UIET/1449
05/09/17

Syllabus for Entrance Test for admission in Ph.D Mechanical Engineering

AC-2738
5/9/17

Instructions: Paper setter is required to set twenty five questions from each section and students are required to attempt all the 100 questions.

Section :I

APPLIED MECHANICS, STRENGTH OF MATERIALS AND DESIGN :Engineering Mechanics: Free body diagrams and equilibrium; trusses and frames; virtual work; kinematics and dynamics of particles and of rigid bodies in plane motion, including impulse and momentum (linear and angular) and energy formulations; impact. Strength of Materials: Stress and strain, stress-strain relationship and elastic constants, 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; strain energy methods; thermal stresses. Theory of Machines: Displacement, velocity and acceleration analysis of plane mechanisms; dynamic analysis of slider-crank mechanism; gear trains; flywheels.

Section-II

FLUID MECHANICS AND THERMAL SCIENCES Fluid Mechanics: 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; viscous flow of incompressible fluids; boundary layer; elementary turbulent flow; flow through pipes, head losses in pipes, bends etc. Heat-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. Thermodynamics: Zeroth, First and Second laws of thermodynamics; thermodynamic system and processes; Carnot cycle ,irreversibility and availability; behaviour of ideal and real gases, properties of pure substances, calculation of work and heat in ideal processes; analysis of thermodynamic cycles related to energy conversion

Section-III

PRODUCTION ENGINEERING and MANUFACTURING TECHNOLOGY Metal Casting: Design of patterns, moulds and cores; solidification and cooling; riser and gating design, design considerations. Forming: Plastic deformation and yield criteria, fundamentals of hot and cold working processes; load estimation for bulk (forging, rolling, extrusion, drawing) and sheet (shearing, deep drawing, bending) metal forming processes; principles of powder metallurgy. Joining: Physics of welding, brazing and soldering; adhesive bonding; design considerations in welding. Machining and Machine Tool Operations: 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, Non-conventional machining. Welding processes friction stir processing ,friction stir welding ,TIG welding, MIG welding, SAW welding and all advanced welding processes

Section-IV

INDUSTRIAL ENGINEERING Production Planning and Control: Forecasting models, aggregate production planning, scheduling, materials requirement planning. Inventory Control: Deterministic and probabilistic models; safety stock; single-item, control systems. Operations Research: Linear programming, simplex and graphical method, transportation model, assignment model, network flow models, simple queuing models, PERT and CPM. Supply Chain Management.

Already approved

Co-ordinator Mechanical

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A.R. (Academic)

Unit–I

Electronic Transport in semiconductor, PN Junction, Diode equation and diode equivalent circuit. Breakdown in diodes, Zener diodes, Tunnel diode, Semiconductor diodes, characteristics and equivalent circuits of BJT, JFET, MOSFET, IC fabrication—crystal growth, epitaxy, oxidation, lithography, doping, etching, isolation methods, metalization, bonding, Thin film active and passive devices.

Unit–II

Superposition, Thevenin, Norton and Maximum Power Transfer Theorems, Network elements, Network graphs, Nodal and Mesh analysis, Zero and Poles, Bode Plots, Laplace, Fourier and Z-transforms. Time and frequency domain responses. Image impedance and passive filters. Two-port Network Parameters. Transfer functions, Signal representation, State variable method of circuit analysis, AC circuit analysis, Transient analysis.

Unit–III

Rectifiers, Voltage regulated ICs and regulated power supply, Biasing of Bipolar junction transistors and JFET. Single stage amplifiers, Multistage amplifiers, Feedback in amplifiers, oscillators, function generators, multivibrators, Operational Amplifiers (OPAMP)—characteristics and Applications, Computational Applications, Integrator, Differentiator, Wave shaping circuits, F to V and V to F converters. Active filters, Schmitt trigger, Phase locked loop.

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Unit–IV

Logic families, flip-flops, Gates, Boolean algebra and minimization techniques, Multivibrators and clock circuits, Counters—Ring, Ripple. Synchronous, Asynchronous, Up and down shift registers, multiplexers and demultiplexers, Arithmetic circuits, Memories, A/D and D/A converters.

