Comparison between IES 2016 and 2017 syllabus for Mechanical Engineering (ME)

Every person knows about the changes in the general studies paper (Paper 1) but they might not be aware about the changes about the technical papers. There are major changes in the technical paper also. Here with the help of different colours we try to highlight the main differences in between what has been added and removed totally in IES ESE syllabus.

RED colours: Content which has to study for IES 2016 only and completely removed from 2017 onward.

BLUE colours: Content which is newly added in IES 2017 SYLLABUS.

IES(ESE) 2016	IES(ESE) 2017
GENERAL ABILITY TEST **Part A**: **General English**: The question paper in General English will be designed to test the candidate's understanding of English and workmanlike use of words. **Part B**: **General Studies**: The paper in General Studies will include knowledge of current events and of such matters as of everyday observation and experience in their scientific aspects as may be expected of an educated person. The paper will also include questions on History of India and Geography of a nature which candidates should be able to answer without special study.	**APTITUDE PAPER (Stage-I, Paper-I)** **General Studies and Engineering Aptitude** 1. Current issues of national and international importance relating to social, economic and industrial development 2. Engineering Aptitude covering Logical reasoning and Analytical ability 3. Engineering Mathematics and Numerical Analysis 4. General Principles of Design, Drawing, Importance of Safety 5. Standards and Quality practices in production, construction, maintenance and services 6. Basics of Energy and Environment : Conservation, environmental pollution and degradation, Climate Change, Environmental impact assessment 7. Basics of Project Management 8. Basics of Material Science and Engineering 9. Information and Communication Technologies (ICT) based tools and their applications in Engineering such as networking, e-governance and technology based education. 10. Ethics and values in Engineering profession
Thermodynamics, Cycles and IC Engines, Basic concepts, Open and Closed systems. Heat and work. Zeroth, First and Second Law, Application to non-Flow and Flow processes. Entropy, Availability, Irreversibility and Tds relations. Claperyron and real gas equations, Properties of ideal gases and vapours. Standard vapour, Gas power and Refrigeration cycles. Two stage compressor. C-I and S.I. Engines. Pre-ignition, Detonation and	**Thermodynamics and Heat transfer:** Thermodynamic systems and processes; properties of pure substance; Zeroth, First and Second Laws of Thermodynamics; Entropy, Irreversibility and availability; analysis of thermodynamic cycles related to energy conversion: Rankine, Otto, Diesel and Dual Cycles; ideal and

