தமிழ்நாடு அரசுப் பணியாளர் தேர்வாணையம்
சிவில் இன்ஜினியரிங்

(பட்டப்படிப்பு தரம்) குறியீடு: 398

அலகு I: கட்டுமானப் பொருட்கள் மற்றும் கட்டுமான நடைமுறைகள்

பொறியியல் பொருட்களின் பண்புகள் மற்றும் பரிசோதனை - செங்கல், கற்கள், எம்-சாண்ட், மணல் மற்றும் சல்லி கற்கள், சிமெண்ட், மரம், மறுசுழற்சி மற்றும் நவீன பொருட்கள் - கண்ணாடி, பிளாஸ்டிக், நார் வலுவூட்டபட்ட பாலிமர் (FRP), பீங்கான்- கற்காரை - பண்புகள் மற்றும் பரிசோதனை- கலவை உட்பொருட்கள் தீர்மானம் (Mix Design) – கலவை ஊக்கிகள் (Admixers), சுய இறுக்க கற்காரை (Self Compacted Concret), எஃகு கட்டுமானம் - கல், செங்கல் கட்டுமானம், கம்பி இழையூட்டப்பட்ட கற்காரை (RCC) மற்றும் திண்ம கட்டி கட்டுமானம் (Block Masonary) - கட்டுமான உபகரணங்கள் - கட்டிட விதிகள் மற்றும் தமிழ்நாட்டில் நடைமுறையில் உள்ள கட்டுமான விதிமுறைகள் - தீ பாதுகாப்பு, வெளிச்சம் மற்றும் காற்றோட்டம் - ஒலியியல்.

அலகு II: இன்ஜினியரிங் சர்வே

சர்வே - செயின்- திசைகாட்டி - ப்ளேன் டேபிள் - லெவலிங் - தியோடோலைட் – பரப்பளவு மற்றும் கனஅளவு கணக்கீடு –நீளஅளவு (LS) மற்றும் குறுக்களவு (C.S.) – சமநிலைக் கோடுகள் (Contur) - டிராவர்சிங் – டிராவர்ஸ் அட்ஜஸ்ட்மென்ட்- - உயரங்கள் மற்றும் தூரங்கள் - டேக்கியோமெட்ரி மற்றும் முக்கோணவியல் (Triangulation) - டோட்டல் ஸ்டேசன் (Total Station) மற்றும் புவியிடங்காட்டி (GPS) அளவீட்டிற்கான தொலை நுண்ணுணர்வு முறைகள்.

அலகு III: பொறியியல் இயக்கவியல் மற்றும் பொருள் வலிமையியல்

விசைகள் - வகைகள் - விதிகள் - புவியீர்ப்பு மையம் - உழற் திருப்புமை (Moment of Inertia) - உராய்வு - தகைவுகள் மற்றும் திரிபுகள் - வெப்பத் தகைவுகள் - மீள் எல்லை மாறிலிகள் (Elastic Constants) - விட்டங்கள் - விட்டங்களில் வளை திருப்புமை (Bending moment) மற்றும் வெட்டுவிசை (Shear Force) - எளிய வளைவுக்கான கோட்பாடு - விட்டங்களின் விலகல் - முறுக்கம் - கூட்டுத் தகைவுகள் - சாய்ந்த தளங்களில் தகைவுகள் - முதன்மை தகை வுகள் மற்றும் முதன்மை தளங்கள் - முறிவுகளின் கோட்பாடு - சமதள தாங்கணைவுகளின் பகுப்பாய்வு.

அலகு IV: கட்டமைப்புப் பகுப்பாய்வு

நேர்முகக் கண்க்கீடற்ற விட்டம் - கட்டமைப்புப் பகுப்பாய்வின் விறைப்பு மற்றும் நெகிழ்தன்மை முறைகள் - சாய்வு விலகல் - திருப்புமைப் பகிர்வு முறை -வளைவுகள் மற்றும் தொங்கல் வடங்கள் - தூண்களின் கோட்பாடு - நகரும் சுமைகள் மற்றும் விளைவுக் கோடுகள் - அணி முறை - தாங்கு சுவரின் நிலைப்புத் தன்மை - குழைமவியல் கோட்பாடு - உயரமான கட்டிடங்களின் நிலநடுக்க பகுப்பாய்வு

அலகு V: புவி தொழில்நுட்ப பொறியியல்

மண்ணின் உருவாக்கம் - மண்ணின் வகைகள் - பொறியியல் பயிற்சிக்கான மண்ணின் வாய்ப்பாடு - மண்ணின் கள அடையாளம் - மண்ணின் புறநிலை இயல்புகள் மற்றும் சோதனைகள் - மூன்று கட்ட வரைபடம் - மண்ணின் ஊடுருவும் பண்புகள் - மண்ணில் தகைவுப் பரவல் - ஒருங்கிணைத்தல் (Consolidation) கோட்பாடு - வெட்டு வலிமை காரணிகள் - மண்ணின் நிலைப்புத்தன்மை - மண்ணின் இறுக்கத்தன்மை - சாய்வு நிலைப்பாட்டின் பகுப்பாய்வு - மண் ஆய்வு - மண் மாதிரிக்கான நுட்பங்கள் – எஸ்பிடி (SPT) - மண் துளை விவரம் - ஆழமற்ற அடித்தளங்கள் - டெர்சாகியின் மண் தாங்கு திறனுக்கான கோட்பாடு - நிலத்தூண் அடித்தளம் - நிலத்தூண் சுமை சோதனை - நிலத்தூண்களின் குழு நடவடிக்கை - அடித்தளங்களின் புதையிறக்கம் - தரை மேம்பாட்டு நுட்பங்கள்

அலகு VI: சுற்றுச்சூழல் பொறியியல் மற்றும் மாசுக் கட்டுப்பாடு

நீரின் ஆதாரங்கள் - நீரின் தேவை - நீரின் பண்புகள் மற்றும் பரிசோதனை - கடத்தல் மற்றும் பரிமாற்றத்திற்கான நீரியல் - நீர் மூலம் பரவும் நோய்கள் - நீர் சுத்திகரிப்பு - நீர் சுத்திகரிப்பு நிலைய இயக்க வடிவமைப்பு - உப்பு நீக்கும் ஆலை - நீர் விநியோக அமைப்பு - குழாய் பின்னல் (Pipe Network) பகுப்பாய்வு - கழிவுநீரின் தன்மைகள் மற்றும் அங்ககங்கள் – கழிவுநீர் அமைப்பின் திட்டமிடல் மற்றும் வடிவமைப்பு - கழிவுநீர் இணைப்புகள் - கழிவுநீர் உந்துதல் - கழிவுநீர் சுத்திகரிப்பு மற்றும் அகற்றல் - மழைநீர் வடிகால் அமைப்பு - உயரமான கட்டிடத்தில் குழாய்கள் அமைப்பு - தொழிற்சாலை கழிவு சுத்திகரிப்பு - திடக்கழிவு மேலாண்மை – காற்று மற்றும் ஒலி மாசு கட்டுப்பாடு – மிண்ணனு கழிவு மேலாண்மை.

அலகு VII: வலுவூட்டப்பட்ட கற்காரை வடிவமைப்பு, அழுத்தப்பட்ட கற்காரை மற்றும் எஃகு கட்டமைப்புகள்

கட்டிட பாகங்களின் வடிவமைப்பு – லிமிட் ஸ்டேட் (Limit State) மற்றும் ஓர்க்கிங் ஸ்ட்ரஸ் (Working Stress) வடிவமைப்பு முறைகள் – தளம்/கூரை வடிவமைப்பு – ஒரு வழி, இரு வழி மற்றும் தட்டையான தளம்/கூரை - ஒற்றை மற்றும் இரட்டிப்பாக வலுவூட்டப்பட்ட பிரிவுகள் மற்றும் பிளாஞ்ச் (Flange) பிரிவுகளின் வடிவமைப்பு – தூண்கள் மற்றும் அஸ்திவாரங்களின் வடிவமைப்பு - முன்-அழுத்த – கற்காரை அமைப்புகள் மற்றும் முறைகள் - பிந்தைய இழுவிசை தளம்/கூரை - நெகிழ்வுக்கான முன்-அழுத்தப்பட்ட பாகங்களின் வடிவமைப்பு. இழுவிசை மற்றும் அமுக்கவிசை கட்டிட பாகங்களின் வடிவமைப்பு - போல்ட் மற்றும் வெல்டட் இணைப்புகளின் வடிவமைப்பு - தூண்கள் மற்றும் அடித்தளங்களின் வடிவமைப்பு - விட்டம், பிளேட் கர்டர் (Plate Griders) மற்றும் கேன்ட்ரி கர்டர் (Gantry Griders) வடிவமைப்பு - உயர்த்தப்பட்ட மற்றும் நிலத்தடி-திரவ சேமிப்பு கட்டமைப்புகளின் வடிவமைப்பு – தாங்கு சுவர் வடிவமைப்பு (Retaining Wall).

அலகு VIII : நீரியல் மற்றும் நீர்வள பொறியியல்

நீர்ம நிலையியல் - பெர்னோலி சமன்பாட்டின் பயன்பாடுகள் - குழாய்களில் ஏற்படும் இழப்புகள்- திறந்த பெருங்கால்வாய் (Channel) ஓட்ட அளவீடு - பம்புகளின் வகைகள் மற்றும் பண்புகள்-உந்த சமன்பாட்டின் பயன்பாடுகள், ஓட்டத்தின் இயக்கவியல்.

தமிழ்நாட்டின் நீர் ஆதாரங்கள் - நீர் வளத் திட்டமிடல் - நீர் மேலாண்மை வெள்ளக் கட்டுப்பாட்டுக்கான மாஸ்டர் பிளான் – நீர் ஓட்ட (run off) மதிப்பீடு - ஹைட்ரோகிராஃப் - வெள்ள வழித்தடம் – மண், பயிர் நீர்தொடர்பு - பயிர்களின் நீர் தேவை - நீர்ப்பாசன முறைகள் - வண்டல் கால்வாய் வடிவமைப்பு மற்றும் தலையணி வடிவமைப்பு. நீர் தேக்கம் மற்றும் நில மீட்பு - குறுக்கு வடிகால் பணிகள்.

