anthurium, Lilium, Alstroemeria, Lisianthus,

Heliconia, fillers (Asparagous, limonium, gypsophylla) and foliage (dracaena and xinadu). Post-harvest management of cut flowers – Floral decorations, bouquets and dry flowers – Grading, packing and marketing of flowers-Flower Auction centres in Tamil Nadu.

Importance of ornamental gardening, landscaping and nursery business– Principles and styles and types of garden - Features of garden - Garden components and adornments – operations in planting and maintenance of trees, annuals, shrubs, climbers, creepers, herbaceous perennials, ferns, cacti and succulents, palm and cycads – Sunken garden, roof garden, rockeries, vertical garden and plant choices-Bonsai making- Lawn and lawn making – sports turf- Flower arrangements and dry flower making.

Unit V: Production Technology of Spices, Plantation Crops, Medicinal and Aromatic Crops (30 Questions)

Area, production and Importance of spice crops in Tamil Nadu – Study of production techniques of important spice crops Pepper, Cardamom, Turmeric, Ginger, Clove, Nutmeg, Cinnamon, Tamarind, Curry leaf and Coriander. Harvesting and processing – grading and packing – Organic farming and GAP in spice production.

Area, production and Importance of plantation crops in Tamil Nadu - Study of cultural operations for Tea, Coffee, Rubber,Cocoa, Cashew, Coconut, Arecanut, Oil palm and Palmyrah – Harvesting and Processing – Grading and packing - Organic farming and GAP in plantation crops.

Area, production and Importance of medicinal and aromatic plants in Tamil Nadu - Contract farming - production technologies – Medicinal crops : Glory lily, Medicinal Coleus, Senna, Periwinkle, Gymnema, Ashwagandha, Phyllanthus, Kalmegh and *Aloe vera.* Aromatic plants: Japanese mint, Rosemary, Lemon grass, Citronella, Palmarosa, Vettiver, Geranium, Patchouli and basil.

Unit VI: Insect Pest and Diseases of Horticultural Crops and Their Management (20 Questions)

Pest - Categories – Pest management - Principles and components. Natural enemies. IPM – different types of traps - Management strategies for important insect pests groups – Chewing insects - Stem borers – Fruit borer – Sap feeders of important fruit, vegetable, spices, medicinal and plantation crops- Special pest management strategies in storage pests and poly house. Management techniques for plant parasitic nematodes –Etiology, symptoms and integrated management of important diseases.

Important pest and diseases of Fruits: Mango, Banana, Citrus, Grapes, Guava, Sapota, Pomegranate, Papaya, Jack, Pineapple, Ber, Apple, Pear, Plum Vegetables: Brinjal, Tomato, Bhendi, chilies, Cucurbits, Moringa, Crucifers, Beans, Peas, Potato and Cassava. Spices and condiments: Onion, Garlic, Chillies, Cardamom, Pepper, Turmeric, Ginger, Coriander, Clove and Nutmeg. Plantation crops: Tea, Coffee, Cocoa, Rubber, Ccoconut, Arecanut and Cashew. Flowers: Jasmine, Rose, Crossandra, Chrysanthemum, Tube rose, Medicinal plants: Gloriosa, Senna, Coleus, Aloe vera, Solanum nigrum and Aswagandha.

Unit VII: Post Harvest Handling and Value Addition of Horticultural Crops (20 Questions)

Scope and importance of post harvest technology in horticultural crops - Washing, grading, sorting - pre cooling and pre treatments - Blanching and peeling methods – Post- harvest handling methods: Dehydration, Canning of fruits and vegetables – Thermal processing - Low temperature processing - Cold storage - Controlled and atmospheric storage - Refrigeration truck, ripening chamber, packaging for horticultural crops - Valueaddition in horticultural crops. Fruits : Jam, Jelly, Squash, RTS and Candy. Vegetables : Pickle, chutney, sauce and ketchup. Spices – Oleoresins, masala powders and mix - Food safety standards, National : Agmark, BIS, FSSAI and HACCP, International – Codex and ISO.

Unit VIII: Livestock Management and Poultry Production (5 Questions)

Significance of Livestock and Poultry - Various systems of livestock production – Important cattle Breeds - Artificial Insemination - Housing management - Feeds and fodder – Major cattle diseases and management. Sheep and Goat farming - Important breeds - Economic traits - Systems of rearing - Housing management - Nutrition - Common diseases, Ecto and endo parasites - Prevention and Control.

Poultry farming - Commercial strains of layer and broiler-backyard poultry-country birds - Housing management - Brooding management - Deep litter - Cage system -Nutrition of Chick - Grower and Layer and Broiler – Diseases - Causative organisms – Symptoms – Vaccination - Disease control and Prevention.

Unit IX: Commercial Agriculture (7 Questions)

Seed Production - varieties –Hybrids- emasculation and Pollination –isolation distance-rogueing-planting ratio-seed production techniques of Tomato, Brinjal, chilli, bhendi, onion, gourds, cluster bean, moringa, Amaranthus– Extraction techniques – Seed processing – Seed treatment – Seed packaging – Seed storage –Seed act-Seed inspection and Certification.

Bio-Control Agents - Importance – Examples of bio-control agents – Role in pest and disease management – Categories of bio-control agents- Spawn and Mushroom Production - Oyster and button-Organic Composting – Enriched FYM-Vermi compost-preparation of vermi beds-coir compost-quality standards.

Unit X: Farm Management, Marketing and Extension Education (8 Questions)

Farm Management – types and systems of farming-collective farming - farm planning and budgeting-risk and uncertainty- Horticultural Marketing-demand and supply- Marketing costs and marketing margins - Warehousing – Processing - Cold storage - Marketing agencies and institutions - Cooperative marketing societies - Role of regulated markets – NAFED – TANFED – NHB - Commodity boards - Marketing of agricultural inputs - Market information and intelligence - AGMARKNET, DEMIC, DMI, Uzhavar Sandhai- Farmers Producers Organisation.

Agricultural Extension – methods of Communication mass contact methods. Participatory Rural Appraisal techniques. Audio - Visual aids –Farm Journalism –writing for media. Information and Communication Technology (ICT) – Computer networks, internet, video conferencing, agriportals, Kisan Call Centre, mobile apps. Geo tagging, Photography – Basic concepts, advancements.

New governmental schemes, flagship programmes, policy notes, Duties and responsibilities of AHO's, Calamity mitigation and enumeration- crop compensation - Crop Cutting Experiment and Crop Insurance- Revenue records of Farmers, Drones in Horticulture crop production-AI based weather forecasting and farm advisory-GIS mapping- Major Research Institutes in Horticulture.

9. Mining Engineering
(Diploma Standard)

Code: 605

UNIT I: Basic Concepts of Mining and Geology (20 Questions)

Basic Concepts of Mining: Terminology, Mineral and energy resources of Tamilnadu , India and World, Resources of minerals in Tamilnadu and India, Export policy of minerals, problems in mining industries – Critical minerals and rare Earth minerals occurrence in Tamilnadu and India.

Geology: Basic terminology of engineering and economic geology; Prospecting and exploration- Principles and techniques; types of rocks; Classification of minerals and their properties; Study of topographic maps; Ore and gangue; Processes of ore formation; Major and Minor Indian mineral deposits- distribution and mode of occurrence; Earthquakes, volcanoes and seismicity, Seismic zones of India.

UNIT II: Mine Planning and Mine Management (20 Questions)

Mine Planning: Sampling methods, practices and interpretation; Reserve estimation techniques: Basics of geo-statistics and quality control; cutoff grade; bench geometry; Pit planning and design; Production scheduling; Work-study, Feasibility report, Detailed project report.

Mine Management ; Personnel management, training, productivity, PERT,CPM, purchase and store management, Inventory control, budget & budgetary control.

Unit III: Mine Developments (20 Questions)

Mine Development: Methods of access to deposits; Underground driveage; Drilling: principles, patterns, methods and machines; Explosives, Initiation systems, blast design, controlled blasting practices; fragmentation assessment, blasting monitoring and Instrumentations.

UNIT IV: Mine Surveying (20 Questions)

Mine Surveying: Levels and levelling, theodolite, tacheometry, triangulation; Contouring; Errors and adjustments; Correlation; Dip fault problems; Underground surveying; Curves; Photogrammetry; EDM and Total Station; Application of GPS, DGPS; GIS and Remote sensing in mining; Drone survey and its application in Mining

UNIT V: Mining Methods (20 Questions)

Mining Methods: Surface mining: layout, development, loading, transportation and mechanization, continuous surface mining systems; Dimensional stone mining methods, machineries and end product process; Underground coal mining: bord and pillar systems, longwall mining, Underground metal mining: open, supported and caved stopping methods.

UNIT VI: Mining Machinery (20 Questions)

Generation and transmission of mechanical, hydraulic and pneumatic power; Materials handling: haulages, conveyors, face and development machinery, hoisting systems, pumps, crushers, continuous miners and associated machineries.

UNIT VII : Rock Mechanics and Slope Stability (20 Questions)

Stress, strain –compressive and tensile, shear strength, uni-axial and tri-axial strength, Poisson's Ratio, Young's Modulus, convergence, elasticity, litho static and hydrostatic pressure, rock mass classifications, protection of surface structures, design and stability of structures in rock, dynamic and static loading, measuring instruments, subsidence ; monitoring of rock mass performance; mechanics of rock fragmentation, slope stability and dump stability, dump management.

Unit VIII: Mine Ventilation (20 Questions)

Mine Ventilation : Mine atmosphere, Mine gases, flame safety lamp, methanometers and multi-gas detectors, gas chromatograph, methane layering; monitoring of different gases, tele-monitoring, coal bed methane/coal mine methane, Heat and humidity, geothermal gradient, Air-flow in mines, Natural Ventilation and Mechanical Ventilation, Airborne dust, Mine fires and dealing with it, Mine explosions,

Fire extinguishers, Mine inundation, rescue and recovery in mines, rescue apparatus, organization of rescue work, emergency preparedness and response system.

UNIT XI: Mine Environment (20 Questions)

Environment: Air, water and soil pollution: Standards of quality, causes and dispersion of contamination, and control; Noise; Land reclamation, Role of Pollution Control Boards, Ministry of Environment and Forest - mine closure plan, R&R (rehabilitation and re-settlement).

UNIT X: Mine Legislation (20 Questions)

Prerequisite for Starting of a Mine: Approval of Mining Plan and Mine Closure Plan, Grant of Mining Lease, Environment and Forest Clearances, Safety, Rehabilitation of project affected families, welfare of workers etc., - Regulatory Frame work for the Exploration and Extraction of Mineral Resources: National Mineral Policy 2019;Mineral Concession Rules; Mineral Conservation and Development Rules; Mineral (Auction) Rules 2015; Mines Act-1952, Coal Mine Regulation-2017, Metalliferous Mine Regulation-1961; Mines and Minerals (Contribution to DMF) Rules -2015; Regulatory authorities; DGMS circulars.

10. Physical Education
(Diploma Standard)

Code: 603

Unit I: History of Physical Education (10 Questions)

Definition of Physical Education, Physical Culture, Physical Training. Aim and Objectives of Physical Education. Physical Education in Ancient Greece – Sparta and Athens – Ancient and Modern Olympic Games Common Wealth Games, Asian Games. Physical Education in India – Sports Authority of India(SAI), Sports Development Authority of Tamil Nadu (SDAT), International Olympic Committee(IOC), Indian Olympic Association (IOA), School Games Federation of India (SGFI), Republic Day Sports(RDS), Bharathiyar Day Games (BDG). General Knowledge in Sports and Games – Awards and Trophies.

Unit II: Biological Foundations, Fitness and Training Methods (30 Questions)

Biological foundation: Growth and Development – Heredity and Environment, Muscle tone, Athletic heart – Reciprocal innervations – types of age – Chronological age – Physiological age – mental age, Classification of Body types. Fitness – Definition and meaning of physical fitness – Importance of physical fitness. Components of physical fitness – Skill related fitness – Health related fitness. Training – meaning and definition of sports training – principles of training – warming up – cooling down – duration, intensity, repetition, recovery, training load – over load Training methods Types of Training - Weight training - Circuit training – Fartlek Training - Interval Training – Continuous training – Aerobic and Anaerobic training. Periodization – structure and types. Training methods for motor components – speed - strength – endurance - coordination – flexibility and agility.

Unit III: Tests, Measurement and Evaluation (20 Questions)

Definition and Meaning of the terms: Test, Measurement, and Evaluation – Need and Importance of Test, Measurement, and Evaluation in Physical Education. Criteria for Evaluation: Validity, Reliability, Objectivity and Norms. Physical Fitness Test: JCR Motor Fitness test, AAHPERD youth fitness test, Muscular Fitness: Kraus Weber Minimum Muscular Fitness Test, Newton Motor Ability Test, Cardiovascular test: Harvard step test, Cooper, 12 minutes run/walk test. Badminton: Miller Wall Volley Test. Basketball: Johnson Basketball Test, Hockey: Friedel Field Hockey Test, Volleyball: Russel Lange Volleyball Test, Brady Volleyball Test. Football: MC-Donald Soccer Test.

Unit IV: Anatomy and Physiology (20 Questions)

Definition of Anatomy and Physiology – Need and Importance of Anatomy and Physiology in Physical Education and Sports - Organ systems – Structure and Function and types of Cell - Tissue – Bones – Joints – Structure and Function of Skeletal – Muscular - Blood and Circulatory – Nervous – Respiratory - Digestive - Reproductive – Excretory and Endocrine Systems.

Unit V: Health Education, Sports Injuries, First Aid and Physiotherapy (20 Questions)

Definition and Meaning of Health Education – Health Services and Supervision – Nutrition and Balanced Diet - Components of Food. Disease- Infection- Immunity-Types of Disease – Causes ,Signs and symptoms ,mode of transmission and prevention of Disease – Malaria, Small Pox, Dysentery, Mumps, Typhoid. First Aid: First Aid Box, Cuts – Kinds of Bandage – First Aid for Electric shock, Poisoning, Drowning, Dog bite, Snake Bite, Bleeding, Fractures, General rule for burns. Sports injuries – Meaning – Importance – Bleeding, Fractures, Sprain, Strain, Dislocation, Fainting, Abrasion. Physiotherapy – Definition – importance of Physiotherapy, Principles of Physiotherapy – Electro therapy – Hydro therapy –Thermo therapy, Massage and its types – Posture and its types and Postural Deformities.

Unit VI: Sports Psychology and Fitness (10 Questions)

Definition and Meaning of Sports Psychology and its importance. Personality traits- Motor Learning and motor performance. Basic consideration in Motor fitness: Body build, Mental aspects, Sense Perception: Vision, Kinesthesis. Tactile Psychological Factors: Tension, Anxiety, Stress, perception, concentration, mental ability, emotion, motivation, frustration, self esteem, self confidence. Learning-Theories of learning: Conditioned Response – Trial and Error – Insightful. Theories of Play. Ideo motor training, Autogenic training and Psycho tonic training.

Unit VII: Yoga (20 Questions)

Meaning and Definition of Yoga. Eight limbs of yoga: Yama – Niyama – Asana – Pranayama - Pratyahara – Dharana – Dhyana – Samadhi. International Yoga Day. Suryanamaskar. Yoga for Physical, Mental , Social, Emotional and Spiritual Health. Nadis,Chakras, Mudras ,Shatkriyas and its importance . Yoga for Sports and games.

Unit VIII: Methods and Management in Physical Education (20 Questions)

Meaning and importance of methods in Physical Education - factors influencing methods. Presentation Techniques - Class Management - Teaching aids - various methods of Teaching-Lesson Plan- Types of Lesson Plan - Types of Tournaments, - Fixtures for Knockout, League and Combination Tournaments. Intramurals and Extramural tournament. Various levels of sports and games in schools, Colleges and Universities - Guiding principles of organization - Records and Registers - Construction and Maintenance of Swimming pool and Gymnasium.

Unit IX: Rules of Games and Sports (30 Questions)

Playfield measurements and maintenance of Equipments - Duties of Officials and Rule of sports and games: Basketball, Ball Badminton, Badminton, Carrom, Chess, Cricket, Football, Handball, Hockey, Kabaddi, Kho-Kho, Table Tennis, Tennikoit ,Tennis, and Volleyball.

Unit X: Track and Field (20 Questions)

Layout of standard track (400 meters), Method of calculating Staggers and Arch start. Relay zone marking for 4*100 and 4*400. Track Events: Sprint, Middle distance, Long distance and relay events. Hurdles –Measurement and distance. Layout of Circle/Runway/ sector for: Javelin, Shot-put, Discus, Hammer throw, Long Jump, Triple Jump and High Jump. Measurements of Standard Athletic Equipments. Combined Events: Triathlon, pentathlon, Heptathlon and Deccathlon.

11. Printing Technology
(Diploma Standard)

Code: 484

Unit I: Imaging Technology (20 Questions)

Design – Concept, Typography, Graphic Design Layout – Stages in preparing a Layout; Imposition Schemes; Book work – Margin Calculations, Dummy. Various Designing Software used for Designing of Newspapers, Booklet, Magazines, Label Work, Book works – Text and Wrapper design, Font Style, Font Size. Digital Prepress – Image Acquisition – Digital Camera – Scanner. Screening – Frequency, Dot Structure, AM and FM Screening, Screen Angles and Resolution. File formats – OPI, PDF, TIFF, EPS, JPEG, GIF, PNG. Work flow – File preparation, Colour Management, Preflighting, Digital Imposition – Raster Image Processor. Type of Image – Bit map, Vector Image. Colour – Colour Separation – CMYK, Greyscale Mode, Additive and Subtractive colour Theory.

Unit II: Image Preparation (15 Questions)

Image for Offset Process; Presensitized Plates (PS), Quality Control Aids – Star Target, Registration Mark, Line resolution target, Ink coverage target. Computer to plate and its architecture, Types of plates used –Computer to Plate Imaging – Laser, UV, Thermal Imaging. Plate Processor – Developing, Fixing, Washing, Gumming. Imaging for Gravure process: Electro Mechanical engraving, Laser Cutting of Gravure Cylinders, System Architecture workflow and quality control.

Imaging for Flexography: Plate types – Rubber and Photo Polymer plates and quality aspects.

Imaging for screen Printing: Stencil Preparation types and quality aspects. Proof Reading Marks, Copy Editing and Checking print elements with originals.

Unit III: Sheet-fed Offset Printing (25 Questions)

Sheet-fed Offset Printing Principles, Types of Offset Machines – Single Colour, Multi Colour, Prefecting Presses and Small Offset Presses; Feeding Unit – File board, Feeder Head, Feed Board, Sheet registering Devices - Front lay, Side lay – Sheet Detectors – Double Sheet Detectors, No Sheet Detector. Printing Unit – Plate Cylinder, Blanket Cylinder, Impression Cylinder, Inking System – Roller Setting, Dampening System – pH, Conductivity of Dampening, Drying System and Delivery System – Grippers, Safety Switches, Safety Guards. Print problem identification and quality control. Green Printing – W ater based inks, recycled papers and chemical free plates.

Unit IV: Web Offset Printing (25 Questions)

Web offset Printing: Principle, Cut of Length, Web fed offset machines - In-line web offset, Blanket to Blanket Press, Stack Type Press, Satellite Presses, Common Impression Cylinder (CIC); Infeed: Types of Reel Stands, Automatic Pasters - Types, Web Control Devices; Dancing roller, Metering roller, Box Tilt, Turner Box, Web Break Detectors. Printing Unit design configuration, Inking and Dampening System, Drying, Chilling, Folding, Sheeting Units and Mail Room Operation. Make-ready Operations, Multi Colour Printing, Automatic Plate Fixing, Computer Controls in Printing, Automatic Blanket Washing Devices, Roller Washing Devices, Spot Coating, Varnishing and Accessories.

Unit V: Gravure, Flexography, Screen Printing (15 Questions)

Gravure Principle, Press configuration, Corona treatment, Doctor Blade – types, Positioning; Impression rollers, inking and drying system. Proofing, Rewind Section, Unwind Section and converting operations.

Flexography Printing: Principle, press configuration, Corona treatment, Anilox roller, plate mounting, inking, drying and proofing. Feed in, feed out and converting operations.

Screen printing – Screen fabrics, frames and squeegees - types; screen printing machine- types.

Unit VI: Book Binding and Finishing (25 Questions)

Production flow in print finishing, Folding – Sheet fed – Knife folding and Buckle folding, Web fed – Former fold, Jaw fold, Chopper fold. Cutting Machine – Parts, Types of Cutting Machine, Mechanism and Maintenance of Guillotines. Gathering, Collating, Stitching, Sewing – Types; Perfect binding, Miscellaneous Operations – Edge Decoration, Case Binding, Embossing, Foil Stamping, Die-Cutting, Indexing, Lamination, Shrink Wrapping, Comb Binding, Spiral Binding, UV Curing. Automation in finishing operations. Finishing problem – Improper wire pinning, Improper Wrapper scoring, Defective cutting, Defective size of book etc.

Unit VII: Printing Materials (20 Questions)

Paper - Raw materials, Manufacturing, Paper making machine Operations, Paper coating methods. Paper Classification and sizes – ISO & British Size. Boards: Raw materials, manufacturing, machineries, classifications and sizes. Paper and Board Properties and testing – GSM, Grain direction, Opacity, Folding endurance, Tensile Strength etc., - Printing Inks - Raw Materials, Manufacturing, Three roll mill, Types of inks, Ink properties of offset, flexography, gravure and screen printing. Coating materials, Varnish, Laminating films and adhesives. Corrugated Board – Types, Flutes and Number of plies - Board Properties and testing – Edge Crush test, Cobb Test, Bursting Strength, etc.,

Unit VIII: Planning, Scheduling and Cost Estimation (20 Questions)

Planning, scheduling the work, Sequencing, Inventory Management, Materials and Capacity requirement. Cost Estimation - Basic concept of costing, Pricing and Estimation. Cost estimation for printing materials and for different printing process in respect to various print jobs.

Estimation Process – Obtain accurate Specifications – Job Sequence – Material Requirement – Time and labour – Fixed Cost and Variable Cost – Job card – Job Scheduling / Sequencing production control and Invoicing. Types of Papers and Boards – Coated and Uncoated paper – Raw Material Cost, Printing Cost – Text, Wrapper, Lamination Cost and Binding Cost. Paper Size, Board Sizes and Costing – Paper and Board requirement calculation - Reams / Weight of paper and Board.

Unit IX: Quality Control in Printing (20 Questions)

Quality Circles, 5S, Kaizen. Process control: Visual inspection, Quality Systems and ISO 9000, Statistical Quality Control, and wastage management. Use of Testing Equipments; GSM, Tearing Strength, Cobb, Bursting Strength, Edge Crush Tester. Stiffness, Tensile Strength. Print Analysis: Solid Ink Density (SID), Dot gain, Print Contrast, Ink Trapping and Dot Area, CIE lab and Delta E. ISO 12647 for printing standards. Wastage minimization in printing industry, Press calibration. Quality Control Equipment – Densitometer, Spectrophotometer. ISO 14000, OSHA Standard. Ensuring the sustainability in Printing and Packaging. Printing problems – Scumming, Mottle, Ghosting, Hickeys, Set off, Pilling, Strike Through and Show Through.

Unit X: Digital printing (15 Questions)

Print on Demand, Variable data Printing, Personalized Printing, Digital Printing Technology: Definition, Non-impact Printing Technology (NIP), Basic principle; Electrophotography, Inkjet printing. Security Printing; Hologram, waterless offset, Hybrid printing and its application E-publishing Layout and Design preparation, eBook, eJournals, QR Code, Ebook converter, ISBN, Barcode, copyright certification, internet advertising and digital libraries. Web to print – Workflow, Optimization of print production using production monitoring system.

12. Town and Country Planning

Single Paper consisting of the Civil Engineering (Diploma Standard), Architecture (Diploma Standard) and Town & Country Planning (Post Diploma Standard)

Code: 508

Unit I: Engineering Mechanics (20 Questions)

Loads - Simple Stresses and Strain – Modulus of Elasticity / Elastic constants – Application of stress and strain in engineering field – Behaviour of ductile and brittle material – Shear Force and Bending Moment – Geometrical properties of sections – Centroid – Moment of Inertia –Stresses in Beams and Shafts – Stresses in Beams due to bending – Stresses in shafts due to torsion – Pin Jointed Frames.

Unit II: Construction Materials and Construction Practice (20 Questions)

Bricks, Lime, Tiles, Cement, Fine Aggregate, Coarse Aggregate, Timber, Ply wood, Steel, Glass, Plastics, PVC, UPVC, Paints, Mortars, Concrete, M-sand, P-sand – Latest construction Materials and Chemicals – Green Building Concepts and Materials - Usage of PPC, Flyash Bricks, Hollow clay Bricks, Solar Panels.

Different types of Foundations - Masonry, Floors, Roofs, Interior Works - False ceiling – Wall paneling – Wooden flooring

Precast Concrete Construction - Doors and Windows - Weathering Course - Damp proof course – Plastering - Painting. Conservation of Heritage Structures.

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

Sources of Water – Collections and Conveyance of Water – Quality of Water – Treatment of Water – Distribution System – Appurtenances and Maintenance of Water Lines – Collections and Conveyance of Sewage – Treatments and Disposal – Environmental Pollution and Control – Waste Water Treatment and Solid Waste Management – Land, Water and Air Pollution - Drainage arrangements and Sanitary fittings in Buildings – Environmental Impact Assessment (EIA) - Methodology – Conservation of Marsh Lands – Reclamation of Water Bodies.

Unit IV: surveying (10 Questions)

Types of Surveys – Chain surveying – Compass surveying – Levelling – Contour surveying – Theodalite surveying – Trignometrical levelling – Tacheometry – Field work – Simple problems.

Unit V: Estimation, Costing and Valuation (20 Questions)

Estimates and its types – System of taking out quantities – Trade and Group systems - Stages of Detailed Estimate – Measurements and Material Requirement – Specification and Report Writing – Approximate Estimates – Areas and Volumes - Detailed Estimate – Data – Abstract Estimate - Valuation of Land and Buildings.

Unit VI: Structural Engineering (20 Questions)

Slope and Deflection of Beams – Propped Cantilevers – Fixed Beams – Arches – Continuous Beams – Theorem of Three Moments – Moment Distribution Method – Columns and Struts – Combined Bending and Direct Stresses – Earth Pressure and Retaining Walls.

Reinforced cement concrete structure – Working Stress Method - Analysis and design of singly and doubly reinforced rectangular and T-beam sections – Cantilever, simply supported,

continuous beams – One way and two way slabs – Lintels and Sunshades – Staircases – Rectangular and Circular short Columns – Isolated column footings (All designs by Limit State Method only). Steel structures – Design of simple beams by Limit state method – Types of welded connections.

Unit VII: Construction Management, Computer Applications and Remote Sensing (25 Questions)

Planning of a project – Factors to be considered – Project reports – Organization structure of construction departments – Construction planning – CPM and PERT networks – Contracts – Tenders and Tender documents – Bill - Supervision and Quality control – Arbitration.

Safety measures in construction sites – Labour legislations - Banking practice – Cash flow diagrams - Financial Management -Ethics.

Disaster Management – Types of Natural calamities – Causes – Preparedness – Response and Recovery.

Use of Computers – Application of CAD softwares – Project management softwares – Use of MS word, Excel, Power Point – Application of Analysis and Design softwares.

Applications of GPS, GIS and Total Station – Geometry of Aerial Photographs – Image characteristics and their significance – Mapping by Manual and Mechanical Methods – Use of Satellites, Aerial Photographs, Drones in Physical Planning.

Unit VIII: Building Services (15 Questions)

Water Supply and Sewage Disposal, Mechanical Systems – Pumps and Motors, Electrical Systems – Generation and Distribution - Ventilation and Lighting - Air Conditioning – Principles, systems and applications - Vertical Transportation systems - Fire Hazards, Safety and Design Regulations - Acoustics – Building Management Systems – Renewable Energy – Rain water Harvesting – Storm Water Management.

Unit IX: Town Planning, Transportation and Planning Practice (30 Questions)

Town Planning Principles – Master Plan - Road and Street Planning – Parks and Open Spaces – Landscape Architecture – Historic and contemporary Landscape – Soft and Hard Landscaping – Indoor and Outdoor Plants - Housing – Economy, Society, Environment and Transport Policy and Planning – Tamil Nadu Combined Development Building Rules, 2019 (TNCDBR, 2019) – Barrier free Design.

Roads – Different types – Methods of formation of water bound macadam Road, bituminous and concrete roads – Hill roads – Camber, gradient, super elevation, carriageway, pavements, drainage system, sight distance - Traffic Engineering - Bridges – Classifications – Site selection and alignment – Foundation, substructure and superstructure.

Railways – Formation of Tracks – Rails – Ballasts – Sleepers – Characteristics of materials – Rail Joints.

Regional Plan concepts and studies – Master plan concept and surveys – Master plan needs and plan formulation – Urban Renewal, Redevelopment, Rehabilitation, Conservation – New Town - Detailed Development Plan - Development Regulations.

Unit X: (20 Questions)

Unit X(A): History and Theory of Architecture

History of Architecture

Prehistoric - Egyptian Architecture – Greek Architecture – Roman Architecture – Early Christian and Byzantine Architecture – Romanesque and Gothic Architecture – Renaissance Architecture.

Indian Architecture – Indus Valley Civilization, Buddhist Architecture, Hindu Architecture – Islamic Architecture in India.

Modern Architecture, Postmodernism, Contemporary World Architecture - Philosophy and works of Post Modern Indian Architects.

Theory of Architecture

Definition of Architecture – Architecture as satisfying functional, aesthetic and psychological human needs - Anthropometrics.

Elements of Architecture – Form, Space, Light, colour, etc.

Principles of Architecture – Proportion, Balance, Scale, Symmetry, etc.

Unit X(B): Hydraulics Engineering and Soil Mechanics

Soil mass as a three phase system – Grain size classification - Atterberg limits – Properties – IS Classification of soils–Compaction – Shear strength – Safe Bearing Capacity.

Measurement of pressure in liquids – Pressure distribution and total pressure on immersed surfaces – Types of flow (Laminar, turbulent, steady, unsteady, uniform, non- uniform) – Flow through pipes – Losses, Frictional losses – Hydraulic gradient and total energy lines - Bernoullis theorem – Use of Orifice, Mouthpiece, Hydraulic Coefficient Cd, Cc, Cv Orifice meter and Venturimeters – Flow through channels – Chezy's formula – Bazin's and Manning's formula – Economical sections for open channels - Conditions for Maximum discharge - Pumps – Reciprocating pumps – Centrifugal pumps – Characteristics – Selection and choice for pump - Discharge – Power and efficiency - Ground water – Types of well – Test for yield of wells.

Unit X(C): Socio - Economic Aspects of Planning

Basic concept and Scope of Study – Urbanization and Ecological theories – Social Issues in urban area – Housing Redevelopment – Citizen participation.

Economic Operation – Project Appraisal – Urbanization and National Housing policy – Economics of Urban Growth.

Evolution of Planning Legislation - Planning System in U.K., The Tamil Nadu Town and Country Planning Act 1971, Coastal Regulation Zone and Tamil Nadu Municipalities Building Rules – Hill Area Conservation – Planning related Acts.

13. Trade - Advanced CNC Machining Technician

(ITI Standard)

Code: 534

Unit 1: General Safety Precaution and First Aid (10 Questions)
Importance of safety – Basic need of Personal Protective Equipment (PPE) – First Aid – Safe Disposal of used engine oil – Hazard identification – Safety signs for Danger Warning – Personal Safety – Fire Extinguishers.

Unit II: Perform Turning, Milling Operations (10 Questions)
Lathe – Types - Parts of the Lathe – Work holding devices – Types of Holder – Cutting tools used for different operations – Performing Face turning – Taper turning – Grooving – Threading Knurling – Drilling – Boring – Jig and fixtures – Coolant - Milling – Work piece setup on Milling Machine – Loading and unloading of cutting tools – Basic operations Step milling, Slot milling, Angle milling etc.,

Unit III: Product specification and Interpret industrial engineering drawing and quality of surface (40 Questions)
Product design and Development – Prepare check List of customer needs - Customer needs & select optimum requirement - Develop product specification report - Symbols used in industrial drawing - Create a checklist of dimensions & customer specific requirements - Geometric dimension - Tolerances - Symbol - Fundamentals of limits fits & tolerances & Symbols – Interchangeability Importance of multi stage drawing - Surface finish and it's importance - Post process manufacturing operation – International standard & symbols used to represent surface finish and calculation – Process flow diagram - Measuring instruments – Vernier Caliper – Micrometer – Gauges and Properties.

