INDIAN INSTITUTE OF INFORMATION TECHNOLOGY TIRUCHIRAPPALLI

(An Institute of National Importance under MHRD, Govt. of India)

NIT CAMPUS, TIRUCHIRAPPALLI -15

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Recruitment of Temporary Faculty - Detailed Syllabus

1. Department of CSE

1. Data Structures and Algorithms:

Development of Algorithms - Notations, Concepts - Arrays - Linked lists - Stacks and queues Trees - Tree Traversing - Operations on Binary Trees – Sorting and Searching techniques - Graphs - BFS, DFS - Shortest path problems.

2. Operating Systems:

Basic OS Concepts - Thread and process scheduling - Synchronization - Semaphores - Critical regions - Deadlock prevention and recovery - Memory Management - File Management - I/O Management – Case Studies on Windows and Linux OS.

3. Computer Organization and Architecture:

Basic structure of Computers - Arithmetic - Addition & subtraction of signed numbers - Multiplication - Integer division - Floating point operations - Pipelining - Multiple bus organization - Micro programmed control – Hazards - Memory System - Semiconductor RAM memory - Cache memory - Virtual memory - Secondary storage - I/O Organization - Interrupts - DMA - Buses - Interface circuits - Serial communication links.

4. C Programming:

C programming – Memory Concepts – Arithmetic Operations - Control Statements – Functions - Pointers – Structures – User Defined Data types - File handling.

5. Microprocessors:

8085 processor - Architecture - Bus organization - Registers - ALU - Instruction set of 8085 - Instruction format - Addressing modes - System design using controllers - Microprocessor Interfacing Techniques - Segmented memory concepts - Bus concepts.

6. Computer Networks:

Introduction to Networks - Application of Networks - Architecture Topology Switching - SLIP, PPP -ALOHA protocols, CSMA/CD, Routing, Congestion control- Internetworking, Source routing, Bridges, Routers, Gateway. Network Protocol- IP datagram - hop by hop routing, ARP, RARP, DHCP -Sub net Addressing, Address Masking, ICMP, RIP, RIPV2, OSPF, DNS, LAN and WAN Multicast. Transport Layer- Connection Management, Transmission Control Protocol (TCP) - User Datagram Protocol (UDP). Application Layer Protocol- Telnet - TFTP - FTP - SMTP - Ping Finger, Bootstrap Network Time Protocol- SNMP.

7. Automata and Formal Languages, Compiler Design:

Regular expressions, NFA, DFA, Closure properties of Regular Languages, CFG, Derivation, Derivation trees, Ambiguity, Simplification of CFGs, Normal forms, PDA and Turing Machines Phases of a compiler, Lexical Analysis – Role of Lexical Analyzer, Context-Free Grammars – Top Down parsing – Recursive Descent Parsing – Predictive Parsing – Bottom-up parsing – Shift Reduce Parsing – Operator Precedent Parsing, Intermediate Code Generation, Code Optimization, and Code generation**.**

2. Department of ECE

Devices and Electronic Circuits, Network Analysis and Synthesis, Signals & Systems, DSP, ADSP, Electromagnetic Theory, Transmission lines, Antennas and Wave Propagations, Metamaterial Antennas, MIC, MICROSTRIP and STRIPLINE fundamentals, Microwave electronics, Microwave Components and Circuits, Statistical theory of Communication, Analog and Digital Communication, Wireless Communication, Broadband Access Technologies, Fiber optics and Optical communication, Satellite Communication, Digital Systems, Analog Integrated Circuits, Microprocessors, Microcontrollers, Embedded systems, ARM system, DSP Processors, Basics of VLSI, Digital VLSI, Analog IC Design, Verilog HDL, ASIC, DSP for VLSI, VLSI Testing, Low Power VLSI, EDA Tools, Computer Networks and Protocols, Computer Architecture and Organization, DIP, Ad Hoc Networks.

3. Department of Mathematics

Algebra, Matrix, Calculus, Differential Equations, Partial Differential Equations, Real Analysis, Complex Analysis, Complex Integration, Integral Transforms, Numerical Methods, Fourier Series, Probability and Statistics.

4. Department of Physics

Mathematical Physics: Determinants and matrices – Vector analysis – Complex analysis – Ordinary differential equations – Fourier analysis.