அலகு IX: நகர்ப்புற மற்றும் போக்குவரத்து பொறியியல்

நகரமயமாக்கல் போக்கு மற்றும் தாக்கம் - குடிசை அகற்றுதல் மற்றும் குடிசை அபிவிருத்தி திட்டங்கள் - பல்வேறு போக்குவரத்து முறைகள் மற்றும் அவற்றின் பண்புகள். நெடுஞ்சாலைகளின் வடிவியல் வடிவமைப்பு. – சாலை பொருட்கள் மற்றும் சோதனை - மாற்று சாலை பொருட்கள்- மாற்றியமைக்கப்பட்ட ஒட்டுபொருட்கள் - பிட்மினஸ் மற்றும் கற்காரை சாலைகளின் வடிவமைப்பு மற்றும் கட்டுமானம் – சாலை தேய்மானம் மற்றும் மதிப்பீடு - சாலைகளை பராமரித்தல் - ரயில்வே - நிரந்தர வழி கூறுகள் (Permanent Way) - சிக்னல், இன்டர்லாக் மற்றும் ரயில் கட்டுப்பாடு - சாலைகள் மற்றும் ரயில்களில் வடிகால் .. விமான நிலைய திட்டமிடல்-விமான நிலையத்தின் கூறுகள் - தள தேர்வு - ஓடுபாதைகள் - முனைய கட்டிடங்களின் திட்டமிடல். சிறு மற்றும் பெருந்துறைமுகங்கள் - ஒரு துறைமுகத்தின் தளவமைப்பு - கப்பல்துறைகள் – கடல்நீர் தடுப்பு அமைப்பு (Breakwaters).

அலகு X : திட்ட மேலாண்மை மற்றும் மதிப்பீடு

கட்டுமான மேலாண்மை - கட்டுமானத் திட்டமிடல் - திட்டமிடல் மற்றும் கண்காணிப்பு - செலவுக் கட்டுப்பாடு, தரக் கட்டுப்பாடு மற்றும் ஆய்வு - நெட்வொர்க் பகுப்பாய்வு - CPM மற்றும் PERT திட்ட மேலாண்மை முறைகள் - வளங்கள் திட்டமிடல் மற்றும் வள மேலாண்மை. மதிப்பீடுகளின் வகைகள் - தொழில்நுட்ப விவரக்குறிப்புகள் மற்றும் ஒப்பந்தப்புள்ளி ஆவணங்களைத் தயாரித்தல் - மின்- ஒப்பந்தப்புள்ளி - கட்டிட மதிப்பீடு - ஒப்பந்தங்கள் மற்றும் நடுவர் தொடர்பான சட்டம்.

TAMILNADU PUBLIC SERVICE COMMISSION

CIVIL ENGINEERING

(DEGREE STANDARD) CODE: 398

UNIT I :BUILDING MATERIALS AND CONSTRUCTION PRACTICES

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

UNIT II : ENGINEERING SURVEY

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

UNIT III :ENGINEERING MECHANICS AND STRENGTH OF MATERIALS

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

UNIT IV :STRUCTURAL ANALYSIS

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

UNIT V : GEOTECHNICAL ENGINEERING

Formation of soils - types of soils - classification of soils for engineering practice - Field identification of soils - Physical properties and testing of soils - Three phase diagram - permeability characteristics of soils - stress distribution in soils - Theory of consolidation, shear strength parameters of soils – stabilization of soil -Compaction of soils- Stability analysis of slope - Soil exploration - Soil sampling techniques – SPT -Borelog profile - shallow foundations - Terzhagi's bearing capacity theory - Pile foundation –pile load test- Group action of piles - settlement of foundations- Ground Improvement techniques.

UNIT VI : ENVIRONMENTAL ENGINEERING AND POLLUTION CONTROL

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

UNIT VII : DESIGN OF REINFORCED CONCRETE, PRESTRESSED CONCRETEAND STEEL STRUCTURES

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

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

UNIT VIII : HYDRAULICS AND WATER RESOURCES ENGINEERING

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

UNIT IX : URBAN AND TRANSPORTATION ENGINEERING

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

UNIT X : PROJECT MANAGEMENT AND ESTIMATION

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

தமிழ்நாடு அரசுப் பணியாளர் தேர்வாணையம்
இயந்திர பொறியியல் / உற்பத்தி பொறியியல் / உருவாக்க பொறியியல்

(பட்டப்படிப்பு தரம்) **குறியீடு: 399**

அலகு - I இயக்கவியல், இயக்கியல் மற்றும் இயங்குவியல்:

துகள்களின் நிலையியல், திடமான உடல்களின் சமநிலை, உருமாறக்கூடிய உடல்களின் பொறிமுறை, மேற்பரப்பு மற்றும் திடப்பொருட்களின் பண்புகள், நடுமம், ஈர்ப்பு மையம், துகள்களின் இயங்குவியல், திடமான உடல் இயங்குவியலின் கூறுகள், பொறிமுறைகளின் அடிப்படைகள், பொறிமுறைகளின் இயக்கவியல், சுழலாளி, பற்சக்கரங்கள் மற்றும் பற்சக்கரங்களின் இணைவமைவு ஓடுவரி, விசையாள்சில்லு மற்றும் ஆள்கருவி, சுழலும் மற்றும் தண்டலையும் நிறைகளை சமநிலைப்படுத்துதல், இயந்திர உறுப்புகளிலுள்ள உராய்வு, விசை பகுப்பாய்வு, சமநிலைப்படுத்துதல், தனிப்பாகை கட்டில்லாவதிர்வு, வலிந்தவதிர்வு, அதிர்வு கட்டுப்பாட்டுக்கான பொறிமுறைகள், தணிப்பின் விளைவு, அதிர்வுராது தனிமைப்படுத்தல், ஒத்ததிர்வு, தண்டின் உய்ய வேகம்.

அலகு - II பருப்பொருளின் வலிமை மற்றும் வடிவமைப்பு

தகைவு, திரிபு, மற்றும் திடப்பொருட்களின் உருமாற்றம், ஒருங்கிணைந்த தகைவுகள், வீழச்சிகளின் கோட்பாடுகள், விட்டங்களில் குறுக்குவாட்டு சுமை ஏற்றம், விட்டங்களிலுள்ள தகைவுகள், முறுக்கம், விட்டங்களின் விலகல், ஆற்றல் கோட்பாடுகள், மெல்லிய உருளைகள் மற்றும் தடிமனான உருளைகள், கோள வடிவ ஓடுகள், இயந்திர உறுப்புகளின் வலிமை மற்றும் விரைப்பிர்க்கான அடிப்படை வடிவமைப்பு, தண்டுகள் மற்றும் பிணைப்பிகளின் வடிவமைப்பு, நிலையான மற்றும் நிலையற்ற சுமை ஏற்றுதலுக்கான வடிவமைப்பு, கட்டுவான்கள் மற்றும் பற்றவைப்பு இணைப்புகளின் வடிவமைப்பு, நிலையிணையாணியிட்ட இணைப்புகள், சுருள்வில்களின் வடிவமைப்பு, தாங்கு உருளைகளின் வடிவமைப்பு, விசையாள்சில்களின் வடிவமைப்பு, நெகிழ்வான கூறுகளுக்கான விசைசெலுத்த அமைப்புகளின் வடிவமைப்பு, கூர்முளை பற்சக்கரம் மற்றும் இணை அச்சு திருகுசுழல் பற்சக்கரம், சாய்வியக்க பற்சக்கரம், திருகுப் பற்சக்கரம் மற்றும் குறுக்கு திருகுசுழல் பற்சக்கரம், ஒருமை மற்றும் இருமை நிலை வேகந்தனிப்பான், ஓடிதழ் வடிவமைப்பு, உரசினைப்பி மற்றும் தடுக்கிகளின் வடிவமைப்பு, உந்துதண்டு மற்றும் இணைப்புத்தண்டுகளின் வடிவமைப்பு.

அலகு - III பாய்ம இயக்கவியல் மற்றும் சுழலூட்ட இயந்திரத்தொகுதி:

பாய்ம பண்புகள், பாய்ம நிலையியல், அழுத்த அளவியல், மிதப்பு, நிறை, உந்தம் மற்றும் ஆற்றலின் கட்டுப்பாட்டு தொகுதி பகுப்பாய்வு, பாய்ம முடுக்கம், தொடர்ச்சி மற்றும் உந்தத்தின் வகையீட்டு சமன்பாடுகள், பெர்னூலியின் சமன்பாடு, பரிமாண பகுப்பாய்வு, அமுக்க முடியாத திரவங்களின் பாகுநிலைப் பாய்ச்சல், விளிம்பு அடுக்கு, அடிப்படை மீசீரற்ற பாய்ச்சல், குழாய்கள் வழி பாய்ச்சல், குழாய்களில் நிலைமட்ட இழப்புகள், வளைவுகள். சுழலூட்ட இயந்திரத்தொகுதி: பெல்டன் சக்கரம், பிரான்சிஸ் மற்றும் கப்லான் சுழலிகள் - உந்துவிசை மற்றும் எதிர்வினை கோட்பாடுகள் - வேக வரைபடங்கள், எக்கிகள் மற்றும் அதன் பயன்பாடுகள்-தடுக்கிதழ்கள் மற்றும் வகைகள் - தாரை உந்தல் கோட்பாடு - அதிர் தாரை – திமிசு தாரை பொறிகள், நிகழ்நிலை தொடர்பாய்ச்சல் கண்காணிப்பு அமைப்பு.

அலகு - IV வெப்ப பொறியியல் மற்றும் வெப்ப இயங்குவியல்:

அடிப்படை கருத்துக்கள், வெப்ப இயங்குவியலின் பூஜிய, முதல் மற்றும் இரண்டாவது விதிகள், வெப்ப இயங்குவியல் அமைப்பு மற்றும் செயல்முறைகள், கார்னோட் சுழற்சி. மீளமுடியாத்தன்மை மற்றும் கிடைப்புத்தன்மை, சீர்மை மற்றும் இயல்பு வாயுக்களின் பண்பு, வெப்ப இயங்குவியல் சார்ந்த தொடர்புகள், தூய பொருட்களின் பண்புகள், சீர்மை செயல்முறைகளிலுள்ள செய்பணி மற்றும் செலுத்து வெப்பத்தை கணக்கிடுதல், ஆற்றல் மாற்றம் தொடர்பான வெப்ப இயங்குவியல் சுழற்சிகளின் பகுப்பாய்வு, எரிபொருள் மற்றும் கனற்சி, எரிபொருள்களின் பண்புகள், உமிழ்வு மற்றும் கட்டுப்பாடுகள், உட்கனர்வு பொறிகளின் சோதனை - புதுப்பிக்கத்தக்க ஆற்றல் மூலங்கள். சக்திசார் பொறியியல்: நீராவி அட்டவணைகள், மீளுருவாக்கம் மற்றும் மறுசூடுபடுத்தல் நிகழ் ரேங்கின், பிரைட்டன் சுழற்சிகள். உட்கனர்வு பொறிகள்: காற்று-செந்தர ஓட்டோ, டீசல் சுழற்சிகள். குளிரூட்டல் மற்றும் காற்றுச்சீரமைத்தல்: நீராவி குளிர்பதன சுழற்சி, வெப்ப எக்கிகள், வாயு குளிரூட்டல், தலைகீழ் பிரேட்டன் சுழற்சி; ஈர காற்று: ஈரப்பதபகுப்புசார் விளக்கப்படம், அடிப்படை ஈரப்பதபகுப்புசார் செயல்முறைகள்.