Unit IV: Introduction CNC Machines (40 Questions)
G Code and M Code and various cycle end code - Importance of Emergency stop function key Tool offset with the help of jog mode - Program in MDI mode, single block option - Edit – Auto - MPG mode – Create, execute and verify GOO,GO1 program - Linear interpolation & Rapid traverse - Orientation of machine movement - Identify the direction of machine movement by using Jog mode - Concept of tool travel with Linear interpolation - Orientation of machine movement – Absolute & Incremental – Circular interpolation Clock wise and Counter clock wise Create, simulate and execute - Concept of grooving, parting off and threading - Straight , taper and multi start - Internal profile using turning facing and pattern repeat cycles - Internal groove using canned cycles -Tool nose radius compensation – Calculation of threading parameters.

Unit V: CNC Turning (15 Questions)
Introduction to CNC Lathe machine – Concept of Numerical Control - Fanuc, Siemens, Mitsubishi, HAAS – CNC turning centre features & its components – Work Piece holding devices used in turning center– Create and run the program using sub routine codes - Concept of sub programming of block in CNC turning programming - Concept of axis & Coordinate system used in CNC turning Centre – Turret – Tail stock.

Unit VI: VMC Machines (15 Questions)
Introduction to VMC milling machine – Work Piece holding devices – Introduction Turn mill centre Dual spindle / Sub spindle – Create and run the program using sub routine codes - Tool holding devices used in VMC - Concept of sub programming - Concept of axis & Coordinate system used in CNC VMC Centre – Tool wear offset –Tool Magazine – Automatic Tool Changer– Concept of interpolation and Canned Cycles.

Unit VII: Routine Maintenance and Trouble Shooting of CNC LATHE & VMC (10 Questions)
Routine and Preventive maintenance & basic troubleshooting of CNC lathe and routine maintenance & basic troubleshooting of CNC VMC - Perform maintenance OEM recommendations.

Unit VIII: VMC G Code and M Code Programming (30 Questions)
Introduction to Vertical Machining Centre – Concept of axis & Coordinate System – Concept of speed, feed & Machining depth of cut - Identifying & replacing of cutting tools – Concept of tool wear & offset – Concept of over travel limits in VMC Machines – Importance Emergency stop function key – Concept of VMC mode like Jog, MDI, Edit, Auto, Single Block, MPG – VMC Machine movement on various G codes & M Codes – Create, execute and verify GOO,GO1 program - Linear interpolation & Rapid Traverse to verify Absolute Programming & Incremental Programming – Circular interpolation Clock wise - Circular interpolation Counter Clock Wise – Work offset – Tool offset – Dry run the program for verifying actual tool path – Cycle time calculation – Polygonal Milling with Polar Co-ordinates – Scaling, Mirroring & Rotation on VMC Concept of Importing and Exporting of VMC program.

Unit IX: Computer Aided Machining (20 Questions)
Computer aided machining – Geometry Creation – Surface – 3D Solid Modelling – Computer Aided manufacturing software - Generate and export NC program for machining - Generation of complex machining part program with the help of CAM software - Concept of Tool Path Verifications on CNC machines – Create Simulate & Execute a complex machining part program Create Tool path using CAM software & Verify with the help of graphical icon on CNC machines.

Unit X: 4th Axis on VMC (10 Questions)
Auxillary axis - Concept of Rotary axis - indexer & its importance - Concept 4 Axis Machining (step wise and continuous) - Referencing of 4th axis - Align 4th axis on machine.

14. Trade - Basic Designer and Virtual Verifier

(ITI Standard)

Code: 532

Unit I: General Safety Precaution (10 Questions)
General Precaution and First aid- 5S Concept (Kaizen) – Occupational – Health and Safety – Knowledge of Design Frame Work and Product Development – Personal Protective Equipment (PPES).

Unit II: Apply Engineering drawing in Computer Aided Design (CAD) / Computer Aided Engineering (CAE) Software (20 Questions)
CAE –Design Steps in CAE - Testing and Analysis in the CAE – Selection of Materials for the Designed Product – Engineering Drawing to Learn Point, Line, Plane, Projection, 2D and 3D Drawing using CAE – CATIA and General Operations in it (Point, Line, Arc, Ellipse, Trim, Offset, Fillet, Chamfer, etc.,) – Move, Copy, Array Command – 3D Concept Modelling Tools – Importing CAD Model – Computer Aided Three Dimensional Interactive Application (CATIA) V5 (2022) Software.

Unit III: Sheet Metal Design and Essential Assembly Components (10 Questions)
Design of Sheet Metal Parts in CATIA – Geometric parameterization – Sheet Metal Design – Assembly Importing – 2D Drawings – (Bill of Material) BOM – Exploded views in CATIA.

Unit IV: Finite Element Method (FEM), Computer Aided Engineering (CAE) Software (Ansys 2022) (15 Questions)
Computer Aided Drawing (CAD) and Finite Element Method (FEM) Capabilities of Computer Aided Engineering (CAE) Software – Familiarization of Graphical User Interface (GUI) of Computer Aided Engineering (CAE) Software – Familiarization with Geometry – Finite elements Modules – Various Type of Materials, Properties and Elements – Discretization.

Unit V: Finite Element Method (FEM) Models Components, Meshing, 1D, 2D, 3D Elements, Element Quality (Ansys 2022) (20 Questions)
Concept of Meshing – Types of Mesh – Material Selection – Geometry Quality Parameter – Checking the Integrity – Creating the Mesh Using 1D, 2D, 3D Elements – Introduction to Various Types of Available 3D Elements.

Unit VI: Simple Analysis by Applying Appropriate Loads and Boundary Conditions (Linear Static Analysis) (Ansys 2022) (25 Questions)
Apply the Appropriate Loads and Boundary Conditions – Preparation of the Finite Element Model (FEM) for Analysis- Submit the Finite Element Model (FEM) to Solve – Checking the Correctness of the Analysis – Post Processing of result – Interpretation of the Analysis.

Unit VII: Analyze by Inertial Relief Method, Non-linear Analysis, Modal Analysis, and it's Components (Ansys 2022) (25 Questions)
Linear Static Analysis – Inertial Relief Method – Analyzing the Components – Non-linearity – Need for Modal Analysis – Concept and Equation of Natural Frequency- Concept of Mass, Stiffness, Resonance, Rigid Body Modes – Difference between rigid body Modes and Local Modes.

Unit VIII: Basic Thermal Analysis (25 Questions)
Heat Transfer Analysis and it's Requirements – Symbols and Mathematical Expression for Conduction, Convection and Radiation – Basic Requirements of Heat Transfer Analysis – Material Data and Physical data Collection to check the Condition of Heat Transfer – Study the Output of Analysis in Ansys.

Unit IX: Frequency response Analysis of Beam and any Suspension Components (25 Questions)
Advanced Analysis – Introduction to Dynamic Loading – Dynamic Stiffness – Frequency Response Analysis – Sinusoidal Frequencies – Introduction of Time Dependent loading – Sinusoidal load – Impulse Load in Ansys.

Unit X: Thermo Mechanical Analysis of Engine Components, Welded Joints (25 Questions)
Thermo Mechanical Analysis – Any Loading type is Converted applied on the Component as a Mechanical load along with Thermal loads and Analysis in Ansys.

15. Trade – Diesel Mechanic
(ITI Standard)

Code: 521

Unit I: Safety Workshop Practice & First Aid, Measuring & Marking Tool (20 Questions)
Importance of Safety and general Precautions to be observed in the work shop, Elementary of First Aid, Occupational Safety, Hazards Health, Fire Extinguisher, House Keeping & 5S Method - Safety disposal of Used engine oil, Electrical safety tips, Safe handling of Fuel Spillage, Safe disposal of toxic dust - Safe handling and Periodic testing of lifting equipment - Hand Tools - Marking Materials - Chalk, Prussian blue - Cleaning Tools – Scraper, wire brush, Emery paper – Marking Tools - Surface plates – Measuring Tools - Steel rule, measuring tape, try square, Callipers-inside and outside, Dividers, surface gauges, Scriber Punches, Types of Punches - prick punch, centre punch, pin punch, hollow punch, number and letter punch – Chisel - flat, cross-cut – Hammer - ballpein, lump, Mallet, Types of Screwdrivers, Allen & key bench vice & C-clamps, Spanners, Types of spanners, Universal adjustable spanner, open end spanner, Sockets & accessories, Types of Pliers, Air impact wrench, air ratchet, wrenches-Torque wrenches, pipe wrenches, Pipe flaring & cutting tool, Pullers-Gear and bearing - Description, Least Count calculation, care & use of micrometer, Outside and depth micrometer, Inside Micrometer, Vernier calliper and its adjustments, Telescope gauges, Dial bore gauges, Dial indicators - Straight edge, feeler gauge - Thread pitch gauge - Vacuum gauge and tyre pressure gauge.

Unit II: Fastening & Fitting, Hydraulics & Pneumatics (15 Questions)
Different types of metal joints - Permanent, Temporary - Methods of Soldering – Screws - Different types of Screws - Nuts, studs & bolts – Locking device - Locknuts, cotter, split pins, keys, circlips - Lock rings - Lock washers – Gaskets, Gasket material - Type of Gaskets - Paper, multi-layered metallic, liquid rubber, copper and printed – Thread Sealants – Various type, locking, sealing, temperature resistance, anti-locking, lubricating – Cutting tools, Different type of cutting tools,

Hacksaw – File - Parts of file, specification, Grade, Shape - Grinding Machine – Drilling Machine, types of drilling machine, Bench, Portable, electrical - Drill holding devices, work holding devices, drill bits – Taps and Dies, Hand taps and wrenches, calculation of tap drill sizes for metric and inch-taps, different type of die and die stock, Screw extractors –Hand Reamers, Different type of hand reamers - Lapping, lapping abrasives, type of laps – Hydraulics and pneumatics – Description, symbols and application in automobile of Gear pump, Internal & External, single acting, double acting & double ended cylinder - Directional control, Pressure relief valve, Non return valve, Flow control valve used in automobile.

Unit III: Basic Electrical & Electronics (15 Questions)

Basic electricity - Electricity principles - Ground connections - Ohm's law - Voltage, current, resistances, Power, Energy - voltmeter, ammeter, ohmmeter, multi meter - Conductors & insulators – Wires – Shielding - Length vs resistance - Resistor ratings – Fuses & circuit breakers - Ballast resistor - Stripping wire insulation - Cable colour codes and sizes - Resistors in series circuits, Parallel circuits and series parallel circuits – Battery - types of battery, Lead acid batteries & Stay Maintenance Free (SMF) batteries – Chemical effect, Magnetic effects, Heating effects - Thermo-electric energy - Thermistors, Thermo-couples – Electrochemical energy - Photo-voltaic energy - Piezo-electric energy - Electromagnetic induction – Relays, solenoids, Primary & Secondary windings – Transformers - Stator and rotor coils.

Unit IV: Vehicle Specification, Service Station Equipments, Engine Classification Dash Board Gauges (20 Questions)

Classification of vehicles on the basis of load as per central motor vehicle rule, wheels, final drive and fuel used, axles, position of engine and steering - Transmission, body and load, Brief description – Uses of vehicle hoists, Two post and four post hoist, Engine hoists, Jacks, Stands – Introduction to Engine – Define of internal & external combustion engines, Classification of IC engines, Principle & Working of 2 & 4-stroke diesel engine Compression ignition Engine (C.I) – Principle of spark ignition Engine (SI), differentiate between 2-stroke and 4-stroke, C.I engine and S.I engine – Main parts of IC Engine – Direct injection and indirect injection, Technical terms used in engine, Engine specification – Study of various gauges / instrument on a dash board of a vehicle – Speedometer, Tachometer, Odometer and Fuel gauge and indicators - Gearshift position, Seat belt warning light, Parking-brake-engagement warning light and an engine -Malfunction light.

Unit V: Engine Constructional details (30 Questions)

Description and Constructional feature of Cylinder head, Importance of Cylinder head design - Type of Diesel combustion chambers - Effect on size of Intake & exhaust passages, Head gaskets Importance of Turbulence Valves & Valve Actuating Mechanism - Description and Function of Engine Valves, different types, materials, - Type of valve operating mechanism, Importance of Valve seats, Valve seats, inserts in cylinder heads - Importance of Valve rotation, Valve stem oil seals, size of Intake valves, Valve trains, Valve - Timing diagram - Concept of Variable valve timing - Description of Camshafts & drives Description of Overhead camshaft (SOHC and DOHC) - Importance of Cam lobes, Timing belts & chains, Timing belts & tensioners Description & functions of different types of pistons, piston rings and piston pins and materials - Used recommended clearances for the rings and its necessity precautions while fitting rings, common troubles and remedy - Compression ratio - Description & function of connecting rod - Importance of big - End split obliquely - Materials used for connecting rods big end & main bearings. Shells piston pins and locking methods of piston pins - Description and function of Crank shaft, camshaft - Engine bearings-classification and location – materials used & composition of bearing materials- Shell bearing and their advantages - Special bearings material for diesel engine application - Bearing failure & its causes-care & maintenance - Crank-shaft balancing - Firing order of the engine - Description and function of the fly wheel and vibration damper - Crank case & oil pump - Gears timing mark - Chain sprockets, chain tensioner - Function of clutch & coupling units attached to flywheel - Description of Cylinder block - Cylinder block construction - Different type of Cylinder sleeves (liner).

Unit VI: Cooling & Lubrication System (25 Questions)

Heat transfer method - Boiling point & pressure - Centrifugal force - Vehicle coolant properties and

recommended change of interval - Different type of cooling systems, Basic cooling system components - Radiator, Coolant hoses - Water pump - Cooling system thermostat - Cooling fans - Temperature indicators - Radiator pressure cap - Recovery system - Thermo- switch Need for lubrication system - Functions of oil, Viscosity and its grade as per SAE - Oil additives, Synthetic oils, The lubrication system, Splash system - Pressure system - Corrosion/noise reduction in the lubrication system - Lubrication system components - Description and function of Sump, Oil collection pan, Oil tank, Pickup tube, different type of Oil pump & Oil filters Oil pressure relief valve, Spurt holes & galleries, Oil indicators, Oil cooler.

Unit VII: Intake & Exhaust System (20 Questions)
Intake & exhaust systems– Description of Diesel induction & Exhaust systems Description & function of air compressor, exhauster - Super charger – Intercoolers - Turbo charger - Variable turbo charger mechanism - Intake system components - Description and function of Air cleaners, Different type air cleaner, Description of Intake manifolds and material - Exhaust system components - Description and function of Exhaust manifold, Exhaust pipe, Extractors, Mufflers - Reactive, absorptive, Combination of Catalytic converters - Flexible connections, Ceramic coatings, Back- pressure - Electronic mufflers

Unit VIII: Diesel Engine Fuel System (20 Questions)
Fuel Feed System in IC Engine (Petrol & Diesel) - Gravity feed system, Forced feed system, main parts, Fuel Pumps - Mechanical & Electrical - Feed Pumps - Knowledge about function, working & types of Carburettor Diesel Fuel Systems - Description and function of Diesel fuel injection, fuel characteristics - Concept of Quiet diesel technology & Clean diesel technology Diesel fuel system components - Description and function of Diesel tanks & lines - Diesel fuel filters - water separator - Lift pump - Plunger pump, Priming pump - Inline injection pump, Distributor-type injection pump, Diesel injectors, Glow plugs, Cummins & Detroit Diesel injection - Electronic Diesel control - Electronic Diesel control systems, Common Rail Diesel Injection (CRDI) system, hydraulically actuated electronically controlled unit injector (HEUI) diesel injection system. Sensors, actuators and ECU (Electronic Control Unit) used in Diesel Engines.

Unit IX: Charging, Starting System and Emission Control (20 Questions)
AC & DC Generators - Constructional details of Alternator and starter Motors - Charging Circuit, Operation of Alternator and starter motor – Regulator unit - Ignition Warning Lamp, Solenoid switches – Environmental & Eco-system, Vehicle Emission, Standard – Euro & Bharat Standards - Euro and Bharat II, III, IV, VI Sources of emission, Combustion, Combustion chamber design, Types of Emission, Characteristics & Effect of hydrocarbons in exhaust gases, Evaporation Emission Control, Carbon Monoxide & Carbon dioxide, crankcase emission control, Exhaust Gas recirculation valve - Controlling air fuel ratio, Charcoal storage device, Diesel Particulate filter (DPF), Selective catalytic Reduction (SCR) - EGR VS SCR.

Unit X: Trouble Shooting (15 Questions)
Causes and remedy - Engine Not starting, Mechanical & Electrical causes - High fuel consumption, Engine overheating - Low power Generation - Excessive oil consumption – Low / high Engine oil Pressure, Engine Noise - Troubles and remedy in charging and starting system.

16. Trade - Draughtsman (Civil)
(ITI Standard)

Code: 388

Unit I: Basic Engineering Drawing (25 Questions)
Engineering Drawing:
State the importance of engineering drawing, State the areas of civil engineering drawing.

List of drawing instruments, equipments and materials to be used during training:
State instruments, equipments and materials, List out instruments, equipments and materials, State the standard as per 962-1987, To use different drawing instruments, equipments and materials, Follow precautions in the use of instruments, equipments and materials.

Layout of drawing Sheet:
State the system of layout of drawing sheet, List the different layout for designated drawing sheet Explain the title block.

Folding of drawing Sheet:
State the purpose of folding a drawing sheet, Explain the method of folding for drawing sheet

Unit II: Geometrical Construction (25 Questions)

Plane Geometrical construction:
Define the terms of most commonly used geometrical shapes

Types of Lines and Angles:
Define points and lines, State the classification of lines, State the different types of angles, Explain the method of measuring angles.

Triangles and their types:
Define triangles, Name the different types of triangles and state their properties.

Quadrilaterals and their properties:
Define a quadrilateral, Name the quadrilaterals, State the properties of quadrilaterals

Polygon and their properties:
Define Polygon, Name the Polygon in terms of the number of sides, State the properties of polygon.

Unit III: Chain Surveying (15 Questions)

Introduction - History and principles of chain survey and instrument & employed
Define surveying, Explain the classification of Surveying, Narrate different methods of measurements, Express the instruments used for chain surveying.

Introduction about chain survey instruments
State the construction and uses of the chain survey instruments

Testing of metric chain (20m/30m)
State the necessity of checking the chain, State the methods of testing, List out then errors in the chain, State the limits of error in chain, Explain the adjust the chain, State Indian optical square

Measurement of distance by chain and chaining
State chaining and chaining a line, State unfolding the chain, Describe the reading the chain, State folding the chain, Calculate the errors in chaining

Unit IV: Compass Surveying (35 Questions)

Identification and parts of instruments in compass survey:
State about traversing, State types of compass, Name the prismatic compass and construction, Construction of survey's compass

Determining the bearing of a given triangular plot of ABC and calculation of included angles:
Calculate angles from bearing, Calculate bearing from angles
Determining the bearing of a given pentagonal plot of ABCDE and calculation of included angles
Calculate angles from bearings for a closed traverse, Calculate bearing from angles for a closed traverse, Calculate bearing of a pentagon

Magnetic declination and local attraction
Define the dip of the Magnetic needles, State the magnetic declination and variations, Calculate true Bearing, State local attraction and its elimination, Explain about errors and limits, State the testing the prismatic compass

Unit V: Plane Table Surveying (10 Questions)

Instrument used in plane table surveying:
State plane tabling, Name the instruments and accessories used in plan tabling, State the construction and uses of instruments and accessories used in plan tabling, Explain about leveling, centering and orientation in plain tabling, Explain the methods of plain tabling

Resection method of plane table survey:
State the resection method of plane table survey

Unit VI: Levelling (5 Questions)

Types of levelling:
Name the various types of levelling, Explain simple levelling, Explain differential levelling, Complete the reduced levels of points.

Unit VII: Road Engineering-I: (5 Questions)

Introduction to road engineering:
Define road, Define highway engineering, Define necessity and characteristics of road

Technical term used in road engineering:
Define road and Total Station advantage, Define various terms used in road engineering, Describe the various advantages of road

Principle of road alignment:
Alignment of road, Express the principle of highway alignment, Explain the different survey required for alignment

Classification of roads:
Describe the different classification of roads

Unit VIII: Road Engineering II (5 Questions)

Road Margins:
Define road margin, Describe the element Total Station of road margin

Camber, super elevation, sight distance and gradient:
Define camber, Explain super elevation, sight distance and express gradient

Unit IX: Total Station (35 Questions)

Introduction to total station:
Get introduced to the Total station, Learn the evaluation of Total station from the convectional equipment Total Station, Explain the benefit of Total Station and uses of Total station
Types of total station:
Explain the advantages and disadvantages of Total station, Explain the types of Total Station, Explain the precautions to be taken while using Total Station

Measurement with total station:
Explain the equipment required for Total Station surveying, Explain the procedure of measurement

with Total Station

Characteristics and features of total station:
Define the features of Total Station, State the characteristics of Total Station, Advantages and disadvantages of Total Station

Principle of EDM- Working need setting and measurement Total Station:
Define EDM, State the principle of EDM, Features of EDM

Setting and measurement Total Station:
Define distance measuring, State principal of EDM, State classification of EDM

Total station Prism- instrument error operation:
Explain Total Station prisms, Describe sources of error in EDM, EDM instrument operation, Uses of EDM

Electronic display and data recording:
Define electronic data recording, Explain field computers, Define recording module, Internal memories

Rectangular and Polar Co-ordinate system:
Illustrate rectangular and polar coordinates

Unit X: Global Positioning System (40 Questions)

Introduction of GPS:
Explain GPS coordinate system, Describe Geographic latitude and longitude, GPS equipment

Satellite and Conventional Geodetic system:
What is satellite system, Define Geodetic system

GPS coordinate system and component Total Station of GPS & System segment Total Station:
Explain GPS coordinate system, Describe Geographic Latitude and Longitude, Explain and describe component Total Station GPS receiver

GPS segment Total Station:
Define GPS segment

Principle of Operation of GPS and surveying with GPS:
State the Principle of Operation of GPS, Describe the role of transit in GPS

Remote sensing:
Explain Remote sensing, Distinguish between GPS, GIS and Total Station

GPS signal code - GPS basics:
Introduction to digital signal, Explain data acquisition system, Describe signal processing, Explain code and basics

17. Trade - Desktop Publishing Operator (ITI Standard)

Code: 612

Unit I: Fundamentals of Computers, Safety Rules, Fire Extinguishers (10 Questions)
Fundamentals of computer, Safety working practice, rules and signs, Types of working of Fire extinguishers, computer Components, Concept of Hardware and Software, Functions of the Motherboard components and various processors, Various Input/Output devices in use and their

features.

Unit II: Basics of MS-Windows, Applications, Document Features, and File Types (Text and Image Formats) (10 Questions)

Basics of MS-Windows, Accessories and Applications, Features of Document File, Difference between document and text files, Image files including BMP and other formats, Shortcut Commands.

Unit III: Introduction to MS-Office and Its Applications (Word, Excel, PowerPoint) with Typing Tutor (25 Questions)

MS-Word : Introduction of Typing Tutor, Introduction to MS-Office, Word Processing and Formatting, Creating and formatting tables, page layout, columns and page formatting, Shortcut Commands, Features of MS-Word.

MS-Excel: Sorting, Formatting, Data Files, Cell Locking & Dropdowns in Spreadsheets, Formula and Function in MS-Excel, Features of MS-Excel, Shortcut Commands.

MS-Power Point: Text formatting, inserting objects, creating/editing tables, Slide animations, transitions, action buttons, rehearse timings, Shortcut Commands, Features of MS-Power Point.

Unit IV: Networking Basics, Internet Tools, and Printer–Scanner Setup (15 Questions)

Network: Necessity and advantages of networking, Network topologies, LAN, MAN, and WAN, Network Components (Network Interface Card (NIC), Hub, Switch, Router, Modem, Repeater, Bridge, Gateway, Access Point) Firewall,

Internet: Web browser, Search Engines, Domain Name System, Email communication, Video Chatting, Social Networking Concepts, Concepts of Various Network Security Protocols,

Printer and Scanner: Preparing to scan, Setting of the Scanner, Setting up the printer with USB or wireless, Fax, Multi Function Printer, Types of Printer.

Unit V: Features and Benefits of Adobe InDesign and PageMaker (25 Questions)

Benefits of Adobe Indesign, Features of Adobe PageMaker, Adobe Indesign Tools and Pannels and their uses, Concepts of font style and color schemes, Compare Adobe InDesign and Adobe PageMaker, Features of Adobe InDesign Version, Shortcut Commands for Adobe Indesign.

Unit VI: Adobe Illustrator: Features, Benefits and working with Bitmap & vector Graphics (25 Questions)

Working with formatting Bitmap & Vector graphics, Adobe Illustrator Tools and Pannels and their uses, Features and Benefits of using Adobe Illustrator, Compare the features of different versions of Adobe Illustrator., Character design and User experience, Shortcut Commands.

Unit VII: Adobe Photoshop: Features, Versions, Tools, Panels and Image Creation Techniques (25 Questions)

Benefits of Adobe Photoshop, Features of Adobe Photoshop., Compare the various versions of Adobe Photoshop., Concept of font style, Color scheme, Tools and Panels, Menu bar, Arrange, Layout, Effects, Bitmap, etc., Create and format images using Adobe Photoshop, Shortcut Commands.

Unit VIII: CorelDRAW: Workspace overview, Tool Box, Docker, Versions, and Graphic Design Concepts (25 Questions)

Formatting and Design operations, Benefits and Various Versions of CorelDraw, Tool Box and

Docker, Advanced tools in the latest versions, Difference between Vector and Bitmap images. Color Palettes - CMYK, RGB and Pantone Colors. Toolbars - Property bar, Status bar, Standard bar etc, Shortcut Commands.

Unit IX: Cloud Computing, Web Servers, Web Hosting, and Online Tools (15 Questions)
Cloud servers and their types, Cloud storage and its types (Amazon, Google Drive, and Microsoft Azure Storage/OneDrive), Web servers and types of web servers, Web Hosting and Procedures, Online Tools (google forms, google sheets, google drive Google class room, Moodle, Chamilo, Open edX, Totara Learn, Canvas).

Unit X: Publishing Processes, Printing Technologies, and Binding (25 Questions)
Publishing Processes: Requirements for publishing content, Categories of content that require publishing, Classification of publication requirements, Types of publishing content.

Printing technologies: Letterpress, Offset Lithography, Screen Printing, Gravure Printing, Flexography, and Digital Printing. Issues related to publishing requirements, Consequences of publishing incorrect versions of content, Publishing content using bilingual software, Need and importance of publishing content, Recommended media for publishing content, Comparison of different publishing methods, Preparing a list of publishing requirements from the requester, Tools for creating and managing multilingual content: email, FTP, Notepad, Unicode fonts, MS Office, PDF reader/creator, Adobe Creative Cloud, translation memory tools, WordPress, and social media.

Binding: meaning, types, and processes, (Sewn binding, Perfect/PUR binding, Lay-flat binding, Spiral binding, Wire-O binding, Saddle-stitched binding).

18. Trade – Electrician

(ITI Standard)

Code: 438

Unit I: Safety Rules – Fundamental of Electricity (10 Questions)

Safety Rules, Hazards, Types of Fire Extinguishers, Personal Protective Equipments, Types of Wires and Joints. Soldering Methods, Ohm's Law – Simple Electrical Circuits and Problems. Kirchhoff's Law and its application – Under Ground Cables - Capacitor types Functions Grouping and uses.

Unit II: AC Circuits – Cells and Batteries – Wiring Installation (20 Questions)

AC Circuits – Power, Energy, Power Factor in AC Single Phase Circuits, Poly phase circuit, Cells and Batteries - Basic Wiring Practice, Wiring Installation and Earthing – Types - Testing a Domestic Wiring Installation – Location of Faults, Remedies. Industrial Wiring – Isolator, Switches, Fuses, Relays, Timers and Limit Switches – Types of Circuit Breakers.

Unit III: Illumination and Electrical Measuring Instruments (20 Questions)

Illumination – Construction Details of Various Lamps – Electrical Measuring Instruments and types - Ammeter, Voltmeter, Ohm Meter, Power Factor Meter, Frequency Meter, Multi meter, Watt Meter, Energy Meters (1 Phase and 3 Phase). Tong Tester (Clamp on Meter), Smart Meters, Automatic Meter Reading - Supply Requirements.

Unit IV: Electrical Appliances (10 Questions)

Domestic Appliances – Concept of Neutral and Earth – Cooking Range, Induction Heater, Food Mixer – Automatic Electric Iron Box, Electric Geyser Wet Grinder, Washing Machine and Fans.

Unit V: Transformers (20 Questions)

Transformer – Principle, Classification, EMF Equation, Transformer Losses. Open Circuit Test, Short Circuit Test – Efficiency – Voltage Regulation. Parallel Operation of Single Phase and Three Phase Transformers – Methods of Cooling of Transformer – Necessity of Cooling - Transformer Oil and Testing – General Maintenance of three Phase Transformer.

Unit VI: DC Machines (30 Questions)

DC Generators – Principle of Operation – Construction – Parts – Types – Characteristics – Build up of emf – Application – Losses efficiency

DC Motors – Principle of Operation – Starters – DOR – Armature reaction – Commutation – Speed Control Methods – Applications – Winding lap and Wave – Losses and efficiency – Maintenance, Service and repair.

Unit VII: AC Machines (10 Questions)

Three Phase Induction Motors – Principle of Working – Construction – Parts – Types – Squirrel Cage Induction Motor – Slip ring Induction Motor – Characteristics – Slip Vs Torque – Type of Starters – Basic Contactor Circuit – Parts and Functions.

Single Phasing Prevention – Losses and efficiency – Methods of Speed Control – Windings– Types– Concentric/Distributed– Single/double layer winding and related terms – Maintenance Service and repair – Trouble Shooting.

Single Phase Induction Motors - Working Principle – Types – Construction – Parts – Starting & running Methods – Domestic and Industrial – Applications Maintenance and Trouble Shooting

Unit VIII: Synchronous Machine (20 Questions)

Alternators - Working Principle – Construction – Parts – Types – Relation between Poles, Speed and Frequency – Voltage Regulation – Losses and efficiency – Characteristics – Phase Sequence – Parallel Operation – Care and Maintenance.

Synchronous Motor – Working Principle – Power factor improvement.

Unit IX: Electronics (30 Questions)

Resistors – Colour Code, Types and Characteristics – Active and Passive Components Diodes – Rectifiers – Characteristics – Transistors, SCR, DIAC, TRIAC – Applications – Digital Electronics – Logic gates and Combinational Circuits – UPS and Invertors.

Unit X: Power Generation, Transmission and Distribution (30 Questions)

Types of Power Generation –Conventional and Non-Conventional Energy Sources – Solar and Wind Energy – Solar Panels – Transmission and Distribution Network – Line Insulators – Over Head Poles – Safety Precautions and IE Rules for Service Lines – Terms related to Distribution.

19. Trade - Electronics Mechanic

(ITI Standard)

Code: 535

Unit I: Safety and Workshop Practice (20 Questions)
Importance of safety precautions - Personal Protective Equipment (PPE), First Aid, Fire extinguishers, Basic hand tools, Electrical terms – Calibrate the measuring Instrument Meters, Test and Service the different Cells and Batteries, Measurement and Calibration of equipments, uses and features Controls, Functions of Oscilloscope - Operate the front panel controls of a digital storage oscilloscope - Capturing a single shot signal - Function generator using IC 8038 – Execution of Soldering / Desoldering and various switches.

Unit II: Active and Passive Components, Power Supply Circuits and Transistor (20 Questions)
Testing of various Electronic Components, Resistors - Ohm's Law - Kirchhoff's Laws - DC series circuit – Inductors – Capacitors – Magnetism – Relays - Time constant for RC circuit - R.C. Differentiator - R.L.C. Series and parallel circuit – Semiconductor diodes – Transformer – Rectifiers - Zener diodes - Regulated power supply and Construction and Testing of transistors – Oscillators - Clipper Circuit / Clamper circuits – Introduction of Switch Mode Power Supply (SMPS), Uninterrupted Power Supply (UPS) and INVERTER.