Classical Mechanics: Lagrangian formulation – Central force problem – Hamiltonian formulation – Rigid body motion – Special theory of relativity.

Quantum Mechanics: Schrodinger Equation – Operators and eigenfunctions – solvable problems – angular momentum and spin – approximation methods – scattering theory.

Electronics: Network analysis – semiconductor devices – amplifiers and oscillators – operational amplifiers – digital circuits.

Electromagnetic Theory: Electrostatics – Magnetostatics – Maxwell equations – Electromagnetic waves and propagation.

Statistical Mechanics: Thermodynamics – Ensemble theory – Maxwell-Boltzmann statistics – Bose-Einstein statistics – Fermi-Dirac statistics.

Solid State Physics: Crystal structure – Lattice vibrations and thermal properties – conductors – semiconductors – dielectrics – magnetic materials.

Atomic and Molecular Physics: Atomic spectra – resonance spectroscopy – IR and microwave spectroscopy – electronic spectroscopy.

Nuclear Physics: Nuclear forces – nuclear models – radioactivity – nuclear reactions – elementary particles

5. Department of Chemistry

Organic Chemistry

Reaction mechanism, Nucleophilic substitution, Addition to carbon-carbon multiple bonds, Elimination reactions, Theories of aromaticity, Fundamentals of photochemistry, Pericyclic reactions, Optical activity and chirality, Conformational analysis, Rearrangement reactions, Introduction to retrosynthesis, Two group C-C & C-X disconnections, Protecting groups, Reagents in organic synthesis, Name reactions in organic synthesis.

Inorganic Chemistry

Chemical Bonding Basic concepts, bonding in metals, Alloys, Shape & Intermolecular Interactions, Theories of coordination compounds, Reactions, Electronic spectra and magnetism, IR and Raman spectroscopy, Structure of coordination compounds, Structure and bonding in organometallics, Reaction mechanism and catalysis, Carbenes, Transport of metal ions, Metalloporphyrins/Metalloenzymes, Fundamentals, Theories of solid, X- Ray diffraction, Nuclear structure, Inorganic rings and polymers.

Physical Chemistry

Quantum chemistry, Group theory and chemical applications, Thermodynamics, Entropy and its changes, work & free energy functions, related mathematical expressions, Phase rule, colloids and micelles, Electrochemistry, batteries and fuel cells, their types and chemistry, Chemical kinetics, Statistical thermodynamics, Photochemistry, Surface chemistry.

Engineering Chemistry

Water chemistry and treatment methods, fuels and lubricants-characteristics and their determination, Corrosion and its types, Factors affecting corrosion, protection from corrosion, Solar battery- its working principle. Solid state, packing pattern, semiconductiors, preparation and p-n junction diode. Polymers, types and their applications, molecular weight determination

6. Department of English

Literature: Chaucer to the 20th Century - Contemporary British Literature - American and other non-British Literatures - European Literature - Indian writing in English and Indian Literature in English translation - New Literatures in English - Commonwealth Literature- Literary Theory and Criticism.

Linguistics and Applied Linguistics: Language and linguistics – Relevance of linguistics to language teaching - Language acquisition and learning – Behaviourist and Cognitivist schools - L 2 Acquisition and learning – Theories of SLA and SLL - Theories of language teaching - English for specific purposes - Evaluation methods and testing techniques - Teacher orientation and training – Computer Assisted Language Learning.

7. Department of Civil Engineering

SECTION 1: ENGINEERING MATHEMATICS

Probability and Statistics: Definitions of probability and sampling theorems; Conditional probability; Discrete Random variables: Poisson and Binomial distributions; Continuous random variables: normal and exponential distributions; Descriptive statistics - Mean, median, mode and standard deviation; Hypothesis testing.
Numerical Methods: Accuracy and precision; error analysis. Numerical solutions of linear and non-linear algebraic equations; Least square approximation, Newton's and Lagrange polynomials, numerical differentiation, Integration by trapezoidal and Simpson's rule, single and multi-step methods for first order differential equations.