Diesel-knock, Fuel injection and Carburation, Supercharging. Turbo-prop and Rocket engines, Engine Cooling, Emission & Control, Flue gas analysis, Measurement of Calorific values. Conventional and Nuclear fuels, Elements of Nuclear power production.**2. Heat Transfer and Refrigeration and Air conditioning.** Modes of heat transfer. One dimensional steady and unsteady conduction. Composite slab and Equivalent Resistance. Heat dissipation from extended surfaces, Heat exchangers, Overall heat transfer coefficient, Empirical correlations for heat transfer in laminar and turbulent flows and for free and forced Convection, Thermal boundary layer over a flat plate. Fundamentals of diffusive and connective mass transfer, Black body and basic concepts in Radiation, Enclosure theory, Shape factor, Net work analysis. Heat pump and Refrigeration cycles and systems, Refrigerants. Condensers, Evaporates and Expansion devices, Psychrometry, Charts and application to air conditioning, Sensible heating and cooling, Effective temperature, comfort indices, Load calculations, Solar refrigeration, controls, Duct design.	real gases; compressibility factor; Gas mixtures. Modes of heat transfer, Steady and unsteady heat conduction, Thermal resistance, Fins, Free and forced convection, Correlations for convective heat transfer, Radiative heat transfer – Radiation heat transfer coefficient; boiling and condensation, Heat exchanger performance analysis **IC Engines, Refrigeration and Air conditioning:** SI and CI Engines, Engine Systems and Components, Performance characteristics and testing of IC Engines; Fuels; Emissions and Emission Control. Vapour compression refrigeration, Refrigerants and Working cycles, Compressors, Condensers, Evaporators and Expansion devices, Other types of refrigeration systems like Vapour Absorption, Vapour jet, thermo electric and Vortex tube refrigeration. Psychometric properties and processes, Comfort chart, Comfort and industrial air conditioning, Load calculations and Heat pumps.
Fluid Mechanics. Properties and classification of fluids, Manometry, forces on immersed surfaces, Center of pressure, Buoyancy, Elements of stability of floating bodies. Kinematics and Dynamics. Irrotational and incompressible. Inviscid flow. Velocity potential, Pressure field and Forces on immersed bodies. Bernoulli's equation, Fully developed flow through pipes, Pressure drop calculations, Measurement of flow rate and Pressure drop. Elements of boundary layer theory, Integral approach, Laminar and tubulent flows, Separations. Flow over weirs and notches. Open channel flow, Hydraulic jump. Dimensionless numbers, Dimensional analysis, Similitude and modelling. One-dimensional isentropic flow, Normal shock wave, Flow through convergent – divergent ducts, Oblique shock-wave, Rayleigh and Fanno lines.	**Fluid Mechanics:** Basic Concepts and Properties of Fluids, Manometry, Fluid Statics, Buoyancy, Equations of Motion, Bernoulli's equation and applications, Viscous flow of incompressible fluids, Laminar and Turbulent flows, Flow through pipes and head losses in pipes.
Fluid Machinery and Steam Generators. Performance, Operation and control of hydraulic Pump and impulse and reaction Turbines, Specific speed, Classification. Energy transfer, Coupling, Power transmission, Steam generators Fire-tube and water-tube boilers. Flow of steam through Nozzles and Diffusers, Wetness and condensation. Various types of steam and gas Turbines, Velocity diagrams. Partial admission. Reciprocating, Centrifugal and axial flow Compressors, Multistage compression, role of Mach Number, Reheat, Regeneration,	**Turbo Machinery:** Reciprocating and Rotary pumps, Pelton wheel, Kaplan and Francis Turbines, velocity diagrams, Impulse and Reaction principles, Steam and Gas Turbines, Theory of Jet Propulsion – Pulse jet and Ram Jet Engines, Reciprocating and Rotary Compressors – Theory and Applications

Efficiency, Governance.	
Theory of machines: Kinematic and dynamic analysis of planer mechanisms. Cams. Gears and gear trains. Flywheels. Governors. Balancing of rigid rotors and field balancing. Balancing of single and multicylinder engines, Linear vibration analysis of mechanical systems. Critical speeds and whirling of shafts Automatic controls.	1. **Mechanisms and Machines:** Types of Kinematics Pair, Mobility, Inversions, Kinematic Analysis, Velocity and Acceleration Analysis of Planar Mechanisms, CAMs with uniform acceleration and retardation, cycloidal motion, oscillating followers; Vibrations –Free and forced vibration of undamped and damped SDOF systems, Transmissibility Ratio, Vibration Isolation, Critical Speed of Shafts. Gears – Geometry of tooth profiles, Law of gearing, Involute profile, Interference, Helical, Spiral and Worm Gears, Gear Trains-Simple, compound and Epicyclic; Dynamic Analysis – Slider – crank mechanisms, turning moment computations, balancing of Revolving & Reciprocating masses, Gyroscopes –Effect of Gyroscopic couple on automobiles, ships and aircrafts, Governors.
Machine design: Design of Joints : cotters, keys, splines, welded joints, threaded fasteners, joints formed by interference fits. Design of friction drives : couplings and clutches, belt and chain drives, power screws. Design of Power transmission systems : gears and gear drives shaft and axle, wire ropes. Design of bearings : hydrodynamics bearings and rolling element bearings.	**Design of Machine Elements:**Design for static and dynamic loading; failure theories; fatigue strength and the S-N diagram; principles of the design of machine elements such as riveted, welded and bolted joints. Shafts, Spur gears, rolling and sliding contact bearings, Brakes and clutches, flywheels.
Strength of Materials Stress and strain in two dimensions, Principal stresses and strains, Mohr's construction, linear elastic materials, isotropy and anisotropy, stress-strain relations, uni-axial loading, thermal stresses. Beams : Bending moment and shear force diagram, bending stresses and deflection of beams. Shear stress distribution. Torsion of shafts, helical springs. Combined stresses, thick- and thin-walled pressure vessels. Struts and columns. Strain energy concepts and theories of failure.	**Engineering Mechanics:**Analysis of System of Forces, Friction, Centroid and Centre of Gravity, Dynamics; Stresses and Strains-Compound Stresses and Strains, Bending Moment and Shear Force Diagrams, Theory of Bending Stresses-Slope and deflection-Torsion, Thin and thick Cylinders, Spheres.
Engineering materials: Basic concepts on structure of solids. Crystalline materials. Detects in crystalline materials. Alloys and binary phase diagrams. Structure and properties of common engineering materials. Heat treatment of steels. Plastics, Ceramics and composite materials. Common applications of	**Engineering Materials:** Basic Crystallography, Alloys and Phase diagrams, Heat Treatment, Ferrous and Non Ferrous Metals, Non metallic materials, Basics of Nano-materials, Mechanical Properties and Testing, Corrosion prevention and control