Unit III: Power Electronic Components and Basic Gates, Combinational Circuits, and Flip Flops (20 Questions)
Construction of different power electronic components like Field Effect Transistor (FET) and their types, Silicon Controlled Rectifier (SCR), Triode for Alternating Current (TRIAC), Diode for Alternating Current (DIAC), Uni-Junction Transistor (UJT), Metal Oxide Semiconductor Field Effect transistor (MOSFET), Insulator Gate Bipolar Transistor (IGBT) – Assembling, testing and troubleshoot various digital logic gates, Combinational Circuits – Half adder, Full adder - Testing of flip flops types - Multiplexers & Demultiplexers

Unit IV: Computer Hardware MS Office, OS and Networking (20 Questions)
Cable and Connectors – installation , Configuration demonstration of basic blocks of computer - Hardware / Software - Switch mode power supply for PC - Hard disk drives - Different types of printers - Computer virus and protection - MS office application and its function – Internet / e-Mail - Computer network - Wi-Fi network – Study the library components available in the circuit simulation software.

Unit V: SMD Soldering and Desoldering, Surface Mount Technology (SMT) (20 Questions)
Identification, place the solder / desolder and test different Surface Mount Display (SMD) components - introduction of Surface Mount Technology (SMT), Programming Gate Array (PGA) packages, cold/continuity check of Printed Circuit Board (PCB), lose/dry solders, broken tracks on printed wiring assemblies - Rework on PCB – Necessity of protection devices Main Circuit Breaker (MCB), Earth leakage Circuit Breaker (ELCB) and Fuse - Testing of DC motor, Stepper motor.

Unit VI: Communication Electronics (20 Questions)
Assembling and Testing Commercial AM / FM receiver - Radio wave propagation - Types of modulation and demodulation - Types of radio receivers, Characteristics advantages and disadvantages - Introduction to AM, FM & PM, SSB-SC & DSB-SC - Block diagram of AM and FM transmitter - FM generation & detection - Digital modulation and de multiplexing techniques - Multiplexing and de multiplexing of Amplitude Modulation (AM) / Frequency Modulation (FM) / Pulse Amplitude Modulation (PAM) / Pulse Position Modulation (PPM) / Pulse Width Modulation (PWM) signals.

Unit VII: Microcontroller (8051) (20 Questions)
Test, Service and troubleshoot the various components of microcontroller (8051) - Introduction of Microprocessor and 8051 Microcontroller – Function of different ICs used in the Microcontroller Kit – Differentiate microcontroller with microprocessor – interfacing of memory to the microcontroller

– I/O port pin configuration – Register banks & their functioning. – SFRs & their configuration for different applications

Unit VIII: Sensors, Transducers Used in IOT Applications (20 Questions)
Execution the operation of different sensor, Identify and test various transducers of internet of Things IOT Applications - Different types of level sensors and their working – Thermocouple - Resistance Temperature Detectors (RTD) - Displacement Measurement using Linear Variable Differential Transformer (LVDT) - Proximity Sensors – IOT Applications :
Environmental, Smart Street Lighting and Smart Water & Waste Management - Role and Scope of IOT in Current and Future Market - Smart Objects, Wired - Cables, Hubs etc. Wireless - RFID, WiFi, Bluetooth etc - Different Functional Blocks of IOT Architecture.

Unit IX: Fiber Optic Communication, Digital Panel Meter, Solar System (20 Questions)
Preparation of fiber optic setup and execution transmission - Introduction to optical fiber, optical connection and various types optical amplifier, its advantages, properties of optic fiber, testing, losses, types of fiber optic cables and specifications – Encoding of light - Different types of seven segment displays, decoders and driver ICs - Principles of working of Liquid Crystal Display (LCD) – Use of Digital Panel Meter (DPM) with LCD to display different voltage & current signals – Working of Solar system - Solar Inverter.

Unit X: Cell Phones LCD and LED TV (20 Questions)
Identification, Operation of various controls troubleshoot and replace module of cell phone, Light Emitting Diode (LED) TV and LCD - Mobile Communication - Block Diagram and Features of Cell Phone – Cell phone Interfacing – Global System for Mobile (GSM) and Code-Division Multiple Access (CDMA) Technology – Difference between a conventional CTV with LCD & LED TVs – Principle of LCD and LED TV and function of its different section – Different types of interfaces like High Definition Multimedia Interface (HDMI), Universal Series Bus (USB), Red-Green-Blue (RGB) etc. TV Remote Control – Types, parts and functions.

20. Trade: Engineering Drawing and Draughtsman (Mechanical & Civil) (ITI Standard)

Code: 551

Unit I: Drawing Instruments and their Uses, Sheet Layout, Types of Lines, Lettering and Dimensioning (20 Questions)
Drawing Instruments - Drawing board - 'T' Square - Mini Drafter – Set square - Scales - Protractor - French curves - Large & Bow compass - Divider – Pencils - Erasing shield etc.
Layout of Drawing Sheets - Size of Drawing Sheets - Designation of Drawing Sheets - Method of Folding - Title Block.
Types of Lines and their Applications - Continuous Thick - Continuous Thin (Straight) - Continuous Thin Free Hand - Continuous Thin (Straight) with Zig–Zag - Dashed Thick -Dashed Thin-Chain Thin - Chain Thin, Thick At Ends & Changes of Direction - Chain Thick-Chain Thin Double Dashed.

Lettering - Single Stroke - Double Stroke (Vertical, Inclined) - Styles of Lettering - Standard Heights / Width - Lower Case Letters and Numerals - Uppercase Lettering as per BIS SP: 46-2003-Spacing of Letters.
Dimensioning - Types of Arrowhead- System of Dimensioning (Unidirectional, Aligned) - Functional Dimension – Non-functional Dimension - Auxiliary or Reference Dimension - Method of Dimensioning and Common Features.

Unit II: Geometrical Figures, Special Curves, Free Hand Sketching and Scales (25 Questions)
Angles: Acute angle-Right angle-Obtuse angle-Straight angle-Reflex angle- Adjacent angles-Complementary angles-Supplementary angle
Triangles: Equilateral - Isosceles - Scalene – Right angled triangle - Acute angled triangle - Obtuse angled triangle.
Quadrilaterals: Square, Rectangle, Rhombus, Rhomboid (Parallelogram) Trapezium, Trapezoid.
Polygons - Pentagon, Hexagon, Heptagon, Octagon, Nonagon, Decagon

Definition - Ellipse – Parabola – Hyperbola - Different Methods of Their Construction.
Definition - Method of Drawing Involutes - Cycloidal Curves - Helix and Spiral.
Methods of Free Hand Sketching. (Lines, Circle, Arc, Ellipse, Isometric, Oblique, Orthographic)
Different Types of Scales - Their Appropriate Uses - Principle of R.F – Plain – Diagonal - Comparative and Vernier Scales - Scale of Chords
Conventions – Materials – Metals – Glass - Packing and Insulating Materials – Liquid – Wood - Concrete etc.

Unit III: Orthographic Projection, Projection of Solids, Sections, Conventions and Section of Solids (20 Questions)

Orthographic Projection - First Angle and Third Angle Projection - Principle of Orthographic Projection - Concept - Axes - Plane and Quadrant –Concept of First Angle and Third Angle Projection and its Difference.

Projection of Solids – Cube – Cuboid – Prism – Pyramids - Cylinder - Cone– Sphere and their Frustum.

Types of Sectional Views and their Uses - Cutting Plane and its Representation - Parts not shown in Section - Conventional Signs – Symbols - Abbreviations.

Section – Section Planes – True Shape of a Section

Unit IV: Hatching Techniques in Sectional View, Assembly View and Development of Surfaces (20 Questions)

Hatching Techniques: Hatching Angle - Hatching Assemblies - Hatching Large Areas - Hatching Areas in Different Parallel Planes - Dimensioning with in the Hatched Area - Thin Sections - Omission of Hatching Lines.

Sectional View: Full Section - Half Section - Offset Section – Auxiliary Section in Continuous Planes - Section in Two Intersecting Planes - Revolved Section - Removed Section - Local or Broken / Partial Section.

Definition - Development - Its Need in Industry - Different Methods of Developing the Surfaces - Development of Surfaces Bounded by Plane of Revolution Intersecting each other - Development of an Oblique Cone with Elliptical base - Calculation of Developed Lengths of Geometrical Solids.

Unit V: Isometric Projection and Oblique Projection (10 Questions)

Principle of Isometric Projection and Isometric drawing - Methods of Isometric Projection – Dimensioning - Isometric Scale - Difference between Isometric Drawing and Isometric Projection.

Principles of Making Orthographic views from Isometric drawing - Selection of views for Construction of Orthographic drawings for clear Description of the Object.

Principle and Types of Oblique Projection - Advantage of Oblique Projection over Isometric Projection

Unit VI: Screw Threads, Bolts, Nuts, Washers, Screws, Locking Devices and Foundation Bolts (30 Questions)

Screw Thread: Nomenclature – Proportion and their Uses - External Thread - Internal Thread - Convention of Internal and External Threads - Right Hand and Left Hand Thread – Single/ Multiple Start Threads –‘ V’ Threads – British Standard Whitworth Thread (BSW) - British Standard Fine (BSF) Threads -British Association - Metric - Unified – Sellers - Square - Acme - Buttress Threads

Types of Bolts: Hexagonal -Square head - Cylindrical or Cheese head - Cup head or round head - Hook - Eye - Lifting eye - Counter sunk head - Cap screw or tap bolt.

Types of Nuts: Hexagonal - Square - Collared - Cap -Dome - Capstan or Cylindrical - Ring nut.

Types of Washer: Plain – Chamfered - Spring Washer.

Types of Screws: Flat - Cone - Half dog - Full dog - Cup - Conical Point.

Locking Devices: Spilt Pin - Slotted Nut - Castle Nut - Sawn Nut or Wipes Nut - Simmond Lock Nut – Penn Ring or Grooved Nut.

Foundation Bolt: Eye - Rag - Lewis - Cotter Foundation Bolt.

Unit VII: Rivets, Riveted Joints, Welded Joints, Weld Symbols, Pipe Joints and Carpentry Joints (25 Questions)

Rivets: Snap - Ellipsoid - Pan - Conical - Counter Sunk (Flat / Rounded) - Steeple Head.

Riveted Joints: Lap Joint – Single Riveted -Double Riveted (Chain) - Double Riveted (Zig - Zag) Lap Joint - Butt Joint - Single Riveted (Single Strap) - Single Riveted (Double Strap) Butt Joint - Double Riveted (Single Strap/Double Strap) (Chain/ (Zig - Zag)) Butt Joint

Welded Joint & Symbols: Butt Joint: Square Butt - Bevel Groove – V/J/U (Single/Double) - Flare V Groove Weld. Corner Joint: Fillet - Spot -Square Groove Or Butt – V / U /J Groove - Bevel Groove – Flare V Groove – Edge - Corner Flange Weld – **T Joint:** Fillet - Plug - Slot - Bevel Groove - J Groove – Flare Bevel Groove - Melt Through Weld. **Lap Joint:** Fillet Weld - Bevel - J Groove - Plug - Slot - Spot - Flare Bevel Groove Weld. **Edge Joint:** Square Groove or Butt - Bevel Groove - V / J / U Groove Weld - Edge Flange Weld - Corner Flange Weld.

Pipe Joints: Screwed pipe - Welded pipe - Flanged pipe(Integral / Screwed)- Glued pipe or Cemented - Soldered pipe joint - Pipe Fittings - Coupler- Reducer coupler- 90° elbow - 90° Reducer elbow - 90° bend - Return bend - Tee - Reducer Tee - Cross - Close Nipple - Short Nipple - Short Nipple with Hexagonal grip - Hose nipple - Male plug - Female plug - Screwed Union – Flange - Piping Layout - Single line isometric layout - Double line isometric layout - Single line Orthographic layout - Double line Orthographic layout.

Carpentry Joints: Mortise and Tennon – Butt – Dove Tail –Tongue and Groove – Dowel – Mitre - Half Lap - Spline – Lap – Bridle Joint.

Unit VIII: Electrical, Electronics and Network Components, Layout, Circuit and Block Diagram (20 Questions)

Electrical Components: Fire alarm - Geyser - Thermostats - Electric Iron - Automatic electric Iron - Electric bell - Electric buzzer - Electric heater - Heater plate - Electric stove - Hotplate - Micro oven.

Electrical wiring diagram and Layout diagram: Layout arrangement of DC Generator control panel - Compound motor layout arrangement - 3 phase squirrel cage motor - Automatic voltage regulation - Connections of 3 phase alternator with load - Connection diagram of auto transformer starter - Wiring diagram of a direct online starter with protective devices – Pipe / Plate earthing.

Electrical circuit diagram: Three phase switching circuit diagram - Three phasing squirrel cage motor - circuit diagram - Circuit diagram controlling by MCB - Schematic diagram of two point and three point starters.

Block diagram of Instruments and Equipment: Block diagram of invertor - ON line UPS - OFF line UPS - Block diagram of DSO - Block diagram of Function generator.

Electronics Components: Carbon composition - Metal Film - Metal Oxide - Radial Leads - Precision Resistor - Metal film Resistor - Network Resistor - Low ohm metal Flim Resistor - Integrated Resistor - Capacitor.

Electronics Wiring diagram and layout diagram: SPV system and solar charge controller – Stand alone system - Hybrid system - Grid connected system - Single Phase UPS system - SMPS in DVD player - SMPS in home theatre main board - SMPS in cell phone charger - SMPS in LED TV - SMPS in LCD monitor.

Electronics circuit diagram: Different schematic of LED drivers - Composite video signal - TV signal spectrum - Buck converter - Function of SMPS in PC - Un interruptible power supply (UPS) - IC based AM Transmitter.

Electronics Block diagram: Fly back converter type SMPS - Forward converter type SMPS - Online UPS using pic micro controller - Online UPS - OFF line UPS - CDMA system - Features of cell phone system - Television broadcasting system - B/W TV receiver system - LED back light and driver system - LED TV system - DSO system - Generator using IC 8038 system - FM Receiver system - micro controller IC 8051 system.

Network Components and Internet topologies: Network Components – Modems – Firewall – Hubs – Bridges – Routers – Gateways – Repeaters – Transceivers – Switches - Access point – Types.

Network Topologies – Star – Ring – Bus – Tree – Mesh - Hybrid - Type of Networks – Local Area Networks (LAN) - Metropolitan Area Networks (MAN) - Personal Area Network (PAN) - Controller Area Network (CAN) - Wide Area Networks (WAN) – Internet – Ethernet - Wi-Fi – Bluetooth - Mobile Networking - Wire and wireless Networking.

Unit IX: Mechanical, Automobile, RAC Components, Layout, Circuit and Block Diagram (20 Questions)

Mechanical symbols : Bulb indicator - Cruise control indicator - Traction control indicator - Stability control indicator - Center differential lock - Proximity sensor indicator - Econ indicator - Electric power steering indicator - Glow plug indicator - Check engine light – Seat belt indicator - Airbag indicator - ABS indicator - Temperature warning - Oil level / pressure warning - Electrical system warning - Transmission warning light - Tire pressure monitoring system - High beam indicator - Manual general - Push button - Foot pedal - Spring return - Spring centered - Plunger - Roller operated - Hydraulic direct actuation - Hydraulic pilot actuation - Pneumatic direct actuation - Electrical - Battery - Generator - Resistance - Coil with core - Contact breaker - Fuse - Bulb - Earth - Heavy duty switches - Rheostat - Induction coil - Condenser - Wire crossed - Ammeter - Motor - Switch - Coil - Spark gap - Rectifier - Wire joint - Voltmeter.

Components used in Automobile: Flat type rim - Drop center rim - Wheel construction - Wire spoke wheels - Tube Tyre - Tubeless tyre - Disc wheel - Wire wheel - Split wheel - Drum brake - Disc brake - Spiral bevel gears - Herring bone gears - Spur gears - Helical gears - Rack and pinion - Worm gears – Multi plate clutch - Ignition coil - Distributor - Steering gear box - Traction battery pack - DC converter - Electric motor - Charge port - Controller - Auxiliary batteries - Engines use spark plug with tapered seats.

Wiring diagram and layout diagram used in Automobile: Wind shield wiper motor wiring diagram - Twin horn circuit - Construction Electric horn - Mechanical brakes - Vacuum assisted power brakes - Vacuum suspended power brakes - Wiring diagram of Electronic flasher - Electric car wiring diagram - Lighting system - Horn circuit connection.

Circuit diagram used in Automobile:
Twin - horn circuit - Distributor less ignition system - Flasher circuit - Automotive electric system - Description of starting circuit - Alternator charging circuit - Construction of solenoid switch - The circuit for electric operation of a rear passenger window - Central door locking circuit.

Block diagram used in Automobile:
Electronic power steering system - Dual air bag arrangement with one HCV front and two HCV rear -

TCS block diagram - Block diagram of an electric car - Block diagram of an electric vehicle with V2G - Block diagram of a typical plug in electric vehicle PEV system - EV power train block diagram - 3 speed automatic gearbox with electro hydraulic control - shift pressure controls - Block diagram of electronic automatic gear box control - Engine immobilizer system diagram.

Wiring diagram and layout diagram used in RAC:
Wiring diagram of water cooler - Wiring diagram of Upright freezer - Single Phase wiring circuit - 3 phase wiring circuit - Wiring diagram of Walk in cooler - Hot gas defrosting - Ozonisation of cooling tower water - wiring circuit of cold storage plant - Circuit diagram of a cold storage with air cooled condenser and 3 compressor motor and all interlocking controls - Typical wiring diagram of Air cooled self contained unit - Motor control with protective device - Condenser water pump - Control power to the cooling tower fan starter - Electric over load (over current protector) Car AC wiring circuit - Location of heat exchanger - Fake ice maker machine - System pressure test by dry nitrogen - System with charging connection near king valve.

Circuit diagram used in RAC:
Two speed motor control capacity control - Schematic electrical power circuit for a ice plant (3 phase) - Schematic electrical control circuit for a ice plant (Single phase) - Three wire control of a magnetic contactor type on line starter - Basic refrigeration cycle in a VRV/VRF system - Refrigeration cycle cooling of VRV/VEF - Heating cycle of heat pump VRF/VRV - Heat recovery VRF - Refrigeration system with liquid cooler and water cooled condenser - Wiring diagram of circuit for upright freezer.

Block diagram used in RAC: Problem tree of brine leak in ice plant - Block diagram of VRV/VRF - Block diagram of Digital Oscilloscope - Functional block diagram of Ionization Vaccum Gauge - Block diagram of Digital speed Tachometer.

UNIT X: Computer Aided Drafting (10 Questions)

Computer basics - Windows operating system - file management system - Computer hardware and software specification - installation of application software.

CAD - Advantages of using CAD - CAD main Menu - screen menu - command line - model space, - layout space - Drawing layouts - Tool bars - File creation – Save - Open existing drawings - creation of Drawing Sheet as per ISO.

Absolute Co-ordinate system - Polar Co-ordinate System - Relative Co-ordinate System – Draw tools -Create Line.

Draw commands - Line – polyline – ray – polygon – circle – rectangle – arc – ellipse - using different options.

Modify commands – Trim – Offset – Fillet – Chamfer – Break – Erase - using different options

Move – Copy – Array - Insert Block - Make Block – Scale – Rotate – Hatch - Commands.

Creating templates - Inserting drawings – Layers - Modify Layers.

Format dimension style - Creating new dimension style - Modifying styles in dimensioning - Writing text on dimension line and on leader - Edit text dimension.

Shortcut keyboard commands - Customization of keyboard command - Customization of drafting settings - Changing orthographic snap to isometric snap.

Procedure to create viewport in layout space in zooming scale.

3D modelling - 3D primitives (viz. box, sphere, cylinder, mesh and poly-solids), solid figure – extrude - revolve - sweep and loft command - solid editing – fillet – offset – taper - shell and slice command. Setting of User co-ordinate Systems – Rotating - Print preview and Plotting.

21. Trade: Fire Technology and Industrial Safety Management

(ITI Standard)

Code: 610

Unit I: Discipline, Fire Science and Fire Behaviour (25 Questions)

Discipline: Importance of discipline, General Principles of Discipline, Essentials for Discipline and Outward Signs, Meaning and Definitions of Discipline.

Basic Physics and Chemistry Related to Fire: Definition of Matter and Energy – Physical Properties of Matter Including Density, Specific Gravity, Relative Density, Vapour Density, Melting Point, Boiling Point, Latent Heat and Flammable Limits – Effects of Density on The Behaviour of Gases and Vapours – Basics of Oxidizing and Reducing Agents and Acids – Flammable Liquids Including Classification and Types of Storage Tanks – Dust and Dust Explosion Phenomena – Liquid and Gas Fires Including LPG – Fire and Explosion Phenomena such as UVCE, BLEVE, Slop–Over and Boil–Over – Basic Gas Laws and P–V–T Relationship for a Perfect Gas.

Anatomy of Fire: Definition of Combustion, Elements of Combustion, Products of Combustion, Heat of Reaction and Calorific Value, Flash Point, Fire Point, Ignition Temperature and Spontaneous Combustion – Fire Triangle, Tetrahedron and Pyramid – Sources of Heat (Chemical, Mechanical, Electrical and Nuclear) – Classification of Fire and Methods of Fire Extinguishment – Oxygen and its Effects on Combustion – Modes of Heat Transfer (Conduction, Convection and Radiation).

Unit II: Fire Extinguishers, Foam and Foam Equipments (25 Questions)

Classification of Fire and Extinguishers: Types of Extinguishers as per Indian Standards and NFPA Codes – Maintenance and Methods of Operation – Techniques of Fire Extinction—Smothering, Cooling and Starvation – Halon and its Detrimental Effect on the Environment – Alternatives to Halon – Introduction and Function of Fire Extinguishing Balls and Automatic Modular Fire Extinguishers – Types of Fire Extinguishing Agents – Rating System for Portable Fire Extinguishers – Limitations of Fire Extinguishers – Inspection Requirements.

Foam and Foam–Making Equipment: Water as an Extinguishing Agent Including its Merits, Demerits and Modifications – Introduction to Types of Foam Concentrates – Properties of Foam and Techniques of Extinguishment – Types of Foam – Characteristics of Good Foam – Foam–Making Equipment—Mechanical, Low–Expansion and High–Expansion Foam – Storage of Foam Compounds – Dry Chemical Powder—Types and Applications – Carbon Dioxide as an Extinguishing Agent – Methods of High–Expansion Foam Generation and Special Uses – Methods of Foam Application.

Unit III: Hose and its fittings, Hydraulics, Hydrant and its fittings (25 Questions)

Hose and Hose Fittings: Types and Construction of Suction and Delivery Hoses – Hose Reels – Causes of Hose Decay – Care and Maintenance – Marking of Hoses – Hose Repair Methods – Standard Tests for Delivery Hoses – Definition and Classification of Hose Fittings – Types and Construction of Suction Strainers – Monitors and Water–cum–Foam Monitors – Nozzles and Branch Pipes/Holders – Collecting Heads and Suction Hoses – Special Fittings Including Frost Valves, Deep–Lift Suction Fittings, Breechings, Adaptors, Blank Caps and Suction Reduction Pieces – Hose Ramps – Care and Maintenance of Hose Fittings – Types of Fire Streams Including Solid Stream and Special–Purpose Streams.

Hydraulics: Pressure and Head – Pressure and Flow – Mensuration – Nozzle Discharge – Calculation of Water Capacity of Tanks – Water Requirement for Specific Fire Sizes – Composition of Water – Atmospheric Pressure – Weight and Capacity of Water per Cubic Foot – Practical and

Theoretical Suction Lift – Friction Loss and Water Hammer.

Hydrant and Fittings: Introduction to Hydrants and Water Supplies – Hydrant Gears and Equipment – Marking, Testing, Care, Maintenance and Operation – Sources of Water Supply – Water Distribution Systems – Rural Water Supply – Determination of Static, Residual and Flow Pressure.

Unit IV: Pumps, Appliances and Fire Service Equipment (25 Questions)

Pump and Pump Operation: Classification of Common Pumps in Use – Methods of Priming – Testing and Fault–Finding – Care and Maintenance and Standard Tests – Introduction to Centrifugal Pumps – Advantages and Disadvantages of Centrifugal Pumps – Importance of Atmospheric Pressure – Cooling Systems.

Water Tender and Special Appliances: Introduction and Description of Rescue/Emergency Tender, CO2 Tender, DCP Tender, Hose–Laying Lorry, Water Bowser and High–Pressure Pumps – Types and Operation of Foam Tender, Multipurpose Fire Tender, Crash Fire Tender and Hydraulic Elevated Platform.

Ropes and Lines: Construction and Fibres Used – Rope Materials (Natural and Synthetic) and Characteristics – Methods of Rope Construction – Types and Uses of Lines – Causes of Deterioration – Inspection and Testing – Care and Maintenance – Standard Knots and their Uses.

Small and Special Gears: Function and Construction of General Tools – Breaking–in and Cutting Tools – Pulley Blocks – Lighting Equipment – Lifting and Rescue Tools – Operation of Hydraulically, Diesel–Operated and Electrically Operated Tools – Care and Maintenance.

Ladders: Introduction – Types of Ladders – Construction Features of Conventional Ladders (Terminology and Parts) – Operational Use – Elementary Knowledge of Turntable Ladders and Snorkels – Ladder Pitching and Climbing Methods – Arm–Hold and Leg–Lock Techniques (As per Bureau of Indian Standards).

Unit V: Fixed Fire Protection and Detection Systems (15 Questions)

Fixed Fire Fighting Installations: Introduction to Sprinkler Systems Including Operation, Care and Maintenance – Elementary Requirements of Drenchers, Rising Mains, Hose Reels, Down–Comers and Fire Pump Control Panels – Types of Fixed Fire–Fighting Installations—Water–Based and Non–Water–Based Systems – Fixed Foam Installations Including Foam Pourers and Foam Makers – High–Velocity Water Spray (HVWS) And Medium–Velocity Water Spray (MVWS) Systems – Total Flooding Systems such as CO2, FM–200, Novec–1230, Etc.

Automatic Fire Detection–cum–Alarm System: Introduction to Types of Detectors—Smoke, Heat and Flame/Gas Detectors – Operating Principles – Fire Detection and Alarm (FDA) Panel – Manual Call Points (MCP) – Public Address (PA) System with Talk–Back Facility.

Unit VI: Building Construction, Means of Escape and Smoke Control (10 Questions)

Building Construction: Introduction and Importance of Building Construction under Fire Situation – Classification of Buildings as per NBC 2016 – Building Materials and their Behaviour under Fire Conditions – Effects of Fire on Structural Elements and Signs of Building Collapse – Types of Occupancies and Associated Fire Hazards – Firefighting Techniques Based on Occupancy – Importance and Positioning of Fire Escapes and Means of Egress – Smoke Management and Role of HVAC Systems During Fire – Fire Safety Construction Requirements and Firefighting Provisions as per NBC 2016 Part 4 – Fire and Life Safety (Volume II).

Means of Escape: Classification of Escape Routes with Reference to NBC – Fire Exit Drills –

Definition of Fire Exits – Places of Relative Safety and Ultimate Safety – Exit width Requirements and Calculations.

Unit VII: Rescue, Salvage and Disaster Management (10 Questions)

Rescue Techniques: Rescue Techniques from Lifts, Sewers, Collapsed Buildings, Motor Vehicle Accidents, Wells and Rivers – Special Equipment and Training Requirements for Rescue Operations – Hazards Associated with Rescue Operations – Search of Burning Structures – Extrication from Motor Vehicles and Machinery – Specialized Rescue Situations and Tools.

Salvage Operations: Introduction to Salvage Operations – Equipment and Tools Used – Working Procedures at Fires – Safety Considerations During Salvage.

Disaster Management: Natural and Man–Made Disasters – Disaster Preparedness – Role of Various Agencies and First Responders – Control of Situations Using the Incident Command System (ICS), Incident Response System (IRS) and Joint Response Teams (JRT) – Disaster Classification, Significance, Causes, Effects and Mitigation Measures.

Unit VIII: Fire Service Administration, Operations and Special Fires and Fire fighting (20 Questions)

Fire Service Administration: Fire Service Organization – Executive Duties of the Officer–in–charge of a Fire Station – Administrative Duties Including Report Writing, Occurrence Book, Hose Card/Register, Fire Reports, Workshop Orders, Log Books, Stock Registers, Orderly Room Registers, Defaulter Register, Leave Register and Station Discipline.

Firemanship: Qualities and Duties of a Fireman at the Station and on the Fire Ground – Duties en Route to the Fire Scene, During Operations and after Returning from a Fire Call.

Watch Room Procedure and Mobilizing: Identification of Communication Requirements in the Fire Service – Layout of Watch Room, Control Room, Equipment Station Ground, Turnout Area, Topography and Telephone Call Areas – Use of Mobilizing Boards and Maps – Introduction to Communication Lines and Equipment – Radio Communication and VHF Sets – Method of Receiving Emergency Reports.

Rural Fire: Fire Hazards in Rural Areas and their Causes – Firefighting Methods for Haystacks and other Rural Structures – Special Appliances and Equipment – Challenges in Controlling Rural Fires.

Water Relay Operations: Types of Water Relay Systems – Water Distribution System – Advantages and Disadvantages – Calculation of Hose Lengths and Spacing of Intermediate Pumps – Key Points for Relay Operations – Study of Gauges.

Aircraft Fire and Rescue: Common Terminology Including Ejection Seats – Fire Hazards in Aircraft and Action Required for Rescue and Firefighting – Resources for Firefighting at Airports – Types of Aircraft – Aircraft Firefighting and Rescue Procedures – Types of Emergencies and Methods of Dealing with each Emergency – Hangars—Types, Fire Protection and Firefighting.

Ship Fires: Elementary Knowledge of Ship Fire Protection and Firefighting – Rescue From Ships – Risks and Firefighting on Ships – Types of Shipboard Emergencies – Dock Fires – Fire Protection of Jetties.

Unit IX: Electrical Safety, Industrial Safety, Engineering Safety, Construction Safety, Occupational Hazards and PPE (30 Questions)

Electricity: Fundamentals of Electricity – Generation and Distribution – Common Causes of Electrical

Fires and Remedial Measures – Electrical Hazards Including Static Electricity and Protective Measures – Firefighting Procedures – Elementary Knowledge of Fire Protection in Different Premises – Electrocution – Electrical Safety in Non–Industrial Installations, Industrial Installations and Mines – Hazardous Area Classification and Use of Electrical Equipment in Hazardous Areas – Case Studies.

Safety Concept: Introduction to Safety Management – Safety Policy – Safety Committee – Management Responsibilities – Duties of Safety Officers – Safety Targets, Objectives, Standards, Practices and Performance

Accidents: Definition and Classification of Industrial Accidents – Accident Analysis and Prevention Objectives – Accident Reports – Methods of Accident Reduction – Investigation and Analysis – Causes and Costs of Accidents – Accident Prevention Techniques – Safety Slogans and Precautions.

Working at Height and Confined Space: Safety Precautions Related to Scaffolds and Ladders – Work at Height Including Roof Work – Fall Arrestors – Confined Space Hazards – Work Permit System – Excavation Safety

Material Handling: Safety Related to Mechanical and Manual Material Handling – Lifting Appliances – Transport, Earthmoving and Material–Handling Equipment Including Cranes, Forklifts, Hoists and Conveyors.

Safety in Engineering Industries: Safety in the Use of Machines – Precautions while using Hand Tools and Power Tools – Selection, Care and Maintenance of Tools – Types of Machine Guarding.

Construction Industry: General Safety Provisions Related to the Construction Industry – Safety in the use of Construction Machinery – Safe Access and Egress for Normal and Emergency Situations – Importance of Good Housekeeping in Accident Prevention and Rescue Operations.

Hazard and Risk: Causes, Identification, Evaluation and Control – HAZOP and HIRA – Sources of Information for Hazard Evaluation – Risk Analysis with Special Reference to Confined Spaces.

Occupational Hazards and Dangerous Chemicals: Occupational Health Hazards and Dangerous Properties of Chemicals – Dusts, Gases, Fumes, Mists, Vapours, Smoke and Aerosols – Threshold Limit Values (Tlvs) – Classification of Hazards – Hazchem Codes – Chemical Accidents—Sources and Causes – Transportation Risks by Rail and Road – Emergency Management for Release or Leakage of Gases and Chemicals.

Hazardous Chemicals: Dangerous Chemicals and Substances – Transportation and Handling of Hazardous Chemicals and Explosives – Storage of Hazardous Chemicals – Fire Safety and Firefighting – Interpretation and Use of MSDS – Chemical Labelling.