அலகு - V வெப்பம் மற்றும் நிறை பரிமாற்றம்:

வெப்ப பரிமாற்ற முறைகள் - ஒரு பரிமாண வெப்ப கடத்தல், வெப்பந்தடை கருத்து, மின்சார் ஒப்புமை, நிலையற்ற வெப்ப கடத்துத்திறன், நிமிர் நேர் விளிம்புடைய தகடு, கட்டில்லா மற்றும் கட்டுறு பாய்ம விரவு வகை பரிமாற்றத்தின் பரிமாணமற்ற அளவுருக்கள். தட்டையான தட்டுகள் மற்றும் குழாய்கள் வழியாக வெப்ப பரிமாற்றத்திற்கான பல்வேறு தொடர்புகள், வெப்ப விளிம்பு அடுக்கு, மீசீரற்ற பாய்ச்சலின் விளைவு, கதிர்வீச்சு வெப்ப பரிமாற்றம், கருப்பு மற்றும் சாம்பல் மேற்பரப்புகள், வடிவ காரணிகள், பிணைய பகுப்பாய்வு: வெப்பப் பரிமாற்றியின் செயல்திறன், LMTD மற்றும் NTU முறைகள். நிறை பரிமாற்றம், ஊடுபரவ நிறை பரிமாற்றம், ஊடுபரவலின் ஃபிக்கின் விதி, நிலைப்பு நிலை மூலக்கூறு ஊடுபரவல், பாய்ம விரவு முறை நிறை பரிமாற்றம், உந்தம், வெப்பம் மற்றும் நிறை பரிமாற்ற ஒப்புமை, பாய்ம விரவு முறை நிறை பரிமாற்ற இணை தொடர்புகள், கதிரியக்க வெப்ப பரிமாற்றம்.

அலகு - VI மூலப்பொருள்கள்சார் அறிவியல் மற்றும் உலோகவியல்:

உலோகக்கலவைகள் மற்றும் நிலை வரைபடங்கள், இரும்பு இரும்பு கார்பைடு நிலை வரைபடம் - எஃகுகள், வார்ப்பிரும்பு, நிலை மாற்றங்கள்- பரவல் - TTT வரைபடம், இரும்பு மற்றும் இரும்பு அல்லாத உலோகக் கலவைகள், இரும்பு மற்றும் இரும்பு அல்லாத உலோகத்தின் வெப்பச் சிகிச்சை, மேற்பரப்பு மாற்றும் நுட்பங்கள், தூள்சார் உலோகவியல், உலோக அல்லாத பொருட்கள், இயந்திர பண்புகள் மற்றும் சோதனை, படிக குறைபாடுகள் மற்றும் வலுப்படுத்தும் வழிமுறைகள், கடத்துதல் மற்றும் குறை-கடத்துதல் பொருட்கள், காந்த மற்றும் மின்கடத்தா பொருட்கள், பொறியியல்வுரு வெங்களி, பொறியியல் மற்றும் பயன்பாட்டு பலபடிமங்கள், கலவைகள், மீநுண் பொருட்கள்.

அலகு - VII உற்பத்தி தொழில்நுட்பம்:

வார்ப்பக தொழில்நுட்பம் – வடிவ உரு வகைகள், அகடு உள்ளகம், அச்சுருவாக்கம் மற்றும் வார்ப்பு முறைகள், திடப்படுத்துதல், வார்ப்புகளின் வடிவமைப்பு, குறைபாடுகள், உருக்கும் உலைகள், தனல் மற்றும் தனலற்ற செயல்பாடு, உலோகத்தை உருவாக்கும் செயல்முறைகள் - வகைகள், குறைபாடுகள் மற்றும் தீர்வுகள், தாள் உலோக செயல்பாடு, உலோகத்தை இணைக்கும் செயல்முறைகள், வகைகள் மற்றும் பற்றவைப்பு வடிவமைப்பு, வெல்டிங் உலோகம். பற்றவைப்பின் குறைபாடுகள், வார்ப்பு, பற்றவைப்பு ஆய்வு (NDT), வெப்ப இறுக்க மற்றும் வெப்பத் தளர்வு நெகிழியின் உற்பத்தி, உலோக வெட்டு, வெட்டு கருவியின் இடுபெயர்த்தொகுதி, இழைப்புறு இயந்திர கருவிகள் – நடும கடைசல் இயந்திரம், துளையிடுதல், துருவல், அரைத்தல், பற்சக்கரம் வெட்டுதல் மற்றும் கொந்துதல், இழைப்பு நேரத்தை கணக்கிடுதல், வழக்கஞ்சாரா இழைப்பு செயல்முறைகள், நுண் இழைப்பு, CNC இயந்திர கருவிகள், கைமுறை உறுப்பு நிரலாக்கம் – இழைத்தல் மற்றும் கடைதல் நிலையம்.

அலகு - VIII அளவையியல் மற்றும் தரக் கட்டுப்பாடு:

வரம்புகள், பொருத்தங்கள் மற்றும் ஏற்ப்புமை, நேரியல் மற்றும் கோண அளவீடுகள், ஒளி அளவியல், லேசர் ஒளி அளவை மானி- வகைகள், கணினிசார் ஆய்வு, CMM இன் அடிப்படைக் கருத்து - CMM இன் வகைகள், இயந்திர நோக்கு, உருவடிவ அளவீடு - நேர் தன்மை – தட்டை தன்மை, உருள் தன்மை, மேற்பரப்பு சீர்மை அளவீடு, தொடர்பு மற்றும் தொடர்பற்ற முறைகள், சக்தி, பாய்ச்சல் மற்றும் வெப்பநிலை அளவீடு. புள்ளியியல் தரக் கட்டுப்பாடு, கட்டுப்பாட்டு விளக்கப்படங்கள், ஏற்பு மாதிரி, நம்பகத்தன்மை, TQM, 5S, ISO தரநிலைகள்.

அலகு: IX CAD / CAM / CIM / FEA:

கணினிசார் வரைகலையின் அடிப்படைகள், வடிவியல்சார் மாதிரியாக்கள், காட்சி நடப்பியல், கூறுகளின் இணைப்பு, CAD தரநிலைகள், CIM இன் அடிப்படைகள், உற்பத்தித் திட்டமிடல் மற்றும் கட்டுப்பாடு, கணினிசார் செயல்முறை திட்டமிடல், தனியறை உற்பத்தி, நெகிழ்வான உற்பத்தி அமைப்பு மற்றும் தானியங்கு வழிகாட்டி வாகன அமைப்பு, குழு தொழில்நுட்பம், உற்பத்தி அடுக்கு நிகழ்வு பகுப்பாய்வு, தொழில்துறை எந்திரனியல், சேர்க்கை உற்பத்தி, நிகழ் நேர உற்பத்தி (JIT), மெலிவு உற்பத்தி, FEA விலுள்ள ஒரு பரிமாண கணக்குகள், இரு பரிமாண அளவுரு மாறிகள் சார் கணக்குகள், இரு பரிமாண திசையன் மாறிகள் சார் கணக்குகள், சமநீள துணைமாறி உருவாக்கம்.

அலகு – X தொழில்துறை பொறியியல் மற்றும் மேலாண்மை:

பணி ஆய்வு - நுட்பங்கள், முறை ஆய்வு மற்றும் பணி அளவீடுகள் நோக்கங்கள் - அடிப்படை, செயல்முறை, இயந்திர சுமை ஏற்றுதல் மற்றும் திட்டமிடல், தயாரிப்பு வரிசைமுறை, சரக்கு கட்டுப்பாடு - E O Q - அளவு தள்ளுபடிகள், ABC பகுப்பாய்வு பொருள் கையாளுதல் அமைப்புகள், செயல்பாட்டு ஆராய்ச்சி, நேரியல் நிரலாக்கம், சிம்ப்லெக்ஸ் முறை, போக்குவரத்து மாதிரி, ஒதுக்கீட்டு மாதிரி CPM மற்றும் PERT, வரிசை மாதிரிகள். மேலாண்மை கோட்பாடு மற்றும் நடைமுறை, திட்டமிடல் - முடிவெடுத்தல், ஒழுங்கமைத்தல், பணியாளர்கள் இடுகை, உந்துதல், தலைமைத்துவம், கட்டுப்படுத்துதல், கட்டுப்பாட்டு நுட்பங்கள், தொழில்துறை பாதுகாப்பு - தரநிலைகள் - OSHA.

TAMIL NADU PUBLIC SERVICE COMMISSION

MECHANICAL ENGINEERING / PRODUCTION ENGINEERING / MANUFACTURING ENGINEERING CODE :399

(DEGREE STANDARD)

UNIT – I MECHANICS, KINETICS AND DYNAMICS:

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

UNIT – II STRENGTH OF MATERIALS AND DESIGN:

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

UNIT - III FLUID MECHANICS AND TURBO MACHINERY:

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

UNIT – IV THERMAL ENGINEERING AND THERMODYNAMICS:

Basic concepts, Zeroth, First and Second laws of thermodynamics, thermodynamic system and processes, Carnot cycle. irreversibility and availability, behaviour of ideal and real gases, thermodynamic relations, properties of pure substances, calculation of work and heat in ideal processes, analysis of thermodynamic cycles related to energy conversion, Fuel and combustion, Fuels Characteristics, Emissions and Controls, Testing of IC Engine-Renewable sources of Energy.

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

UNIT – V HEAT AND MASS TRANSFER:

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

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

UNIT – VI MATERIALS SCIENCE AND METALLURGY:

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

UNIT – VII PRODUCTION TECHNOLOGY:

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

UNIT – VIII METROLOGY AND QUALITY CONTROL:

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

UNIT - IX CAD / CAM / CIM / FEA:

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

UNIT – X INDUSTRIAL ENGINEERING AND MANAGEMENT:

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

TAMILNADU PUBLIC SERVICE COMMISSION

ELECTRICAL ENGINEERING /
ELECTRICAL AND ELECTRONICS ENGINEERING

(DEGREE STANDARD) CODE: 400

UNIT – I ELECTRICAL CIRCUITS

Circuit elements – Kirchoff's Laws – Mesh and Nodal Analysis - Network Theorems and Applications for DC and AC circuits: Thevenin's Theorem, Norton's Theorem, Superposition Theorem, Maximum Power Transfer Theorem – Sinusoidal Steady State Analysis of RL-RC-RLC Circuits- Resonant Circuits - Natural and Forced Response – Transient Response of RL-RC-RLC Circuits-Two-port networks – Three Phase Circuits-Star-delta transformation-real and reactive power-powerfactor

UNIT – II ELECTRIC AND MAGNETIC FIELDS

Coulomb's Law-Electric Field Intensity-Electric Flux Density-Gauss's Law-Divergence - Electric Field and Potential due to Point, Line, Plane and Spherical Charge Distributions - Effect of Dielectric Medium - Capacitance of Simple Configurations- Magnetic Circuits- Magnetomotive force - Reluctance-Faraday's laws-Lenz's law-Biot-Savart's law - Ampere's law - Fleming's Left and Right Hand Rule-Lorentz force - Inductance - Self and Mutual Inductance-Dot Convention-Coupled Circuits