SECTION 2: STRUCTURAL ENGINEERING

Engineering Mechanics: System of forces, free-body diagrams, equilibrium equations; Internal forces in structures; Friction and its applications; Kinematics of point mass and rigid body; Centre of mass; Euler's equations of motion; Impulse-momentum; Energy methods; Principles of virtual work.
Solid Mechanics: Bending moment and shear force in statically determinate beams; Simple stress and strain relationships; Theories of failures; Simple bending theory, flexural and shear stresses, shear centre; Uniform torsion, buckling of column, combined and direct bending stresses.
Structural Analysis: Statically determinate and indeterminate structures by force/ energy methods; Method of superposition; Analysis of trusses, arches, beams, cables and frames; Displacement methods: Slope deflection and moment distribution methods; Influence lines; Stiffness and flexibility methods of structural analysis.
Construction Materials and Management: Construction Materials: Structural steel - composition, material properties and behaviour; Concrete - constituents, mix design, short-term and long-term properties; Bricks and mortar; Timber; Bitumen. Construction Management: Types of construction projects; Tendering and construction contracts; Rate analysis and standard specifications; Cost estimation; Project planning and network analysis - PERT and CPM.
Concrete Structures: Working stress, Limit state and Ultimate load design concepts; Design of beams, slabs, columns; Bond and development length; Prestressed concrete; Analysis of beam sections at transfer and service loads.
Steel Structures: Working stress and Limit state design concepts; Design of tension and compression members, beams and beam- columns, column bases; Connections – simple and eccentric, beam-column connections, plate girders and trusses; Plastic analysis of beams and frames.

SECTION 3: GEOTECHNICAL ENGINEERING

Soil Mechanics: Origin of soils, soil structure and fabric; Three-phase system and phase relationships, index properties; Unified and Indian standard soil classification system; Permeability - one dimensional flow, Darcy's law; Seepage through soils - two-dimensional flow, flow nets, uplift pressure, piping; Principle of effective stress, capillarity, seepage force and quicksand condition; Compaction in laboratory and field conditions; One

dimensional consolidation, time rate of consolidation; Mohr's circle, stress paths, effective and total shear strength parameters, characteristics of clays and sand.
Foundation Engineering: Sub-surface investigations - scope, drilling bore holes, sampling, plate load test, standard penetration and cone penetration tests; Earth pressure theories - Rankine and Coulomb; Stability of slopes - finite and infinite slopes, method of slices and Bishop's method; Stress distribution in soils - Boussinesq's and Westergaard's theories, pressure bulbs; Shallow foundations - Terzaghi's and Meyerhoff's bearing capacity theories, effect of water table; Combined footing and raft foundation; Contact pressure; Settlement analysis in sands and clays; Deep foundations - types of piles, dynamic and static formulae, load capacity of piles in sands and clays, pile load test, negative skin friction.

SECTION 4: WATER RESOURCES ENGINEERING

Fluid Mechanics: Properties of fluids, fluid statics; Continuity, momentum, energy and corresponding equations; Potential flow, applications of momentum and energy equations; Laminar and turbulent flow; Flow in pipes, pipe networks; Concept of boundary layer and its growth.
Hydraulics: Forces on immersed bodies; Flow measurement in channels and pipes; Dimensional analysis and hydraulic similitude; Kinematics of flow, velocity triangles; Basics of hydraulic machines, specific speed of pumps and turbines; Channel Hydraulics - Energy-depth relationships, specific energy, critical flow, slope profile, hydraulic jump, uniform flow and gradually varied flow
Hydrology: Hydrologic cycle, precipitation, evaporation, evapo-transpiration, watershed, infiltration, unit hydrographs, hydrograph analysis, flood estimation and routing, reservoir capacity, reservoir and channel routing, surface run-off models, ground water hydrology - steady state well hydraulics and aquifers; Application of Darcy's law.
Irrigation: Duty, delta, estimation of evapo-transpiration; Crop water requirements; Design of lined and unlined canals, head works, gravity dams and spillways; Design of weirs on permeable foundation; Types of irrigation systems, irrigation methods; Water logging and drainage; Canal regulatory works, cross-drainage structures, outlets and escapes.