Personal Protective Equipment (PPE): Need for PPE – Selection, Proper Use, Care and Maintenance – Types of PPE Including Respiratory and Non–Respiratory Protection – Head, Ear, Face, Eye, Hand, Foot and Body Protection – Applicable Standards and Regulations.

Unit X: Safety Legislation, First Aid, Workplace Environment and Best Practices (15 Questions)

Safety, Health and Environment Legislation: Factories Act 1948 (Amended) and Relevant Statutory Rules—Health, Safety and Welfare Provisions – Workmen Compensation Act – ESI Act – Contract Labour Act – Indian Boiler Act – Static And Mobile Pressure Vessel Rules – BOCW Act – Introduction to Fire and Safety Audit.

First Aid: Definition of First Aid – Qualities of a First Aider – Shock, Asphyxia, Wounds and Haemorrhage—Signs, Symptoms and Management – Burns, Scalds and Frostbite – Fractures, Sprains and Dislocations – Snakebite—Signs, Symptoms and First–Aid Treatment.

Resuscitation: Meaning and Scope of Artificial Respiration – Methods of Resuscitation Including Holger–Nielsen, Silvester, Shepherd, Mouth–to–Mouth and Nose–to–Mouth –Introduction to Cardiopulmonary Resuscitation (CPR) as a Distinct Method.

Housekeeping and Waste Disposal: Principles of Good Housekeeping and Maintenance – Safe Disposal of Waste Materials – Japanese 5S Concept.

Lighting, Ventilation and Work–Related Stress: Introduction to Lighting and Ventilation – Concepts of Luminous Flux and Illuminance (Difference between Lumen and Lux) – Noise and Vibration – Measurement, Assessment and Management of Work–Related Stress Including Heat and Cold Stress.

22. Trade - Fitter

(ITI Standard)

Code: 436

Unit I: Safety and Its Important (10 Questions)
Safety and General Precautions in Industry/Shop floor - Personal Productive Equipments (PPE) - First Aid**–** Operations of Electrical Mains - Disposal of Waste Materials- Occupational Safety and Health– Safety Signs – Response to Emergencies – Importance of House Keeping – Material Handling - Lifting and Handling Loads – Moving Heavy Equipments.

Unit II: Basic Fitting (30 Questions)
Linear Measurement – Base unit of linear measurement, System of units of measurement, Multiples of a Metre and their values. Steel Rule - Purpose of steel rule, Types, precautions to be followed while using steel rule.
Marking Instruments – Feature , uses and type of Scriber , Caliper, Punches, Hammer , "V" Block , Try Square - Bevel Gauge , Bevel Protractor, Combination Set, Surface Gauge , Surface Plate , Angle Plate.
Cutting Tools – Hack Saw Frames, Hacksaw Blades, Files and Special files types and specification, Cold chisel and types, Power Saws, Drilling Machines, Drilling Operations, Drills, Taps, Dies, Tap drill size and Blank Size calculation.
Grinding – Grinding Machines, Grinding Wheel Specification, Loading, Glazzing, Dressing and Truing.
Work holding Devices – Bench Vice, Machine Vice, Clamps and Strap.
Tool Holding Devices – Drill Chuck & Key, Tapper Sleeve & Sockets, Tap Wrench, Die Stock.
Precision Measuring Instruments – construction, Least Count, Graduation and types of Vernier Caliper, Micro Metre, Vernier Micrometer, Screw thread Micrometer, Vernier Bevel Protractor, Dial Caliper, Dial test indicator and camparator.

Unit III: Sheet Metal Work (20 Questions)
Safety in sheet metal work shop - Metal sheets and their uses – Hand lever shear – Sheet metal Tools, Different shear operation - Rivet & Riveting - Solder & Soldering.

Unit IV: Welding (20 Questions)
Safety in welding shop - Welding Hand Tools – Gas Welding Equipments and Process – Setting of Parameter for Arc welding Machines – Oxy – Acetylene cutting Equipments – Arc welding defects and Testing – Types of Joints – Selection and Storage of Electrodes.

Unit V: Limit, Fit, Tolerance and Interchangeabilty (10 Questions)
Necessity of Interchangeability – Standard System of Limit and Fits Terminology – Fits and Classification as per Indian Standard – BIS system of Limits and Fits reading the standard chart – Hole and Shaft basis system of Limit and Fit.

Unit VI: Turning (20 Questions)
Safety while working on Lathes – Lathe Main Parts – Feed & Thread cutting Mechanism – Methods

of Holding Jobs – Different Lathe Operations – Lathe Tool and its Nomenclature – Tool Selection – Lathe cutting speed and Feed – Use of Cutting fluid (Coolant) and Properties.

Unit VII: Basic Maintenance, Erection and Testing Of Machineries (20 Questions)
Total Productive Maintenance – Routine Maintenance – Break down Maintenance & Preventive Maintenance - Installation of Machinery – Foundation bolts and types – Sling Load for Shifting – Erection Tools and Techniques – Fork Lift and Pallet Truck - Lubricant and its Properties – Types of Lubrication - Different Methods of Lubrication.
Repair Technique – Power Transmission Elements and its types, application and Uses (Gear, Belt and Pulley, Coupling, Chain and Sproket, Clutches, Bearing and bearing metals – Velocity Ratio calculation in Gear and Belt and chain drive.

Unit VIII: Metals: Metal & Non Metal (20 Questions)
Ferrous Metal Manufacturing process and properties (Pig Iron , Cast Iron , Wrought Iron and Steel) – Non - Ferrous Metal properties and uses (Aluminium , Lead , Tin Copper , Zinc and their Alloys) – Heat Treatment – Structure of steels – Annealing – Normalizing - Hardening – Tempering – Different methods of Surface hardening - Prevention of Rust and Corrosion - Galvanizing , Electro Plating , Cladding , Metal Spraying and Cementation.

Unit IX: Assembling (30 Questions)
Locking Devices – Screws, Bolt and Nuts, Keys, Cotters, Split Pin, Screw Driver, Spanners, Power Tools.
Gauges and Template – Radius gauge , Screw Pitch gauge , Drill Gauge , Centre gauge , Feeler gauge , Wire gauge , Telescopic gauge.
Limit Gauges – Principle of 'Go' and 'No-GO' - Plug gauge, Snap gauge, Ring gauge, Taper gauge.
Sine bar and Slip gauge – Principle, uses, application and Taper calculation.
Finishing Process – Lapping, Honing, Frosting and Scrapping – Application and Methods.
Jig and Fixtures – Construction, Types and its accessories – Advantages and Disadvantages.
Inspection – Visual inspection, Quality Standard, Quality control inspection.

Unit X: Hydraulics and Pneumatics (20 Questions)
Hydraulics – Safety precautions – Symbols – Filters – Pumps – Cylinders – Flow control Valves – Tube and pipe assembly – application and common maintenance of hydraulic.
Pneumatics – Safety Precautions – Symbols – FRL Unit – Actuator – Cylinder – Types of pneumatic valve – Air compressor parts and function – Electro pneumatic system - application and common maintenance of pneumatic.
Pipe and Pipe fittings – Pipe fitting Tools, Symbols , Standard pipe fitting accessories , Pipe thread , Pipe die and Tap , Repair and maintenance of Water Tap.

23. Trade - Industrial Robotics and Digital Manufacturing Technician

(ITI Standard)

Code: 538

Unit I: General Safety Precautions and First Aid (15 Questions)
Safety and General Precautions – First Aid – PPEs – 5s – Occupational Safety and health – Fire Extinquishers-Safety Signs – Response to Emergencies safe use of tools and equipments.

Unit II: Customer Needs and Product Specifications (10 Questions)
Customer needs and Specifications – Product Design Development – Customer Relationship Management-Prepare check list of customers needs-Products Specifications.

Unit III: Knowledge of Industrial Engineering Drawing and Requirements (15 Questions)
GD & Symbol on Engineering Drawing – Concept of Limits Fits tolerances & Symbols – Reading of Industrial Drawing – Customer Specific Requirements-Checklist of Dimensions-Importance of Interchangeability and ISO standards.

Unit IV: Various Types of Industrial Robots and Perform Their Configuration, Robotic Cell Components and Application of Tools, Installation of Robot, Power on the Robot and Making the Cell (25 Questions)
Application of Industrial Robot – Various types of Robots – Different Configurations of Robots – Robotic cell Components – Types of Sensors used in Industrial Robot – Install and Inspect Mechanical and Electrical Connections – Robot Structure and Functions of Robot System and Additional Equipments – Starting up and Shutdown steps Robot – Concept of Robotic cell Health-Importance of Robots in Manufacturing and – Production Industrial Case Studies of Customization and Trending Application Robot in Industry-Safety Measures of industrial Robots – Physical Grouting of Robot and other Peripheral Devices.

Unit V: Run Operations with Teach Pendent Key Functions and User Interface for Teach Pendant. (30 Questions)
Function of the Front and Back of the Teach Pendant-Tool Coordinate System – User Interface of the Teach Pendant – Different touch Pendant Function Keys – Types of Mode - Types of Motion.

Unit VI: Industrial Robot Simulation / Software, Industrial Need to Create a Program with Help of Robotic Simulation Software. (25 Questions)
Robot components and creating new model in Simulation Position, Variation in Robots – Robot axis Movement – Cycle time and its importance – Importance of tool path optimization Techniques-Calculate the Productivity and Machining cost of Operation-Create Welding and Pick and place program with help of Simulation Software and Compare the Tool Path with manual Program-Various types Communication interface available in Robot Simulation Software-Basic Components of Robots and its Functions-Operator Job In Robot Cell – Safety Consideration-Create the Welding Program and Pick and Place Program in Simulation Software.

Unit VII: Robotic Coordinate System (15 Questions)
Co-Ordinate system by multiple motion movements, Types of Coordinate System-X,Y,Z Coordinate System-Axis System of Robots-Type of Joints in Robot.

Unit VIII: Application of Tools and Components, Architecture of Welding Robot System - Establish Communication with PLC and Assemble Welding Torch for Operation (25 Questions)
Application based modification in Robotic cell Components – Assembling of Gripper to Manipulator, Resolve the Incorporate programming, Pendant & alarm resolution, Parameters setting of application based controllers – PLC and Robot Communication for Communicate with HMI – Loop control instructions – Power source connection with Robot controller-Selection Welding Tool Robot- End effector and their Functions.

Unit IX: Read existing Program and Execution Techniques operation of Industrial Robots, Following the safety procedure for Programmer. (25 Questions)
Different connections of Grippers – Pick and Place Program with help of Gripper – Hand Instruction in Robot-Different Motion Parameters – Program and Execution Techniques – Operation of Industrial Robots-Safety Procedure for Programmer – Welding Parameters Settings, Concept of Industry 4.0 - Remote Monitoring and Connectivity of Industrial Robot.

Unit X: Preventive Maintenance and Basic Trouble Shooting. (15 Questions)
Preventive Maintenance plan – Standard Operating Procedure-Inspect Weld wire and replacing of Weld wire-Verifying the Welding Gas-Use of Tool Kit used for Robotics Preventive Maintenance & basic Trouble Shoot-Verify all the safety Sensors.

24. Trade - Information and Communication Technology System Maintenance (ITI Standard)

Code: 537

Unit I: Basic Electrical and Passive Components (25 Questions)

Safety Precaution – First Aid – Basic Electrical Components – Classification of Measuring Instruments – Measurement of Current, Voltage, Resistance and Power – Soldering and Desoldering – Types and Classifications of Resistors, Inductors, Capacitors, Transformers – Working principles and Applications - Verification of Ohm's Law and Kirchhoff's Laws – Resonance

Unit II: Active Components (30 Questions)

Types of Semi-Conductors, Diodes and Characteristics working principles and application – Types of Rectifiers and Filters working principles and application– Zener Diodes Characteristics and Voltage Regulation working principles and application – Types and Classification of Transistors – Characteristics and Configurations – Working principles and application - Types of Biasing and amplifiers - Working principles and application – Types of Field Effect Transistor (FET) – Uni-Junction Transistor (UJT), Silicon Controlled Rectifier (SCR), Triode for Alternating Current (TRIAC), Diode for Alternating Current (DIAC) working principles and application.

Unit III: Power Supply, Logic Circuits and CRO (35 Questions)

Power Supply – Fixed and Variable – Inverters and converters working principles and application – Uninterruptible Power Supply (UPS) – Types working principles and applications – Cells and Battery Types and its Classification – Construction and Applications - Number system and conversion. Basic Logic Gates – Truth table and Boolean Algebra – Combinational Logic Circuits – Comparator – Decoder and Encoder – Multiplexer and Demultiplexer – Flip Flops – Types and Applications – Counters and its Types – Converters and its Types and Applications – Shift Registers and its Types and Applications – K-Maps – Cathode Ray Oscilloscope (CRO) working principles, Parameters and Applications - Stepper Motor - Drive – Types of Sensors and Relays - Microprocessor – Basic Architecture.

Unit IV: Computer Software and Hardware (20 Questions)

Introduction to word processing and spread sheet software – formatting text and Editing – Mail Merge and printing – formatting cells – formula in cells – features and applications - Introduction to computers – classification Generation and Application - Basic Hand Tools used for computer and specification - Types of cabinet, form factor – cables and connectors - Types and functions of Input / output (I/O) Devices, Ports, Keyboard Mouse, Monitor Speaker, Mike – Types, Classification and specification of Processors and Semiconductor Memories - Memory devices: Floppy Disk Drive , Hard Disk Drive, CD ROM Drive, DVD ROM Drive, Technology and working principles HDD parts and its working principles, performance, features, precautions, preventive maintenance – Complementary Metal – Oxide Semiconductor (CMOS) setting – scan and Defrag – Installation of System software and Application software – Functions of GUI, Description of Desktop icons, control Panel, Properties and Execution.

Unit V: System Utilities, Windows Utilities and Laptop Computer (25 Questions)

Magnetic, optical and magneto optical drives – Types, working principles and application – Formatting and partitioning of Hard disk drive – Redundant Array of Independent Disk (RAID) – Bad sector in HDD – Master Boot Record (MBR) Types of malware – Antivirus and Anti – Spy ware software, Virus removal –Software version and Updation - Different configurations of computer and its peripherals compatibilities - Pre-Installation and Post-Installation software - Backup procedures – Awareness of Legal Aspects of using computers - Installing Hardware drivers – Device Manager – Power on self-Text (POST)- Junk file Removal – Linux OS – outlook configure and Backup – Laptop and its types and working principles – Switched Mode Power Supply (SMPS) – Mother Board types, Components on Mother Board and their Interconnection – Chipset and Bus standards – Processors – Types, versions – BIOS - Description of Communication ports in mother Board – Upgrading components on Mother Board – Jumper setting and CMOS features – Single In-line Memory Module (SIMM) & Dual In-line Memory Model (DIMM) Memory Modules.

Unit VI: Linux Operating System and Computer Peripherals (10 Questions)

Basic Linux Commands – Types of Printers and its Classifications – Dot-matrix, Laser, Inkjet, Passbook - Block diagram and function of each unit installation Techniques - working principles of mechanical assembly and sensors. Replacing and refilling of toner cartridges - Working principles of Plotters, MFD, Network Printers and Scanners – Precaution – Preventive maintenance – Probable Defects – Circuit analysis – Servicing.

Unit VII: Monitors, Projectors and Uninterrupted Power Supply (UPS) (15 Questions)

Types of Monitors, Classifications, Specification and working principles – Comparison between Cathode Ray Tube (CRT), Thin Film Transistor (TFT) and Liquid Crystal Display (LCD) Monitors - Working principles of LCD projector and Touch Pad – Sound Card – Specification and Principles of working – Types of UPS and Specification, Working principles and application – Measurements of UPS parameters – Verification of Back up time – Routine maintenance and Servicing.

Unit VIII: Maintenance and Trouble Shooting of Personal Computer (15 Questions)

Types of MODEM Installation and configuration – Different types of Add on cards – Recognizing POST error message code and rectification– Upgrading of PC – Updating of system software and application software – Safety precaution, preventive maintenance and Troubleshooting of PC – Parts and functions of Backup drives - ZIP Drive, Magneto Optical Disk (MOD) drive, CD Writer, and Troubleshooting – Introduction of TABLET / SMART Devices Working principles – Types of OS used in smart devices, Hardware and Software trouble shooting techniques.

Unit IX: Internet and Network Devices (15 Questions)

Internet and web browser – Search Engine – e-mail - Cloud Computing – Computer Networks – Network Topologies – Classifications - Communication media and connectors - OSI Model – Network devices – IP Addressing and protocols – video Calling and conferencing - Integrate wired and wireless networks – Surveillance using Network devices – Network security Threats and firewall Techniques.

Unit X: Server Configuration and Network Security (10 Questions)

Windows Server – Basic configuration and Installation – DNS and DHCP – Remote Access – RRAS policies – TCP/IP Routing – Web Server – Concept of Backup and Recovery – managing Network traffic – Problems of Internet Connectivity- Linux Server – installation and configuration – SWAT – Password Authentication – Telnet.

25. Trade – Instrument Mechanic Chemical Plant (ITI Standard)

Code: 608

Unit I: Importance of Safety and Chemistry (10 Questions)

Safety Precaution – First Aid – PPEs – Response to emergencies e.g power failure, fire and system failure – Importance of House Keeping And Good Shop Floor Practices – Occupational Safety and Health – Atom, molecule, Element, Compound, mixture, Physical change, Chemical change, Acids, bases, salts-their properties. Molecular weight, Equivalent Weight, Atomic Weight, Normality, Molarity – Metals and Non-Metals – Water – Sources – Introduction to Effluent treatment Plant (CETP) – Corrosion – Allotrophy of Hydrogen, Carbon, Phosphorus and Sulphur – Organic Chemistry Introduction, Purification process, Organic Reactions – Nomenclature – pH, pH scale – Measurement of pH – Conductivity.

Unit II: Basic Fitting and Welding (10 Questions)

Description, Construction and Uses of Different hand tools such as Files, Chisels, Hacksaw and

Hammer etc. Description, construction and uses of different marking tools such as Steel Rule, Caliper, Punches, Scibing block etc. – Job Holding Devices – Linear Measurement – Drilling, Reaming and Treading – Gas Welding – Safety And General Precautions – Metal Joining Method – Oxy-Acetylene Welding –Oxy-Acetylene Flame.

Unit III: Physics (20 Questions)

Introduction to Physics, Measurement with Vernier Caliper, Micrometer, Wire Gauge – Scalar and Vector quantities, their representation, resultant – Triangle and Parallelogram laws of forces – Newton's laws of motion, Inertia, Force, Momentum, Types of Forces – Friction – Definition, Laws of Friction, Advantages And Disadvantages Of Friction – Elasticity – Current Electricity – Electrolysis – Faraday's law of Electrolysis – Thermodynamics – First law of Thermodynamics, Mechanical equivalent of heat, 'J' by Electrical method – Modes of heat transfer, Determination of Thermal conductivity – Temperature and its measurement, expansion of Solid, Liquid and Gases.

Unit IV: Basic Electricity and Electrical Measuring Instruments (30 Questions)

Conductor, Semiconductor and Insulators – Standard Wire Gauge (SWG) – Introduction of Electricity –Static Electricity – Current, Voltage, P.D, E.M.F, Resistance their units – Electrical Circuit – D.C and A.C Circuit differences – Importance of Grounding – Types of Switches – SPST, SPDT, DPST, DPDT, Toggle etc. – Types of Electrical Measuring Instruments – MC and MI, Construction and working principles of Ammeter, Voltmeter, P.F Meter, Frequency meter, Multi meter, Clamp meter, Megger – Resistors – Different Types of resistors and their properties – Different methods of measuring values of resistance – Capacitor – Construction details, charging, discharging, types, uses – Soldering – Different type of Soldering guns, relate temperature with wattages, Types of tips Solder materials and their grading – Use of wax and other materials – Selection of a soldering gun for specific requirement – Soldering and De-soldering stations and their specification – Study of Semiconductor – Semiconductor types and characteristics – Rectifier and its types – Filters – Transistors and its types- FET, MOSFET – Voltage Regulators – Introduction and purpose of Regulators – UPS – Types of UPS – Most frequently occurring faults and their remedies – Concept of UPS, Offline and Online – Difference between Inverters and UPS – Advanced Communication – Need of Modulation, Types of Modulation. Demodulation Techniques – Introduction to AM, FM and PWM.

Unit V: Basic Computer Hardware (15 Questions)

Basic blocks of a computer – Components of desktop and motherboard Hardware and software – I/O devices, and their working – Different types of printers – HDD – DVD – Various ports in the computer Windows OS MS Widows – Starting windows and its operation – file management using explorer– Display & sound properties – Screen Savers – Font Management – Installation Of Program – Setting And Using of Control Panel – Application of Accessories – Various IT tools and applications – Concept of word processing – MS word – Excel – Introduction to Power Point Basics of preparing slides, different design aspects of slides, animation with slides etc – Concept of Internet – Computer Networking Network features – Network Medias – Network topologies – Protocols- TCP/IP, UDP, FTP, models and types – Specification and standards – types of cables – UTP – STP– Coaxial cables – Network components like Hub – Ethernet switch – Router – NIC Cards – Connectors – Media and Firewall – Difference between PC & Server.

Unit VI: Introduction to Instrumentation and Pressure Measurement (30 Questions)

Scope and necessity of instrumentation – Fundamentals of measurement systems – functional block diagram of measurement system – Calibration and calibration standards – Basic standards– Secondary Standards – Working Standards – Fundamental Units – The Metric System – Base & Supplementary Units – Derived Units – Multiplying factors and standards of Length, Mass, Time, & Frequency – Basic Instrumentation Symbols – Static Characteristics – Dynamic Characteristics – Definition of pressure – Types of pressure – Barometric (Atmospheric) Pressure, Gauge Pressure, Differential Pressure – Absolute Pressure – Vacuum pressure & their units – Types of pressure sensing elements – Bourdon Tube – Diaphragms – Capsules and Bellows – Each one types, shapes, material used for various applications – Ranges – Advantages And Limitations – Pressure switches Types and Applications – Different type of Pressure measuring Instruments – Manometers – Gauges – Method of Pressure Instrument Calibration – Dead weight tester and comparators –

Electrical pressure transducers – Potentio-metric pressure transducers – Capacitive pressure transducers – Strain Gauge Pressure Transducers – Piezoelectric – Differentials pressure transducers –Types of Pressure transmitters – principle of construction of different Electronic Transmitters – Study of Pressure Safety valve – Pressure Switch manifolds – Classification of Transmitter such 3-Wire& 4-wire Transmitter.

Unit VII: Temperature Measurement (20 Questions)
Definition – Temperature scale and Units of Temperature and their conversion in between units – Expansion Methods for Temperature Measurement – Liquid Expansion Type – Solid Expansion Type –Gas Expansion Type – Thermistor – Thermocouple and RTD their ranges – Construction – Principle of Operation – Thermocouples Ex-tension wires – Compensating for Changes in Reference Junction Temperature – Construction of Thermocouple Junction – Types of Thermocouple – Advantages and Disadvantages of Thermocouples – Types of Temperature Transmitter – Types of Temperature Indicator – Temperature Scanner – Pyrometry – Pyrometers and Wave Lengths – Using of Optical and Radiation Pyrometer – Types of pyrometers IR Temperature Guns, Radiation and Filament Type – Introduction of Temperature Calibrator

Unit VIII: Flow Measurement (20 Questions)
Basic properties of fluids – Fluids in motion – Getting fluids to flow – Units of flow rate and quantity flow – Factors affecting flow rate – Relation between flow rate and pressure, area, quantity – Types of flow meters – head type, variable area type, quantitative flow meters – Principle of open channel flow, weirs, notches and flumes – Various shapes and their applications – Variable area type flow meter- rotameter, constructions, working principle, applications – Various shapes of float – Type of materials used for body and float – Factors affecting rotameter performance, measuring gas and liquid flow – Turbine flow meter – Magnetic flow meters – Vertex flow meter – Ultrasonic flow meter – Thermal mass flow meter – Advantages AND Disadvantage – Coriolis Mass flow meter – Metering the flow of solid particles

Unit IX: Liquid Level and Solid Level Measurement (20 Questions)
Types of level measurements-solid and liquid – Mechanical and Electrical type – Storage tank gauges, sight glasses, buoyancy – Factors need to consider for open and closed channel level measurements – Level Switches – Electrical method conductivity and capacitance method for Measuring the liquid level – Capacitance probes zero and span adjustments – Ultrasonic level detectors – Diaphragm switch – Using weight to determine level – Ultrasonic solid level measurement with microwaves – Using capacitance probes to measure solid level and point type level detection – Differential pressure measurement Diaphragm and Air Trap Electronic Level Measuring Instrument – Variable capacitance - Ultrasonic and Magnetic type level Switches – Radar Type Level Measurement and Level measurement by Load cell.

Unit X: Calibration and Final Control Element (25 Questions)
Classification of instrument according to accuracy – Generation of calibration report – Hart communicator and calibrator – Universal Calibrator – PH simulator – Conductivity simulator – Principle, Construction, operation of I to P, and P to I Converters – Types of Manometer (ELCTRONIC and PNEUMATIC) – Recorders – Smart Devices- HART transmitters, Its advantages and applications – HART protocol – HART communicators and PC based HART device configuration – Steps in calibration of HART devices – Controllers – Chemical Plant Introduction - Transmitters, valves, process vessels, controller and software – Final Control Element- Control valves – Control valves functions and components – Types of control valves – Based on valve flow characteristics - liner, equal percentage, Quick Opening Valves – Globe Valves – Cage Valves – Butterfly Valves – Ball Valves – Sliding Gate Valves – Diaphragm Valves – Split Body Valves – Capacitive, Inductive Type valve – Proximity Switch – IR switch – Micro Switch – Limit Switch – Role Of pneumatic and Electronic valve positioner – Solenoid valve – Piping Houses and fittings – Introduction to programmable controllers – Difference between DCS and PLC – Fundamentals of SCADA and DCS – Concept of the heat exchanger – Concept the chillier – Concept the stream trap – Heat Transfer – Evaporation – Distillation

26. Machinist

(ITI Standard)

Code: 539

Unit I: General Safety Precaution and First Aid (10 Questions)

First aid – Floor Maintenance - Health Hazard – Safety and Road Signs – Electrical Safety – Fire Extinguishers – Introduction of Personal Protective Equipment's (PPE) – House Keeping – Disposal of Waste Materials.

Unit II: Basic Fitting (20 Questions)

Marking – Hacksawing – Chiselling – Surface Gauges – Surface Plate – Drilling – Vernier Height Gauge – Counter Sinking – Try Square – Divider – Types of Caliper - Punch and their uses - Uses of Different Types of Hamer – Use and Care of Marking Table – Elements of File – Types of Vice – Hacksaw of Frame with Blade – Files Specification and Grade – Tap and Die – Pedestal Grinder – Bench Grinder – Loading Glazing – Dressing – Truing – Radial Drilling – Cutting Speed and Feed of Drilling Machine – Inter Changeable Manufacturer.

Unit III: Gauges (15 Questions)

Scale – Surface Gauge – Universal Surface Gauge – Try Square – Depth Gauge – Combination Set – Marking Media – V Blocks – Angle Plate – Parallel Block – Vernier Height Gauge and their Parts – Limit and Fits – Inter Changeability – Grade and Tolerance - Vernier Caliper and Parts – Types of Micrometer with Parts – Dial test Indicators – Description and Uses of Sinebar and Slip Gauge – Screw Pitch Gauge. Geometrical tolerances – Definition - Symbol. Bore dial gauge and its parts, usage - Telescopic gauge.

Unit IV: Lathe Turning and Advanced Turning (40 Questions)

Lathe Parts – Cutting Tools – Driving Mechanism - Types of Lathe - Orthogonal and Oblique Cutting – Facing – Turning – Drilling – Boring – Grooving – Parallel Turning – Step Turning – Parting – Chambering – U cut – Reaming – Knurling – Types of Cutting Tools, Material, Shapes and Different Angles – Types of Chip, Chip Breaker – Tool life – Driving Mechanism - Types of Taper – Taper Turning by Compound Slide and Offset Method - Vee Threads – Taper Turning Attachments – Mandrels - Centres and Elements – Thread Calculations – Single and Multi Start Threads – Lathe Centre – Lathe Plate – Driving Plate – Face Plate – Rests and their types and uses – Simple Gear Train and Compound Gear Train – Change Gears.

Unit V: Milling Machine (30 Questions)

Introduction of Milling Machine – Types – Parts – Construction and Specification – Different Milling Operations – Plain, Face, Angular, Form, Gang and Straddle – Up and Down Milling - Driving and Feed Mechanism – Types of Milling Cutters their uses and nomenclature - Operation – Attachment - Jig and Fixtures – Types and Uses of Jig and Fixtures - Physical Mechanical – Properties of Metal and Heat Treatment - Indexing Head and Types and Constructional Details - Calculation for Direct Simple Indexing – Grade of Tolerance – Vertical Milling – Helix and Spiral – Reamars.

Unit VI: Grinding and Tool and Cutter Grinding (30 Questions)

Introduction Grinding Wheel – Abrasive Types, Bond, Grade, Grid, Structure and Standard Marking of Wheel - Marking System – Types of Dresser – Glazing, Loading, Truing - Surface Quality – Roughness Value and their Symbol - Surface Grinder – Types, Parts, Construction uses – Specification and Safety - Cylindrical Grinder – Introduction Parts, Construction, Types, Specification – Wet Grinding, Dry Grinding and Various types of Grinding Wheel - Cutting Speed, Feed – Defects and Remedies - Tool and Grinder Cutter – Attachments. Introduction parts construction use and

specification. Various methods of cutter grinding and their uses.

Unit VII: Computerised Numerical Control (CNC) Lathe (10 Questions)

Safety Elements – Functions – Feedback Control System – Operation and Tool bath – Coordinate Geometry – G Code and M Code – Program Modes – Insert Tool Holders - Cutting Speed and Feed – Writing Programme using simulator – Cutting Parameter - Work and Tool Offset, Hard and Safety Jaws – Modes - Edit Program – Important Keys and Norms - Offset – Tool Selection – Collision – Failure and Alarm Course.

Unit VIII: CNC Milling (VMC- Vertical Machining Centre) (10 Questions)

Safety – Functions – Control System – Tool bath – Polar Coordinates – G90 and G91 – Program – G Code – M Code – Sub Programming – Cutting Tool – Speed and Feed – Wear life – Parameter – Tool life – Stimulator Process Planning – Different Modes – Offset - Holding Fixtures – Modes of Operation – Editing – Entering Program – Switches and Buttons and Controls and Program first part – Over Travel – Operation and Effect – Collision – Thread milling - Offset – Emergency Stop – Program Transfer – Concept – Hour rate.

Unit IX: Repair, Overhauling and Slotting (15 Questions)

Lubricants – Lubricants System-types and Importance – Periodic Lubricants System Simple Repair Work - Maintenance – Definition – Types and its Necessity – Routine Maintenance with Checklist – System of Symbol and Colour Coding – Inspection of Machine Tools such as alignment levelling – Accuracy testing of machine tools such as Geometrical Parameters - Remedies of Equipments in Industries - Slotter – Classification – Driving and Quick Return Mechanism – Job Holding Devices – Spline Types and Uses.

Unit X: Advance Milling and Gears (20 Questions)

Spur gear – Rack gear calculation. Curves and their uses - Helix and spiral introduction types and elements - Types of gear calculation cutting helical gear. Reamer Types Calculation for Cutting – Twist Drill – Calculation for Cutting Tool - Cutting of Milling Machine Bevel gear – Cams – Worm wheel – Keys and their applications.

27. Trade - Manufacturing Process Control and Automation

(ITI Standard)

Code: 543

Unit I: Workplace Safety Regulations and Computers operations (10 Questions)

Workplace Safety - Basics of First Aid - Electrical Safety - Personal Protective Equipment (PPE) - Handling Emergencies: Power Failure, Fire and System Failures - 5S Concept and Its Industrial Applications - 5S Concept and Its Applications - Occupational Safety - Health and Environmental Regulations - Manufacturing Process and Automation.

Introduction to Computers - Windows Operating System (OS) - File Management - Computer Hardware - Software Specifications - Application - Software Installation.

Unit II: Manufacturing Processes and Automation (15 Questions)

Basics of Process Control and its industrial applications - Quality Control in Process Industries - Discrete Manufacturing and Applications - Continuous Manufacturing Process - Batch Manufacturing and Quality Testing.

