

**JNTUH Full Time Ph.D. Programme in Engineering Under TEQIP –II Scheme
2012-2013**

Entrance Examination Syllabus

CIVIL ENGINEERING

Strength of Materials : Bending moment and shear force in statically determinate beam. Simple stress and strain relationship: Stress and strain in two dimensions, principal stresses, stress transformation, Mohr' s circle Simple bending theory, flexural and shear stresses, unsymmetrical bending, shear centre. Thin walled pressure vessels, uniform torsion, buckling of column, combined and direct bending stresses.

Structural Analysis: Analysis of statically determinate trusses, arches, beams, cables and frames, displacements in statically determinate structures and analysis of statically indeterminate structures by force / energy methods, analysis by displacement methods (slope deflection and moment distribution methods), influence lines for determinate and indeterminate structures. Basic concepts of matrix methods of structural analysis.

Concrete Structures: Concrete Technology- properties of concrete, basics of mix design – Special Concretes - Concrete design basic working stress and limit state design concepts, analysis of ultimate load capacity and design of members subjected to flexure, shear, compression and torsion by limit state methods. Basic elements of prestressed concrete, analysis of beam sections at transfer and service loads, IS Code provisions.

Steel Structures: Analysis and 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, IS Code provisions.

Soil Mechanics: Origin of soils, soil classification, three - phase system, fundamental definitions; relationship and interrelationships, permeability and seepage, effective stress principle, consolidation, compaction, shear strength.

Foundation Engineering: Sub-surface investigations- scope, drilling bore holes, sampling, penetration test
plate load test. Earth pressure theories, effect of water table, layered soils. Stability of slopes- infinite slopes finite slopes. Foundation types- foundation design requirements. Shallow foundations- bearing capacity effect of shape, water table and other factors, stress distribution, settlement analysis in sands and clays. Deep foundations - pile types, dynamic and static formulae, load capacity of piles in sands and clays, negative skin friction.

Fluid Mechanics and Hydraulics: Properties of fluids, principle of conservation of mass, momentum, energy and corresponding equations, potential flow, applications of momentum and Bernoulli' s equation, laminar and turbulent flow, flow in pipes, pipe networks. Concept of boundary layer and its growth. Uniform flow, critical flow and gradually varied flow in channels, specific energy concept, hydraulic jump. Forces on immersed bodies, flow measurements in channels, tanks and pipes. Dimensional analysis and hydraulic modeling. Kinematics of flow, velocity triangles and specific speed of pumps and turbines.

Hydrology: Hydrologic cycle, rainfall, evaporation, infiltration, stage discharge relationships, unit hydrographs, flood estimation, reservoir capacity, reservoir and channel routing. Well hydraulics.

Irrigation: Duty, delta, estimation of evapo-transpiration. Crop water requirements. Design of: lined and unlined canals, waterways, head works, gravity dams and spillways. Design of weirs on permeable foundation. Types of irrigation system, irrigation methods. Water logging and drainage, sodic soils.

ENVIRONMENTAL ENGINEERING

Water requirements: 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, sludge disposal, 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.

TRANSPORTATION ENGINEERING

Highway Planning: Geometric design of highways, testing and specifications of paving materials, design of flexible and rigid pavements.

Traffic Engineering: Traffic characteristics, theory of traffic flow, intersection design, traffic signs and signal design, highway capacity.

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MECHANICAL ENGINEERING / ENERGY SYSTEMS

Syllabus for Energy Systems: (The candidates having Mechanical Degree have to attend Mechanical Entrance Examination along with candidates applied for Mechanical Engineering.

The candidates having Electrical Degree have to attend Electrical Entrance Examination along with candidates applied for Electrical Engineering).