SECTION 5: ENVIRONMENTAL ENGINEERING

Water and Waste Water: Quality standards, basic unit processes and operations for water treatment. Drinking water standards, water requirements, basic unit operations and unit processes for surface water treatment, distribution of water. Sewage and sewerage treatment, quantity and characteristics of wastewater. Primary, secondary and tertiary treatment of wastewater, effluent discharge standards. Domestic wastewater treatment, quantity of characteristics of domestic wastewater, primary and secondary treatment. Unit operations and unit processes of domestic wastewater, sludge disposal.
Air Pollution: Types of pollutants, their sources and impacts, air pollution meteorology, air pollution control, air quality standards and limits.
Municipal Solid Wastes: Characteristics, generation, collection and transportation of solid wastes, engineered systems for solid waste management (reuse/ recycle, energy recovery, treatment and disposal).
Noise Pollution: Impacts of noise, permissible limits of noise pollution, measurement of noise and control of noise pollution.

SECTION 6: TRANSPORTATION ENGINEERING

Transportation Infrastructure: Highway alignment and engineering surveys; Geometric design of highways - cross-sectional elements, sight distances, horizontal and vertical alignment; Components and Geometric design of railway track; Airport runway length and orientation, taxiway and exit taxiway design.
Highway Pavements: Highway materials - desirable properties and quality control tests; Design of bituminous paving mixes; Design factors for flexible and rigid pavements; Design of flexible pavement using IRC: 37-2012; Design of rigid pavements using IRC: 58-2011; Distresses in flexible and rigid pavements.
Traffic Engineering: Traffic studies on flow, speed, travel time - delay and O-D studies, PCU, peak hour factor, parking study, accident study and analysis, statistical analysis of traffic data; Microscopic and macroscopic parameters of traffic flow, fundamental relationships; Control devices, signal design by Webster's method; Types of intersections and channelization; Highway capacity and level of service of rural highways and urban roads.

SECTION 7: GEOMATICS ENGINEERING

Principles of surveying; Errors and their adjustment; Maps - scale, coordinate system; Distance and angle measurement - Levelling and trigonometric levelling; Traversing and triangulation survey; Total station; Horizontal and vertical curves.
Photogrammetry - scale, flying height; Remote sensing - basics, platform and sensors, visual image interpretation; Basics of Geographical information system (GIS) and Geographical Positioning system (GPS).

8. Department of Mechanical Engineering

FLUID MECHANICS AND THERMAL SCIENCES

Fluid properties; fluid statics, manometry; Bernoulli's equation; dimensional analysis; viscous flow of incompressible fluids, boundary layer, flow through pipes, head losses in pipes, bends and fittings.

Modes of heat transfer; one dimensional heat conduction, resistance concept and electrical analogy, heat transfer through fins; unsteady heat conduction, lumped parameter system, free and forced convective heat transfer, heat exchanger performance, LMTD and NTU methods; radiative heat transfer, StefanBoltzmann law, Wien's displacement law, black and grey surfaces.

Thermodynamic systems and processes; properties of pure substances, behaviour of ideal and real gases; zeroth and first laws of thermodynamics, calculation of work and heat in various processes; second law of thermodynamics; thermodynamic property charts and tables, availability and irreversibility; thermodynamic relations.

APPLIED MECHANICS, DESIGN AND ENGINEERING MATERIALS

Free-body diagrams and equilibrium; trusses and frames; virtual work; kinematics and dynamics of particles and of rigid bodies in plane motion; impulse and momentum (linear and angular) and energy formulations, collisions.

Stress and strain, elastic constants, Poisson's ratio; Mohr's circle for plane stress and plane strain; thin cylinders; shear force and bending moment diagrams; bending and shear stresses; deflection of beams; torsion of circular shafts; Euler's theory of columns; energy methods; thermal stresses; strain gauges and rosettes; testing of materials with universal testing machine; testing of hardness and impact strength.

Displacement, velocity and acceleration analysis of plane mechanisms; dynamic analysis of linkages; cams; gears and gear trains; flywheels and governors; balancing of reciprocating and rotating masses; gyroscope.

Free and forced vibration of single degree of freedom systems; effect of damping; vibration isolation; resonance, critical speeds of shafts.

Design for static and dynamic loading; failure theories; fatigue strength and the S-N diagram; principles of the design of machine elements such as bolted, riveted and welded joints; shafts, gears, rolling and sliding contact bearings, brakes and clutches, springs.

Structure and properties of engineering materials, phase diagrams, heat treatment, stress-strain diagrams for engineering materials.

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