Unit III: PLC Numbering Systems and Memory Organization (20 Questions)
Number Systems in Computer Architecture - Binary, Octal, Decimal and Hexadecimal Systems – Conversions - Programming Devices in PLC - PLC Program Development and Storage - Memory Unit and Control Actions in PLC.

Unit IV: PLC Applications and Selection Criteria (15 Questions)

Programmable Logic Controller (PLC) Basics - Functions of PLC – Logic - Timer - Counter - PLC Memory - Instruction Storage - On/Off Control - Sequencing in PLC – Arithmetic - Data Handling in PLC - PLC Block Diagram - Working Principle.

Unit V: PLC Input / Output Modules and Devices (25 Questions)

PLC Input and Output Modules - Signal Conversion and Isolation in Input/Output Modules – Input / Output Interface and Signal Conversions - Types of Input/Output Modules: DC, AC, AC/DC - Sinking and Sourcing in Input/Output Modules - Communication Between Input/Output and CPU - Input Devices - Push Buttons - Switches, Sensors - Output Devices – Indicators – Buzzers - Actuators - Types of Motors – DC Motor - Brushless Motor - Stepper Motors.

Unit VI: PLC Panel Wiring and VFD Operation (30 Questions)

Programmable Logic Controller (PLC) Panel Components – DIN Rail and Equipment Mounting - Cable Channel and Wire Connections - Power Supply – Switch Mode Power Supply (SMPS) – Transformer - Power Sockets - Control Devices – Relays – Contactors - Connectors - HMI, Selector Switch, Push Buttons, Indicating Lamps - Variable Frequency Drive (VFD) Basics - AC Motor Speed Control: Voltage vs Frequency - VFD Power Conversion and Function – Variable Frequency Drive (VFD) Components – Insulated Gate Bipolar Transistor (IGBT), Metal Oxide Semi-Conductor Field Effect Transistor (MOSFET), Microprocessor, Digital Signal Processing (DSP) - Working Principle of VFD.

Unit VII: PLC Ladder Diagrams and Advanced Instructions (30 Questions)

PLC Programming Basics - Types of PLC Programming Languages - Textual Languages - Instruction List - Structured Text - Graphical Languages - Ladder Diagram (LD) - Function Block Diagram (FBD) - Sequential Function Chart (SFC) - Ladder Logic (Relay Logic) - Basic PLC Programming Instructions- XIC and XIO Instructions.
PLC Timers – ON Delay Timer (TON) – OFF - Delay Timer (TOFF) - Retentive Timer (RTO) - Preset and Accumulated Values in Timers.
PLC Counters - Up Counter - Down Counter - Up/Down Counter - Trigger Inputs in Counters - Interpreting Timers and Counters in PLC Programming - Internal Instructions in PLC.

Unit VIII: HMI Installation, Configuration and PLC Interface (15 Questions)
Interfacing of PLC and HMI - Types of Communication Cables for PLC – Human Machine Interface (HMI) Connection - HMI Panel and Touchscreen Interface - HMI Application in Industrial Automation - Types of HMI Screens - Changing Screens and Viewing Process in HMI.

Unit IX: SCADA Operation, PLC Interface and Communication Networks (20 Questions)
Introduction to SCADA - SCADA System Architecture - Functions of Supervisory Control and Data Acquisition (SCADA) - SCADA Communication with PLCs and PID Controllers - Master Terminal Unit (MTU) in SCADA - Remote Terminal Unit (RTU) and Its Functions.
SCADA Data Communication and Network Protocols – Real Time Data Acquisition in SCADA - Information/Data Presentation in SCADA – Human Machine Interface (HMI) in SCADA - Monitoring and Control in SCADA.

Unit X: SCADA Architecture, HMI vs SCADA and Simulation (20 Questions)
HMI vs SCADA: Key Differences - SCADA as a Remote Monitoring System - HMI as a Local

Monitoring Interface - Programmable Logic Controller (PLC) vs Distributed Control System (DCS): Understanding the Differences - Role of PLCs in Automation - HMI as a PC Based Interface - SCADA System Hardware Architecture - Client Layer and Data Server Layer in SCADA - SCADA Software Architecture – Real - Time Database in SCADA - Functions of SCADA Servers - Trending and Diagnostic Data in SCADA - SCADA for Maintenance and Logistics - SCADA with PLC interface Simulation.

SCADA Project Import and Export (CSV File) - Open Database Connectivity (ODBC) in SCADA - Multi-Language Switching in SCADA - Project Archiving and Retrieval in SCADA - SCADA Simulation: Simple Heat Exchanger - SCADA Simulation: Chemical Reactor.

28. Trade - Marine Engine Fitter

(ITI Standard)

Code: 614

Unit I: Occupational Safety & Health (10 Questions)

Importance of safety and general precautions to be observed in the shop floor - Basic First Aid – Personal protective equipments used in marine plant - Hazard identification and avoidance - Safety signs for Danger, Warning, caution & Personal Safety messages - Classification of fire - Fire extinguishers and its types - Uses - Storing and handling of inflammable materials – Environmental pollution - Source - Consequences and control.

Unit II: Basic Fitting (10 Questions)

Systems of measurement - Conversion of English into metric measurement – Marking material - Marking tools – Steel rule – Try square - Scribers - Calipers - Divider - Punches - "V" block - Surface plate – Angle plate.

Cutting tools - Chiesel - types of Chiesel - Types of hacksaw frames - Types of hacksaw blades - Their selection and uses - Types of files and their uses - Care and maintenance of files - Drilling machines - Types of drills - Cutting angles and speeds of drills - Calculation of tap drill sizes - Taps & dies - Types of taps and dies - Precautions while using taps and dies – Pitch gauge – Feeler gauge - Scrapers, types - Reamers, types - Emery papers – Grinding machine – Fitter hand tools - Safe working practice while using work shop tools.

Precision Measuring instruments - Construction of micrometer (outside & inside) and vernier caliper, vernier bevel protector - Calculation of least count for micrometer, vernier caliper and vernier bevel protector - Calculation of errors and correct dimension for Micrometer - Use and care of measuring instruments - Use of combination sets.

Unit III: Sheet Metal work, Pipe fittings (20 Questions)

Sheet metal workers hand tools and uses – Use of sheets – Wire gauge - Types of sheet metal joints and uses – Simple soldering and Brazing – Use of fluxes - Common joints – Blow lamp and its uses. Different between pipes and tubes – Types of pipe fittings in marine and its purpose – Connecting two pipe pieces - Branching - Changing in diameter - Direction & stopping the end of pipes.

Unit IV: Engine Introduction (30 Questions)

Engine classification - Construction of diesel engine - Working principle of 4 stroke cycle diesel engine - Working principle of 4 stroke petrol engine – Comparisons between petrol and Diesel Engine – Working principle of 2 stroke Diesel Engine - Scavenging – Types of scavenging – Uniflow – Loop flow – Difference between two stroke and four stroke Diesel Cycle.

Cylinder block – Function – Material used – Construction of water jackets passage - Cylinder liner – Construction and purpose – Material used finish provided – Types of liners- Advantages of wet and dry liner – Wear pattern and allowable wear - Cylinder wear and its causes.

Cylinder heads – Construction - function – Care and maintenance of cylinder head – Location of combustion chamber - Open and closed types - Advantages & disadvantages - Heater plugs - Port and valve arrangements compression ratio – Compression pressure - Engine valves – Material used

- valves operating mechanism – Parts and function – Valve timing diagram - Cam shaft – Timing gears – Types of drives used in engine – Chain tension and its importance – Exhaust and intake manifold construction – Function.
Piston and Piston rings – Function – Types - Material used – Connecting rod – Types – Function and material used - Crank shaft – Construction – Function – Material used - Arrangements of crank pins and main journal – Balancing method – Flywheel – Construction – Function – Material used - Elementary knowledge of function of clutch and coupling units attached to flywheel.
Engine bearings – Classification – Location – Material used – Composition of bearing materials – Shell bearing – Advantages - Special bearing material for diesel engine application – Bearing failure and its causes - Care and maintenance.

Unit V: Lubrication and cooling system, starting system of marine diesel engine (25 Questions)
Friction – Importance methods to reduce friction in engines – Use of lubricants – Oil – Grease – High detergent oil for diesel engine lubricants - Need for lubrication system for Diesel Engines – Lubrication system - Types - System components - By pass and full flow arrangement – Types of oil pumps, oil filters, pressure relief valves - Oil coolers - Common troubles – Care and maintenance.
Need for cooling an engine – Cooling system - Types of air and water cooling used in Engine – Cooling system components – Function - Radiator – Thermostat – Water pump - Need to maintain Engine working temperature - Effect of sea water in Marine Engine cooling system - Prevention of corrosion of Engine parts from sea water.
Starting system – types of methods used for starting marine diesel engines - Air starting system – Hydraulic starting system – Electrical starting system – Starting system components - Methods to eliminate starting difficulty in a Diesel Engine.

Unit VI: Fuel system and power transmission system (20 Questions)
Fuel feed system in diesel engine - Air injection and airless injection system - Fuel feed system components - Importance of water separators - Constructional details of water separators (centrifuges).
Fuel filter types and constructional details - Reasons for using no. of filters - Sequence of replacement of filter elements - Importance of diesel fuel cleanliness - Types of diesel fuel HSD & HFO - Constructional details of fuel injection pumps - Feed pumps - Function and operation - Importance of fuel valve and pump timing - Method of advancing and retarding and its effects on the firing - Fuel injection nozzles – Construction and operation - Each type spray angles and orifices and their characteristic - Injector Tester - construction and function - Types of tests and their purpose - Effects of incorrect setting of nozzles on engine performance.
Power transmission system – Types – Belt pulley - Chain – Gear- Coupling - Governors - Types - Pneumatic type - Construction and operation - Venturi unit and its purpose - Precaution to be observed in attending to the governor - Definition of rated speed - Maximum speed - Over run of governors - Purpose of auxiliary venturi in the Governor - Principle of idling damper - Mechanical governors – Construction and function - Operation under different load and speed - Maintenance - Common troubles and remedies - Hydraulic governors.

Unit VII: Diagnosis and Trouble shooting of engine faults (25 Questions)
Step by Step method of diagnosis of troubles in the lubrication and cooling system - Reasons for engine overheating and remedies for the same - Crank case contamination - Crank case ventilation - Flow test rate recommended for radiator - Reasons for excessive exhaust smoke – Overheating - Vibration - missing and hunting noises - Reasons for development of noises in engine - Methods of rectification for noises for smooth working of the engine – Necessity of valve clearance – Effect of incorrect clearance – common trouble and remedies – Reason for lapping of cylinder head – Compression testing of cylinder and its importance.

Unit VIII: Maintenance and Engine assembling (25 Questions)
Need of maintenance – Check up in IC engines – Methods used to fit the liner in cylinder bore - Piston ring clearance and its necessity – Precautions while fitting the rings – Methods of fixing gudgeon pin on small end - Method of lubrication provided for small end bushes - Fixing of cylinder head and mountings - Fixing of accessories like oil pump, water pump - filters - Oil flow passages and cleaning

plugs - Engine assembly procedure - Need for cleanliness and special tools and gauges used for engine assembling – Periods of decarburizing and overhauling engine in terms of hours of run – Running in procedure of overhauled Engines - Engine assembling practice for overhauling of Engine – procedure – Observations – Precautions – Alignments between spare parts - Foundations for Diesel Engine in marine - Details of foundation bolts & nuts its dimensions - Boxes to suit Engine base - Purpose of template - Need for aligning the engine on HD Bolts - Checking methods for alignment.

Unit IX: Engine auxiliary components, Marine refrigeration system, Marine paints (20 Questions)

Air compressor – Construction – Operation and uses – Common troubles – Maintenance - Turbo chargers - Construction – Operation – Common troubles and maintenance - Different types of pumps – Centrifugal pump - Reciprocating pump - Gear pump – Screw pump.

Basic refrigeration system in marine – Operation - maintenance – Refrigerant used - Marine paints - Specialty - types - Recommended paints for inside and outside of ships/vessel - Anti-fouling - Leaching - Pigment operation for paints.

Importance of periodical maintenance - Upkeep of shop equipments - Preventive maintenance avoid sudden and major failure.

Unit X: Basic electrical (15 Questions)

Simple electrical circuit - Series and parallel circuits - Identification of alternating current and direct current - Meters - insulators and conductors - Types of resistance - Ohm's law and its application - Common electrical terms and symbols - Primary and secondary cells - Lead acid battery - Construction - Common troubles and remedy - Safe working practice while working on electrical systems Ignition system - Components - Purpose of induction coil – Condenser - Spark plugs - Common troubles in ignition circuit and its remedy

Charging circuit - Operation of dynamo and regulator Unit - Ignition warning lamp - Troubles and remedy in charging system - Starter motor circuit - Constructional detail of starter motor - Solenoid Switches - Common troubles and remedy in starter circuit.

29. Trade: Mechanic Agricultural Machinery

(ITI Standard)

Code: 609

Unit I: Workshop Safety, Precautions and First Aid (10 Questions)

Basic first aid – Safety signs – Warning and Caution - Personal Safety – Fire extinguishers – Disposal of toxic dust – Disposal of used engine oil – Electrical safety – Agricultural machineries driving safety

Unit II: Tools, Engineering Measurement and Marking (10 Questions)

Hand and Power Tools

Steel rule - Measuring tape - Try square - Calipers – Punches – Prick punch – Hollow punch – Chisel-flat – Crosscut – Air impact wrench – Drilling machine

Sockets and Accessories

Torque wrenches - Pliers – Pipe wrenches

System Measurement

Micrometers – Outside and depth micrometer – Vernier calipers – Telescope gauges – Straightedge – Feeler Gauge – Thread pitch gauge – Vaccum gauge

Cutting tools

Types of cutting tools – Hacksaw – Different type of cut and uses – Bench and pedestal grinders

Unit III: Basic Electrical and Electronics and Hydraulic and Pneumatics (10 Questions)

Basic Electrical
Electrical Principles - Multimeter – Conductors & Insulators – Wires – Shielding – Length vs. Resistance – Cable colour code and sizes – Parallel Circuit and Series Parallel Circuit - AC Motors – Staters – Capacitors – Fuses – Resistance – Circuit breakers – Description of charging circuit – Warning circuit – Batteries

Basic Electronics
Diodes – Transistors – Thyristors – Uni Junction Transistors (UJT) – Metal Oxide Field Effect Transistors (MOSFETs) – Logic gates – OR, AND & NOT and Logic gate – Semi conductors

Hydraulic & Pneumatics
Definition of Pascal law – Pressure – Force – Viscocity – Description – Direction control valves – 2/2, 3/2, 4/2, 4/3 way valve – Pressure relief valve – Non return valve – Flow control valve used in automobile – Types of jacks and engine hoists, stands

Unit IV: Engine and Engine Components (20 Questions)
C.I & S.I Engine – 2 Stroke and 4 Stroke diesel engine – Cylinder head – Cylinder block – Piston – Types of piston - Crankshaft – Crankshaft balancing – Firing order of the engine - Camshaft – Fly wheel – Timing mark – Wheel and damper – Valve stem – Oil seals – Engine valve

Unit V: Cooling System, Lubrication System and Fuel System (20 Questions)

Cooling System
Purpose of cooling system - Water pump – Function of thermostat – Pressure cap – Recovery system & Thermo-switch – Radiator

Lubrication System
Oil pump – Oil filter and service – Turbo charger – Lubrication system and their types – Types of pump system

Electrical System
Tractor starting and stopping methods – Alternator – Fault and finding system in tractor – Charging and discharging of Lead acid battery

Fuel System
Fuel filter – Feed pump - Types of fuel injection pumps – Types of drive injectors – Types and functions – Governor and their types

Unit VI: Transmission, Control System and Differential (30 Questions)

Clutch
Types of clutch – Components of clutch – Driver & driven – Plates – Torsion spring – Cushion spring – Operation fingers – Clutch shaft – Slave cylinder & Oil seal – Clutch release bearing – Linkages

Manual Transmission
4 X 4 wheel drive - Low & high gear ratio – Universal joint and propeller shaft

Final Drive & Drive Shaft
Double reduction gearing – Differential lock – Crown wheel and pinion – Adjustments – Function and types of power take off (PTO)

Steering System

Types of steering system – Gear box – Arm slink – Ball and sockets – Working principles of steering system – Use of power tiller – Tractor & Bulldozer – Chassis frame of tractor

Wheels and Tyres
Construction and functions of wheel – Rim sizes – Types of tyre sizes – Solid – Pneumatic & Radial – Ply rating

Brake System
Drum & disc brakes – Brake types used on tractor principles

Brake System Components
Brake pedal – Brake lines – Brake fluid – Master cylinder – Tandem master cylinder

Drum brake and Components
Wheel cylinder – Disc brake – Disc brake and systems

Unit VII: Agriculture Equipments (30 Questions)
Tillage equipments
Cultivator and their types – Types of harrows – Types of disc plough – Mould board plough and their types – Disc plough and their types, angle adjustments of disc plough – Chisel plough and subsoiler types and uses – Rotavator types and their uses

Soil Forming Equipments
Levelers – Scrapers – Bund former – Dozer – Trencher – Dumper – Post hole digger

Fertilizer Equipments
Sprayer and their types – Power sprayer – Knapsack sprayer – Duster - Calibration and adjustments.

Sowing Equipments
Seed drill and their types – Planters and their types with adjustments – Trans planter

Unit VIII: Irrigation and Drainage System (20 Questions)
Types of irrigation system – Irrigation pumps and valves – Types of centrifugal and Submercible pumps
Unit IX: Agriculture Machineries (30 Questions)

Power Tiller
Types of power tiller and their uses – Transmission methods – weed control methods

Harvesting Machineries
Types of harvesting machineries – Paddy harvesting machineries – Reaper and their functions - Sugarcane harvesting machineries – Maize harvesting machineries – Working principles of harvesting machineries – Combine harvester – Method of filed operation – Types of grain losses and their causes and remedies – Green harvesting machineries – Mower and their types

Diggers
Types of diggers and their uses – Potato and Ground nut diggers – Route harvesting machineries – Prime mover attachments

Threshers
Types of threshers – Meize sheller and ground nut decorticators

Winnowers
Types of winnowers – Cleaning methods – Adjustment method – Driving system – Troubleshooting and maintenance

Cleaning and Grading Machineries
Destoners and their types – Cleaning and adjustment method

Flour Mills and Rice Huller
Construction details of flour mills – Troubleshooting and maintenance – Importance of rice huller –

Dehusker
Types of Dehusker – Rubber role dehusker – Stone dehullers – Coconut dehusker – Pulse and corn dehusker – Working principles of dehusker and construction details

Unit X: Farm Grain Storage Care and Maintenance (20 Questions)
Grain drying principle – Grain drying types – Grain moisture measuring methods – Storage and transport methods – Working of fan and blowers – Purpose of grain auger – Constructional details and working of grain drier – Operation of transporting and handling equipment

30. Trade - Mechanic Electric Vehicle (ITI Standard)

Code: 542

Unit I: Safety Precautions in Auto Workshop, First Aid, Hand Tools, Workshop Tools and Equipment (15 Questions)
Safety - General Precautions observed in the Industry / Shopfloor - First aid - Operation of Electrical Mains and Electrical Safety - PPEs - Response to Emergencies e.g. - Power Failure – Fire - System Failure - Housekeeping and Good Shopfloor Practices - 5S Concept and its Application - Occupational Safety and Health: Health, Safety and Environment guidelines, Legislations and Regulations - Basic Understanding on Hot Work, Confined Space Work and Material Handling Equipment - Vehicle Hoists – Two Post and Four Post Hoist - Engine Hoists - Mechanical Jacks - Hydraulic Jacks – Stands.

Unit II: Automobile Vehicle Types and their Specifications (10 Questions)
History of Automobile - Evolution and Growth of the Industry - Key Automobile Companies and their Products - Brief Description of Components and their Locations - Classification of Automobiles based on Various Aspects and Determining the Reason (Commercial, Passenger), Product Segments (Criteria for Vehicle Types, Variants and Versions, Markets: India, EU and US).

Unit III: Electrical Circuits and Test their Parameters by Using Electrical Measuring Instruments (15 Questions)
Basic Electricity - Electricity Principles - Ground Connections - Ohm's Law – Power – Energy - Voltmeter, Ammeter, Ohmmeter, Mulitmeter Conductors and Insulators - Wires, Shielding, Length vs resistance, Resistor Ratings - Capacitors and Coils Fuses and Circuit Breakers, Ballast Resistor, Stripping Wire Insulation - Cable Colour Codes and Sizes - Resistors in Series Circuits - Parallel Circuits and Series-Parallel Circuits - Electro Static Effects - Capacitors and its Applications - Capacitors in Series and parallel, Cells in series and parallel, Magnetic Effects - Heating Effects - Thermo-Electric energy – Thermistors - Thermo Couples - Electrochemical Energy - Photovoltaic Energy - Piezo Electric Energy - Electromagnetic Induction - Relays, Solenoids - Primary and Secondary Windings in Transformers, Stator and Rotor Coils in Motor - Basics of AC & DC - Various terms such as +ve Cycle, -ve Cycle – Frequency - Time Period – RMS – Peak - Instantaneous Value - Single Phase and Three Phase supply - Terms like Line and Phase voltage/ Currents – Insulators - Conductors and Semiconductor Properties - Different type of Electrical Cables.

Unit IV: Electronic Circuits and Analyse their Circuit Functioning (15 Questions)
Basic Electronics - Electrical and Electronic Components - Switches - Normally Open, Normally Closed - Single Pole Single Throw Switch (SPST) - Ganged, and Mercury Switches Used in Automobile Circuit - Relay, ISO Relays, Solenoids, Buzzers – Resistors - Different Type of Resistors and Their Colour Codes - Fixed, Stepped, and Variable Resistors, Rheostat, Potentiometer - Diodes - Diode Identification and Ratings - Zener Diodes - Avalanche Diodes - Light Emitting Diodes - Photo

Diodes And Clamping Diodes – Transistors - NPN, PNP, Field-Effect Transistor (FET), IGBT, Phototransistors - Integrated Circuits - Circuit Protection Devices - Different Type of Fuses - Glass or Ceramic - Blade And Bullet or Cartridge Fuses - Fusible Links, Maxi Fuses, Circuit Breaker, Positive Temperature Coefficient (PTC) Resistor, Device, Logic Gates-OR, AND & NOT And Logic Gates Using Switches - Input and Output Interfacing - PWM Generation.

Unit V: Electric Vehicle Components and Comparison of EV and IC Engine Vehicles Based on Performance (25 Questions)

Electric Vehicle Technology - EV Terminology Comparison of Electric Vehicle With IC Engine Vehicle Based on Emissions, Range, Fuel Type - Types of Electric Vehicle, (Battery Electric Vehicle) BEV, (Hybrid Electric Vehicle) HEV, (Plug-in Hybrid Electric Vehicle) PHEV and (Fuel Cell Electric Vehicle) FCEV - Lux Meters - Performance Parameter, Basics of Motors, Selection, Sizing and Characteristic of Motor - Calculation for Motor Effort, Electric Transmission - Principle, Working and Operation of Propulsion System - DC Motor - Drives Armature Voltage, Chopper Circuit, Step Up, Step Down Chopper, Control Strategy, Chopper Amplifier - Brushless DC Motor Principle Working, Features, Speed Control System of Brushless DC Motor, Efficiency, Calculation.

Unit VI: **Automobile Systems and Subsystems (20 Questions)**

Various Automotive Systems and Subsystems - Power Train - Engines and its Types - Transmission and Driveline Systems - Chassis System: Chassis and Monocoque Body, Steering Systems, Suspension System (Its Functions and Different Components, Different Types Like Double Wishbone - Trailing Twist Axle Suspension, Macphersons Rut Suspension, Multi-Link etc) - Tyres and Wheels - JATMA/ATMA/ETRTO Standards - Tyres and Wheels Markings - Tyre Selection Considerations for Automobile, Tyre Designs Diagonal vs Radial Ply, Tubed vs Tubeless, Wheel Alignment - Working and Construction of Automatic Transmission System (Single Speed Reduction Gear) Body Engineering: Styling, Exterior, Interior, Trims etc. Vehicle Integration – (Diesel Multiple Unit) DMU, Ergonomics, Layout and Packaging Studies.

Unit VII: Battery Pack Components, Monitor and Check Performance of High Voltage Rechargeable Energy Storage System and Battery Management System (20 Questions)

Cells - Cell Types Lead Acid/Lithium-ion polymer/liquid cooled lithium-ion heating system/Li-ion/NiMH, NiCad etc., Chemistries and Geometries, Cell Selection and sizing, Handling Cells, Understanding Cell Charging and Discharging Curves, Understand Temperature impact on cell, Internal resistance, Cell Construction and Manufacturing, Life cycle of various types of batteries Battery Module and Pack Development - Battery Pack Configuration, Pack and Module Construction, Configurations, Types and Energy Concepts, Voltage, and Temperature Measurement, Current Measurement, Thermal Management, Pack Sealing Sensors used in BMS Battery capacity and rating Battery charging and discharging calculation. Battery Management System (BMS)/Energy Management System (EMS) - Need of BMS, Voltage, Current and Temperature Monitoring, Cell Balancing - Types, Active, Passive, SoC Determination, SoC Algorithms, Battery cooling System.

Unit VIII: Test and Troubleshoot Accessory and Auxiliary Components - Power Steering, Braking and HVAC Comfort System (30 Questions)

EV Thermal Management Cooling of Battery Pack - Motor and Inverter, Active and Passive Cooling - Fluid Based Cooling - Ethylene Glycol - Forced Air Cooling - Cabin Air Based Cooling Description of Electric Power Assisted Steering - Basic Electric Power Steering Operation - Electronic Adjustable - Rate Shock Absorbers, Brakes – Mechanical, Hydraulics and Air Brake System - Drum Wheel Brake - Disc Wheel Brake System - Electric Brakes, Electro Hydraulic Braking (EHB), ABS Brake System, Antilock Braking System Operation, Principles of ABS Braking, ABS Master Cylinder, Hydraulic Control Unit, Wheel Speed Sensors - ABS With Electronic Brake Force Distribution (EBD) Control Unit - Heating Ventilation Air Conditioning (HVAC) Legislation - Vehicle Heating, Ventilation and Cooling Systems - Basic Air Conditioning Principles - Air Conditioning Capacity - Air Conditioning Refrigerant – Humidity - Fixed Orifice - Control Devices - Thermostatic Expansion Valve - Thermal Expansion Valves - Air-Conditioning Compressors, Condensers and Evaporators, Receiver Drier, Lines and Hoses, Txvalve Construction – Temperature - Monitoring Thermostat, Refrigerants - Pressure Switches, Heating Elements - Air-Conditioning ECU, Ambient Air Temperature Sensor,

Servomotors - Electric Servomotors, Automatic Climate Control Sensors, Evaporator Temperature Sensor - Blower Speed Control - Ventilation Systems Electric Inverter Compressor.

Unit IX: Checking and Troubleshooting of Wiring Circuits – HV and LV and the Electrical Components in the Electric Vehicle (20 Questions)

Wiring and Circuit Diagrams Automotive Wiring - Primary Wiring and Secondary Wiring - Comparison between Solid and Stranded Primary Wire - Wire Size - Metric and American Wire Gauge (AWG), Importance of Ground Straps Used in Automotive Wiring - Different Type of Terminals and Connectors Molded - Multiple-Wire Hard Shell – Bulkhead - Weather Pack, Metri-Pack, Heat Shrink Covered Butt Connectors - Printed Circuit Boards - Wiring Harnesses, Wiring Diagrams and Color Codes and Circuit Numbering - Common Electrical and Electronic Symbols - Horn Circuit, Wiper Circuit - Power Window Components and Circuit - Power Door Lock Circuit, Automatic Door Lock Circuit - Remote Keyless Entry System Circuit - Antitheft System - Immobilizer System - Navigation System - Car Infotainment System – Airbags – Seatbelt - Vehicle-Safety Systems - Crash Sensors - Seat Belt Pre Tensioners - Tyre Pressure Monitoring Systems - Integrated Communications - Proximity Sensors - Reflective Displays - Global Positioning Satellites – Triangulation / Trilateration – Telematics - Application of Automotive Bus System - CAN (Control Area Network) - LIN (Local Interconnect Network) - MOST (Media Oriented Systems Transport) - High Voltage Elements - PDU, Voltage Converters - Switching Devices - HV – Diagnostics and Troubleshooting - HV Cabling – Repair - Safety Certification, HVIL, Isolation Testing Power Electronics Inverter and Voltage Converters, Scan Tool and Reading Vehicle Diagnostics.

Unit X: Battery Testing, Charging and Cycling Operations - Selecting, Operating and Troubleshooting of Electric Vehicle Charging Ecosystem (30 Questions)

Charge and Discharge Cycles - Understanding State of Charge and State of Health - Battery Life - Cycles of Operation - SoH, Concept of State of Energy (SoE) and State of Power (SoP) Battery Handling at Swapping Stations - Charging System- The Purpose of Charging System - Charging System Components - Charging System Circuit - AC Charger, DC Charger - Solar Integrated (MPPT Based) Charger High Voltage Charging Systems - Charger Cooling - Constant Current (CC) & Constant Voltage (CV) Charging Standard -Chademo, GB/T, DC001, CCS –Protocols - Connectors Electric Vehicles Charging Station - Type of Charging Station - Selection and Sizing of Charging Station - Components of Charging Station - Terms Associated with EV Charging Station Charging Station Indicators - Charging Station Installation - Charging Station for Swappable Battery Packs DC/DC Converter - Working Principle – Type – Calculation - Relay, Operation, Types and Application - Rule Based and Optimization Based Control - Software Based Control - Thermal Management System - Cell Load Distribution - SOC and SOH Determination - Repair and Maintenance of Electric Vehicle System - Chopper Circuit of DC Motor - Using Second Life Batteries - Selection, Redeployment, Refurbishment Battery Disposal, Storing Batteries.

31. Trade - Mechanic Motor Vehicle

(ITI Standard)

Code: 437

Unit I: Safety Precautions and First Aid (10 Questions)

Importance of Safety and general Precautions to be observed in the shop. Basic first aid, safety signs. Safe handling of Fuel Spillage, Fire extinguishers and its types. Different types of fire. Safe disposal of toxic dust, Safe handling and Periodic testing of lifting equipment, Authorization of Moving & road testing vehicles. Electrical safety tips.

Unit II: Hand Tools and Measuring Instruments, Frame and Body (20 Questions)

Marking materials, Cleaning tools, Workshop tools, Common and Special hand tools, Micrometers, Vernier calipers, Telescope gauges, Dial bore gauges, Dial indicators, Straightedge, Feeler gauge, Thread pitch gauge, Vacuum gauge, Tire pressure gauge. Drill bits, Drilling machines and holding devices, Taps and Die sets, Calculation of Tap drill sizes for metric and inch taps. Screw extractors,

Hand Reamers and its types. Lapping, Lapping abrasives, Type of Laps. Fasteners.
Function of frame, Types of frame, Chassis repair and alignment, Frame maintenance, Safety standards for cars.

Unit III: Engine, Transmission system, Fuel supply system, Cooling systems and lubrication system (80 Questions)

Internal & External combustion engines, Classification of IC engines, Principle & working of IC engines. Differentiate between 2- stroke and 4 stroke, C.I engine and S.I Engine, Direct injection and Indirect injection, Engine Technical terms, Engine specification, Various gauges/instrument on a dash board Petrol Engine. Engine Components and materials: Cylinder head, combustion chambers, Head gaskets, Engine Valves & Valve Trains, Type of valve operating mechanism, Valve - timing diagram, Camshafts & drives, Timing belts & chains, Timing belts tensioners. Pistons, Piston rings and Piston pins. Compression ratio, Connecting rod, Crank shaft, Engine bearings, Fly wheel and vibration damper. Crank case & oil pump, Gears timing mark, Chain sprockets, Chain tensioner etc. Function of clutch & coupling units attached to flywheel. Cylinder block, Sleeves (liner). Intake & Exhaust systems and Components, Firing order of the engine.

