SYLLABUS FOR KPSC EXAMINATIONS FOR MECHANICAL ENGINEERING -
GRADUATE LEVEL AND ABOVE

1. BASIC ENGINEERING

**Mechanical Engineering Science:** Energy and steam, forms Sources and Classification of energy, Steam boilers- classification, Classification, Principle of operation of Impulse and reaction, gas & water turbine, Classification, I.C. Engines parts, Refrigeration and Air conditioning, Lathe and Drilling Machines, Milling and Grinding Machines, Joining Processes, Lubrication and Bearings Soldering, Brazing and Welding, Power Transmission Belt Drives & Fasteners.

**Engineering Mechanics:** Introduction to engineering mechanics, Composition of forces, Free body diagram, equations of equilibrium, Conditions of static equilibrium for different force systems, Lami’s theorem, Friction, Statically determinate beams, Centroids and moment of inertia.

**Strength of Material:** Stress and strain, Shear stress, Bending moment and Shear force diagrams, Elastic constants, principal stresses, Maximum stresses in beams, Deflection of beams, and Torsion of shafts.

**Engineering Drawing:** Introduction, Drawing Instruments and their uses, BIS conventions, Lettering, Dimensioning and free hand practicing, Orthographic Projections, Orthographic Projections of plane surfaces, Projections of Solids, Sections and development of lateral Surfaces of Solids, Isometric projection (Using Isometric Scale only). Computer Assisted Drafting/Modeling.

**Engineering Mechanics:** Statically indeterminate structures, Frames & trusses, Projectiles, Central force motion, Virtual work, Types of supports.

**Strength of Material:** Mohr’s diagram, Column and Struts. Slopes and deflection of beams, Combined stresses, Failure theories, Curved beams, Centrifugal stresses, Stresses in thin cylinders, changes in dimensions of cylinder (diameter, length and volume), Thick cylinders subjected to internal and external pressures (Lame’s equation).
2. ENGINEERING MATERIALS


3. THERMAL & FLUIDES ENGINEERING


**Fluid Mechanics**: Fluid-definition, concepts of continuum, shear stress as applied to fluids, fluid properties viscosity, Newton’s law, surface tension, bulk modulus, compressibility, vapour pressure, capillarity, gauge and absolute pressures of a fluid. Principle of manometers, simple and differential manometers, Bourdon’s pressure gauge, Pascal’s law, Hydrostatic forces on plane and inclined surfaces. Archimedes principle, stability of foliation bodies. Bernoulli’s equation, viscous flow of incompressible fluids, boundary layers.

**I.C. Engines**: Working of SI and CI two-stroke and four-stroke engines. Efficiency calculation and heat balance.

**Power Plant Engineering**: Steam power: Coal, ash handling and different types of boilers: Diesel and gas turbine power plant: Hydro-electric plants: Nuclear power plant.


**Fluid Mechanics**: Determination of metacentric height- experimental and analytical methods. Forces acting of fluid mass, Eulers equation of motion, energy possessed by a fluid particle, Bernoulli’s equation derivation from one dimensional Eulers equation of motion.
Application of Bernoulli’s principle venturimeter, orifice meter, pitot tube, notches-
rectangular, triangular, trapezoidal notches orifices: vertical, horizontal, Vortex motion, 
Reynolds number & its significance. Hagen poiseuilles equation for flow through pipes, 
Turbulent flow: Darcy’s equation for turbulent flow through pipes, Unsteady Flow-Water 
Hammer. Principle of dimensional analysis, Buckingham pi-theorem, application 
dimensionless number and introduction to model studies.

**Turbo machinery:** Theory of turbines and classification of turbines, study of construction, 
working, velocity diagrams and efficiencies of pelton-wheel, Francis and Kaplan turbines-
Impulse and reaction principle and velocity diagram. Various types of steam and gas turbine, 
velocity diagrams. Reciprocating, centrifugal and axial flow compressors, multistage 
compression, reheat, regeneration, efficiency. Performance of turbines, specific speed and 
unit quantities. Characteristic Curves, cavitations, governing of turbines, model testing of 
turbines.

**Refrigeration & Air Conditioning:** Introduction- Application of refrigeration –
Performance of a refrigerator (COP) – Units of refrigeration - The reverse cannot cycle- The 
reversed Brayton or Bell Coleman air cycle – Air refrigeration system – Vapour compression 
refrigeration system – methods to improve simple refrigeration system- properties of a good 
refrigerant – Vapour absorption refrigeration System – COP interms of operating 
temperatures of vapour absorption refrigeration system. Summer air conditioning & winter 
air conditioning, equipments used for air conditioning system. Introduction to psychrometry, 
terms involved in air conditioning – psychrometric chart- Psychrometric processes- Concept 
of comfort air condition- Cooling loads affecting air conditioning.