UNIT – III MEASUREMENTS AND INSTRUMENTATION

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

UNIT – IV CONTROL SYSTEMS

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

UNIT –V ELECTRICAL MACHINES

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

UNIT –VI POWER SYSTEMS

Single Line Diagram of Power System-Per Unit Quantities-Power Generation Types- Hydro, Thermal and Nuclear Stations – Pumped storage plants – Co generation– Economic and operating factors – Modelling and performance characteristics of Power transmission lines and Cables-HVDC transmission– Mechanical Design of Transmission Lines-Sag-Insulators - Z_{Bus} and Y_{Bus} formulation - Load flow studies – Shunt and Series Compensation-Symmetrical and Un symmetrical Faults Analysis - Transient and Steady-

State Stability of Power Systems – Equal Area Criterion-Voltage and Frequency Control – Power System Transients – Power System Protection – Circuit Breakers – Relays classification of protection schemes-overcurrent, distance, differential and carrier-Equipment protection-transformer, generator, motor, busbars and transmission line –AC and DC Distribution-deregulation-energy conservation and energy auditing

UNIT –VII ANALOG AND DIGITAL ELECTRONICS

Semiconductor Devices – PN junctions – Transistors – FET – Zener, Photo diodes and their applications – Rectifier circuits – Voltage regulators – Multipliers. Biasing circuits – Small signal amplifiers – Frequency response – Multistage amplifiers – Coupling methods – Large signal amplifiers – Push-pull amplifiers – Feedback amplifiers – Oscillators – Operational amplifiers and its applications – Precision rectifiers – Multivibrators - Voltage Controlled Oscillator-Timer. Digital logic gate families (DTL,TTL,ECL,MOS,CMOS) – Logic gates - Simplification of Logic Functions- Design of Combinational circuits - Sequential logic circuits-latch–Flipflops– Counters – Registers – multiplexers and demultiplexers- Schmitt triggers-Memories(ROM,PLA and FPGA).

UNIT - VIII POWER ELECTRONICS AND DRIVES

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

UNIT –IX DIGITAL PROCESSORS AND COMMUNICATION

Architecture of 8085, 8086 and 8051 – Instruction Sets – Assembly Language Programming – Interfacing for memory and I/O: 8255 Programmable Peripheral Interface – 8253 Programmable Timer Interface – 8279 Programmable Keyboard and Display Interface – 8257 Direct Memory Access Interface - Embedded processors (ARM and PIC basics only). Classification of Signals and systems – Properties of Discrete Fourier Transforms - FFT Computation – FIR Filters – IIR Filters: Butterworth Filters – Chebyshev Filters.
Digital Communication Systems**:** Pulse Code Modulation and Demodulation – Adaptive Delta Modulation - Frequency Division and Time Division Multiplexing – Data Communication Network Topologies - 7-layer OSI Protocol-IoT concepts

UNIT –X RENEWABLE ENERGY SOURCES AND STORAGE DEVICES

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

Note: Medium of Instruction is English only.

TAMILNADU PUBLIC SERVICE COMMISSION

ARCHITECTURE

(DEGREE STANDARD) CODE: 401

UNIT – I: INTRODUCTION TO ARCHITECTURE

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

UNIT – II: HISTORY OF ARCHITECTURE & CULTURE

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

UNIT – III : MATERIALS AND CONSTRUCTION TECHNIQUES

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

structures for rehabilitation. Specification – necessity, importance, types & classification – Specification writing - Estimation (Approximate & detailed) – Current trends. Advanced construction technologies - Construction systems & Practice – Construction methods & equipments, Construction Technology for High-rise buildings, Construction management.

UNIT – IV: BUILDING SYSTEMS AND SERVICES – CURRENT DEVELOPMENT& NEW TRENDS

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

UNIT – V: HUMAN SETTLEMENTS PLANNING

Origin of Human settlements In India & the rest of the world – River valley civilizations(Indus Valley, Mesopotamia, Egyptian & Chinese) – Traditional planning principles in India – approaches & concepts – Classical & Medieval planning in Europe and India - Evolution of modern planning theory, concepts and works of town planners - Planning models. Elements of Human settlements – functions & linkages, Structure & form. Types of plan like Regional plan, Perspective plan, Master plan, Zonal plan etc. URDPFI and RADPFI Guidelines, DCR,CRZ for coastal areas; JNNURM, AMRUT, Zoning regulations, SEZ, PUD,TOD; Contemporary Urban planning – Issues and Trends. National and state level government organizations -initiatives, schemes and projects.

UNIT – VI: URBAN STUDIES – Urban Design, Urban Housing & Conservation

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

UNIT – VII: ENVIRONMENTAL STUDIES, SITE PLANNING & LANDSCAPEECOLOGY

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

UNIT – VIII: CLIMATIC DESIGN & ENERGY EFFICIENT ARCHITECTURE

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

UNIT – IX: PROJECT MANAGEMENT AND CURRENT TRENDS

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

UNIT – X: PROFESSIONAL PRACTICE AND ETHICS

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

Note: Medium of Instruction is English only.

TAMILNADU PUBLIC SERVICE COMMISSION

ELECTRONICS AND INSTRUMENTATION ENGINEERING

(DEGREE STANDARD) CODE : 402

UNIT-I ANALOG ELECTRONICS

Characteristics and Applications of Diode, BJT, JFET, SCR, UJT, MOSFET-Small Signal Analysis of BJT and JFET amplifiers, Feedback Amplifiers, RC and LC Oscillators –Characteristics and Applications of Operational Amplifier, Differentiator, Integrator, Instrumentation Amplifier, Precision Rectifier, V to I and I to V Converter, Active Filters, Oscillators and Signal Generators.

UNIT-II DIGITAL ELECTRONICS

Digital Logic Theory:

Number Systems – Combinational Logic Circuits – Minimization of Boolean Functions – IC Families: TTL and CMOS – Arithmetic Circuits, Multiplexer & Decoders – Sequential Circuits: Flipflops, Counters, Shift Registers, Schmitt Trigger, Timers, Multivibrators, S/H Circuit,– Analog to Digital Converter (Successive approximation, Integrating and Sigma Delta) – Digital to Analog Converters (Binary Weighted Resistor, R-2R, Inverted R-2R) – Characteristics of ADC and DAC.

Embedded Systems:

Microprocessor and Microcontroller Applications, RISC and CISC Processors, Memory and Input-Output Interfacing, Embedded C Programming, Multiprocessors, Scheduling, Power Optimization Strategies, I^2C and CAN Buses.

UNIT-III DIGITAL SIGNAL PROCESSING AND COMMUNICATION ENGINEERING

Discrete Time Signals and Systems:

Sampling Theorem, Characteristics and Classifications of DT Signals and Systems - LTI System Characteristics, Convolution and Correlation, Time Domain and Frequency Domain Analysis – ZT, DTFT, DFT - FFT Algorithms –IIR and FIR Filters.

Communication Engineering:

Amplitude and Frequency Modulation and Demodulation – Shannon's Sampling Theorem, Pulse Code Modulation, Frequency and Time Division Multiplexing. Digital Communication System (ASK, FSK, PSK and QAM) - Digital Communication Concepts – Network Protocols – ISO/OSI reference model – Fiber Optic Communication.

UNIT-IV TRANSDUCER ENGINEERING

Units and Standards - Calibration Methods – Errors in Measurement and Uncertainty analysis – Static and Dynamic Characteristics of First and Second Order Transducers - Resistive, Capacitive, Inductive, Piezoelectric, Magnetostrictive, Hall Effect and Smart Sensors and Associated Signal Conditioning Circuits.

UNIT-V ELECTRICAL AND ELECTRONIC MEASUREMENTS

Measurement of Resistance, Capacitance, Inductance and Frequency using Bridges (Wheatstone, Kelvin, Megohm, Maxwell, Anderson, Schering and Wien Bridge) - Q-meter– Galvanometer, Measurement of Voltage and Current - Power and Energy Measurements – Potentiometers, and Instrument Transformers - Digital Voltmeter, Digital Multimeter, Time, Phase and Frequency Measurements – Oscilloscopes – Digital and Recording Devices.

UNIT-VI INDUSTRIAL INSTRUMENTATION

Measurement of Displacement (Linear and Angular), Force, Torque, Velocity, Acceleration, Vibration, Density, Viscosity, Humidity and Moisture, Measurement of Flow (Variable Head, Variable Area, Mass, Electromagnetic, Ultrasonic, Turbine and Open Channel Flow Meters) – Measurement of Level, pH, Temperature (Thermocouple, Bolometer, RTD, Thermistor, Pyrometer and Semiconductor) and Pressure – Universal Smart Transmitter.

UNIT-VII ANALYTICAL AND BIO-MEDICAL INSTRUMENTATION

Analytical Instruments: Spectrophotometers – Spectral Methods of Analysis – Source, Detectors and Applications – Ion Conductivity: Sampling System, Ion Selective Electrodes, Conductivity and pH meters – Gas Analyzers – Chromatography – NMR Spectroscopy – Mass Spectrometers – Dust and Smoke Measurements – Water Quality Analyzer.
Biomedical Instruments: Bio-potentials and their Measurement Techniques & Signal Conditioning Circuits – ECG, EEG, EMG and ERG - Medical Imaging Systems: X-Ray, Computed Tomography (CT), Magnetic Resonance Imaging (MRI), Positron Emission Tomography (PET), Ultrasound.

UNIT VIII - CONTROL SYSTEMS

Modeling of Mechanical and Electrical Systems (First Principle, Transfer Function and State Space Models) **-**Block Diagram Reduction-Signal Flow Graphs-Time and Frequency Domain Analysis - Stability Analysis (Root Locus, Routh Hurwitz Criterion, Nyquist Stability Criterion) -Lead/Lag Compensators-Controllability and Observability.

UNIT IX -PROCESS CONTROL

Process Modeling: Level and Thermal Processes-Interacting and Non-Interacting Systems- Self regulation - Degrees of freedom - Characteristics of ON/OFF, PID Control Modes-PID Controller Tuning (Z-N, Cohen-Coon and Continuous Cycling)- PID Implementation Issues (Bumpless Transfer and Anti-reset Windup)- Control Valve Characteristics and Sizing- Control Schemes: Cascade, Feed-Forward, Ratio, Adaptive, Internal Model Controller and Model Predictive Control.

UNIT X PLC, SCADA AND DCS

PLC: Architecture, I/O Modules, Programming Languages (Ladder Logic, Instruction List and Functional Block Diagram) -Internet of Things.
SCADA: RTU, Master Station and Communication Architectures.
DCS: Architecture, Local Control Unit, Field Control Unit, Operator and Engineering Human Interface Station, Displays – HART and Field Bus Communication Protocols.

Note: Medium of Instruction is English only

TAMILNADU PUBLIC SERVICE COMMISSION

ELECTRONICS / ELECTRONICS AND COMMUNICATION ENGINEERING

(Degree Standard) CODE : 403

UNIT – I SEMICONDUCTOR THEORY AND ELECTRONIC DEVICES

Intrinsic and Extrinsic semiconductors, Energy Bands, Diffusion ad Drift current densities. PN junction diode, current equation, Transition and Diffusion capacitances, Zener diode, Tunnel diode, Varactor diode, Photo diode, Schottky diode, LED, BJT, FET, JFET, MOSFET, UJT, SCR, DIAC, TRIAC.