Clutch, Gear ratios, Gearbox Automated Manual Transmission (AMT) Gearbox layout & operation, Baulk-ring synchromesh unit, Transaxle synchromesh unit drive transfer case, Freewheeling hubs, Four wheel drive differentials All-wheel drive- four wheel final drives, All-wheel drive transfer case, Transfer case differential action Automatic Transmissions - Torque converters, Planetary gears, Electronic control transmission, Propeller shaft, Universal Joint, Final drive, Differential unit, Rear axle & Front axle.
Fuel characteristics, concept of Quiet diesel technology & Clean diesel technology. Diesel fuel system components – Description and function of Diesel tanks & lines, Diesel fuel filters, water separator, Lift pump, Plunger pump, Priming pump, Electronic Diesel control Electronic fuel control systems, Common Rail Diesel Injection (CRDI) system, Sensors, actuators and ECU (Electronic Control Unit) used in Diesel Engines, Gasoline Fuel Systems, Stoichiometric ratio, Air density, CNG –Gas circuit components.
Different type of cooling systems, components - Radiator, Coolant hoses, Water pump, Cooling system thermostat, Cooling fans, Temperature indicators, Radiator pressure cap, Recovery system, Thermo switch. Functions of oil, Viscosity and its grade as per SAE, Oil additives, Synthetic oils, The lubrication system, Splash system, Pressure system, Corrosion/noise reduction in the lubrication system. Lubrication system components - Description and function of Sump, Oil collection pan, Oil tank, Pickup tube, different type of Oil pump & Oil filters Oil pressure relief valve, Spurt holes & galleries, Oil indicators, Oil cooler.

Unit IV: Wheels & Tyres, Steering Systems, Suspension Systems, Braking Systems (30 Questions)

Wheel, Tyre, Rim and is types, materials, Construction, Characteristics. Tyre sizes & designations, Tyre information, Tyre tread designs, Tyre ratings for temperature & traction. Descriptions Tire wear Patterns and causes Nitrogen v/s atmospheric air in tyres

Principles of steering, Rack-and-pinion steering system, Recirculation ball & nut steering system, Four-wheel steering systems, collapsible steering system. Steering boxes & columns, Power Assisted steering, Electric power assisted steering. Wheel alignment:- Basic principles , wheel base, wheel track, king pin inclination, Caster, Camber, Scrub radius, Toe-in & toe out, Toe-out on turns, Turning radius, Thrust angle & centre lines.

Principles of suspension, Types of suspension Independent suspension, Rear independent suspension, Rear-wheel drive independent suspension, non independent suspension, electronically controlled air suspension (ECAS), Adaptive air suspension operation. Types of springs - Description and function of Coil springs, Leaf springs, Torsion bars, Rubber springs. Shock absorber types- Hydraulic shock absorbers, Gas-pressurized shock absorbers, Load adjustable shock absorbers, Manual adjustable-rate shock absorbers, Electronic adjustable-rate shock absorbers, Automatic load

adjustable shock absorbers Front suspension types & components - Mc person Strut suspension, Short/long arm suspension, Torsion bar suspension Rear suspension types & components -Rigid axle leaf spring suspension, Rigid axle coil spring suspension, Independent type suspension, Rigid non-drive suspension.

Brake type - principles, Air brakes, Exhaust brakes, Electric brakes, Parking brakes, Engine brakes, Regenerative braking Braking system. Components brake system. Brake friction materials. Antilock braking system operation, Principles of ABS braking, CABS master cylinder, Chydraulic control unit, Wheel speed sensors, ABS with EBD electronic control unit. The construction and Operation of ABS. Braking system components.

Unit V: Diagnostic Trouble Code (DTC) (10 Questions)
Use of scan tool and retrievals of codes. EFI sensors - Intake Temperature sensor, Mass airflow sensor, Manifold absolute pressure sensor, Air vortex sensor, Fuel system sensor, Throttle position sensor, Exhaust gas oxygen sensor, Crank angle sensor, Hall effect voltage sensor, Optical type sensors.

Unit VI: Emission Control (10 Questions)
Vehicle emissions Standards - Euro and Bharat II, III, IV, V Sources of emission, Combustion, Combustion chamber design. Types of emissions: Characteristics and Effect of Hydrocarbons, Hydrocarbons in exhaust gases, Oxides of nitrogen, Particulates, Carbon monoxide, Carbon dioxide, Sulphur content in fuels Description of Evaporation emission control, Catalytic conversion, Closed loop, Crankcase emission control, Exhaust gas recirculation (EGR) valve, , Controlling airfuel ratios, Charcoal storage devices, Diesel particulate filter (DPF). Selective Catalytic Reduction (SCR), EGR VS SCR.

Unit VII: Battery (15 Questions)
Magnetic effects, Heating effects, Thermoelectric energy, Thermisters, Thermo couples, Electrochemical energy, Photo-voltaic energy, Piezoelectric energy, Electromagnetic induction, Relays, Solenoids, Primary & Secondary windings, Transformers, stator and rotor coils.
Basic electronics: Description of Semi conductors, Solid state devices- Diodes, Transistor, ignition systems - Distributor less ignition systems, Insulated coils, Distributor less ignition system timing. Horn, Wiper, power window Power door lock, Automatic door lock, Remote keyless entry system, Antitheft system, Immobilizer system circuits and its components. Description and function of Airbags, Seatbelt, Vehicle safety systems, Crash sensors, Seat belt pre tensioners, Tire pressure monitoring systems Integrated communications, Proximity sensors.

Unit VIII: Heating Ventilation Air Conditioning (HVAC) (10 Questions)
Principles, Air-conditioning capacity, Air-conditioning refrigerant, Humidity Description and function of Fixed orifice, Control devices, Thermostatic expansion valve system, Thermal expansion valves, Air-conditioning compressors, Condensers & evaporators, Receiver drier, Lines & hoses, TX valve construction, Temperature monitoring thermostat, Refrigerants, Pressure switches, Heating elements Air-conditioning ECU, Ambient air temperature sensor, Servo motors, Electric servo motors, Automatic climate control sensors, Evaporator temperature sensor, Blower speed control, Ventilation system

Unit IX: Basic Electrical and Electric Vehicle Technology (10 Questions)
Electricity principles, Basic Electrical connections, Ohm's law, Voltage, Current, Resistance, Power, Energy. Voltmeter, ammeter, Ohmmeter, Mulitmeter, Conductors & insulators, transformer, Wires, Shielding, Length vs. resistance, Resistor ratings Fuses & circuit breakers, Ballast resistor, Stripping wire insulation, cable colour codes and sizes, Resistors in Series circuits , Parallel circuits and Series-parallel circuits, Electro static effects, Capacitors and its applications, Capacitors in series and parallel.
Description of charging circuit operation of alternators, regulator unit, ignition warning lamp troubles and remedy in charging system. Description of starter motor circuit, Constructional details of starter motor solenoid switches, common troubles and remedy in starter circuit.

Introduction to Hybrid & Electronic vehicle, Hydrogen fuel cell vehicle, EV Terminology Comparison of Electric Vehicle with IC engine vehicle based on emissions, range, fuel type. Types of electric vehicle, BEV, HEV, PHEV and FCEV. Architecture of Electric Vehicle, working principle of fully electric vehicle, Major component, performance parameter, Basics of Motors, Selection, sizing and characteristic of Motor, calculation for motor effort, electric transmission. Principle, working and operation of propulsion system, DC Motor - Drives Armature Voltage, chopper circuit, step up, Step down chopper, control strategy, chopper amplifier. Brushless DC Motor – principle working, features, speed control system of brushless DC motor, efficiency, calculation. Battery management system.

Unit X: Traffic rules (5 Questions)
Signals & controls. Locating vehicle information, Obtaining & interpreting scan tool data.

32. Trade – Painter (General)

(ITI Standard)

Code: 615

Unit I: Safety and Identification of tools and Equipment (15 Questions)

Safety – PPE – MSDS – FIRST AID – Safety Disposal of waste - Hazard and Non Hazard – Use of Fire Fighting Equipment – Safety signs – Understand precautions to be followed while working in the painting Jobs – 5s trainings - Accident – Causes – Effects of an Accident – Fracture wound and electric shock.

Tools and Equipments - Cleaning and Painting Assembly and function of trade machineries.

Unit II: Free hands sketching (15 Questions)

Pencil – Different Types of Pencils (Black & White / Colour Pencil Shading) - Free hands Sketching – Lines – Different Types of Lines – Construct for design – Geometrical forms in perspective – Types of Perspective.

Graph and figure enlargement with pencil shading – Sketching benefits and importance in our culture and traditions - Human organs and their proper place – Body structures of Male and Female.

Unit III: Brush and Colours for drawing and painting (20 Questions)

Charcoals, oil and dry pestles, poster colour, acrylic oil colours and reducer medium - Colours & Colour knowledge – Colour blindness, tone, colour shade, Primary, Secondary & Tertiary – Colouring 2D design in Warm & Cool Colours, Contras Colours – Colour wheel – Types of Colour Schemes & Colour harmony – Colour Shades – Gray scale - Composition paint in High key, middle key & low key by poster colour – Colour mixing - Use graph on portrait picture & Enlarge outline drawing – Lettering – Uses of devnagri, Roman, Gothic, Italic and Text writing – Spacing – Mechanic and Optical Spacing – Sketching and Colouring Gothic letter, Devnagri letters, Italic letters, Roman letters in English & Mother Language.

Different types of Brushes with shapes & sizes, Use & Care of Brushes.

Drawing instruments – Drawing board – T-square – Steel and wooden scale – set square – Compass – Colour dish.

Drawing paper - Types of drawing paper – its uses and care – Marking & Cutting different Drawing Paper as per given size

Knife – Uses – Different Types of Knife.

Unit IV: Photoshop & Corel Draw (10 Questions)

Tool handling in Photoshop – Edit special effect of different layer, colours, textures, filter effect - Edit & Save image in PSD, JPEG & Other format – Export Design, image, photograph from Photoshop to other different format for different software's & Print file for different printers.

Corel Draw - Drawing simple geometric objects using Corel Draw Transforming objects, Organizing objects, Working with text – Flex design for marketing offers – Convert & Save to CD/DVD/PD for final printing – Ornamental designs.

Unit V: Stencils & Screen Printing (15 Questions)

Stencils – Stencils Uses – Care and cleaning of different types of stencils – Instruments and equipments for stencils – Types of stencils, cut it & stencilling.
Screen Printing – Types, definition and explanation, Origin and development of screen painting – Selection of cloth, instruments, chemicals, cloth fitting, exposing - Screen developing – printing and de-exposing / washing – Types of ink –Testing of registration with squeezing ink – single colour & multi colour – Decorating used screen with bleach powder or decorating solution, wash & clean.

Different medium paper for plotter cutting. Manual cutting instruments & their safety / care / precaution, proper pasting procedure, pasting techniques.

Unit VI: Polish & Varnish (15 Questions)

Polish paper – Types and uses.

Putty – Definition, their material types and uses. Method of mixing & its different system of application.

Polish – Types and uses - Different application methods.

Varnish – Definition – Types and characteristics of varnish – process of making of varnish its importance and contains – Clean, sanding, knotting, stooping, staining preparation wooden surface properly for polish.

Prepare wooden article and apply melamine or PU wooden finish with spray – Wooden top with thick layer of melamine polish & varnish.

Unit VII: Paint & Painting (30 Questions)

Paint Definition, Different type of paints, classification and use – pigment, Binders, Solvent, oil, dryers, additives.

Painting – Definition and importance of painting – method of wooden surface painting – Prepare wooden surface properly with brush - Prepare & spray painting on different wooden surface – Types, uses of building (wall) paints – wall primer – water base / oil base, types of putty for wall. Mixing, Preparation process of Lime and Distemper. Other required Equipments – Below lamp, bucket, plum-bob, putty blender, Paint Strainer. Types of Trestle, ladder, scaffolding – Colour selection for interior and exterior wall painting and use of Paints – purpose of colours – paint mixing and preparation process – Difference between emulsion paint and Oil paint – Different between brush painting and Roller painting – Types of roller - Prepare wall & design roller / Stamp / Stencil.

Wall defect and defects removal process of wall painting – Building Painting estimate & costing.

Paint a ceiling and wall with dip-feed roller / pad or airless spray.

Paint different pipe line with colour code as per ISI - Safety procedures in industrial pipe line painting.

Unit VIII: Corrosion & Metal Surface cleaning (20 Questions)

Corrosion - Definition and classification, Reasons for rusting and effect of climate, Different anti-rusting process.

Metal Surface – Types and selection of sanding paper (polish paper) – Metal surface cleaning - Mechanical and chemical cleaning. (Dry/Wet Sanding, scraping, wire brushing - paint burning - sand and shot blasting - pickling and phosphating) – Degreasing, de-rusting, activation, passivation & water rinsing as required etc.,

Primer – Types of Primer – Metal Primer - Types purpose, application and use – Types of surface – Types of solvent or reducers / thinner / automotive paints (Enamel, NC, Stoving, PU, Epoxy, rubber base sound deadener paint, metallic, pearl, water base automotive paint), lacquer.

Unit IX: Types of Painting process (30 Questions)

Traditional and modern technology - Brushing, Deeping, barrelling, Aerosol, roller coating, suction spray, vertical spray, pressure vessel, spray airless, electrostatic, powder coating etc – Identify pneumatic components.

Compressor, pressure gauge, Filter – Regulator – Lubricator (FRL) unit, and Different types of valves and actuators.

Spray Gun – Principles of spray painting, spray gun accessories and their function different types of spray guns. Holding of spray gun and stroke adjustment. Types of spray painting method. Air compressor for painting process. Required instruments for spray painting.
Description of spray painting plant - Types of booth, description of booth, care and maintenance of spray booth.

Types of oven for painting - Description of oven and its care – Safety aspects of Oven Setting, temperature & timing – Oven Maintenance.

Paint preparation & mixing for spray painting – Paint viscosity – importance, method of the paint viscosity. Paint preparation & mixing for different application – Measure the viscosity of paint – Introduction and uses of pressure feed – Airless and Electrostatic Spray painting – apply priming, undercoat & top coat finish – Process of article and machine painting.

Unit X: Process of repainting and testing of paint (30 Questions)

Car – Process of repainting (Removal of dent, car patch, putty process, metal primer, surface, paint) Spray painting – Types of paint defects & its remedies – Importance of polishing, removal defects by polishing – Use Automotive paints – Apply Graphic sticker on painted surface properly & apply lacquer coat evenly.

Identify the parts of Electrostatic gun assembly, Airless gun assembly & operate it carefully.

Inspect & mark denting area – Choose & decide process tools for denting.

Paint defects & its remedies – Find out different paint defects (run down, sagging, pin hole, orange peel, oil & water spot, over/dry spray, uncover shade variation etc.,

metal/surface with all pre-treatment process – Operating system of powder coating technique – Types of coating powders – powder coating on cleaned article & bake it in oven in appropriate temperature & timing.

Types of paint - painted surface testing equipments, Types of testing - Use & Care method and instruments.

33. Trade - Plumber

(ITI Standard)

Code: 613

Unit I: General Safety, First aid and Various Electronic Component (05 Questions)
Importance of Safety, Methods of First aid – Hazard identification – Preventive measurement – Types of fire extinguishers - Electrical Safety – PPE – 5S – OHM's Law – Kirchhoff's Law – Resistor colour code and power rating – Distribution of V and I in series parallel circuit – Type inductors – Fundamental of Electricity Units – Conductor's and insulator's – Techniques of soldering and Types of solders and flux.

Unit II: Identify different tools, equipment, fitting Test and measure equipments in pluming (10 Questions)
Tools – Vice - Chain wrench - Hand Tools – files – Hammer – V block - Threading dies – Sink – Internal Pipe cutter – Pipe fittings etc – Drilling machine - Straight grinder – Pressure Testing Machine infrared thermometer – Advanced laser distance meter – Water leakage testing – Combustible gas detector - Wall chaser.

Unit III: Plumbing System and Terminology (25 Questions)
Plumbing Terminologies – Cess pool – Cross connection – Float value Flush Tank and cock – Inspection Chamber – Sensor operated faucet – Septic tank – Trap – Vent pipe – Water Hammer and Pressure – Water spruces – Water distribution – Hot water generation – Types of Pipe – Selection of drill bit - Pipe fitting in different position - List out the Plumbing system – Types of pipe materials.

Unit IV: Interpret water distribution System, Water meter and maintain Pressure in boosting pumps (30 Questions)
Quality of water and treatment – Fire Sprinkler – Types of insulation for hot water – Plumbing equipment and method required distribution system of cold and hot water system – Geyser - Solar water heater - Method of ventilating pipe – Water meter – Booster pump – Pressure head, delivery pipe and suction pipe etc.,

Unit V: Reduce water wastage and increase efficiency (25 Questions)
Types of Traps - Soil and waste drainage – Waste water treatment plant – Types and size of pipe – Taps, inspection chamber and manhole – Sewage treatment system – Type of bent for water flow – Jig saw machine type of pipe cutter – Bending machine, Hot and Cold - Plumbing symbols and code for tools and materials on water line.

Unit VI: Joining fitting and laying of different type of PVC pipe and Taps and valve maintain etc., (20 Questions)
PVC / CPVC, UPVC, GI, PPR etc - Pipe fittings and Joints – Test of water hard and soft – Pumps (Centrifugal pump, Submersible, Hand pump, Booster pump etc.,) – Type of Taps and cock (Angle cock, Stop cock, Bottle trap, Bib cock, Two in one mixer, 2 and 3 way diverter, Health faucet) – Water hammer arrester – Water purifier.

Unit VII: Type of faucets, water closet and water pressure in plumbing system (30 Questions)
Types of faucet and its selection - Types of water closet (Open and concealed) – P and S trap - Telephonic wall mixer – Telephone shower – Sensor based in faucet – Water closet – Static water pressure – Bernoullis principle – Pascal law – Types of wash basin – Hydraulic manual pressure testing machine.

Unit VIII: Fix and maintain sanitary ware system, sink, wash basin and bath tub etc. (30 Questions)
Sanitary fixtures – Cistern (open and concealed) – 23 inch Orissa pan (Indian Pan) – Types of urinals – Advanced Plumbing trends and diff materials – Scrapper and painter of pipeline – Sanitary symbols and its plumber codes – Washroom accessories – Wash basin – Kitchen sink –Shower - Bathtubs – Grab bars – Bottle traps – Type of walls and floors mounting EWC.

Unit IX: Rainwater harvester and repairing and maintenance of plumbing system (20 Questions)
Water conservation- concept of rainfall intensity – Layout, types of drainage system – Siphonic rain water system Collection and Storage – Recharge and disposal system – Method of testing drainage lines – Inspection chamber – Septic tank – cess pool – Soak pit etc., - Study rainwater harvesting system and bore well recharge system – Periodic inspection - Testing of water quality – Inspect leakage of pump – Water pressure – Water level indicator and sensor – Check operation and effectiveness of non return valve - Effect of water and frost on materials – Replace, assemble and disassemble of different taps, cistern and valve.

Unit X: Maintaining the records of plumbing system (05 Questions)
Preparation & maintaining the record of Installation and repair maintenance of plumbing – SOP as per Indian standard for water supply – Cement mortar and plain cement concrete – Application of Mason hand tools – Industrial case study of Commercial complex – Case study of Residential buildings – Calibration certificate – Brick bonds (Various bonds) – damp proofing – Traps / foul and unfoul inspection chambers – Benching and channelling sewers man hole.

34. Trade – Mechanic Refrigeration and Air Conditioner

(ITI Standard)

Code: 435

UnitI: Basic Safety and Refrigeration System (20 Questions)

General Safety precautions and first aids, Fire fighting Equipment and Electrical Safety - Different types of Fitting Hand Tools – Their use - Electrical Terms such as AC and DC supply, Voltage, Current, Resistance, Power, Energy, Frequency, Safety Precautions to be observed while working on Electricity, Conductors, Insulator Materials – Measuring Instruments such as Voltmeter, Ammeter, Ohm Meter, Watt Meter, Energy Meter and Frequency Meter – Earthling and its importance, Basic Principle of Semi-Conductors, Application of Diodes – Transistors – IC's, Soldering, Brazing, Oxy-Acetylene Welding, Basic Principles of Welding Processes commonly used, Basic Principles of Refrigeration, Working, use specification, Refrigeration Tools, Instruments and Equipment – Fundamentals Refrigeration and it's units – Thermodynamic Laws.

Science Related to Refrigeration, work, power, energy, force, heat and Temperature, Different Temperature Scales, Thermometers, Units of Heat, Sensible Heat Latent Heat, Super Heating and Sub-Cooling, Saturation Temperature, Pressure Types, Units –Type of Refrigeration System – Study the Construction and working of Vapour Compression Cycle – Low side & High Side of Vapour Compression System, COP (Coefficient of Performance), Ton of Refrigeration.

Unit II: Refrigerators and Its Types (20 Questions)

Refrigerator (Direct coot of frost free), Function, Construction working of Single Door Direct Cool Refrigerator, Frost Free Refrigerator, Specifications, Trouble Shooting, Heat Insulation Materials, Care and Maintenance of Refrigerators, Mechanical and Electrical Components of Refrigerator's.
Importance of Flushing in Evaporator, and condenser, Use of Dry Nitrogen for Flushing – Evacuation, Leak Testing, Gas Charging Method in Refrigerator.
Frost Free Refrigerator Two or Three Door Parts – Function – Electrical Accessories and its Function (Timer, Heater, Bimetal, Relay, OLP), Refrigerator Cabinet Volume Calculation).
Refrigerator Inverter Technology – Two and Three Door Construction –Working – Care and

Maintenance.

Unit III: Compressor, Motor and Refrigerants (20 Questions)

Types of Compressors used in Refrigeration and Air-Conditioning, Function, Construction – Wet Compression – Oil Properties – Lubrication Methods – Applications.

AC Motors – Types – Advantages of AC Motor Over DC Motor – Starting and Running Winding – Starting Current, RSIR, CSIR, CSR and PSC Motor, Functions of Starting Relay, Capacitors, OLP.

Classification of Refrigerants – Properties of Refrigerants – Pressure and Temperature of Different Refrigerants – GWP, ODP of various Refrigerants – Properties of Insulating Materials used in Refrigeration and Air-Conditioning.

Unit IV: Condenser, Expansion Valve and Evaporator (20 Questions)

Function of Condenser, Type, Liquid Receiver, Pump Down, Drier Function, Types – Expansion Value used in Domestic Refrigeration and Air-Conditioning – Capillaries, Automatic and Thermostatic Expansion Value and Electronic Expansion Value, Evaporator – types, construction, working and its uses.

Unit V: Air-Conditioner and Its Types (30 Questions)
Window Air-Conditioner, Split Air-Conditioner, Construction, Multi split AC, Inverter Split AC Working, Mechanical, Electrical Components – Types of Split Air-Conditioners – Study of Wiring Circuits – Installation and Servicing – Fault Finding – Testing Components.

Unit VI: Commercial Compressor and Its Types (10 Questions)

Commercial Compressor: Function, types Construction & Working Applications. Compressor Lubricant Oil, Properties types of Lubricant Methods.

Unit VII: Water Cooled Condenser, Cooling Tower, Evaporator/Chiller and Water Treatment (30 Questions)

Water Cooled Condenser: Types and Capacity, Construction, Working and De-Scaling Application, Evaporative Condenser – Function, Construction and Application.
Cooling Tower: Types, Construction, Capacity, Efficiency, Approach and Cooling Tower Range.
Water Treatment: Causes for Water Contamination and Water Treatment.
Evaporator and Chillers: Construction Function and Types of DX Chiller, Types of Defrost System, Water / Brine Chiller, Types of Brine used as secondary Refrigerant.

Unit VIII: Heat Exchanger, Accumulator, Water Cooler and Deep Freezer (10 Questions)
Heat Exchanger and Accumulator: Function and Construction, Applications, Oil Separator – Function and Construction.
Water Cooler: Types, Construction and Working Principle and its Applications.
Deep Freezer: Description, Construction, Working Specifications, Care and Maintenance, Fault and Remedies.

Unit IX: Ice Candy Plant, Ice Plant and Cold Storage/Walk in Cooler (20 Questions)

Ice Candy Plant: Function, Construction Working Principle, Capacity, Types of Compressor used.
Ice Plant: Details about Components of Ice Plant their Functioning.
Cold Storage/Walk in Cooler: Details about Components, their Functioning, Working Principle, Circuit Diagram, Capacity and types, Care and Maintenance, Food Preservation Spoiling agents, Preservation by Refrigeration System, Types of Cold Storage and its Details.

Unit X: Direct and Indirect Air Conditioning System, Duct, Air Filter and Control System Of Ac Plant (20 Questions)

DUCT and Air Filters: Function, Types, Materials, and Designing DUCT, Function of Air Filter Types, Construction, Maintenance, Effect of Chocked Air Filter.

Direct Central Air Conditioning Plant: Construction and Working Principle, Types, Maintenance of Direct Airconditioning plant.

Humidification and Dehumidification method Description of AHU and FCU.

Temperature and Pressure control used in AC Plant, its Construction, Working, Safety Device and Pipe Line.

Indirect/Chiller System: Construction and Working Principles, Maintenance of Indirect/Chiller System, Air-Washers used in chilled water system.

Control System of AC Plant: Controls used in AC System, Electromechanical, Pneumatic and Electronic, Details study of Heat Load Calculation for Commercial and Industrial Buildings.

35. Trade – Remotely Piloted Aircraft (Drone Pilot)

(ITI Standard)

Code: 611

Unit I: Directorate General of Civil Aviation (DGCA) Safety Regulations and Guidelines (15 Questions)

Safety Signs – Personal Protective Equipment's – Fire Extinguishers and Types – Safety Rules while flying a RPA – DGCA Safety Regulations – Do's and Don'ts – Air Space – Traffic Patterns – Safety altitude – Radio Telephony – Air Traffic Control – Specific Fly planning procedure – Importance of Weather and Meteorology in RPA flight – Met Terminal Aviation Routine Weather Report (METAR).

Unit II: Types of Remotely Piloted Aircraft, Fundamentals of Flight & Airframes (20 Questions)

Types of Remotely Piloted Aircraft(RPA) – Basic Components – Fundamentals of flight Aerodynamics – Basic Principles of flying – Three Axes of flight – Air frame – Newton's Law of Motions – Four forces of flight – Current/future uses of RPAs

Unit III: Parts of Remotely Piloted Aircraft (30 Questions)

Components in Remotely Piloted Aircraft(RPA) – Assembling and Disassembling procedure of RPA – Multi rotor design – Configurations – Air frame size and construction materials – Selection and design of propeller – Fixed pitch and variable pitch – Airfoil design– Electricity fundamentals– Calculation of Motor rating for load capabilities – Batteries and Connectors – Li-Po Battery Characteristics – Charging and Discharging of Batteries – Cell balancing – Brushed vs Brushless Motor – Kv rating – Role on flight controller and Electronic Speed Controller – Calibration Procedures – GPS applications in RPA flying – Radio Control System – Sense and avoid technology – Open Source and Closed Source of Programming Controllers – Transmitters and Receivers

Unit IV: Weather effects and analyse the performance of RPA (25 Questions)

Performance factors of RPA – Measurement system and sensor – Measurement of Atmosphere pressure – Effects of obstructions on wind speed and directions – Measurements of Temperature and Humidity – Different types of sensors used in RPA –

Unit V: Ground Control Stations (GCS) (25 Questions)

GCS telemetry – GCS features and flight plans – Flight mode of operations – GUI parameters – 3D mapping and modelling – First person view(FPV) of flying – RPA data – UAV trajectory – Way points and flight plan – Data mapping and navigations

Unit VI: Basic Inspection and Assembling of RPA (20 Questions)

Inspection procedures and types – Checklist before piloting a RPA – Landing Gears – Propellers – antennas – Safety precautions – pre-flight checks – Arming and disarming – Importance of cleaning the RPA – Storage Maintenance resources and standards

Unit VII: Basic training procedures to flying RPA in flight simulator (20 Questions)
Basic operating features of RPA flights simulator – Different types of aircrafts / RPAs and Aerodromes – Demo flights in RPA flight simulator with pre-flight checks – Start-up – Take-off RPAs – Safe landing procedures – Photogrammetry for Stitching and analysis of RPA pictures – Practical flying with and without instructor in RPA simulators – Flying operations from pre-flight checks to after flight checks while flying RPA with instructor and solo flying – Fail safe Mechanism

Unit VIII: Training to flying RPA in controlled environment (15 Questions)
First person view(FPV) of flying – Requirements of flying RPA in Controlled environment – Basic flight modes of RPA – Control and Safety precautions of RPA – Flying RPA in different patterns – GPS failsafe – Radio failsafe – Battery failsafe – Auto pilot system – Camera options and resolutions – Payloads and its calculations – Different types of payloads used in RPAs

Unit IX: Training to flying RPA in uncontrolled environment including VLOS and BVLOS flight (15 Questions)
Visual Line of Sight (VLOS) – Beyond visual line of sight (BVLOS) – Safety practices for VLOS and BVLOS – Communications system between UAV and GCS – Autonomous waypoint navigation – Video based navigation – UAV location – Camera view polygon – waypoints and flight plan – Specific applications of RPA

Unit X: Emergency protocols to control and manage RPA flight (15 Questions)
Flying rules in Manual / semi-autonomous flight mode – aircraft structural failure – Safety risks – Guidelines to fly RPA, UAV regulations in India – Emergency identification and handling in flight emergencies (Loss of link, fly-away, loss of power, control surface failure)

36. Trade - Sewing Technology

(ITI Standard)

Code: 546

Unit I: Safety Precautions & First Aid, Tools & Fabric Fundamentals (15 Questions)
Safety Precaution: First Aid- Pwd – Gender - Sanitization
Tools: Trade related Tools, Their Importance and Safety, Measuring Tools - Drafting Tools - Marking Tools - Cutting Tools - Sewing Tools - Finishing Tools

Fabric Fundamentals: Brief idea about Fibers - Types of Fabrics - Selection of Needle and Thread According to Fabric Types - Weaves Type - Needle Guard Policy - Fabric Preparation for Cutting - Fabric Grain - Characteristics of Fiber - Selvedge- Shrinkage - Straightening of Fabric Grains - Measurements - Units - Measuring Techniques – Marketing – Collecting Marketing – Information – Implementing Marketing - Collect Needed Information - Implementing Marketing Research Plan - Basic Garment Analysis.

Unit II: Sewing Machine & Overlock Machine (20 Questions)
Sewing Machine: Types - Parts and functions - Machine Needle - Stitch Formation - Care and Maintenance - Troubleshooting - Types of Industrial Sewing Machine - Parts - Function,
Overlock Machine: Parts and Functions - Types - Care and Maintenance – Troubleshooting.

Unit III: Seams, Fullness, Hand stitches and Decorative Stitches (20 Questions)
Seams: Classification - Uses - Properties of Seams - Seam Finishes - Sewing Aids - Special Attachments - Presser Foots - Folders - Guides - Gauges
Fullness: Darts - Necessity - Type - Precautions during Stitching
Pleats: Types and uses necessity
Gathering and Shirring – Ruffles/Flares - Frills
Tucks: Types and uses
Hand Stitches: Hand Needles - Size and Types, Application of Hand Stitches Types - Decorative Stitches - Usage.

Unit IV: Hems, Corner making, Casing and Edge Finishing (20 Questions)
Hems: Types & Uses
Corner Makings: Types & Uses
Casing: Types and Uses
Edge Finishing: Facing - Types and Uses - Binding - Piping - Banding

Unit V: Neckline, Placket, Pockets, Collars and Sleeves (20 Questions)
Neckline: Different Shapes of Neckline
Placket: Types and Sample Makings
Pocket: Types and Design Variations
Collars: Classification and Collar Terms
Sleeves: Classification - Sleeve Length Variation - Making of Sleeve with Cuff, Types and Without Placket.

Unit VI: Trimmings, Buttonhole, and Mending (15 Questions)
Trimmings: Types - Applications - Fixing of Buttons, Hooks, etc.
Buttonhole: Buttonhole and Types
Mending: Darning, Patching and Types

Unit VII: Human Figures, Patterns, Pressing, and Mass Production (30 Question)
Human Figures: Eight Head Theory - Brief about Joints and Muscles - Types of Figures - Body Measurements - Importance - Types & Measuring Techniques - Precautions - Measurement Charts - Record and alterations as per Requirement of Customer.
Patterns: Importance - Pattern Information - Types of Spreading - Pattern Layout - Pattern Drafting - importants Spreading methods/Machines. Types of Pattern Layout - Pattern Terminology - Pattern Drafting - Tools for Pattern Making.
Pressing: Tools - Methods - Importance of Pressing - Trial Room - Necessity - Specification - Techniques of Pressing
Mass Production: Sequence of operations - Types of Cutting Machines - Fusing Technology - Types of Industrial Machines. Used Sewing Section - Finishing.