1. **Thermodynamics.** Laws. Properties of ideal and real gases and vapors, Power Cycles, Gas Power Cycle, Gas Turbine Cycles, Fuels and Combustion.
2. **I. C. Engine.** C.I and S.I. Engines, Detonation. Fuel injection and carburetion. Performance and Testing. Turbo prop. Engines, Rocket Engines. Elementary knowledge of Nuclear Power Plants and Nuclear Fuels.
3. Steam Boilers, Engines, Nozzles and Steam Turbines. Modern boilers. Steam Turbines, Types. Flow of steam through nozzles. Velocity diagrams for Impulse and Reaction Turbines. Efficiencies and Governing.
4. **Compressors, Gas Dynamics and Gas Turbines.** Reciprocating, centrifugal and axial flow compressors. Energy transfer equation. Velocity diagrams. Efficiency and Performance. Gas Turbine Cycle with multistage compression. Reheating and Regeneration.
5. **Heat Transfer, Refrigeration and Air Conditioning.** Conduction. Convection and Radiation. Heat Transfer, Heat Exchangers, Boiling and condensation. Refrigeration and heat pump cycles. Refrigeration systems. Coefficient of performance. Psychometric and psychometric chart. Comfort indices. Cooling and dehumidification methods. Industrial Air-conditioning Processes. Cooling and heating loads calculations.
6. **Fluid Mechanics and Machines.** Fluids-Properties, Pressure. Forces, Buoyancy and stability. Laminar and turbulent flow, equation of continuity. Energy and momentum equation. Bernoulli's Theorem. Dimensional analysis. Critical Reynolds number Layer concepts. Film lubrication. Incompressible flow through pipes, critical velocity. Friction loss due to sudden enlargement and contraction. Compressible flow through nozzles.
7. **Theory of Machines.** Velocity and acceleration of moving bodies; in machines. Inertia forces in machines. Cams; Gears and Geartrains, Flywheels and Governors. Balancing of Rotating and Reciprocating Masses. Free and Forced vibrations of systems. Critical speeds and whirling of shafts.
8. **Machine Design. Design of :** Joints-Threaded fasteners and Power Screws-Keys, Cotters, Couplings-Welded Joints. Transmission system :-Belt and chain drives-wire ropes-shafts. Gears-Sliding and Rolling bearings.
9. **Engineering Mechanics.** Forces and moments-Equilibrium and analysis of force systems-friction-centre of gravity, moment of Inertia-Kinetics.

10. **Strength of Materials.** Stress and strain in two dimension ; **Mohr's** circles ; Relations between Elastic Constants.
Beams :- Bending Moments, Shear forces and deflection.
Shafts :- Combined bending, Direct and torsional stresses.
Thick :-Walled cylinders and spheres under Pressure, Spring, Struts and Columns. Theories of failure.
11. **Engineering Materials.** Alloys and Alloying Materials, Heat treatment ; Composition Properties and uses. Plastics and other newer engineering materials.
12. **Metallurgy.** Phase diagrams of Alloy systems, Iron carbon system, Solidification, Heat treatment Processes.
13. **Production Engineering.** Metals Machining :-Cutting tools ; Tool Materials, Wear and Machinability, Measurement of cutting forces.
Process :- Machining-Grinding, Boring, Gear Manufacturing, Metal forming, Metal Casting and Joining, Basic special purpose Programme and Numerically controlled machine Tools, Jigs and Fixtures (locating elements).
14. **Welding Proceres.** Gas welding, Arc welding, resistance welding-welding equipment.
15. **Industrial Engineering.** Work study and work measurement. Wage incentive. Design of Production Systems and Product Cost. Principals of plant Layout. Production Planning and Control. Material Handling. Operations Research. Linear Programming. Queuing Theory. Value Engineering. Network Analysis. CPM and PERT. Use of Computers.

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ELECTRONICS AND COMMUNICATION ENGINEERING

MICRO ELECTRONICS

Semi conductor physics, semiconductor Devices, single and multistage amplifiers, feedback amplifiers, oscillators, high frequency transistor circuits, and power amplifiers, linear and non-linear wave shaping circuits, differential amplifiers, operational amplifiers, linear and nonlinear applications of op-amp, PMOS, NMOS, CMOS, Bi-MOS technologies, VLSI technology, VLSI circuit design process, gate-level design using PLAs, FPGAs, CPLDs and PALs-design approach.

DIGITAL SYSTEM DESIGN

Logic families, Bipolar Logic & Interfacing, Digital ICs: Standard 74xx & CMOS 40xx series, Boolean Algebra, Combinational Circuits and their design, Design using VHDL, Sequential circuits and their design, Threshold Logic, 8085 & 8086 microprocessors-architecture, instruction set, addressing modes, 8051 microcontroller- architecture, modes of operation, interrupt structure, memory and I/O interfacing. Embedded systems-general purpose processors, state machine and concurrent process models, RTOs.