Unit–V

Architecture of 8085 and 8086 Microprocessors, Addressing modes, 8085 instruction set, 8085 interrupts, Programming, Memory and I/O interfacing, Interfacing 8155, 8255, 8279, 8253, 8257, 8259, 8251 with 8085 Microprocessors, Serial communication protocols, Introduction of Microcontrollers (8 bit)—8031/8051 and 8048.

Unit–VI

Introduction of High-level Programming Language, Introduction of data in C. Operators and its precedence, Various data types in C, Storage classes in C, Decision-making and forming loop in program, Handling character, Arrays in C, Structure and union, User defined function, Pointers in C, Advanced pointer. Pointer to structures, pointer to functions, Dynamic data structure, file handling in C, Command line argument, Graphics-video modes, video adapters, Drawing various objects on screen, Interfacing to external hardware via serial/parallel port using C, Applying C to electronic circuit problems. Introduction to object-oriented Programming and C++.

Introduction of FORTRAN language, programming discipline, statements to write a program, intrinsic functions, integer-type data, type statement, IF statement, Data validation, Format-directed input and output. Subscripted variables and DO loops. Array, Fortran Subprogram.

Unit–VII

Maxwell's equations, Time varying fields, Wave equation and its solution, Rectangular waveguide, Propagation of wave in ionosphere, Poynting vector, Antenna parameters, Half-wave antenna, Transmission lines, Characteristic of Impedance matching, Smith chart, Microwave components-T, Magic-T, Tuner. Circulator isolator, Direction couplers, Sources—Reflex Klystron, Principle of operation of Magnetron, Solid State Microwave devices; Basic Theory of Gunn, GaAs FET, Crystal Defector and PIN diode for detection of microwaves.

Unit–VIII

Basic principles of amplitude, frequency and phase modulation, Demodulation, Intermediate frequency and principle of superheterodyne receiver, Spectral analysis and signal transmission through linear systems, Random signals and noise, Noise temperature and noise figure. Basic concepts of information theory, Digital modulation and Demodulation; PM, PCM, ASK, FSK, PSK, Time-division Multiplexing, Frequency-Division Multiplexing, Data Communications—Circuits, Codes and Modems. Basic concepts of signal processing and digital filters.

Unit–IX (a)

Characteristics of solid state power devices—SCR, Triac, UJT, Triggering circuits, converters, choppers, inverters, converters. AC - regulators, speed control of a.c. and d.c. motors.

Stepper and synchronous motors; Three phase controlled rectifier; Switch mode power supply; Uninterrupted power supply.

Unit–IX (b)

Optical sources—LED, Spontaneous emission, Stimulated emission, Semiconductor Diode LASER, Photodetectors—p-n photodiode. PIN photodiode, Phototransistors, Optocouplers, Solar cells, Display devices, Optical Fibres—Light propagation in fibre, Types of fibre, Characteristic parameters, Modes, Fibre splicing, Fibre optic communication system—coupling to and from the fibre, Modulation, Multiplexing and coding, Repeaters, Bandwidth and Rise time budgets.

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Unit–X (a)

Transduces—Resistance, Inductance Capacitance, Peizoelectric, Thermoelectric, Hall effect, Photoelectric, Techogenerators, Measurement of displacement, velocity, acceleration, force, torque, strain, speed and sound temperature, pressure, flow, humidity, thickness, pH, position.

Measuring Equipment—Measurement of R, L and C, Bridge and Potentiometers, voltage, current, power, energy, frequency/time, phase, DVMs, DMMs, CRO, Digital storage oscilloscope, Logic probes, Logic State Analyser, Spectrum Analyzer, Recorder, Noise and Interference in instrumentation, Instrumentation amplifiers, Radio Telemetry.

Analytical Instruments Biomedical instruments—ECG, blood pressure measurements, spectrophotometers, Electron Microscope, X-ray diffractometer.

Unit–X (b)

Open-loop and close-loop control system. Error amplifier, on-off controller, Proportional (P), Proportional-Integral (PI), Proportional-Derivative (PD), PID controllers, Dynamic Behaviour of control systems—servomechanism characteristics parameters of control systems—Accuracy, Sensitivity, Disturbances, Transient response, Stability, Routh-Hurwitz criterion, Bode plots, Nyquist criterion, Controlling speed. Temperature and position using analog/digital control circuits.

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This syllabus is already approved and is also available on M.D.U-Lohtak website. There is no change in the syllabus.

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