**I.C. Engines:** Air standard efficiency & - mep of otto cycle – diesel cycle – dual combustion 
cycle numerical problems – deviation o Morse test f real cycle from theoretical air cycle. 
Theoretical air required, excess air actual air required for complete combustion of solid, 
liquid and gaseous fuels, analysis of products of combustion. Four stoke and two stroke cycle 
engines – Valve time diagram for four stoke engine combustion in SI Engines – detonation 
(KNOCK) in SI engines, combustion in CI engines & Knock in the CI engine. Carburetion – 
simple and complex carburettor – fuel pump for SI engine – ignition systems for SI engines –
fuel injection system for CI engine – Supercharging of IC engines – Cooling of IC engines – Governing of IC engines.

**Heat and Mass Transfer:** Basic modes of heat transfer, mechanism and basic laws of heat transfer, Thermal conductivity for various types of materials, heat capacity, heat diffusivity connective heat transfer co-efficient, Stefan Boltzmann’s Law of Thermal radiation. Overall heat transfer co-efficient variable Thermal conductivity, critical thickness of insulation for cylinder and sphere, heat transfer from extended surfaces, Dimensional analysis, application to free and forced convection, physical significance of Reynolds, prandtl Nusselt and Stanton numbers numerical problems. Classification of heat exchangers, Heat changers effectiveness and LMTD for parallel and counter flows, fouling and fouling factor, significance of NTU. Types of boiling & condensation, Krichoff’s law, Plank’s law and Wein’s displacement law, Radiation heat exchange between two parallel infinite black surfaces, between two parallel infinite gray surfaces. Effect of radiation shield; definitions of terms used in mass transfer analysis; Flick’s first law; Steady state equimolar counter diffusion in gases: Steady state unidirectional in gases; steady state unidirectional in gases; steady state diffusion in liquids, Schmidt Number, Sherwood Number.

4. DESIGN

**Theory of machines:** Kinematic and dynamic analysis of planer mechanisms. Cams, gears and gear trains, transmission of power, friction, flywheels, governors, balancing of rotating and reciprocating masses, free and forced vibration of single degree freedom systems, effect of damping, transmissibility, vibration isolation, critical speed of shafts.

**Design of machine elements:** Design for static and dynamic loading; principles of the design of machine elements such as bolted, riveted and welded joints, shafts, springs, spur gears, rolling and sliding contact bearings, brakes and clutches. Lubrication & Bearings: Drop feed, wick feed and needle lubricators. Ring, splash and full pressure lubrication. Pivot bearing, collar bearings and antifriction bearings. Introduction to Computer Aided Design.

**Mechanical Measurements:** Measurements and measurement systems: Definition, significance of measurement, generalized measurement system, definitions and concept of accuracy, precision, calibration, sensitivity, repeatability, linearity, standards of measurement, limits, fits, tolerance and gauging, principle of interchangeability, Indian
standards, comparators and angular measurement, mechanical and optical comparators, LVDT, Pneumatic comparators; Transducers, primary and secondary transducers, electrical, mechanical, electronic transducers; intermediate modifying and terminating devices: mechanical, cathode ray oscilloscope, oscillographs, X-Y plotters. Measurement of force, torque, pressure, temperature and strain.


5. **PRODUCTION & INDUSTRIAL ENGINEERING**

**Metal Casting:** Gravity die-casting, pressure die casting, melting furnaces: working principle of choke fired, oil fired and gas pit furnace, electric arc furnace, welding process: arc welding: inert gas welding (TIG & MIG) submerged arc welding (SAW), gas welding: Acetylene welding, soldering & brazing.


Non-Traditional machining: Ultrasonic machining, Abrasive Jet Machining (AJM), Electrochemical Machining (ECM): Accuracy, surface finish, ECM tooling: ECM tooling technique, Chemical Machining (CM): Electrical Discharge Machining (EDM): EDM, Plasma Arc Machining (PAM), Laser Beam Machining (LBM).

Industrial Engineering and Management: Production planning, scheduling, routing, dispatching, ERP, push and pull production systems, supply chain management, inventory control. Quality-TQM, TPM, statistical quality control, six sigma, linear programming, simplex and duplex method, PERT and CPM. Design of Experiments- Taguchi method. Work Study: Introduction, Work-study procedures Human Considerations In work study concepts of work content, work study as a tool to improve productivity. Method Study: Objectives, steps in method study recording techniques, micro motion study, and principal of
motion economy Work Measurement: Objectives, techniques of work measurement, time study equipment, computation of standard time, work sampling predetermined motion time analysis.