Unit VIII: Drafting the Pattern for Ladies Suits / Wear (20 Question)
Drafting the Pattern for Ladies Suit: Kameez - Salwar - Features of Salwar - Churidar - Features of Churidar.
Ladies Wear: Ladies Top - Short Kurties - Ladies Suit - Princess Line Kameez - Types of Anarkalli - Nightwear - Types (One Piece, Two Piece, etc.,) - Types of Cloth - Collar - Saree Blouse - Types - Saree Petticoat.

Unit IX: Kids Wear and Gents Wear (20 Question)
Kids Wear: Dresses For Newborn - Zabala - Types - Dresses For Toddler - Baby Chemise - Types of Slips - Baby Set - Kids Wear - Umbrella Frock - Baby Set - Combination Suit - Types of Cloth - T-Shirt - Trouser - Skirts and Shorts.
Gents Wear: Kurtha Types - Pyjama's Types - Shirt Types - Cloth Grain - Neck Types - Sizes - Gents Trousers Types.

Unit X: Laundry Stains and Techniques of Quality Control (20 Question)
Laundry Stains: Classification and Removing techniques. International Label System - new Development fabric performance code, different kinds of stain - cleaning agents.
Quality Control : Techniques of Quality Control - Need & Planning, Types of Inspection - Stages of Inspection - Role of Quality Controller.

37. Trade - Surveyor and Draughtsman (Civil)
(ITI Standard)

Code: 490

Unit I: Basic Engineering Drawing (25 Questions)

1. Role of Surveyor cum Assistant Draughtsman:
Know about the role of a surveyor cum Assistant Draughtsman - State the importance of survey and drawings.

2. Layout of drawing sheets and title block:
State the measuring of the term 'Layout' of drawing sheet - List the different layout styles of drawing sheets - Explain margin, frame, title block etc.

3. List of drawing instruments, equipments and materials to be used for Drawing:
Instruments, equipments and materials, State the standard as per IS 962, Follow precautions in the use of instruments, equipments and materials.

4. Layout of drawing Sheet:
State the system of layout of drawing sheet, List the different layout for designated drawing sheet, Explain the title block.

5. Folding of drawing Sheet:
State the purpose of folding a drawing sheet, Explain the method of folding for drawing sheet.

6. Scales & Dimensioning:
Scales for building plan, site plan, layout plan, regional plan, master plan and detailed development plan, Explain the methods of dimensioning.

Unit II: Basic Surveying (25 Questions)

1. Introduction - Principles of chain survey and instrument employed:
Define surveying, Explain the classification of Surveying, different methods of measurements, Express the instruments used for chain surveying.

2. Testing of metric chain (20m/30m):
State the necessity of checking the chain, State the methods of testing, List out the errors in the chain, State the limits of error in chain, Explain the adjustment of chain, State Indian optical square.

3. Measurement of distance by chain and chaining:
State chain and chaining a line, State unfolding the chain, Describe the reading the chain, State folding the chain, Calculate the errors in chaining

4. Ranging:
State ranging - State the necessity of ranging - State the types of ranging - Interpret the signals to surveyor and the corresponding action by assistance.

5. Chaining on sloping ground:
Explain the methods of chaining on sloping ground - State necessity of calculating horizontal distances.

6. Offset and Offsetting:
State the meaning of offset and offsetting - State the classification of offsets, its limits and its definition - State the methods of taking offsets for various site conditions.

7. Obstacles in chain surveying:
Define obstacles - State the three types of obstacles - Calculate the obstructed distance.

8. Instruments used for setting out right angles:
Instrument used for setting out right angles - State the types of cross staff and optical square - State the construction of cross staff and optical square - Explain the principles of optical square - State the uses of cross staff and optical square.

9. Triangulation survey:
Define the triangulation and traverse in survey - State closed and open traversed survey - State the three types of survey lines in triangulation.
Explain about field work.

10. Calculation of area:
Calculate the areas of an irregular field - Apply geometrical formula for calculating the area.

11. Setting up of plane table and methods of plane tabling:
State plane tabling - Name the instruments and accessories used in plane tabling - State the construction and uses of instruments accessories of plane tabling - Explain about the setting up of plane table over a station - Explain about leveling, centering and orientation in plane tabling - Explain the methods of plane tabling.

Unit III: Levelling (20 Questions)

1. Instruments Used for Levelling:
Explain the tilting level and auto level - Explain the construction a dumpy level - Explain the classification of leveling staff.

2. Types of Levelling:
Name the various types of levelling, Explain simple levelling, Explain differential levelling, Complete the reduced levels of points.

Unit IV: Compass Surveying & Theodolite (25 Questions)

1. Identification the parts of instruments in compass survey:
State about traversing, State types of compass, Prismatic compass and its construction, Construction of surveyor's compass.

2. Determining the bearing of a given triangular plot of ABC and calculation of included angles:
Calculate angles from bearing & Calculate bearing from angles.

3. Determining the bearing of a given pentagonal plot of ABCDE and calculation of included angles: Calculate angles from bearings for a closed traverse, Calculate bearing from angles for a closed traverse, Calculate bearing of a pentagon.

4. Theodolite:
Definition and Terms of Theodolite, Parts of Theodolite, Types of Theodolite, Fundamental Axis, Geometry of Theodolite & Adjustment of Theodolite.

Unit V: Road Engineering (10 Questions)

1. Technical term used in road engineering:
Define road, Define various terms used in road engineering, Describe the various advantages of road.

2. Principle of road alignment:
Alignment of road, Express the principle of highway alignment, Explain the different survey required for alignment.

3. Classification of roads:
Describe the different classification of roads.

Unit VI: Total Station (25 Questions)

1. Introduction to total station:
Definition, Important parts of Total Station, Features of Total Station and Uses of Total Station.

2. Types of total station:
Explain the advantages and disadvantages of Total station, Explain the types of Total Station, Explain the precautions to be taken while using Total Station.

3. Measurement with total station:
Explain the equipment required for Total Station surveying, Explain the procedure of measurement with Total Station.

4. Open and Closed Traverse:
Principle of EDM, 3D Co-ordinates.

Unit VII: GPS (Global Positioning System) (20 Questions)

1. GPS coordinate system and component of GPS System & segment:
Explain GPS co-ordinate system, Describe Geographic Latitude and Longitude, describe component of GPS receiver.

2. GPS segment:
Define GPS segment.

3. Principle of Operation of GPS and surveying with GPS:
State the Principle of Operation of GPS, Describe the role of transit in GPS.

Unit VIII: Construction Material & Practice (20 Questions)

1. R.C.C. (Reinforced Cement Concrete):
Define R.C.C., Advantages of R.C.C., material used in R.C.C., Grade of Cement, Reinforcement materials, bending of bars, finding the Quantities.

2. Foundation:
Definition, Types of foundation, purpose of foundation, failure of foundation.

Unit IX: Auto-CAD (20 Questions)

1. Introduction to CAD:
Explain the term CAD - Explain the use of CAD.

2. Draw tool bar:
Explain draw commands in CAD - Explain the method of drawing geometrical shapes in CAD.

3. Layers:
Explain the dimensioning method in CAD - Explain the use of object snap in CAD.

4. Modifying tool bar:
Various modifying tools in CAD - Explain the uses of modifying tools in CAD.

5. Printing CAD drawing:
Explain the steps involved in plotting in CAD.

Unit X: Building Drawing (10 Questions)

Plan, Section and Elevation of buildings, Layout plan, Site plan, Key plan, Topo plan, Master plan and Area Calculation.

38. Trade- Technician Power Electronics System (ITI Standard)

Code: 616

Unit I: Basics of AC and Electrical Cables, AC&DC Measuring instruments, CRO and Digital Storage Oscilloscope (15 Questions)

Electrical terms – Electric charge, Voltage, current, Resistance. Frequency, Time Period, RMS, Peak value,

Electrical Measuring instrument instantaneous Value – Parts of simple meter, specification, symbols. MC and MI meters classification, characteristics of meter and errors.

Electronics measuring instruments, uses and features, Controls and functions of cathode ray of Oscilloscope, DSO, Function Generator and LCR meter.

Operate the front panel controls of a digital storage oscilloscope capturing a single shot signal Function generator using IC8038 – Applications and advantages

Unit II: Cells and Batteries - Soldering of wires - Switches (15 Questions)

Cells and Batteries - Secondary batteries - Charge and Discharge of battery – Maintenance and Purpose of efficiency life of cell - use of Hydrometer - type of electrolytes - Series / Parallel connection of batteries.

Soldering of Wires – Types of soldering guns - temperature and wattages - use of flux and specifications – Types of switches and specifications.

Unit III: Active and Passive components - Power supply circuits – Transistor - Oscillator and wave shaping circuit (30 Questions)

Active electronic components - Passive components - Resistors Ohm's Laws - Kirchaffs Law - DC series circuit - Inductors Components - Capacitors Magnetism – Relays- Time constant for RC circuit- R.C. Differentiator - R.L.C. Series and parallel circuit – Inductive reactance - Self and Mutual induction – Behaviours- Q factor - Capacitive Reactance – Impedance - Dielectric constant - Series parallel connection of capacitors – Induction at High and Lower Frequencies.

Semiconductor – Diodes – Transformer – Rectifiers - Working principle of zener diodes - Regulated power supply - Integrated circuit voltage regulation - error corrections and amplification – Filter components and their role in reducing ripple - Varactor diodes specification and applications – Losses in Transformers.

Transistors and its Classification - their needs - Biasing of Transistors significance α, β. - Transistor power ratings and characteristics - applications as switch and amplifier – Various configurations and classification of amplifier Voltage gain and loading effects – Distinguish between voltage and power amplifier - α, β Current gain - concept of dB dBm.

Oscillators: RC Phase Shift Oscillator - Types of Multi vibrators and Study of Circuit Diagrams - Clipper Circuit - Clamper circuits.

Unit IV: Power Electronic Components - Opto Electronics - OP Amp and Timer applications (25 Questions)

Construction of FET, JFET, difference with BJT – Purpose of Gate, Drain and source terminals - voltage/current relations between them and impedance relations between various terminal - dimmer/fan motor speed regulator using TRIAC and DIAC MOSFET - Working of different Power electronic components such as SCR, UJT, power MOSFET and IGBT - Characteristics and switching speed - power ratings.

Working Characteristics and Applications of LED – IR LED – Photodiode - Photo transistor and Optical sensor - Opto–couplers - Opto Isolator and Laser Diodes.
Operational amplifiers types and their applications – comparators - differentiator Op-Amp -Differential & Instrumentation Amplifiers – integrator – summing - inverting voltage amplifier - Non-inverting voltage amplifier.

Unit V: Basic Gates - Combinational circuits - Flip flops - Electronic Circuit Simulator (15 Questions)

Introduction of Digital Electronics: All Logic gates - Difference between analog and digital signals, Decimal – Octal – Hexadecimal - BCD and ASCII code conversion - Binary Concept of encoder and decoder Multiplexers - De - multiplexers Latch circuits and applications – Magnitude comparator - Half adder- Full adder - applications and operations.

Unit VI: Computer Hardware – OS - MS office & Networking - Basic SMD (2, 3, 4, terminal components) - SMD Soldering & de soldering - PCB Rework (25 Questions)

Basic blocks of a computer - components of desktop and mother board - Computer hardware - Variable Ports in the computer –MS-office - Windows OS - MS-word - Paint tools in Windows - MS excel - Power point presentation - Networking – Topologies - protocols (TCP/IP, UPD & FTP) - NIC card - Ether Net switch - router.

SMD technology: identification of 2,3,4 terminals - components and advantages - various connections of SMD soldering station - SMD components - advantages of SMD Soldering/de-soldering of SMD components - identification of PGA packages - soldering/de-soldering of the above PGA components - identification of crimping tool - cold/continuity check of PCBs identification of lose/dry solders, broken tracks on printed wiring assemblies – ESD: Static charges, handling of Static sensitive devices, various standards for ESD.

Introduction of Rework: Repair concepts, Repair of damaged track, Repair of damaged pad and plated through hole, Repair of solder mask.

Unit VII: Microcontroller (15 Questions)

Introduction of 8051 micro controller - architecture pin details - bus system - Identify the address range of RAM and ROM - Different variants of 8051 & their resources - Register banks and their functioning- SFRs & their configuration for different applications- Utilization of on chip resources such as ADC - Availability of assembly software & compiler for 8051 - Application of microcontroller in domestic consumer & industries - Differentiate microcontroller with microprocessor - Interfacing of memory to the microcontroller - Internal hardware resources of microcontroller - I/O Port pin configuration

Unit VIII: Protection Devices & Electrical control Circuits - Digital Panel Meter - 3 Phase Rectifier (Controlled & Uncontrolled) – Chopper - Power Supplies & SMPS (25 Questions)

Fuses – terminology – types - uses Miniature circuit breaker (MCB) – types - construction- working – specification ELCB – types and working principle, Types of conductor and its working Fundamentals

of single phase induction motors-types- resistance start- induction run motor, centrifugal switch-capacitor start, induction run motor – capacitor start, capacitor run motor

Digital panel meter – Seven segment display - decoders and driver ICs (IC 7106 and IC 7107) - LCD: Working of LCD - Use of DPM to display different voltage and current signals

3 – Phase Rectifier: Control and Uncontrolled High power rectifiers (using SCR, working condition in the applications) – Difference Between controlled and uncontrolled rectifier

Chopper: Various types of chopper, DC-DC step up and stepdown converter and its applications - ICs used for converting DC-DC converters.

SMPS – Working Principle - Types and Applications – Different types of power switches and heat sinks used in power supplies.

Unit IX: Inverter - UPS - Fibre Optic - Solar Inverter and Sensor (20 Questions)

Inverter and its principle – Operation – Protection circuits used in inverter – Battery level - over load - over charging various fault and rectifications - three Phase inverter circuit - principles and workings- Uninterruptible Power Supply (UPS) - specifications – types - working load power factor - controlling circuit - charging circuits - alarm circuits - single phase - three phase UPS circuits - installation.

Introduction to Fibre optic as a transmission media – Properties – testing – losses- encoding of light – joints - splicing and safety aspects.

Need for renewable energy - sources Basics of photovoltaic cells -SPV system - solar charger controller – Basics of active and passive transducers

Different types of sensors (RTD, LVDT, Strain gauge, Proximity sensor, Hall sensor, Techo-generator, optical sensor) - working principle.

Unit X: Electrical Control of AC/DC Machines - AC Drive - DC Drives and Servo Motor - Electronic Pneumatics - PLC (15 Questions)

AC motor and DC motors – Synchronous speed – slip - rotor frequency - torque speed and starters (3 point and 4 point) – Field flux control and armature current control - brushless of DC motors.

AC Drive 1 phase Inverter 3 phase Inverter Variable frequency drive and microcontroller - switching timing control – PWM technique and switching devices – PID controller - Tacho- generator / encodes technical data related to DC drive - Servo mechanism - Servo motor principle - AC-DC brushless servo motor - control method of servo motor and study of servo driver and types.

Pneumatic power source (measure and storage of compressed air), application of pneumatics in industries - symbols of different pneumatic - (electro-pneumatic: Compressor, reservoir, pressure regulating valve, such push button valve, roller lever valves, proximity switches, Air barriers).

PLC: Evaluation control technology of PLCs - advantage - modular architecture of PLC's - working principle of PLCs Wiring of field devices to various modules - Interpretation of indications on CPU and other modules - implementation of relays in timers and counters using PLCs.

39. Technician (Operation)

(ITI Standard)

Code: 523

Unit I: Safety Rules – Fundamentals of Electricity (15 Questions)

Safety Rules, Hazards, Types of Fire Extinguishers personal Productive Equipments, Types of Wires and Joints. Soldering methods, Ohm's Law – Types of Capacitors & Inductors uses – Handling and Periodic testing of lifting equipments – Authorization of moving and road Testing vehicles, Electrical safety tips. Safe handling of Fuel Spillage - Safety standards for cars.

Unit II: Hand Tools Electrical Measuring Instruments - Motor Starters (30 Questions)

Angle Plate, Cutting Tools, Types of Hack saw frame and Blades – Types of files and chisels – Holding devices – Bench vice, Machine Vice, Clamps and Strap - Tool Holding Devices – Drill chock and key, Tapper sleeve & sockets, Tap wrench, Die stock - Absolute and Secondary instruments – Electrical measuring instruments and Types – Ammeter, Voltmeter, Ohm Meter, Power Factor Meter, Frequency Meter, Multimeter, Watt Meter, Energy Meter, Megger, Tong Tester, (Clamp on Meter) Smart Meters – Micro Meter, Vernier Calipers, Telescope Gauges, Dial bore Gauges, Dial indicators - Types of Gauges – Bevel Gauge, Bevel Protector, Surface Gauge, Surface plate function of frame, Types of frame – Chasis repair & Alignment, Frame maintenance.

Types of Motor Starters – Basic Contactor Circuit – Parts and Functions – Single Phasin Prevention – Maintenance Service and Repair – Methods of Trouble Shooting.

Unit III: Electronics (15 Questions)

Semi Conductor – PN Junction Diode – Special Diodes, Transistor – Types of Rectifier - Filter Circuits – Voltage Regulators – Types of Power supply – UPS - SMPS –Inverters – Convertor.

Unit IV: Compressor, Motor and Refrigerants (20 Questions)

Types of compressors used in Refrigeration and Air-Conditioning, Function, Construction – Wet Compression – Oil properties – Lubrication methods – Applications.

AC Motors – Types – Advantages of AC Motor over DC Motor – Starting and running winding – Starting current, RSIR, CSIR, CSR and PSC Motor, Functions of starting relay, Capacitors, OLP.

Classification of Refrigerants – Properties of Refrigerants – Pressure and Temperature of different Refrigerants – GWP, ODP of various Refrigerants – Properties of Insulating materials used in Refrigeration and Air-Conditioning.

Unit V: Condenser, Expansion Valve and Evaporator (20 Questions)

Function of Condenser, Type, Liquid receiver, Pump down, Drier – Function, Types - Expansion valves used in domestic refrigeration and Air-Conditioning – Capillaries, Automatic and Thermostatic expansion valve and Electronic expansion valve, Evaporator – Types construction, working and it's uses.

Unit VI: Water Cooled Condenser, Cooling Tower, Evaporator / Chiller and Water Treatment (30 Questions)

Water Cooled Condenser: Types and capacity, Construction, Working and De-Scaling application, Evaporative condenser – Function, Construction and Application Cooling Tower: Types, Construction, Capacity, Efficiency, Approach and Cooling Tower Range.

Water Treatment: Causes for water contamination and water treatment.

Evaporator and Chillers: Construction, Function and types of DX Chiller , Types of Defrost

System, Water / Brine Chiller, Types of brine used as secondary refrigerant.

Unit VII: Heat Exchanger, Accumulator and Control System of Air-Conditioning Plant (10 Questions)

Heat Exchanger and Accumulator: Function and Construction, Applications, Oil Separator – Function and Construction.

Control System of Air-Conditioning Plant: Temperature and Pressure control used in AC plant, it's construction, working, safety devices, Piping lines, Electromechanical, Pneumatic and electronics used in Air-Conditioning plant.

Unit VIII: Measurement of Pressure and Flow (20 Questions)

Pressure – Unit of Pressure – Types of pressure – Pressure switches – Types of pressure sensors

FLOW – Basic properties of fluids in flow measurement – Types of flow meters – Calibration – Installation & Service – DPT.

Unit IX: Measurement of Level and Temperature (20 Questions)

Level - Level measurement – Types of level measurement instrument in open channels & closed channels – Level switches – Sonic level defector.

TEMPERATURE: Heat & Temperature – properties – Units-types – Thermocouple RTD – Thermistor – Types pyrometers – Recorders.

Unit X: Networking (20 Questions)

Networking – Types of networks used in digital Instrument system – Connection – Types of cables – Various networking tools - fundamentals of SCADA and DCS – Types of communication & field instruments – Field bus – HMT, interfacing modules, I/O modules, Field bus devices basic of RTP Ethernet, EDDL.

40. Trade – Textile Wet Processing Technician

(ITI Standard)

Code: 626

Unit I: General Safety Precautions and First Aid (10 Questions)

Safety Precautions related to the trade, Machines – Materials – various processes – Steaming – hot air drying – exhaust arrangement – gases. Handling of corrosive chemicals – Handling of electrical installation – Handling of various machines in Wet Processing. Fire Hazards and Fire Extinguisher.

Unit II: Classification of Textile Fibres and Physical & Chemical properties (10 Questions)

Fiber-definition, Classification of Fibres – Cotton – Jute – Silk – Wool – Nylon – Polyester – Acrylic – Viscose rayons. Physical and chemical properties - cotton, silk, wool, polyester and Viscose rayon. Identification of textile fibers and their blends. Yarn and fabric-definition. Types of fabrics - woven – knitted.

Unit III: Role of PH and Chemical Auxillaries in Textile Wet Processing (20 Questions)

PH – definition and importance in textile processing , Chemicals- organic, Inorganic, acids, alkali, salt, oxidizing agents , Reducing agents, Surfactant , Sequestering agents. Application of Water in Textile Processing and Specification- Soft Water , Hard Water , Water Softening. Cycling and Recycling of

water – Reverse osmosis method – Benefits of Water Recycling – Water Conservation method.

Unit IV: Inspection of Grey Fabric and Preparatory Process (20 Questions)

Inspection of grey fabric – repairing – mending – stitching and marking, cropping – Shearing – Singeing – Desizing – Scouring – Bleaching – Mercerizing. Souring process for cotton and blended materials. Degumming of Silk, Scouring of Wool. Washing of Yarns – Fabrics after preparatory process with suitable washing machines. Drying of yarns and fabrics – Stentering.

Unit V: Classification of Dyes and Dyeing Process (30 Questions)

Definitions of Chromophore – Auxochrome – affinity – substantivity – exhaustion – Expression – Percentage of Shade – Leveling. Classification of dyes and Pigments – Study of various dyes for natural and manmade fibers and blended fabrics – Direct – Basic – Sulphur – vat – solubilised vat – azoic – Reactive Dyes - Mordant & Mineral colours – aniline Black and metal complex – acid dyes – disperse dyes. Dyeing defects - causes and remedial measures.

Unit VI: Dyeing Machines (30 Questions)

Fibre Dyeing Machine – loose stock dyeing, yarn dyeing machines – rotary hank dyeing, package dyeing machines, Fabric dyeing machines - jigger – Padding mangle – winch – soft flow – Air flow and multi flow dyeing machines . Continuous dyeing ranges – beam dyeing machine – HTHP (High Temperature High Pressure) Jet dyeing machine. study of Garment dyeing machines – Steaming – Soaping and after treatment – Manual colour matching – Computer Aided Colour matching – Measurement of Colour parameters – Test for colour fastness for dyed textiles against washing – Rubbing – Hot Ironing – UV Light- Sunlight and perspiration.

Unit VII: Types of Printing and Printing Machines (20 Questions)

Difference between Printing and Dyeing – Fabric requirements for Printing – Method of Printing – Styles of Printing. Various Printing Machine - roller printing – flat bed printing – Rotary Screen Printing – Transfer Printing – Garment Printing Machine .Printing with –direct dyes – azoic dyes– vat dyes – Reactive dyes – acid dyes . Pigment printing with Nylon, Disperse Dyes on Polyester Fabric Specialized Printing- Raised, Rubber, Brasso, Bronze Printing . Application of CAD (Computer Aided Design) Systems and their Advantages in printing. Principle of Engraving – Wax jet engraving – Digital Inkjet Printing.

Unit VIII: Finishing of textiles by mechanical and chemical methods (20 Questions)

Mechanical finishes – Calendaring – anti shrink finish [sanforisation]. Chemical Finishes – Enzymatic Softening – Anti crease Finish – Water Proof – Water Repellency – Fire Retardency – Fire Proofing – Heat Setting of polyester cotton blended fabric – Finishing of Silk – Decatizing – Weighting of Silk – Tampering & breaking of silk – Scroppy finish of Silk. Carbonization of Wool – Milling – Shrink Proofing of Woollen Fabric. Types of Flame Retardants – Application of Flame Retardants – Bio Polishing of Cotton Fabric – Eco Friendly Processing – Eco Standards – Nano Finishes and Plasma technology.

Unit IX: ETP (Effluent Treatment Plant) Plants and Environment Pollution (30 Questions)

Working Principle of Effluent treatment plant – Water and Air Pollution parameters and their permissible limits – Noise Pollution and its control – Permissible limit of noise in different cases – Health hazards for water – air – noise pollution – Measures for prevention or reduction of level of water – air – noise pollution – Energy saving in Textile Chemical Processing – Awareness about eco friendliness (eco–mark scheme) of textile products – Eco–parameters and their permissible limits for textiles .

Unit X: Operation of Boiler (10 Questions)

Boilers and its efficiency – Efficient use of steam – Efficient utilization of water – water circulation system – Different heating system and drying system and uses. Boiler operation and maintenance - Application of boiler in textile processing – dyeing - kier boiling - finishing and drying.

41. Trade - Turner, Tool and Die Maker

(ITI Standard)

Code: 552

Unit I: Safety and General Precautions and First Aid (10 Questions)

Safety and General Precautions observed in the Industry- Protective Personal Equipment (PPE) - Safety -First Aid Method and Basic Training - Remember ABC – Electrical Maintenance and Safety – Response to Emergencies - Road Safety and Signs - Disposal of Waste material – Colour Code for Waste Segregation - Importance of housekeeping - 5s – Confused Space Work and Material Handling – Moving Heavy Equipments – Fire Extinguishers –Occupational Safety & Health - Safe use of tools and Equipment used in the trade.

Unit II: Marking tools and Measuring tools and Accessories (20 Questions)

Measuring Tools : Steel Rule – Types of Vernier Caliper – Types of Micrometer – Vernier bevel protractor – Combination set – Try Square – Vernier height gauge –Screw pitch gauge – Radius gauge – Wire gauge – Plug gauge – Ring gauge – Telescopic Gauge - Dial Test Indicator its uses and Care – Sine bar and Uses – Slip Gauge – Checking of Taper with Roller Calculation.

Marking Tools: Scriber- Calipers- Type of Calipers – surface gauge – divider – Punch- Straight Edges- Surface Plate .

Hand Tools: Hammer –Screw driver – Spanners -Tap Wrench.

Cutting Tools: Chisel – Hacksaw - Type of Hacksaw Blades – Pitch – Different Type of Punches – Files – Different Type- Uses- Grade – Shape – drills – Different Parts, Types and Sizes – Tap & Die –Tap Extraction - Die and Die Stock – Method of Removing Broken Tap and Studs - Lathe Cutting tools – Type of Reamers – Knurling Tools.

Holding Tools Accessories : Vice – Types of Vice – Vee block – Drill chuck – Lathe Chuck – 3 jaw Chuck – 4 Jaw Chuck – Self Chuck – Collet - Face Plat – Driving Plat – Catch Plat – Various Types of Lathe Centres – Lathe Carriers – Types of Lathe Mandrels - Travelling Steady – Fixed Steady – Angle Plat – Jigs & Fixtures.

Unit III: Turning on a Lathe (35 Questions)

Main Component – Lever Positions & Lubrication Points – Different Parts Of Lathe - Classification of Lathe and Function and construction of Parts of Lathe – Specification of Lathe – Types of lathe drive its Merits and demerits –Description in details - head stock – Types of Tool post and setting - Conepully type – All geared type – Construction & Function – Tumbler Gear set – Reducing speed – necessary & Back Gear Unit Construction and Use – Knurling meaning – Necessity and types – Grades & Cutting speed for Knurling - Lathe Cutting Tools – Different Types – Shapes – Specification of Lathe Tools – Lathe Operations – Facing - Plain Turning – Step Turning – Taper Turning – Contour Turning – Form Turning – Chamfering – Cutoff –Threading –Boring – Drilling – Knurling - Eccentric Marking Vernier height gauge - Eccentric boring - Templates its function and construction – Toolmakers button and parts – Counter boring – Counter Sinking - Spot Facing - boring of split bearing – Holding split bearing Fixture and use in turning – Angles of Lathe Cutting Tools - Combination Drill (Centre Drill - Appropriate Selection of Size from Chart, Drill Chucks – Lathe Accessories

Unit IV: Taper Turning and Form Turning (10 Questions)

Taper - different method of expressing tapers and Standard Taper its Use - Important dimensions of taper – Taper turning by form swivelling, compound slide, Taper turning Attachment - Method of taper angle measurement – Form tool function types and use – Template purpose & use - Jig and fixture

definition type and use – Chip breaker on tool, purpose and type – Checking of taper with sine bar and roller – Cutting speed, feed, turning time and depth of cut calculation.

Unit V: Allied Operation and Heat treatment (10 Questions)
Basis process of soldering – welding and brazing - Basis process of Welding – Gases used in gas welding - welding Nozzles.
Heat treatment – Meaning & Procedure - Hardening and Tempering – Annealing of steel – carburizing of steel – Heat treatment purpose – Normalising – Surface Hardening Critical – Lower and Upper.

Unit VI: Eccentric turning and boring (10 Questions)
Eccentric Marking Vernier height gauge - Eccentric boring - Templates its function and construction – Toolmakers button and parts – Counter boring - boring of split bearing – Holding split bearing Fixture and use in turning.

Unit VII: Thread cutting and Other forms of thread (35 Questions)
Different types of screw thread - Form and elements and application – Drive train – change gear formula & Calculation – checking of thread by using screw thread gauge and plug gauge.
Different methods of forming threads – Calculation involved in core dia – simple gearing - driver & driven and lead screw pitch thread to be cut - Thread chasing dial function constructions and use.
Different profile of metric - BA and with worth and pipe thread – Calculation involving gear ratio and gearing. Screw thread micrometer and use.
Multiple thread function use – Multi start thread and methods – Calculation involves depth core and pitch and Proportion Acme thread & Buttress thread.
Calculation involving gear ratios - metric threads - cutting on inch lead screw lathe and vice versa - metric threads using inch leadscrew and vice – Calculation involving fractional thread odd & even threads.
Multistart thread – different methods of multistart thread - Calculation involving shape of tool (Square thread tool)
Helix angle and its effects on threading tool clearance angles – Tool life and negative top rake angle application and performance - positive top rake angle – Thread on Taper Surface.

Unit VIII: Advance Turning and CNC Turning (35 Questions)
CNC Technology Basics – Types of CNC Lathe – Control system and specification – Preparation of Part Programming - Axis Convention of CNC Machine – Feedback control system and Interpolations – Concept Co – ordinate geometry – Tool Offset- Job Offset – Trouble Shooting in CNC Machines.
Programming sequence G codes and M codes CNC – Machine Operation Modes, Jog Mode and MPG and Edit Mode - Fanuc – Canned Cycle – Cutting Speed and Feed – Process Planning & Sequencing tool layout & selection.
Machining Operation and tool path – Tool nose radius Compensation - Selection of Cutting Parameters from a tool Manufacturers – Factors affecting Quality & Productivity – Input and output Data – DNC system – Use of CAM Programme.

Unit IX: Special Operation on lathe and Special job Maintenance (25 Questions)
Preventive Maintenance -Lubrication functions and type source - method of lubrication – Grinding wheel – abrasive – grit & grade and bond – Interchangeability Meaning – Quality control procedure & Production – Frequency Classification Symbol.
Mass Production - System of Limits – Tolerance – Fit Different Types – Symbol for Holes and Shafts – Hoe Basis & Shaft Basis etc. Representation of Tolerance in Drawing – As Per BIS 919- Unilateral and Bilateral System of Limit- – Terms used in part Drawing &Geometrical Tolerances – Symbols – Automatic lathe main parts - Different types – Tool holder & used.

Unit X: Metals and Non Metals Characteristics (10 Questions)
Selection of Metals – Properties of Lathe cutting tools – MS-HCS – HSS – Cemented carbide – Types & Uses – Properties of Good Cutting Tool Materials – Different Tool Materials – Sterlite – Coated Carbides- Ceramic- Diamond – Single Point Cutting Tool- LH Tool –RH Tool – Drills for Difference Material and Tool Angle –Different Types Material of Lathe Tool.

42. Trade - Welder (Gas & Electric)
(ITI Standard)

Code: 440

Unit I: Introduction and Definition of Welding (10 Questions)

Safety Precautions SHIELDED METAL ARC WELDING (SMAW) & OXYGEN ACCETYLENE WELDING (OAW) Arc and Gas Welding Equipments, Tools and accessories - Various Welding Processes and its applications - Arc and Gas Welding terms and definitions.