COMMUNICATIONS

Need for modulation, FDM, Analog modulation, AM and FM transmitters and receivers. Sampling, TDM, PCM, DM and ADM systems. Comparison of PSK, FSK, ASK and QPSK with reference to BW and Probability of error, matched filter, optimum filter, coherent and non-coherent reception, average information, Shannon's theorem, channel capacity, error detecting and error correcting codes, fundamentals of optical communication, types of fibers, attenuation, losses, dispersion, light sources and detectors. OSI and TCP/IP Models, network services, switching concepts, congestion, routing, error control, flow control and security. ISDN channels, services, ATM fundamentals, Multiple access techniques, co-channel interference, cell splitting Handoff mechanism, frequency response concept, basics of satellite communication, Spread Spectrum.

DIGITAL SIGNAL AND IMAGE PROCESSING

Linear Time invariant Systems, Analysis of signals and systems using Fourier transforms, z-transforms and Laplace transforms, DFT, FFT, multirate signal processing, power spectral estimation, and finite word length effects. Image processing fundamentals, enhancement in spatial and frequency domains. Lossless and Lossy compression methods, Image coding methods, compression standards, Edge detection using derivation operators, transformation, segmentation based on region growing methods.

ELECTRO MAGNETIC FIELDS, ANTENNAS AND MICROWAVES

Electrostatic and Magneto static fields, Maxwell's equations, EM wave characteristics, Guided waves, wave guides, Transmission lines, Antenna Fundamentals, Antenna Arrays, Low Frequency and High frequency antennas and Antenna Measurements wave propagation, Microwave tubes, solid state devices and components, microwave measurements.

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ELECTRICAL AND ELECTRONICS ENGINEERING

Circuit Theory: Single phase RC, RL, and RLC circuits, resonance, Three phase circuits, Network topology, Network theorems, RC, RL, RLC transients, ABCD, Z and Y parameters, two port networks.

Electro mechanical energy conversion, performance analysis of all types of DC generators and DC motors. Single phase transformers, equivalent circuit efficiency regulation parallel operation.

Induction motor torque calculations slip torque characteristic, equivalent circuit, performance analysis and speed control.

Synchronous generator emf calculation armature reaction regulation calculation using emf, mmf and ZPF methods. Synchronizing torque, parallel operation and effect of change of excitation and mechanical power input. Steady state, transient and subtransient reactances. Synchronous motor torque calculation V and inverted V curves.

Control Systems: Time domain analysis, Routh stability criterion and Root locus technique and frequency domain analysis compensation techniques and state variable method.

Power Systems: Transmission line parameters, performance of short, medium and long lines surges, traveling wave phenomenon, corona, insulators and cables. Power flow studies, economic operation, load frequency control symmetrical and unsymmetrical fault analysis and power system stability. Principles of over current, differential, impedance mho relays and their application. Different types of circuit breakers. Arc quenching methods, restriking voltage rate of restriking voltage.

Power electronics: Converters and Inverters and Choppers. AC voltage regulators, control of DC motors using single phase and three phase converters and choppers. Control of induction motors with voltage source and current source inverters.

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COMPUTER SCIENCE ENGINEERING

1. Programming and Data Structures:

Algorithm, flowchart, C Language, Control Statements, Functions, Structures, union and files, pointers in C, C programming covering all aspects. Simple and abstract data types and data structures stacks, queues, linked list, Trees balanced trees, Graphs, classes and objects, complexity of algorithms, divide and conquer, greedy, dynamic programming searching and traversal techniques, backtracking, Branch & Bound, NP Hard and NP complete problems.

2. Computer Organization and Architecture:

Processor basics, CPU organization, Data representation, Arithmetic representation, ALU's control design, Micro Programming, Nano programming. Memory Hierarchy, Cache and Virtual memory concepts. Parallel processing: PP in Uniprocessor, pipelining, SIMD and Vector processing, Multi programming, Data Flow computing. Introduction to VLSI computing.

3. Computer Networks:

Evolution of Data Communication and Networks, Transmission fundamentals, signals, media, encoding and modulation, switching techniques. OSI & TCP/IP models, functions and performance details of all layers. Network Security and communication security. Network programming, Sockets, TCP client server, Multiplexing and Socket options. UDP Sockets. IPC and Remote login.

4. Operating Systems and system Programming.

Process, CPU scheduling, Process synchronization, deadlocks, memory management, file system interface I/o systems assembles, Macros and MACRO Processors, Linkers. Distributed systems communication, synchronization, deadlocks, filesystems, shared memory Unix Utilities, Problem solving approaches in Unix, Unix Internals, Unix process, Threads and signals and Inter Process Communication.