**Production and Operation Management:** Historical evolution of POM, the system concept, system efficiencies and effectiveness, decision making for POM systems, role of models, the internal & external environment of POM, concepts of production and the measurement. Output design, materials & processing considerations, design specifications and tolerances, standardization & interchangeability, human engineering. Requirements of forecasting for operations, categories of forecasting methods, moving averaging method, exponential smoothing with trend and seasonality, forecasting errors, regression analysis, Delphi method, problems. Inventory types, Inventory costs, ABC’s of inventory, EOQ models with and without shortage, production Inventory model, inventory model with price break, problems. Inventory types, Inventory costs, ABC’s of inventory, EOQ models with and without shortage, production Inventory model, inventory model with price break, problems.


**Automated Manufacturing Systems:** Single station automated cells, flexible manufacturing systems, taguchi methods in quality engineering.

**Nanotechnology:** Nano scale-electron microscope. Fullerenes-conductivity and superconductivity- ferromagnetism. Carbon nanotubes, nanosensors electrochemical sensors molecular nanomachines motors and machines nanotribology.

**Note:** The above syllabus is furnished such that the core is to be covered for all competitive examinations. Questions with increased difficulty can be included for these examinations.

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SYLLABUS FOR KPSC EXAMINATIONS FOR MECHANICAL ENGINEERING –
BELOW GRADUATE LEVEL (DIPLOMA)

1. BASIC ENGINEERING

Mechanical Engineering Science: Energy and steam, forms Sources and Classification of energy, Steam boilers- classification, Classification, Principle of operation of Impulse and reaction, gas & water turbine, Classification, I.C. Engines parts, Refrigeration and Air conditioning, Lathe and Drilling Machines, Milling and Grinding Machines, Joining Processes, Lubrication and Bearings Soldering, Brazing and Welding, Power Transmission Belt Drives & Fasteners.

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Strength of Material: Stress and strain, Shear stress, Bending moment and Shear force diagrams, Elastic constants, principal stresses, Maximum stresses in beams, Deflection of beams, and Torsion of shafts.


2. ENGINEERING MATERIALS


3. THERMAL & FLUIDES ENGINEERING


Fluid Mechanics: Fluid-definition, concepts of continuum, shear stress as applied to fluids, fluid properties viscosity, Newton’s law, surface tension, bulk modulus, compressibility, vapour pressure, capillarity, gauge and absolute pressures of a fluid. Principle of manometers, simple and differential manometers, Bourdon’s pressure gauge, Pascal’s law, Hydrostatic forces on plane and inclined surfaces. Archimedes principle, stability of foliation bodies. Bernoulli’s equation, viscous flow of incompressible fluids, boundary layers.


Power Plant Engineering: Steam power: Coal, ash handling and different types of boilers: Diesel and gas turbine power plant: Hydro-electric plants: Nuclear power plant.

4. DESIGN

Theory of machines: Kinematic and dynamic analysis of planer mechanisms. Cams, gears and gear trains, transmission of power, friction, flywheels, governors, balancing of rotating and reciprocating masses, free and forced vibration of single degree freedom systems, effect of damping, transmissibility, vibration isolation, critical speed of shafts.
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Mechanical Measurements: Measurements and measurement systems: Definition, significance of measurement, generalized measurement system, definitions and concept of accuracy, precision, calibration, sensitivity, repeatability, linearity, standards of measurement, limits, fits, tolerance and gauging, principle of interchangeability, Indian standards, comparators and angular measurement, mechanical and optical comparators, LVDT, Pneumatic comparators; Transducers, primary and secondary transducers, electrical, mechanical, electronic transducers; intermediate modifying and terminating devices: mechanical, cathode ray oscilloscope, oscillographs, X-Y plotters. Measurement of force, torque, pressure, temperature and strain.

5. PRODUCTION & INDUSTRIAL ENGINEERING

Metal Casting: Gravity die-casting, pressure die casting, melting furnaces: working principle of choke fired, oil fired and gas pit furnace, electric arc furnace, welding process: arc welding: inert gas welding (TIG & MIG) submerged arc welding (SAW), gas welding: Acetylene welding, soldering & brazing.


Metal Forming: Closed die forging by slab analysis, Rolling: Types of rolling mills, effects of front and back tensions, Drawing: Slab analysis, Extrusion: extrusion equipment & dies,

**Computer Integrated Manufacturing systems:** WIP ratio, TIP ratio, High volume production system: Transfer mechanism-linear-walking beam, Rotary-rack and pinion, Rachet & pawl, geneva wheel, buffer storage, automated assembly systems: CNC machining centres. Computer controlled manufacturing systems, CNC machining centers and programming, concept of group technology, cellular manufacturing, robotics, FMS.

**Non-Traditional machining:** Ultrasonic machining, Abrasive Jet Machining (AJM), Electrochemical Machining (ECM): Accuracy, surface finish, ECM tooling: ECM tooling technique, Chemical Machining (CM): Electrical Discharge Machining (EDM): EDM, Plasma Arc Machining (PAM), Laser Beam Machining (LBM).

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