Unit II: Different Process of Metal Joining Methods (20 Questions)

Bolting, riveting, soldering, brazing, seaming etc. - Types of welding joints and its applications. Edge preparation and fit up for different thickness - Surface Cleaning - Basic electricity applicable to arc welding and related electrical terms & definitions - Heat and temperature and its terms related to welding - Principle of arc welding and characteristics of arc, Permanent and Temporary Joints.

Unit III: Set The Oxygen - Acetylene Gas Cutting Plant (Oagc) and Oxygen - Acetylene Welding (OAW) (10 Questions)

Common gases used for Welding & Cutting, Flame temperatures and uses. - Types of Oxygen - Acetylene flame Temperature and uses - Oxygen-Acetylene Cutting Equipment principle, parameters and application.

Unit IV: Arc Welding Power Sources (20 Questions)

Transformer, Motor Generator Set, Rectifier and Inverter Types of Welding Machines and its Care & Maintenance - Advantages and disadvantages of A.C (Alternative Current) and D.C (Direct Current) welding machines.

Unit V: Arc Welding Positions (30 Questions)

As per EN & ASME Flat, horizontal, Vertical and Over head Position - Weld Slope and Rotation - Welding Symbols as per BIS & AWS - Arc length – Types - Effects of Arc Length - Polarity: Types and its applications - Weld quality Testing & inspection, Common Welding mistakes and appearance of good and defective welds - Weld gauges & its uses.

Unit VI: Gas Cylinders and Regulators (20 Questions)

Calcium Carbide uses and Hazard – Acetylene Gas Properties and flash back arrestor – Oxygen Gas and its properties, uses in welding. Charging process of Oxygen and Acetylene gases – Color coding for different Gas Cylinders – Regulator – Single and Double Stage – Oxy and Acetylene Gas Welding System (Low and High Pressure) – Gas Welding Techniques – Rightward and Leftward Technique – Filler Rod – Flux – Specification and uses.

Unit VII: SMAW Defects (20 Questions)

Arc Blow – Causes and Methods of Controlling – Distortion in Arc & Gas Welding – Pipe Welding – Types of Pipe Joints – Positions – Difference between Pipe & Plate Welding – Pipe Butt Joint - Pipe Development for Elbow, 'T' ,'Y' and Branch Joint.

Unit VIII: Arc Welding Electrode (20 Questions)

Types, Functions of Flux, Coating Factor, Sizes of Electrode Coding of Electrode as per BIS, AWS - Effects of moisture pick up. Storage and baking of electrodes - Special purpose electrodes and their applications. Weldability of metals, Importance of Pre heating, Post heating and maintenance of inter pass temperature.

Unit IX: Testing Welded Joints by Different Method of Testing (10 Questions)

Destructive Test - Nick Break - Free Bend – Tensile – Non Destructive Test - Dye Penetration -

Magnetic Particle – X Ray – Gamma Ray.

Unit X: Gas Tungsten Arc Welding (Gtaw) & Gas Metal Arc Welding (GMAW) (Co2) Welding Process (40 Questions)

Brief Description - AC and DC Welding, Equipments, Polarities and applications. Various Welding Process **(GTAW and GMAW (CO_2))** - Power sources for **GTAW** - AC [Alternative Current] & DC [Direct Current] - Tungsten electrodes - Types & Sizes - GTAW and GMAW Torches - Types, Parts and their functions - GTAW filler rods and selection Criteria - GMAW - Wire Feed System – Shielding Gases (Argon, CO_2) - **Advanced Welding Process** - Submerged Welding -Thermit Welding - Resistance Welding (Spot, Seam, Projection) - Friction Welding (Flash Butt) – Plasma Arc Welding and Cutting - Plastic Welding (Polypropylene(PP), Polyethylene (PE), Polyvinylchloride(PVC) - Induction Welding.

Workshop Calculation and Science : Unit, Fraction – Square root, Ratio and Proportions, Percentage – Material Science – Mass, Weight, Volume and Density – Heat & Temperature and Pressure – Basic Electricity – Mensuration – Trigonometry.

Engineering Drawing: Introduction – Drawing Instrument – Free Hand Drawing - Geometrical - Hand Tools, Measuring Tools – Fabrication Drawing, Sectional View of Different Types of Welding Joints and Pipe Joints – Symbols used in related Trades – Reading of Job Drawing of related Trades.

43. Trade - Wireman

(ITI Standard)

Code: 550

Unit I: Safety and Tools Handling (10 Questions)

Safety rules and signs – to prevent accidents -hazard identification- Warning Signs labels. Fire types and extinguishers -electrical fires - rescue operations and first aid- Waste material disposal-prevent environmental hazards –Factory safety - The use of Personal Protective Equipment (PPE) - Reason for shock – power failure – fire and system failure – BIS/ISI symbols of electrical accessories - 5S concept –trade tools and equipment – specification – uses – care and maintenance.

Unit II: Electrical Wire Joints and Cables (20 Questions)

Types of electrical wire and cables – specification – voltage grade – precaution – application – Different wire joints - stripping – skinning – SWG and micrometre - domestic, commercial, and industrial wiring system - wire and cables - Insulation - voltage grading - temperature rise, Insulator-semiconductors and resistor - soldering techniques- solder, flux- brazing, Crimping tools and thimbles–lugs and co-axial plug and socket.

Cables - advantages and disadvantages, various types –(PVC, XLPE, PILC, oil filled etc.) Cable insulation & voltage grades. Joints and terminations- pre-moulded, heat shrinkable, extrusion moulded joints Slip on, cold shrink terminations, Types of connectors - cable, current path.
Methods of conductor connection, contact resistance. Galvanic corrosion and use of bimetals. Connectivity - screen and armour, mechanical protection, Kits - joints and terminations.
Cable termination to equipment, Standards and testing; type, routine, field test, Stress control.

Unit III: Electrical and Electronics Circuits (25 Questions)

Fundamental of electricity – National electrical code 2011-terms and definition, measure resistance - voltage drop method, wheatstone bridge method –, Fundamental laws - Ohm's Law and Kirchhoff's Laws, Electrical circuits and networks – Law of resistance – types of resister – series and parallel connections and its characteristics, Magnetism – terms, materials and properties, Law's of electro magnetism – solenoid – effects of current – EMF – (Self and Mutually Induced EMFs)-Capacitors Types– functions – grouping and uses of capacitors.

AC circuits – RL,RC and RLC – series and parallel connections- vector concept – inductive and capacitive reactance, effects, DC and AC system – advantage, related terms-frequency, instantaneous value, RMS value, average value, peak factor, form factor and impedance, Power – active and reactive – single phase and three phase system Advantages of ploy phase system –star and delta connections - balanced and unbalanced – problems, PN-Junction diode, Rectifier – half, full and bridge, resistance - colour coding, types, and characteristics, safety and disposal of electronic components.

Unit IV: Electrical Machines and Earthing (25 Questions)

DC machine–Principle, parts and uses- EMF equations –Exciting of Generators (Self and Separately). Armature reaction, Commutation, interpoles and connection of interpoles. Parallel Operation of DC Generators, Application, losses &efficiency, Principle and types of DC motors. Changing the direction of rotation, DC – motor starters, Methods of speed control of DC motors.

Transformers – Single and three phase - principle, construction and classification, Testing (OC and SC test).

AC Machines – Motor and Alternator - principle, construction and classification, AC motor starters and soft starter, Service, troubleshoot and maintenance.
Earthing – IE Rules – plate, pipe earthling, Earth tester/Megger, earth - resistance, leakage current, difference between grounding and earthling – Circuit main earth and portable.

Unit V: Power Generation and Distribution (20 Questions)

Power Generating system - Power generation, transmission and distribution (LV MV and HV) –Hydro, Thermal, Nuclear power plant etc. Types of distribution system substation – Indoor and outdoor and pole mounted – line protective devices, equipment's – switch gears , circuit breakers and switches , Protection scheme – current and potential transformer – protective relay and lightning arrestors

Unit VI: Measuring Instruments and Testing (25 Questions)

Measurement of electrical parameters - system maintenance. Instruments classification - analog and digital meters - voltage, current and resistance values.MC and MI meters measure - DC and AC currents - Wattmeters and energy meters - power consumption. Phase sequence and frequency meters stability and tong testers (clamp meters). MRI meters, Testing in domestic wiring - fault tracing, earth leakage tests, and insulation resistance checks & safety.

Unit VII: Illumination and Lighting Systems (20 Questions)

Law's Illumination – types – factors – intensity, advantages/ disadvantage – applications, calculation of lumens and efficiency, Proper lighting - homes, offices, and industries, LED, CFL, spotlight, down light and strip light, HPMV lamp, Sodium vapour lamp and fluorescent lamps. Decorative and under-cabinet lighting - workspace visibility. DMX controllers - PAR lights stage lighting - LED video walls serve commercial displays. Motion sensor lighting saves energy and remote-controlled lights and fans enhance automation.

Unit VIII: Renewable Energy Systems and Electric Vehicles (20 Questions)

Renewable energy - power generation, solar energy - photovoltaic cells, charge controllers, and battery storage. Solar panel installation -tilt angles and sun exposure for efficiency. Solar water pumps and DC applications–ON/OFF Grid- Grid solutions, solar inverters - DC to AC. EV charging stations support electric mobility, requiring - battery maintenance and proper power distribution for public and home installations.

Unit IX: Control Panels and Wiring Installation (20 Questions)

Electrical circuit drawing – control element, equipment and symbols, Control panels - relay, ladder logic and wiring contactor, and overload relay wiring. Power distribution drawing

Control panel components - DIN rails, trunking, connector blocks, screw terminals, relays, contactors, protective units, fuses, fuse holders; chassis mounted, fuse-links, resistors; fixed, variable, capacitors, switches, lamps, labelling grommets and clips, Cable forming - template, wiring schedule, run out sheet, binding, continuous lacing, loop tie, lock stitch, finish knot, breakouts, lacing breakouts, spot ties, laying of wires, twisted pair, Cable markers and colour codes, Connections and routing of cables - Consideration of EMI/EMC, Conductors of different circuits.

Symbols and use of relay contacts: NO, NC, changeover, make/break after delay, Testing of various control elements and circuits.

Circuit breakers, fuses, MCCB, MCB, and ELCB for fault protection. Conduit wiring - surface and concealed PVC wiring, Cable forming and routing, Smart home automation wiring - lights, fans, and appliances. Estimation and costing.

Unit X: Domestic, Industrial Wiring and Winding (15 Questions)

Types of domestic wiring and industrial wiring - IE Rules related to wiring, National Building codes for house wiring, specification and types, rating & material, Terms - Maximum demand, Load factor and Diversity factor, Various wiring accessories/ electrical fittings Grading of cables and current ratings, Principle of laying out of domestic wiring - Voltage drop concept. IS 732-1863. Wiring materials - PVC cables, Indian standards regarding wiring materials, wiring estimation procedure, Branching of circuits - lighting and power.

Installation and maintenance - electrical appliances - Electric bells and buzzers, induction heaters and food mixers, Ceiling fans, washing machines, refrigerators, and pump sets- and their periodic servicing. Air conditioners (window and split).Industrial motors and pump, Battery maintenance and transformer winding. Wiring Estimation– domestic, commercial, and Industrial, smart wiring concept, Communication and entertainment wiring, Ground fault circuit interrupter.

Types of winding- Concentric, distributed - single/ double layer winding and related terms.
Troubleshooting of single-phase - AC induction motors and universal motor.

Industrial Wiring – Adverse conditions affect the installation, Degree of mechanical and electrical protection, Peak-Non-peak Loads, Lighting Design - lighting power density, Estimation - load cable size - bill of material and cost - Inspection and testing of wiring installations , Special wiring - hospital, go down, tunnel and workshop, Danger notice as per IE rules.

Cable Management - Types of cables, uses, cable glands, IP ratings, IP Codes format. Importance of Bonding and grounding, various types. Testing of cables-locating faults, open circuit, short circuit and leakage in cables.

44. Trade - Workshop Calculation and Science (ITI Standard)

Code: 540

Unit I: Units, Fraction, Square Root, Ratio, Proportion and Percentage (20 Questions)
Classification of Unit system – Fundamental and derived units – System of International (SI) units – Measurement of units and conversion – Factors, Highest Common Factor(HCF), Lowest Common Multiple (LCM) – Simple and Decimal Fractions – Addition, subtraction, multiplication and division related problems - Square and square root problems – Applications of Pythagoras theorem – Direct and Indirect proportions – Percentage -Conversion of percentage into decimal fraction and fraction to percentage.

Unit II: Material Science and Heat Treatment (30 Questions)

Types of metals - Ferrous and Non-ferrous metals – Physical and Mechanical properties of metals – Iron, Cast iron, Steel – Alloy steel and Carbon Steel – Difference between Iron and Steel – Properties and uses of rubber, timber and insulating materials.

Heat treatment purpose and advantages - Process – Annealing – Normalizing – Hardening – Tempering – Case hardening – Structural changes of steel – Lower, upper critical temperatures (LCT, UCT).

Unit III: Mass, Weight, Volume, Density, Speed, Velocity and Work Power Energy (20 Questions)

Mass, Volume, Density, Weight and Specific gravity – Related problems – Speed, Velocity - Rest, Motion, acceleration and retardation - Related problems

Work – Power – Energy - Horse Power (HP), Indicated Horse Power (IHP), Brake Horse Power (BHP) and efficiency - Potential energy - kinetic energy and related problems.

Unit IV: Heat and Temperature (20 Questions)

Heat and temperature – concept - effects - difference - Boiling point & melting point of different metals and non-metals – Measuring Instruments – Thermometer – Pyrometer – Transmission of heat – Conduction – Convection – Radiation – Co-efficient of Linear expansion and related problems –Heat loss and heat gain - Thermal conductivity and insulators - Concept of pressure - Units of pressure, atmospheric pressure, absolute pressure, gauge pressure and gauges used

Unit V: Basic Electricity (15 Questions)

Uses of electricity - electric current - alternating current - direct current - comparison – voltage - resistance - units - conductor - insulator, types of connections - series and parallel - Ohm's law - related problems - magnetic induction - self and mutual inductance - Electro Motive Force (EMF), electrical Power, Horse Power, energy - units of electrical energy

Unit VI: Mensuration – Area of Cut-Out Regular and Irregular Surfaces (20 Questions)

Area and perimeter of square - rectangle - parallelogram - triangles - circle - semi-circle - circular ring - sector of circle - hexagon and ellipse

Lateral surface area(LSA), total surface area(TSA) and volume of solids – cube – cuboid – cylinder - sphere and hollow cylinder - capacity in litres of hexagonal, conical and cylindrical shaped vessels – related problems.

Area of cut out regular surfaces – circle - segment - sector of circle - related problems - area of irregular surfaces and application related to shop problems

Unit VII: Friction (15 Questions)

Friction - Advantages and disadvantages - Laws of friction – co-efficient of friction - angle of friction - simple problems related to friction - application and effects of friction in workshop practice - lubrication.

Unit VIII: Centre of Gravity, Levers and Simple Machines and Elasticity (20 Questions)

Centre of gravity - Centre of gravity and its practical application - Simple machines - Effort and load - mechanical advantage - velocity ratio - efficiency of machine - relationship between efficiency - velocity ratio and mechanical advantage - Elasticity - Elastic, plastic materials – stress - strain and their units - young's modulus of elasticity - Ultimate stress - working stress – stress – strain curve.

Unit IX: Algebra & Trigonometry (20 Questions)

Algebra – addition – subtraction - multiplication - division - Theory of indices - algebraic formulae - related problems - Measurement of angles - Trigonometrical ratios – workshop related height and distance calculation.

Unit X: Estimation and Costing, Profit and Loss (20 Questions)

Estimation and costing - Simple estimation - requirement of material estimation and costing - Problems on estimation and costing.

Profit and loss - Simple problems in Profit and loss - Simple interest - compound interest.

45. Trade - Diesel Mechanic and Mechanic (Motor Vehicle) (ITI Standard)

Code: 627

Unit I: Safety Workshop Practice and First Aid, Measuring& Marking Tool (10 Questions)

Importance of Safety and general Precautions to be observed in the work shop, Elementary of First Aid, Occupational Safety, Hazards Health, Fire Extinguisher, House Keeping and 5S Method - Safety disposal of Used engine oil, Electrical safety tips, Safe handling of Fuel Spillage, Safe disposal of toxic dust - Safe handling and Periodic testing of lifting equipment - Hand Tools - Marking Materials - Chalk, Prussian blue - Cleaning Tools – Scraper, wire brush, Emery paper – Marking Tools - Surface plates –Measuring Tools- Steel rule, measuring tape, try square, Calipers-inside and outside, Dividers, surface gauges, Scriber Punches, Types of Punches - prick punch, centre punch, pin punch, hollow punch, number and letter punch – Chisel - flat, cross-cut – Hammer - ballpein, lump, Mallet, Types of Screwdrivers, Allen and key bench vice and C-clamps, Spanners, Types of spanners, Universal adjustable spanner, open end spanner, Sockets and accessories, Types of Pliers, Air impact wrench, air ratchet, wrenches-Torque wrenches, pipe wrenches, Pipe flaring and cutting tool, Pullers-Gear and bearing - Description, Least Count calculation, care and use of micrometer, Outside and depth micrometer, Inside Micrometer, Vernier calliper and its adjustments, Telescope gauges, Dial bore gauges, Dial indicators - Straight edge, feeler gauge - Thread pitch gauge - Vacuum gauge and tyre pressure gauge.

Unit II: Vehicle Specification, Service Station Equipments, Engine Classification, Dash Board Gauges, Hydraulics and Pneumatics (15 Questions)

Classification of vehicles on the basis of load as per central motor vehicle rule, wheels, final drive and fuel used, axles, position of engine and steering - Transmission, body and load, Brief description – Uses of vehicle hoists, Two post and four post hoist, Engine hoists, Jacks, Stands – Introduction to Engine – Define of internal & external combustion engines, Classification of IC engines, Principle and Working of 2 and 4-stroke diesel engine Compression ignition Engine (C.I) – Principle of spark ignition Engine (SI), differentiate between 2-stroke and 4-stroke, C.I engine and S.I engine – Main parts of IC Engine – Direct injection and indirect injection, Technical terms used in engine, Engine specification – Study of various gauges / instrument on a dash board of a vehicle – Speedometer, Tachometer, Odometer and Fuel gauge and indicators - Gearshift position, Seat belt warning light, Parking-brake-engagement warning light and an engine -Malfunction light.
Hydraulics and pneumatics – Description, symbols and application in automobile of Gear pump, Internal and External, single acting, double acting and double ended cylinder - Directional control, Pressure relief valve, Non return valve, Flow control valve used in automobile.

Unit III: Engine Constructional details, Cooling and Lubrication System (30 Questions)

Description and Constructional feature of Cylinder head, Importance of Cylinder head design - Type of Diesel combustion chambers - Effect on size of Intake and exhaust passages, Head gaskets, Importance of Turbulence, Valves and Valve Actuating Mechanism - Description and Function of Engine Valves, different types, materials, - Types of valve operating mechanism, Importance of Valve seats, Valve seats inserts in cylinder heads - Importance of Valve rotation, Valve stem oil seals, size of Intake valves, Valve trains, Valve - Timing diagram - Concept of Variable valve timing - Description of Camshafts and drives, Description of Overhead camshaft Single Overhead Camshaft (SOHC) and Double Overhead Camshaft (DOHC) - Importance of Cam lobes, Timing belts and chains, Timing belts and tensioners, Description and functions of different types of pistons, piston rings, piston pins and materials - Recommended clearances for the rings and its necessity, precautions while fitting rings, common troubles and remedy - Compression ratio - Description and function of connecting rod - Importance of big - End split obliquely - Materials used for connecting rods big end and main bearings shells. Piston pins and locking methods of piston pins - Description and function of Crank shaft, camshaft- Engine bearings-classification and location – materials used and composition of bearing materials- Shell bearing and their advantages - Special bearing materials for diesel engine application

- Bearing failure and its causes; care and maintenance - Crank-shaft balancing - Firing order of the engine - Description and function of the fly wheel and vibration damper - Crank case and oil pump - Gears timing mark - Chain sprockets, chain tensioner - Function of clutch and coupling units attached to flywheel - Description of Cylinder block - Cylinder block construction - Different type of Cylinder sleeves (liner).

Heat transfer method - Boiling point and pressure - Centrifugal force - Vehicle coolant properties and recommended change of interval - Different type of cooling systems, Basic cooling system components - Radiator, Coolant hoses - Water pump - Cooling system thermostat - Cooling fans - Temperature indicators - Radiator pressure cap - Recovery system - Thermo- switch.

Need for lubrication system - Functions of oil, Viscosity and its grade as per SAE - Oil additives, Synthetic oils, The lubrication system, Splash system - Pressure system - Corrosion/noise reduction in the lubrication system - Lubrication system components - Description and function of Sump, Oil collection pan, Oil tank, Pickup tube, different type of Oil pump & Oil filters. Oil pressure relief valve, Spurt holes and galleries, Oil indicators, Oil cooler.

Unit IV: Intake and Exhaust System, Diesel Engine Fuel System (25 Questions)

Intake and exhaust systems – Description of Diesel induction & Exhaust systems. Description and function of air compressor, exhauster - Super charger – Intercoolers - Turbo charger - Variable turbo charger mechanism- Intake system components - Description and function of Air cleaners, Different type of air cleaners, Description of Intake manifolds and material - Exhaust system components - Description and function of Exhaust manifold, Exhaust pipe, Extractors, Mufflers - Reactive, absorptive, Combination of Catalytic converters - Flexible connections, Ceramic coatings, Back-pressure - Electronic mufflers.

Fuel Feed System in IC Engine (Petrol and Diesel) - Gravity feed system, Forced feed system, main parts, Fuel Pumps - Mechanical and Electrical - Feed Pumps - Knowledge about function, working and types of Carburettor Diesel Fuel Systems - Description and function of Diesel fuel injection, fuel characteristics - Concept of Quiet diesel technology and Clean diesel technology Diesel fuel system components - Description and function of Diesel tanks and lines - Diesel fuel filters - water separator - Lift pump - Plunger pump, Priming pump - Inline injection pump, Distributor-type injection pump, Diesel injectors, Glow plugs, Cummins and Detroit Diesel injection - Electronic Diesel control - Electronic Diesel control systems, Common Rail Diesel Injection (CRDI) system, hydraulically actuated electronically controlled unit injector (HEUI) diesel injection system. Sensors, actuators and ECU (Electronic Control Unit) used in Diesel Engines.

Unit V: Basic Electrical and Battery, Charging, Starting System, (20 Questions)

Basic electricity - Electricity principles - Ground connections - Ohm's law - Voltage, current, resistances, Power, Energy - voltmeter, ammeter, ohmmeter, multi meter - Conductors and insulators – Wires – Shielding - Length vs resistance - Resistor ratings – Fuses and circuit breakers - Ballast resistor - Stripping wire insulation - Cable colour codes and sizes - Resistors in series circuits, Parallel circuits and series parallel circuits – Battery - types of battery, Lead acid batteries and Stay Maintenance Free (SMF) batteries – Chemical effect, Magnetic effects, Heating effects - Thermo-electric energy - Thermistors, Thermo-couples – Electrochemical energy - Photo-voltaic energy - Piezo-electric energy - Electromagnetic induction – Relays, solenoids, Primary and Secondary windings – Transformers - Stator and rotor coils.

AC and DC Generators - Constructional details of Alternator and starter Motors-Charging Circuit, Operation of Alternator and starter motor – Regulator unit - Ignition Warning Lamp, Solenoid switches

Unit VI: Transmission system (30 Questions)

Clutch, Gear ratios, Gearbox Automated Manual Transmission (AMT) Gearbox layout and operation, Baulk-ring synchromesh unit, Transaxle synchromesh unit drive transfer case, Freewheeling hubs, Four wheel drive differentials All-wheel drive- four wheel final drives, All-wheel drive transfer case, Transfer case differential action Automatic Transmissions - Torque converters, Planetary gears, Electronic control transmission, Propeller shaft, Universal Joint, Final drive, Differential unit, Rear

axle and Front axle.

Unit VII: Wheels and Tyres, Steering Systems, Suspension Systems, Braking Systems (30 Questions)

Wheel, Tyre, Rim and its types, materials, Construction, Characteristics. Tyre sizes and designations, Tyre information, Tyre tread designs, Tyre ratings for temperature and traction. Descriptions Tyre wear Patterns and causes Nitrogen v/s atmospheric air in tyres
Principles of steering, Rack-and-pinion steering system, Recirculation ball and nut steering system, Four-wheel steering systems, collapsible steering system. Steering boxes and columns, Power Assisted steering, Electric power assisted steering. Wheel alignment:- Basic principles , wheel base, wheel track, king pin inclination, Caster, Camber, Scrub radius, Toe-in and toe out, Toe-out on turns, Turning radius, Thrust angle and centre lines.
Principles of suspension, Types of suspension Independent suspension, Rear independent suspension, Rear-wheel drive independent suspension, non independent suspension, electronically controlled air suspension (ECAS), Adaptive air suspension operation. Types of springs - Description and function of Coil springs, Leaf springs, Torsion bars, Rubber springs. Shock absorber types- Hydraulic shock absorbers, Gas-pressurized shock absorbers, Load adjustable shock absorbers, Manual adjustable-rate shock absorbers, Electronic adjustable-rate shock absorbers, Automatic load adjustable shock absorbers Front suspension types and components - Mc person Strut suspension, Short/long arm suspension, Torsion bar suspension Rear suspension types and components -Rigid axle leaf spring suspension, Rigid axle coil spring suspension, Independent type suspension, Rigid non-drive suspension.
Brake type - principles, Air brakes, Exhaust brakes, Electric brakes, Parking brakes, Engine brakes, Regenerative Braking system, Components of brake system, Brake friction materials, Antilock braking system operation, Principles of ABS braking, CABS master cylinder, Hydraulic control unit, Wheel speed sensors, ABS with EBD electronic control unit. The construction and Operation of ABS. Braking system components.

Unit VIII: Basic Electronics and Heating, Ventilation, Air Conditioning (HVAC) (20 Questions)

Basic electronics: Description of Semi conductors, Solid state devices- Diodes, Transistor, ignition systems - Distributorless ignition systems, Insulated coils, Distributorless ignition system timing. Horn, Wiper, power window, Power door lock, Automatic door lock, Remote keyless entry system, Antitheft system, Immobilizer system circuits and its components. Description and function of Airbags, Seatbelt, Vehicle safety systems, Crash sensors, Seat belt pre tensioners, Tyre pressure monitoring systems Integrated communications, Proximity sensors.
Principles, Air-conditioning capacity, Air-conditioning refrigerant, Humidity Description and function of Fixed orifice, Control devices, Thermostatic expansion valve system, Thermal expansion valves, Air-conditioning compressors, Condensers and evaporators, Receiver drier, Lines and hoses, Thermostatic Expansion (TX) valve construction, Temperature monitoring thermostat, Refrigerants, Pressure switches, Heating elements Air-conditioning ECU, Ambient air temperature sensor, Servo motors, Electric servo motors, Automatic climate control sensors, Evaporator temperature sensor, Blower speed control, Ventilation system.

Unit IX: Electric Vehicle Technology (10 Questions)

Introduction to Hybrid and Electronic vehicle, Hydrogen fuel cell vehicle, EV Terminology Comparison of Electric Vehicle with IC engine vehicle based on emissions, range, fuel type. Types of electric vehicle, Battery Electric Vehicle (BEV), Hybrid Electric Vehicle (HEV), Plug-in Hybrid Electric Vehicle (PHEV) and Fuel Cell Electric Vehicle (FCEV). Architecture of Electric Vehicle, working principle of fully electric vehicle, Major component, performance parameter, Basics of Motors, Selection, sizing and characteristic of Motor, calculation for motor effort, electric transmission. Principle, working and operation of propulsion system, DC Motor - Drives Armature Voltage, chopper circuit, step up, Step down chopper, control strategy, chopper amplifier. Brushless DC Motor – principle working, features, speed control system of brushless DC motor, efficiency, calculation. Battery management system.

Unit X: Diagnostic Trouble Code (DTC) and Emission Control (10 Questions)

Use of scan tool and retrievals of codes. EFI (Electronic Fuel Injection) sensors - Intake Temperature sensor, Mass airflow sensor, Manifold absolute pressure sensor, Air vortex sensor, Fuel system sensor, Throttle position sensor, Exhaust gas oxygen sensor, Crank angle sensor, Hall effect voltage sensor, Optical type sensors.
Vehicle emissions Standards - Euro and Bharat II, III, IV, VI Sources of emission, Combustion, Combustion chamber design. Types of emissions: Characteristics and Effect of Hydrocarbons, Hydrocarbons in exhaust gases, Oxides of nitrogen, Particulates, Carbon monoxide, Carbon dioxide, Sulphur content in fuels Description of Evaporation emission control, Catalytic conversion, Closed loop, Crankcase emission control, Exhaust gas recirculation (EGR) valve, , Controlling airfuel ratios, Charcoal storage devices, Diesel particulate filter (DPF). Selective Catalytic Reduction (SCR), EGR Vs SCR.

46. Mine Mate

(Certificate Course Standard)

Code: 591

Unit I: Duties and Responsibilities of Mine Mate and Blaster as per Metalliferous Mines Regulation 1961 (40 Questions)
Provisions of the Metalliferous Mines Regulation 1961 relating to the safety of persons employed in mines in general and the duties of Mining Mates and Blaster in particular
Appointment of Competent persons – Duties and Responsibilities of Mining mates – Blasters – Magazine In charge – Register keepers.

Unit II: Duties and Responsibilities of Mine Mate and Blaster as per the Mines Rules, 1955 (20 Questions)
Provisions of the Mines Rules 1955 relating to the safety of persons employed in mines in general and the duties of Mining Mates and Blaster in particular
Medical Examination of persons employed in Mines – Returns – Workmen's Inspector and Safety Committee – Health and Sanitation provisions – First aid medical appliances – Employment of persons – Leave with wages and overtime – Welfare amenities – Maintenance and production of reports, registers and other records – Miscellaneous.

Unit III: Duties and Responsibilities of Mine Mate and Blaster as per the Mines Act, 1952 (10 Questions)
Provisions of the Mines Act 1952 relating to the safety of persons employed in mines in general and the duties of Mining Mates and Blaster in particulars - Mining operations and management of Mines – Provisions as to Health and Safety – Notice to be given of accidents – Hours and Limitations of Employment – Leave with wages – Penalties and Procedures – General provisions for disobedience of orders.

Unit IV: Machinery and Plant (10 Questions)
Machinery and Plant - Use of certain machinery in opencast Mines – Maintenance of Machinery – Apparatus under pressure – Precautions regarding moving parts of Machinery – Working and Examination of Machinery.

Unit V: Safe Operating Procedures for Loading and Transport in Mines (20 Questions)
Safe Operating Procedures for Loading, unloading and transport of mineral / overburden - Equipment and Vehicle safety – Braking systems – Road maintenance – Speed Limits – Haul Roads – Material handling – Avoiding overloading – Maintenance of Road gradient – Worker's safety and training.

Unit VI: Benching, Sloping and Fencing of Open Cast Mines (30 Questions)
Benching and sloping of opencast workings and Fencing of opencast Mines - Examination and dressing of the sides Benching in quarries, Dressing of overhangs, Fenchings, First aid and Hygiene - Protective works before a mine is closed – Working near mine boundaries – Examination of fencing and gates – Avoidance of dangers – General Precautions.

Unit VII: Mines Vocational Training Rules (05 Questions)
General management – General vocational training – Refresher training - Training of persons on shortfiring – Training of persons in handling of explosives – Shortfiring and Safety regulations.

Unit VIII: Explosive and Shotfiring, Blasting and transport and use of explosives in opencast mines (45 Questions)

Storage of Explosives – Transport of Explosives – Blasters – Drilling, Charging, Stemming and Firing of shortholes – Deep hole drilling and blasting – Taking Shelter – Inspection after shortfiring – Misfires – Duties of Blaster – General precautions regarding Explosives.

Unit IX: Miscellaneous and General Safety (10 Questions)
Fences – Notices – Danger from poisonous substances – General Safety – Use of supply and maintenance of Protective footwear / helmet – Supply of other protective equipment – Place of accident.

Unit X: Precautions against danger from fire, dust, and water and Occupational Health Hazards (10 Questions)
Precautions against fire – equipment for fire fighting – Precautions against dust – Danger from Surface water – Occupational health hazards in open cast mines relating to dust, noise and vibration, heat stress.