UNIT - II CIRCUIT THEORY, SIGNALS AND SYSTEMS

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

UNIT-III ANALOG CIRCUITS

BJT, JFET, MOSFET amplifiers – Biasing analysis, Small signal analysis and frequency response, BJT and MOSFET multistage amplifiers: Differential, Darlington, Cascade and Cascode, Feedback amplifiers, Tuned amplifiers, RC and LC oscillators, Power amplifiers. Rectifiers and wave-shaping circuits, Operational amplifier characteristics and applications, CMRR, slew rate, waveform generators, active filters, timers, PLL, VCO, ADC, DAC, Regulators and Converters.

UNIT-IV CONTROL SYSTEMS

Control system components, Feedback, Transfer function, Transient and Steady state analysis of LTI systems, Frequency response, Bode, Polar and Nyquist plots, Routh-Hurwitz and Nyquist stabilities, Lag, Lead, Lag-lead compensation, State variable model.

UNIT – V COMMUNICATION SYSTEMS

Random Processes: Stationary process, Ergodic process, Auto correlation, Power spectral density, White noise, Filtering of random signals through LTI systems.
Analog Communication: Amplitude and angle modulation / demodulation, Spectral characteristics.
Noise: Thermal noise, Noise figure and Noise temperature.
Digital Communication: PCM, DPCM, ADPCM, DM, ADM, LPC.
ine coding schemes, Bandpass signaling: Binary and M-ary versions of ASK, PSK, FSK, BER and spectral characteristics. Principles of QAM, OQPSK, MSK, GMSK. Link budget calculations, Eye diagram, ISI, Symbol and carrier synchronization, Frame synchronization.
Information Theory and coding: Entropy, Mutual information, Channel capacity (AWGN), Source coding and Channel coding techniques.

UNIT-VI ELECTROMAGNETIC THEORY

Divergence, Stokes, Coulomb, Poisson and Laplace Equation, Ampere's law, Biot-Savart law, Gauss law for magnetic fields, Maxwell's equations, Displacement current, Uniform plane waves, Poynting vector.
Plane waves and properties: Reflection and refraction, Polarization, Phase and group velocity, Propagation through various media, Skin depth.
Transmission lines: Equations, Characteristic impedance, Impedance matching, Impedance transformation, S-parameters, Smith chart.
Rectangular and circular waveguides.
Dipole and monopole antennas, Linear antenna arrays.

UNIT-VII WIRELESS COMMUNICATION TECHNIQUES

Wireless channel characteristics, Frequency reuse, Channel assignment and and handoff, Multipath effect, Spread spectrum, OFDM, Adaptive equalization, Rake receiver, Diversity techniques, MIMO systems.

UNIT – VIII DIGITAL SIGNAL AND IMAGE PROCESSING

DFT, FFT, Overlap and save methods, IIR filters: Butterworth and Chebyshev filters, Impulse invariant and Bilinear transformation methods, FIR filter: Linear phase design, Windowing techniques: Rectangular, Barlett, Hanning and Hamming, Digital Filter realization structures, Finite word length effects in IIR and FIR filters, Scaling, Decimation and interpolation, multirate signal processing.
Image enhancement: Contrast enhancement, Histogram equalization, Filtering. Image compression: JPEG. Video compression: Intra-frame / Inter-frame redundancy and motion estimation.

UNIT – IX DIGITAL CIRCUITS

Number representations: Binary, Integer and Floating point numbers, Combinational logic circuits, Boolean algebra, Minimization of functions using Boolean identities and Karnaugh map, Logic gates and their static CMOS implementations, Arithmetic circuits, Code converters, Multiplexers, Decoders.
Sequential circuits: Latches and flip-flops, Counters, Shift registers, Finite state machines, Propagation delay, Setup and hold time, Critical path delay.
Data converters: Sample and hold circuit, ADC and DAC.
Semiconductor memories: ROM, SRAM, DRAM.
Computer organization: Machine instructions, Addressing modes, ALU, Data path and Control unit, Instruction pipelining.

UNIT – X: DATA NETWORKS

OSI model, TCP/IP reference model, Data link layer: Framing, error and flow control, HDLC, P to P – Medium Access Control: Random and controlled access, Channelization. Network layer: IPV4 and IPV6, ARP and RARP, Network routing algorithms – Distance Vector routing, OSPF, Dijkstra's and Bellman Ford, Congestion control, Transport layer: TCP and UDP, Application layer: WWW, HTTP, FTP and TELNET.

Note: Medium of Instruction is English only

TAMIL NADU PUBLIC SERVICE COMMISSION

AUTOMOBILE ENGINEERING

(DEGREE STANDARD)

CODE: 404

UNIT I ENGINES

Working principle and constructional details of petrol and diesel engines, four stroke and two stroke engines. Fuel supply system in SI engines – Carburettors, types, working principle, different circuits, compensation circuits, TBFI, MPFI, GDI. Fuel Injection system in diesel engines – Mechanical injection, CRDI. Dual fuel engines. Engine Accessories - Cooling system, air and water cooling system, forced circulation and pressure cooling system. Lubrication system – pressure lubrication – splash lubrication – wet and dry sump lubrication. Properties of lubricants and coolants. Combustion in SI and CI engines – stages of combustion – flame propagation – detonation in SI engine and knocking in CI engines. Combustion chambers – Turbo and super chargers. Fuels for IC engines, Desirable Properties of IC engine fuels, Gaseous fuels, LPG, CNG, Hydrogen, Alcoholic fuels, Flexi fuel engines. Advanced engine technologies - VVT, HCCI, Lean burn engines. Engine testing – Performance parameter calculations.

UNIT II AUTOMOTIVE CHASSIS

Types of chassis layout – various types of frames – front axles – types, stub axle, front wheel geometry – Condition for true rolling motion - Ackermann and Davis steering mechanism – steering gear boxes – Under steer, Neutral steer and Over steer - Hydraulic and Electric Power Assisted Steering. Hotchkiss and torque tube drive. Propeller shaft – Universal Joint and Constant Velocity joint - Final drive – types. Differential – principle and construction details – Differential housing - Limited Slip Differential – Rear axle - types. Wheels – types and construction. Tyres – types and construction details.

UNIT III SUSPENSION AND BRAKING SYSTEM

Suspension system – requirements – types - construction details of leaf spring, coil spring and torsion bar. Rubber and air suspension systems. Front and rear independent suspension systems – shock absorbers. Braking system – need, stopping distance, classification of brakes. Constructional details of drum brake and disc brakes - Power assisted braking systems. Retarders, ABS, TCS, EBD, ESP.

UNIT IV AUTOMOTIVE TRANSMISSION

Clutches – coils spring, diaphragm clutches – centrifugal and semi centrifugal clutches – multiplate clutches. Electromagnetic clutch - Gear box – sliding mesh, constant mesh and synchromesh – construction and operation. Automated Manual Transmission - Automatic transmission – fluid coupling, torque converter, epicyclic gear box, CVT, Dual Clutch Transmission – Hydrostatic transmission, Electric Vehicle powertrain.

UNIT V AUTOMOTIVE ELECTRICAL AND ELECTRONICS

Lead acid battery – types, battery charging, rating, and testing. Lithium Ion battery. Ignition system – principle and operation of coil, magneto and electronic ignition system. Spark plug. Starting system – types of drives - bendix drive, solenoid drive system. Charging system – generator system – types – alternator, principle and operation of cut-out and regulators. Engine sensors and actuators – types, principle and operation. Recent Trends - Navigation system, ADAS, TPS, Rain sensing wipers, micro-hybrid, keyless entry, antitheft technologies, V2V communication, CAN, LIN, OBD, Climate control system, Power windows and central locking system.

UNIT VI VEHICLE BODY ENGINEERING

Classification of cars, buses, HCVs and LCVs – Driver visibility – forward and rearward visibility – Vehicle Safety – Passive and Active Safety systems. Car Body terminology - Constructional details of cars body panels. Construction of buses – conventional and integral construction. Driver’s seat design considerations – compactness of driver’s cab – segmental design – modern painting processes for car bodies. Body trim items. Body mechanisms – window winding, door locking and seat height adjustment – Body repair – hand and power tools - Aerodynamics of vehicles – different types of drags – optimization techniques - Wind tunnel testing to measure aerodynamic coefficients.

UNIT VII VEHICLE DYNAMICS

Concept of vibration –Types of vibration. Response analysis of single DOF, Two DOF and multi DOF. Magnification factor and Transmissibility factor. Vibration absorbers. Tyre forces and moments – longitudinal and lateral forces. Rolling resistance. Tractive and cornering properties of tyres. Tire Testing. Human response to vehicle vibration. Design and analysis of passive, semi active and active suspension using quarter car, half car and full car models. Load distribution. Vehicle Resistances to motion, vehicle performance characteristics. Steady state and transient state handling characteristics – direction control of vehicle. Stability of vehicle under various conditions.

UNIT VIII VEHICLE CONTROL SYSTEMS

Degree of freedom for vehicle control – calculation of the control - degree of freedom. Selection of control, manipulator and measured disturbances variables. General types of vehicle controllers configuration. Dynamic behaviour of first order and second order vehicle system – dynamic responses characteristics of vehicle systems. Basic control modes – proportional control – integral control. PID controls. Lambda control – knock control – adaptive knock control – drive line modelling – active suspension control. Adaptive cruise control. Lane Departure Warning System. Adaptive Headlamps.

UNIT IX AUTOMOTIVE POLLUTION AND CONTROL

Pollutants – sources, formation and effects on environment and human beings. Emission standards. HC, CO and NOx formation in SI and CI engines. Smoke formation and NOx emission and its types from diesel engine, Particulate emissions. Control techniques – EGR, SCR, LNT, Secondary air induction, Positive crankcase ventilation system particulate trap and catalytic converters. Test procedures CVS1, CVS3 – Test cycles – SHED test. NDIR analyser – Flame ionization detectors – Chemiluminescent analyser – dilution tunnels – gas chromatograph – smoke meters.

UNIT X MOTOR VEHICLE ACT, MAINTENANCE & SERVICING

Motor vehicle act – registration, driving licence, insurance, pollution and control. organization and management of workshop - Scheduled and unscheduled maintenance – Workshop stores – inventory management – 5S Principles in workshops – Cost estimation for maintenance and servicing – Different forms and registers for workshop – Workshop Safety - Trouble shooting and servicing of clutch, gear box, brakes, suspension and steering systems. Trouble shooting and servicing of engine and its auxiliary systems – Servicing of vehicle air conditioning system – Manual, power tools and equipment required for servicing and maintenance.