various materials.	
Production engineering: Metal Forming : Basic Principles of forging, drawing and extrusion; High energy rate forming; Powder metallurgy. Metal Casting : Die casting, investment casting, Shall Moulding, Centrifugal Casting, Gating & Riser design; melting furnaces. Fabrication Processes : Principles of Gas, Arc, Shielded arc Welding; Advanced Welding Processes, Weldability: Metallurgy of Welding. Metal Cutting : Turning, Methods of Screw Production, Drilling, Boring, Milling, Gear Manufacturing, Production of flat surfaces, Grinding & Finishing Processes. Computer Controlled Manufacturing Systems-CNC, DNC, FMS, Automation and Robotics. Cutting Tools Materials, Tool Geometry, Mechanism of Tool Wear, Tool Life & Machinability; Measurement of cutting forces. Economics of Machining. Unconventional Machining Processes. Jigs and Fixtures. Fits and tolerances, Measurement of surface texture, Comparators Alignment tests and reconditioning of Machine Tools. **Industrial Engineering:** Production Planning and Control : Forecasting – Moving average, exponential smoothing, Operations, scheduling; assembly line balancing, Product development, Break-even analysis, Capacity planning, PERT and CPM. Control Operations : Inventory control ABC analysis, EOQ model, Materials requirement planning. Job design, Job standards, Work measurement, Quality Management – Quality analysis and control. Operations Research : Linear Programming – Graphical and Simplex methods, Transportation and assignment models. Single server queueing model. Value Engineering : Value analysis for cost/value.	**Manufacturing ,Industrial and Maintenance Engineering:**Metal casting-Metal forming, Metal Joining, Machining and machine tool operations, Limits, fits and tolerances, Metrology and inspection, computer Integrated manufacturing, FMS, Production planning and Control, Inventory control and operations research – CPM-PERT. Failure concepts and characteristics-Reliability, Failure analysis, Machine Vibration, Data acquisition, Fault Detection, Vibration Monitoring, Field Balancing of Rotors, Noise Monitoring, Wear and Debris Analysis, Signature Analysis, NDT Techniques in Condition Monitoring.
Elements of computation: Computer Organisation, Flow charting, Features of Common computer Languages – FORTRAN, d Base III, Lotus 1-2-3, C and elementary Programming.	**Mechatronics and Robotics:**Microprocessors and Microcontrollers: Architecture, programming, I/O, Computer interfacing, Programmable logic controller. Sensors and actuators, Piezoelectric accelerometer, Hall effect sensor, Optical Encoder, Resolver, Inductosyn, Pneumatic and Hydraulic actuators, stepper motor, Control Systems- Mathematical modeling of Physical systems, control signals, controllability and

	observability. Robotics, Robot Classification, Robot Specification, notation; Direct and Inverse Kinematics; Homogeneous Coordinates and Arm Equation of four Axis SCARA Robot
	Renewable Sources of Energy: Solar Radiation, Solar Thermal Energy collection – Flat Plate and focusing collectors their materials and performance. Solar Thermal Energy Storage, Applications – heating, cooling and Power Generation; Solar Photovoltaic Conversion; Harnessing of Wind Energy, Bio-mass and Tidal Energy – Methods and Applications, Working principles of Fuel Cells. NOTE: This is totally new added topic.
	Power Plant Engineering: Rankine and Brayton cycles with regeneration and reheat, Fuels and their properties, Flue gas analysis, Boilers, steam turbines and other power plant components like condensers, air ejectors, electrostatic precipitators and cooling towers – their theory and design, types and applications; NOTE: This is totally new added topic.