5. Automata, compilers and OOPS:

Chomsky Hierarchy of languages, Grammers, machines and their designs. NP Hard and NP complete problems, Lexical, Syntax and Semantic analysis. Top down, Bottomup parsing. Intermediate code forms and code generation. Principles of Programming Languages, BNF notation, functional programming, LISP. Scope & Extent overloading, concurrency. Object oriented programming and features. C++ and Java programming.

6. Data Base Management Systems.

File systems, various data models, Relational algebra and calculus, Query optimization and evaluation, Database design, Concurrency control and recovery, Storing and Indexing

Distributed data base design, Distributed Transaction Management, Reliability, Data Mining primitives, Languages and system Architectures, Mining association rules, classification and prediction, Cluster Analysis.

7. Software Engineering:

Generic View of Process, Process models, Software requirements, requirement engineering process, system models, Design Engineering, Object-oriented Design, performing user interface design, Testing Strategies, Plans for testing, preparing for the tests. Management of Software Engineering, Software Engineering Tools and Environments. Introduction to UML Concepts.

8. Computer Graphics and Image Processing.

Raster Scan Graphics, 2D & 3D Transformations, Viewing, Projection Variable surface detection, Shading, Animation. Digital Image processing fundamentals, Image enhancement techniques, Morphological Image processing, Image Segmentation, Knowledge representation. Reasoning Techniques, Gameplaying, Learning and Natural language Processing. HTML, Javascript/j script, Dynamic HTML, AJP, XML and Multimedia systems.

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METALLURGICAL ENGINEERING

Thermodynamics and Rate Processes: Laws of thermodynamics, activity, equilibrium constant, applications to metallurgical systems, solutions, phase equilibria, Ellingham and phase stability diagrams, thermodynamics of surfaces, interfaces and defects, adsorption and segregation; basic kinetic laws, order of reactions, rate constants and rate limiting steps; principles of electro chemistry- single electrode potential, electro-chemical cells and polarizations, aqueous corrosion and protection of metals, oxidation and high temperature corrosion - characterization and control; heat transfer - conduction, convection and heat transfer coefficient relations, radiation, mass transfer - diffusion and Fick's laws, mass transfer coefficients; momentum transfer - concepts of viscosity, shell balances, Bernoulli's equation, friction factors.

Physical Metallurgy: Crystal structure and bonding characteristics of metals, alloys, ceramics and polymers, structure of surfaces and interfaces, nano-crystalline and amorphous structures; solid solutions; solidification; phase transformation and binary phase diagrams; principles of heat treatment of steels, cast iron and aluminum alloys; surface treatments; recovery, recrystallization and grain growth; industrially important ferrous and non-ferrous alloys; elements of X-ray and electron diffraction; principles of scanning and transmission electron microscopy; industrial ceramics, polymers and composites; electronic basis of thermal, optical, electrical and magnetic properties of materials; electronic and opto-electronic materials.

Mechanical Metallurgy: Elasticity, yield criteria and plasticity; defects in crystals; elements of dislocation theory - types of dislocations, slip and twinning, source and multiplication of dislocations, stress fields around dislocations, partial dislocations, dislocation interactions and reactions; strengthening mechanisms; tensile, fatigue and creep behaviour; super-plasticity; fracture - Griffith theory, basic concepts of linear elastic and elasto-plastic fracture mechanics, ductile to brittle transition, fracture toughness; failure analysis; mechanical testing - tension, compression, torsion, hardness, impact, creep, fatigue, fracture toughness and formability.

Manufacturing Processes: Metal casting - patterns and moulds including mould design involving feeding, gating and risering, melting, casting practices in sand casting, permanent mould casting, investment casting and shell moulding, casting defects and repair; hot, warm and cold working of metals, Metal forming - fundamentals of metal forming processes of rolling, forging, extrusion, wire drawing and sheet metal forming, defects in forming; Metal joining - soldering, brazing and welding, common welding processes of shielded metal arc welding, gas metal arc welding, gas tungsten arc welding and submerged arc welding; welding metallurgy, problems associated with welding of steels and aluminium alloys, defects in welded joints; powder metallurgy; NDT using dye-penetrant, ultrasonic, radiography, eddy current, acoustic emission and magnetic particle methods. Mechanics of machining, single and multi-point cutting tools, tool geometry and materials, tool life and wear; economics of machining; principles of non-traditional machining processes; principles of work holding, principles of design of jigs and fixtures.

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