Note: Medium of Instruction - English only

TAMIL NADU PUBLIC SERVICE COMMISSION

CHEMICAL ENGINEERING

(DEGREE STANDARD) CODE: 405

UNIT I: CHEMICAL PROCESS CALCULATIONS AND CHEMICAL ENGINEERING THERMODYNAMICS

Properties of gases, liquids and solids, Humidity and saturation, Gas laws, steady and unsteady state material and Energy balances including multiphase- involving recycle, by-pass and purge systems, Material and Energy balance with reactions, use of tie components, Gibbs Phase rule and degree of freedom analysis. Laws of Thermodynamics and its applications- Thermodynamics functions - Chemical and Phase Equilibrium -Ideal and non-ideal gases and solutions – Equation of state and residual properties, compression of fluids, Second law and entropy, Chemical potentials, properties of mixtures- fugacity, partial molal properties, excess properties and activity coefficient. Predicting VLE of systems, Free Energy Change and Chemical Reaction Equilibrium.

UNIT II: MECHANICAL OPERATIONS AND ENGINEERING MATERIALS

Characteristics of solids, laws of size Reduction, free and hindered settling, centrifuge and cyclone, thickeners and classifiers, Mixing and agitation, Filtration, Sedimentation. Conveying of solids. Materials of construction for chemical Industries, Metallic, Non-metallic, Polymeric and composite materials, Refractory, corrosion -prevention and control. Smart materials for Chemical Engineering applications- Nano and biomaterials.

UNIT III: CHEMICAL TECHNOLOGY AND RENEWABLE ENERGY SOURCES

Acids, Fertilizers, marine Chemicals, Cement, Glass, Ceramic and Refractories, Petroleum Refining Products, Fermentation Products, Oils, Soaps and Detergents, Pulp and paper, Dyes, sugar, leather and rubber, polymer, pharmaceutical and food industries. Sustainable energy resources- solar, thermal, photoelectric, tidal, geothermal, nuclear, wind, bio-energy, sources, energy storage and conversion- battery and fuel Cells, Energy efficiency estimation.

UNIT IV: FLUID MECHANICS AND HEAT TRANSFER OPERATIONS

Fluid Statics, Newtonian and Non-Newtonian fluids, Types of Manometers, Equation of continuity, Equation of motion, Bernoulli equation, Friction Factor, Dimensional analysis and similitude, Flow though pipes, velocity profiles, flow through fixed and fluidized beds, flow meters, Fans, blowers, pumps and compressors, Energy Equations, Modes of Heat transfers, Heat transfer with phase change, thermal insulation, thermal boundary layer and heat transfer coefficient. Design of heat exchangers- Double pipe, Shell and tube, single and multiple effect evaporators

UNIT V: MASS TRANSFER AND SEPARATION OPERATIONS

Fick's Laws, Diffusion, Mass Transfer Coefficient and theories of Mass Transfer, Momentum, heat and mass transfer analogies, Inter phase Mass transfer operations, HTU, NTU and HETP concepts, Design of equipment - Distillation column, Extraction, Adsorption, Absorption, Drying, humidification and de-humidification. Crystallization, Membrane separation processes - frame, tubular, spiral wound and hollow fibre membrane reactors, dialysis, reverse osmosis, nano/ultra filtration, microfiltration. Ion Exchange chromatography and electrodialysis, Separations involving pervaporation and permeation techniques for solids, liquids and gases, supercritical fluid extraction.

UNIT VI: CHEMICAL REACTION ENGINEERING

Reaction rates - laws - theories and analysis, homogeneous and heterogeneous reactions, single and multiple reactions in ideal reactors. Kinetics of enzyme reactions. Non ideal reactors - Residence time distribution, Single parameter model. Design of reactors- Isothermal and adiabatic fixed bed reactors, non-isothermal and non-adiabatic fixed bed reactors, fluidized bed reactors. Kinetics of heterogeneous catalytic reactions. Diffusion effects in catalysis- rate and performance equations for Catalyst deactivation.

UNIT VII: PROCESS DESIGN, INSTRUMENTATION AND CONTROL

Problem formulation, degree of freedom analysis, objective functions, Simplex method, Barrier method, sensitivity analysis, Convex and concave functions, unconstrained NLP, Newton's method, Quasi-Newton's method, Direct substitution, Quadratic programming, Cost estimation, Plant utilities, Heat exchanger networks, Pinch technology. Principles of measurements and classification of process instruments, measurement of process variables - Laplace transformation, application to solve ODEs. Open-loop systems, first order systems, first order systems in series, linearization and its application in process control, second order systems and their dynamics; transportation lag. Closed loop control systems, feed-back control systems, BODE diagram, stability criterion, frequency response, tuning of controller settings, cascade control, feed forward control, control of distillation towers and heat exchangers.

UNIT VIII: NUMERICAL AND COMPUTATIONAL METHODS

Curve fitting, Equations with real and rational Coefficients, Imaginary roots and irrational roots, Transformation of equations. Numerical solutions of linear and non linear algebraic equations- solution of initial value and boundary value, ordinary and non-linear differential equations, Integration of trapezoidal and Simpson rule. Solution of partial differential equations. Partial Differential equation – finite element, finite difference method - Matrix, determinants and properties – Elementary Row transformations algebraic equations; ordinary differential equations and non homogeneous first order ordinary differential equations, rank of Matrix, Eigen value problems, Orthogonal and ortho normal vectors; Gram-Schmidt orthogonalization; Theorem for Eigen values and Eigen functions.

UNIT IX: ENVIRONMENTAL ENGINEERING, OCCUPATIONAL SAFETY AND HEALTH IN CHEMICAL INDUSTRIES

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

UNIT X: PROFESSIONAL ETHICS, LAWS & LEGISLATIONS:

Morals, values and Ethics – Integrity – Work ethic - Valuing time – Cooperation – Commitment – Empathy – Senses of Engineering Ethics – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles – Theories about right action - Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law. Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights. Intellectual Property Rights (IPR), Employee Discrimination. Multinational Corporations, Environmental Ethics & legislation – Engineers as Managers, Expert Witnesses and Advisors. Moral Leadership, Code of Conduct, Corporate Social Responsibility. Labour laws and legislations – Criminal procedure code – Indian Penal Code.

NOTE: The medium of instruction is only in English.

TAMIL NADU PUBLIC SERVICE COMMISSION

TEXTILE TECHNOLOGY

(DEGREE STANDARD) CODE:406

UNIT- I: FIBRE PROPERTIES AND MANUFACTURE

i) Classification of fibres, production of natural fibres - cotton, jute, silk, wool; Identification of natural and synthetic fibres
ii) Fine, gross structure and properties of fibres
iii) Microscopic, physical and chemical test methods for fibre identification; blend analysis
iv) Morphology characterization – Density, XRD, Electron microscopy
v) Thermal characterization methods - DSC, TGA, DMA / TMA, FTIR spectroscopy
vi) Mechanical – Tensile, Elastic recovery, Time Effect, Bending, Twisting and Compression
vii) Optical - Absorption and dichroism, Reflection and lustre.
viii) Electrical and Thermal Properties - Dielectric property, Static Electricity, Structural changes in fibres on thermal treatment.
ix) Moisture Property – Absorption, Desorption, Swelling, Theories of moisture sorption
x) Requirements of fibre forming polymers
xi) Spinning of Polymers - Melt Spinning, Wet spinning, Dry spinning, Dry-jet-wet Spinning and Gel spinning
xii) Post Spinning Operations – Drawing, Crimping, Heat setting, Tow-to-top conversion, Texturing methods.

UNIT- II: YARN MANUFACTURE, YARN STRUCTURE AND PROPERTIES

i) Principle of ginning
ii) Blow room machines; principles of opening, cleaning and mixing / blending of fibrous materials; cleaning efficiency; calculations
iii) Carding machine; Fundamentals of carding, settings, card clothing, autoleveller; calculations
iv) Comber; Lap preparation, combing cycle, mechanisms; combing efficiency; calculations
v) Draw frame; doubling and drafting, settings, autoleveller; calculations
vi) Roving frame; drafting, twisting, bobbin building; calculations
vii) Ring frame; drafting, twisting, cop formation, forces acting on yarn and traveller; limitations, compact yarn spinning; calculations
viii) Ring doubler and TFO - principle; single and folded yarn twist
ix) Alternate Spinning systems - rotor, two nozzle air-jet, air vortex, friction, core, wrap, twist-less spinning process
x) Helical geometry, packing density, yarn diameter, yarn contraction, yarn twist and relation to yarn strength - staple fibre yarn and filament; mass irregularity of yarn; structure - property relations of ring, rotor, air-jet and friction spun yarns

UNIT- III: WEAVING PREPARATORY AND WEAVING, FABRIC STRUCTURE AND PROPERTIES

i) Cheese, Cone winding - random and precision winding, winding parameters
ii) Yarn clearers and Tensioners; yarn splicing
iii) Types of warping - beam and sectional warping, pirn winding process;
iv) Sizing techniques, sizing of spun and filament yarns; Beam Gaiting
v) Principles of fabric formation in shuttle looms – primary, secondary and auxiliary motions
vi) Shedding – Types and Principles, Reversing Motions
vii) Beat up - types, kinematics of sley
viii) Principles of weft insertion in shuttleless looms - Rapier, air-jet, projectile, water-jet, circular and multiphase
ix) Basic woven fabric constructions and its derivatives - plain, twill, satin; honeycomb, warp and weft figuring, warp and weft pile, backed fabrics, double cloth
x) Pierce's geometry of plain woven fabrics; structure - property relationship

UNIT - IV: KNITTING and NONWOVEN MANUFACTURE

i) Knitting - yarn quality requirements, principles of weft and warp knitting
ii) Basic weft and warp knitted structures and its properties; calculations
iii) Circular, Flat and Warp knitting machines
iv) Geometry of plain knitted fabrics
v) Nonwovens – Needle punch, spun lace, spun bond, melt blown, thermal bond
vi) Finishing of nonwovens - mechanical, chemical

UNIT - V: PREPARATORY AND COLOURATION

i) Preparatory processes for natural fibres, synthetics and common blends
ii) Classification of dyes, auxiliaries and their properties
iii) Dyeing of fabrics using various dye classes.
iv) Batch-wise and continuous dyeing techniques
v) Dyeing machines for fibre, yarn, woven and knitted fabrics
vi) Styles and methods of printing; print paste preparation
vii) Pigment printing
viii) Digital Printing and Transfer Printing
ix) Fixation and after treatment process
x) Washing and drying of fabrics
xi) Colour measurement and colour difference calculation of dyed fabrics
xii) Fastness to wash, perspiration, light and rub

UNIT - VI: FINISHING AND SUSTAINABLE PROCESSING

i) Mechanical finishing of Textiles - shrink proof, raising and calendering
ii) Heat setting of synthetic fabrics
iii) Chemical finishes - crease resistant, water proof, water repellant, flame retardant, soil release, UV resistant, anti microbial, anti-static, softening, stiffening, elastomeric, self cleaning
iv) Bio-polishing of cotton fabrics
v) Washing and fading of denim fabrics
vi) Eco-friendly processing; Eco standards and Eco labels
vii) Minimum application technique, waterless dyeing
viii) Characteristics of Effluent and Effluent treatment

UNIT- VII: QUALITY EVALUATION OF TEXTILES

i) Sampling techniques
ii) Measurement of fibre properties - length, strength, fineness, maturity and trash
iii) HVI and AFIS techniques
iv) Determination of yarn properties - count, twist, strength and elongation, unevenness and hairiness
v) Determination of fabric properties - construction parameters, tear, tensile strength and elongation; air permeability, drape, bending, crease and wrinkle recovery, thickness, pilling, abrasion, shrinkage
vi) Low stress mechanical properties of fabrics - FAST and KESF
vii) Yarn defects and analysis; diagram, spectrogram, VL curve

UNIT- VIII: GARMENT MANUFACTURE AND SPECIAL FINISHES

i) Fabric defects and analysis
ii) Garment manufacture - Pattern making, Marker planning, Spreading and Cutting,
iii) Stitches and Seams, Sewing defects
iv) Types of spreading, cutting and sewing machines; mechanisms and accessories
v) Sewing threads
vi) Components and trims
vii) Pressing, packing, care labels
viii) Garment Inspection and Merchandising

UNIT- IX: TECHNICAL TEXTILES

Fibre, yarn and fabric requirement for

i) Industrial Textiles - Belts, Ropes, Tyre-cords, Coated abrasives
ii) Automotive Textiles - Filter fabrics, Airbags, Seatbelts
iii) Geotextiles – Applications in civil engineering
iv) Agriculture Textiles – Crop covers, bird nets, soil mats and sacks
v) Medical Textiles – Non-implantable, Implantable, hygiene products
vi) Protective Textiles - Ballistic textiles, cold protective clothing, UV Protection, Clean room garments
vii) Sports Textiles

UNIT X: MANAGEMENT OF TEXTILE INDUSTRY

i) Industrial Engineering – Work study, method study, motion study, work measurement
ii) Costing of yarn, fabric and garment; costing - elements, cost sheet, Balance sheet, P & L Account, ratio analysis
iii) Depreciation, investment appraisal techniques
iv) Management Tools – Lean, TQM, TPM, 5S, Kaizen, MIS, Supply chain management, six sigma, FMEA
v) Industrial safety and industrial hygiene
vi) Industrial relations and Labour laws
vii) Energy conservation in textile industry

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TAMIL NADU PUBLIC SERVICE COMMISSION

COMPUTER SCIENCE AND ENGINEERING

(DEGREE STANDARD)

CODE: 407

UNIT - I: C PROGRAMMING AND OOP

Data Types, Operators, Expressions, Type casting - Arrays – Structures, Unions - Enumeration Types – Bit fields - Storage Classes - Preprocessor directives - Functions, Recursion - Pointers to arrays, structures, unions and functions – Dynamic Memory Allocation – Files. Object Oriented Programming using C++ and Java: Classes – Objects - Methods – Constructors and Destructors – Scope – Data Encapsulation – Polymorphism - Overloading and Overriding –Inheritance – Types of Inheritance – Interfaces - Abstract Classes and Methods – Virtual Classes and Functions – Final Methods and Classes - Exception Handling - Assertions – Garbage Collection – Cloning – Reflections - Files. Streams – Formatted Input and Output – Collections – Generic Classes and Methods Multithreading – Object Concurrency – Serialization.

UNIT – II: DATA STRUCTURES AND ALGORITHMS

Arrays – Searching and Sorting - Lists – Singly and Doubly linked lists – Stack Operations and Applications - Queue Operations and Applications – Trees – Binary Trees – Binary Search Trees : Representation, Traversals, Operations and Applications – AVL Trees, Heaps – Priority Queues – Graph – Representation, Traversals and Applications – Topological Sort – Hashing – Growth of Functions – Asymptotic Notation, O, Ω, θ – Recurrence Equations – Algorithms Design Strategies – Divide and Conquer – Quicksort, Merge Sort, Binary Search – Dynamic Programming – Warshall and Floyd's algorithms – Greedy Strategy – Minimum Cost Spanning Tree – Shortest Path Algorithm – Branch and Bound – Backtracking - String Matching algorithms – Naïve, Knuth Morris Pratt algorithm– NP Problems – Vertex Cover, Hamiltonian Cycle – Travelling Salesperson Problem – Approximation algorithms.

UNIT – III: DIGITAL LOGIC AND COMPUTER ARCHITECTURE

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

UNIT – IV: OPERATING SYSTEMS AND SYSTEM SOFTWARES

Process Concepts – Process Scheduling, Context Switch – Operation on Processes - Threads - Types of threads, Multithreading. Uniprocessor and Multiprocessor scheduling, Real time scheduling – Inter process Communications: shared memory, message passing - Mutual exclusion, semaphores, monitors, reader-writer problem - Deadlock prevention, avoidance, detection, integrated deadlock strategy, Dining Philosopher's problem. Address binding, logical versus physical address space, dynamic loading and linking, shared libraries, overlays, swapping, contiguous memory allocation, paging, segmentation - Demand paging, page replacement, frame allocation, thrashing - I/O devices, Organization of I/O function, I/O buffering, Disk scheduling - File access and organization, File directories and sharing, Storage management - Linux Operating Systems features - Phases of Compilers - One and Two Pass Assemblers – Loaders, Linkers - Macroprocessors and Emulators.

UNIT – V: DATABASE MANAGEMENT SYSTEMS

Database Applications – Data Models – Database Architecture – Key issues and Challenges in Database Systems – ER Models – ER to Relational Mapping – Object Relational Mapping – Relational Model - Constraints – Keys – Dependencies – Relational Algebra – Normalization – First, Second, Third & Fourth Normal Forms – BCNF – Join Dependencies – SQL – Embedded & Dynamic SQL – Triggers and Views – Data Constraints – Database Security – Transaction Systems – ACID Properties – System & Media Recovery – Concurrency – Locking Protocols – Log Based Recovery – Two Phase Commit Protocol - Recovery – Deadlocks & Managing Deadlocks – Indexing & Hashing Techniques – Query Processing & Optimization – Sorting & Joins – RAID Levels – Database Tuning – Data Mining and Warehousing – NoSQL – Geographical Information Systems (GIS).

UNIT – VI: SOFTWARE ENGINEERING

Software life-cycle and process models – Agile Models – Extreme Processing – Adaptive Software Development, Scrum – Dynamic System Development Models - Process Assessment Models; Project management activities. Requirements elicitation and analysis; Functional and non-functional requirements; User and system requirements, Requirement validation and specification. Design principles; System Models-Context, Behavioural, Data and object models, Architectural design-system structuring, Control models; Structured and object-oriented design; User interface design; Verification and validation planning; Test plan creation and test case generation; Black-box and White-box testing techniques; Unit, integration, validation and system testing; Object-oriented testing; Software inspections. Software maintenance; Reengineering; Legacy systems; Software reuse. Roles and responsibilities in a software team, Project

Planning and Scheduling; Software measurement and estimation; Risk analysis and management; Quality management; Configuration management. Quality assurance and Process Improvement; ISO 9000, CMMI, TQM and Six Sigma; programming environments; Project management tools; Requirements analysis and design tools; Testing tools; Configuration management tools; CASE tools – Documentation Tools – Presentation Tools.

UNIT - VII: COMPUTER NETWORKS AND SECURITY

ISO/OSI Model, Application Layer Protocols: HTTP, FTP, Telnet, Email, DNS – Performance Metrics, Transport Layer Protocols: User Datagram Protocol (UDP), Transmission Control Protocol (TCP), Flow Control, Congestion Control – Network Layer Protocol: Internet Protocol, IPV4/IPV6 Packet Format, IP Addressing, Subnetting, Classless Inter Domain Routing (CIDR), BOOTP/DHCP, ICMP, Routing Principles, Distance Vector Routing, Routing Internet Protocol – Link State Routing Protocol, OSPF, BGP. Data Link Layer Protocol: Framing, Addressing, Error Detection/Correction – Multiple Access Protocols – Address Resolution Protocol (ARP) – Ethernet Basics, CSMA/CD, Frame Format, Switching, Types (datagram, virtual), Wireless LAN (802.11), Piconet, Bluetooth, Security: Modes of operation, Encryption Techniques, DES, Triple DES, AES, RSA, Diffie-Hellman Key exchange, Elliptic Curve Cryptography, Message Authentication codes, Hash functions, Digital Signatures, Kerberos, X.509, PGP, S/MIME, IP Security, Web Security, SSL, TLS, SET, System security, Attacks : DoS, DDoS, Ethical Hacking, Firewalls, Blockchain Technologies.

UNIT – VIII: EMBEDDED SYSTEMS

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

UNIT – IX: CLOUD COMPUTING AND VIRTUALIZATION

Cloud Components, Infrastructure, Architecture, Applications, Benefits, Limitations, Cloud Deployment Models, Cloud Technologies. Infrastructure as a Service (IaaS) – Storage as a Service – Compute as a Service –

Platform as a Service (PaaS) – Software as a Service (SaaS): CRM as a Service, Social Computing Services, Document Services. Taxonomy, Server Virtualization, Desktop Virtualization, Network Virtualization, Storage Virtualization, Hypervisor. Hardware and Infrastructure – Server, Clients, Network, Software Defined Networks (SDN). Accessing the Cloud-Web Applications, Web API, Web Browsers. Scalable data storage techniques – Big Data Analytics. Map reduce Framework – Hadoop, HDFS. Artificial Intelligence – Machine Learning: Supervised Learning, Unsupervised Learning, Reinforcement Learning – Deep Learning – Transfer Learning – Natural Language Processing (NLP) – Data Visualization.

UNIT – X: WEB TECHNOLOGY AND MOBILE COMPUTING

Internet and WWW Protocols, Client side Programming: HTML, CSS, JavaScript, XML, DTD, Schema, XSLT, server side Programming: Python, PHP, Web Servers: configuration, security, Core Java: I/O, Network Programming, RMI, JDBC, Swing, Advanced Java: JSP, Servlets, Beans, MVC. Web Frameworks: sessions, user management, legacy databases and applications, Web Application development. Web Services: SOAP, UDDI, WSDL, Smart Devices and Mobile Operating Systems. Data compression and decompression – Augmented Reality/Virtual Reality. Mobile Computing : GSM, EDGE, GPRS, IS-95, CDMA 2000 and WCDMA, Recent Mobile Technologies – Mobile Application Development – Digital Marketing – E-commerce.

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TAMIL NADU PUBLIC SERVICE COMMISSION
INFORMATION TECHNOLOGY CODE: 408

(DEGREE STANDARD)

UNIT I PROGRAMMING IN C, PYTHON AND OBJECT ORIENTED PROGRAMMING

C Programming:

Introduction to IT – Problem Solving – C Programming – Constants – Variables – Data Types – Expressions – Input/Output Operations – Decision Making and Branching Statements – Looping Statements – Arrays – Initialization – Declaration – One dimensional and Two dimensional arrays. String – string operations – String Arrays. Simple programs – sorting – searching – matrix operations – Function – Definition of function – Declaration of function – Pass by value – Pass by reference – Recursion – Pointers – Definition – Initialization – Pointers arithmetic - Pointers and arrays – structure date type – structure definition – Structure declaration – Structure within a structure – Union – Programs using structures and Unions – Storage classes, Pre-processor directives - File Handling

Python Programming:

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

Object Oriented Programming:

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

UNIT-II DATA STRUCTURES AND ALGORITHMS

Linear Data Structures – Abstract Data Types (ADTs) – List ADT – array based implementation – linked list implementation – singly linked lists – circularly linked lists – doubly-linked lists – applications of lists –

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

UNIT III-DIGITAL PRINCIPLES, COMPUTER ORGANIZATION AND IoT CONCEPTS

BOOLEAN ALGEBRA AND LOGIC GATES – Review of Number Systems – Arithmetic Operations – Binary Codes – Boolean Algebra and Theorems – Boolean Functions – Simplification of Boolean Functions using Karnaugh Map and Tabulation Methods – Logic Gates – NAND and NOR Implementations. COMBINATIONAL LOGIC – Combinational Circuits – Analysis and Design Procedures – Circuits for Arithmetic Operations, Code Conversion – Decoders and Encoders – Multiplexers and Demultiplexers – Introduction to HDL – HDL Models of combinational circuits – SEQUENTIAL LOGIC - Sequential Circuits – Latches and Flips Flops – Analysis and Design Procedures – State Reduction and State Assignment – Shift Registers – Counters – HDL for Sequential Logic Circuits – Computer Organization – Components of a computer system – Technology – Performance – Power Wall - Uniprocessors to multiprocessors; Instructions – operations and operands – representing instructions – Logical operations – control operations – Addressing and addressing modes – ALU – Addition and subtraction – Multiplication – Division – Floating Point operations – PROCESSOR AND CONTROL UNIT – Basic MIPS Implementation – Building datapath – Control Implementation scheme – Pipelining – Pipelined datapath and control – Handling Data hazards & Control hazards – Exceptions – MEMORY AND I/O SYSTEMS – Memory hierarchy – Memory technologies – Cache basics – Measuring and

improving cache performance – Virtual memory, TLBs – Input/ output system, programmed I/O, DMA and interrupts, I/O processors.

8-Bit Embedded Processor - IOT Devices – Arduino - Sensors and Actuators - IOT Communication Models and API - Communication Protocols - Programming and Interfacing - Connecting to the Cloud.

UNIT – IV PROBABILITY AND QUEUEING THEORY

RANDOM VARIABLES – Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions – TWO – DIMENSIONAL RANDOM VARIABLES – Joint distributions – Marginal and conditional distributions – Covariance – Correlation and Linear regression – Transformation of random variables – RANDOM PROCESSES – Classification – Stationary process – Markov process – Poisson process – Discrete parameter Markov chain – Chapman Kolmogorov equations – Limiting distributions – QUEUEING MODELS – Markovian queues – Birth and Death processes – Single and multiple server queueing models – Little's formula – Queues with finite waiting rooms – Queues with impatient customers: Balking and reneging.

UNIT – V DATABASE MANAGEMENT SYSTEMS

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

Introduction to Distributed Databases – Multidimensional and Parallel databases – Spatial and Multimedia databases – Mobile and web databases – Data Warehouse – Mining – Data marts - NoSQL Database-

CAP Theorem - Document Based Systems-Key Value Stores-Column Based Database-Graph Database-Database Security-Access Control Mechanisms-Big Data-Big Data Analytics-Big Data Tools

UNIT-VI OPERATING SYSTEMS AND CLOUD TECHNOLOGIES

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

Distributed Systems: Distributed System Models-Distributed Communications-Global States-Causal Ordering of Events-Distributed Mutual Exclusion Algorithms-Deadlock detection in Distributed Systems-Consensus and Agreement Algorithms

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

UNIT –VII SOFTWARE ENGINEERING

SOFTWARE PROCESS AND PROJECT MANAGEMENT: Introduction to Software Engineering, Software Process, Perspective and Specialized Process Models - Software Project Management: Estimation – LOC and FP Based Estimation, COCOMO Model – Project Scheduling – Scheduling, Earned Value Analysis – Risk Management – Introduction to Agility - Agile Process - Extreme Programming - XP Process - REQUIREMENTS ANALYSIS AND SPECIFICAION – Software Requirement: Functional and Non –

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

UNIT –VIII WEB TECHNOLOGY

SCRIPTING LANGUAGES –Web page designing using HTML, Scripting basics – Client side and server side scripting. Java Script – Object, names, literals, operators and expressions – statements and features – events – windows –documents – frames –date types –built-in functions – Browser object model – Verifying forms – HTML5 – CSS3 – HTML 5 canvas – Web site creation using tools – Event Handling- PhP Scripting - JAVA PROGRAMMING – Features of java – Data types, variables and arrays – Operators – Control statements – Classes and Methods – Inheritance. Packages and Interfaces – Exception Handling – Multithreaded Programming – Input / Output – files – Utility Classes – Strong Handling – JDBC – JDBC Overview –JDBC implementation – Connection class – Statements – Catching Database Results, handling database Queries. Networking –Inet Address class – URL class – TCP sockets – UDP sockets, Java Beans –RMI – APPLETs – Java applets – Life Cycle of an Applet – Adding Images to an Applet – Adding Sound to an Applet – Passing Parameters to an Applet - Event Handling. Introducing AWT: Working with Windows Graphics and Text. Using AWT Controls, Layout Managers and Menus. Servlet – life cycle of a servlet. The Servlet API, Handling HTTP Request and Response, Using Cookies, Session Tracking - MVC Architecture – Nodejs - Events – Listeners – Timers - Callbacks - Handling

Data - Implementing HTTP Service in Nodejs – NOSQL – MongoDB – Frameworks – SPRING – MERN – MEAN - Flutter

UNIT –IX COMPUTER NETWORKS

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

UNIT X ARTIFICIAL INTELLIGENCE, MACHINE LEARNING AND DATA SCIENCE

Artificial Intelligence: Problem Solving Agents-Search Algorithms-Uninformed Search strategies-Heuristics Search Strategies-Local Search and Optimization Problems-Adversarial Search –Constraint Satisfaction

Problem(CSP)-Logics-Propositional Logic-First Order Logic- Reasoning: Probabilistic Reasoning

Machine Learning: Types of Learning-Linear Regression Models and Types-Logistic Regression-Bayesian Linear Regression - Gradient Descent-Linear Classification Models - Discriminant Functions - Probabilistic Discriminative Models-Probabilistic Generative Models- SVM-Decision Tree - Naïve Bayes-Bayesian Modelling - Ensembling-Bagging and Boosting – Stacking - Random Forest - Clustering-Gaussian Mixture Models - Expectation Maximization Algorithm - K Means - Probabilistic Graphical Models – HMM - Bayesian Inference - Neural Network - Multi Layer Perceptron - Feed forward Neural Networks - Back Propagation - Regularization

Data Science: Types of Data and Variables - Describing Data - Describing Relationships – Statistical Testing-Python Libraries for Data Wrangling – NumPY – Pandas -Data Visualization – MATPlotLIB – Seaborn – Keras - Tensor Flow.

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TAMIL NADU PUBLIC SERVICE COMMISSION

AGRICULTURAL ENGINEERING CODE: 409

(DEGREE STANDARD)

UNIT-I: SURVEYING AND HYDROLOGY

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

UNIT-II: SOIL EROSION AND CONSERVATION

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

UNIT-III: WATERSHED DEVELOPMENT AND MANAGEMENT

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

UNIT-IV: IRRIGATION AND DRAINAGE

Irrigation - Sources – Soil- water- Plant relationship - Water requirement of crops – Measurement of irrigation water - Weirs and flumes - Methods of irrigation - Surface, Sprinkler, Rain gun and drip irrigation - Irrigation automation - Drip irrigation – Components - Wetting pattern - Filters and Fertigation tanks - Design of laterals - Submain - Main lines - Pump capacity - Operation and maintenance - Sprinkler irrigation - Components - Sprinkler performance - Hydraulic design of sprinkler systems - Duty and delta relationship – Irrigation scheduling - Irrigation efficiencies and their estimation - Pumps - Types, selection and installation - Drainage - Causes of water logging and salt problem - Methods of drainage - Design of surface, sub-surface and vertical drainage systems - Improvement and utilization of poor quality water - Reclamation of saline and alkali soils.

UNIT-V: FARM AND IRRIGATION STRUCTURES

Design and construction of farm structures – Site selection - Materials of construction – Quality– types of masonry – RCC - Foundation, basement and superstructure – Types of roofs – building plan and estimation, requirements of farm house, threshing floor, drying floor, poultry house, dairy farm, rat proof godown and farm roads - Design features earthen dams and gravity dams - Water conveyance structures – Earthen channels and lined channels – Advantages of lining – materials of lining – Design of channel cross section – Crossing control structures – Drop spillway, chute spillway, pipe inlet spill way – Road crossing structures – Culvert, inverted siphon aqueduct – Their uses - Underground pipe line system – Components and their functions – Structures for plant environment – Green houses, polyhouses and shade nets – Construction and utilization - Soilless culture.

UNIT-VI: FARM POWER

Sources of Farm Power- Construction and working of IC engines-SI and CI engines-Thermodynamic principles of SI an CI engine - two stroke and four stroke engines-Turbo charging - Fuel, Ignition, lubrication, air cleaning, cooling, governing, electrical, systems of IC engines- Different types of tractors, bull dozers and power tillers - power transmission systems, clutches, gear system, differential, Final drive system, Brake system, steering system, hydraulic system, hitching system, three point linkage- tractor power outlets-traction-traction theory-operations using bull dozer, wheels and tyres-terminology-tractor stability-mechanics of tractor implement combination, weight transfer - Ergonomical considerations in operation of tractors and safety devices in tractor-care and maintenance of tractors. Single phase induction motor - three phase power measurement methods- Power factor- Electrical pump sets - regulated DC power supply, DC machine, DC generator, DC motor, starter - torque and efficiency - Electronics in Agriculture - Semi conductors, transistors, operational amplifiers - Digital

electronics, counters, encoders, decoders, Digital to Analog and Analog to digital converter-Instrumentation - transducers - strain gauges, types and gauge factor - force measurement using strain gauges, Torque measurement, pressure measurement, flow measurement temperature measurement, thermocouples, speed measurement micro processors, micro controllers, PID controllers, PLC - Electric vehicles in Agriculture.

UNIT- VII: FARM MACHINERY

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

UNIT-VIII: UNIT OPERATIONS IN FOOD AND AGRICULTURAL PROCESSING

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

UNIT- IX: PROCESS ENGINEERING OF AGRICULTURAL AND HORTICULTURALCROPS

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

UNIT-X: RENEWABLE AND BIOENERGY

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

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