

SYMBIOSIS INTERNATIONAL (DEEMED UNIVERSITY)

Ph D ENTRANCE TEST

The Syllabus of Mechanical Engineering

Design:

1. Types of simple stresses, principal stresses, compound stresses in machine parts, stress- strain relationship, stress concentration factor
2. Static loading, theories of failures, allowable stress, factor of safety, Fluctuating stresses, fatigue failure, endurance limit, fatigue strength, modified Goodman diagram, Gerber line, Soderberg line, design for combined fatigue loading
3. Shafts: static loading: stresses, design principle, types and uses of key, design of keys.
4. Couplings: Types and uses, design of rigid and flexible couplings, Introduction to design of helical springs, design of helical springs for variable load, design of leaf springs
5. Multi disk clutches, cone clutches, centrifugal clutches, block brake, internal expanding brake, band brake, disc brake ,solid disk flywheel, rimmed flywheel, Analysis of belt tension, condition of maximum power, flat belts, v-belts, chain drives, Helical spring design
6. Spur, Helical, Bevel gear design, Force analysis, Beam strength of gears, Cylinders and pressure vessels design, Thin cylinders, thick cylinders, cylindrical and spherical shells
7. Optimization in the design process, Optimization methods - Genetic Algorithms, the Complex method, gradient based methods, Formulation of design problems as optimization problems, Formulation of objective functions, Multi-objective optimization.

MANUFACTURING TECHNOLOGY:

1. METAL CUTTING THEORY AND PRACTICE
Geometry of single-point cutting tool: Tool-in hand system, ASA system, Significance of various angles of single point cutting tools, Orthogonal Rake System (ORS), Conversions between ASA and ORS systems, Normal Rake System (NRS) & relation with ORS. Orthogonal and Oblique cutting, Mechanics of Chip formation: Types of chips, chip-breakers, Chip reduction coefficient, shear angle, shear strain, Built-Up-Edge and its effect in metal cutting.
2. ADVANCED MANUFACTURING PROCESSES
Introduction to solid state welding processes, Advantages and applications and imitations, Classification of solid state welding processes and describe each processes ,friction welding processes, advantages ,limitations and applications, processes parameters, Friction welding of similar and dissimilar metals, Friction stir welding process. Introduction forming processes, advantages ,limitations and applications, Vacuum forming and hydro forming, advantages and applications.
3. MICRO AND NANO MANUFACTURING
Importance of Nano-technology, Emergence of Nanotechnology, Bottom-up and Top-down approaches, challenges in Nanotechnology. Methods for creating Nanostructures; Processes for producing ultrafine powders- Mechanical grinding;

Wet Chemical Synthesis of nanomaterials- sol-gel process.

4. FLEXIBLE MANUFACTURING SYSTEMS

Evolution of Manufacturing Systems, FMS: Definition, objective and Need, FMS: components, Merits, Demerits and Applications, Flexibility in Pull and Push type. FMS: Layouts and their Salient features, Single line, dual line, loop, ladder, robot centre type etc. Processing stations- Machining Centers, Turning centre, Coordinate measuring machine (CMM), Washing/ Deburring station. Material Handling System Conveyor, Robots, Automated Guided Vehicle (AGV), Automated Storage Retrieval System (ASRS).

Tool Management, tool magazine, Tool preset, identification, Tool monitoring and fault detection, FMS: Configuration planning and routing, FMS: Production Planning and Control.

5. Industrial Robotics: Robot-Technology-Robot classifications and specifications- Design and control issues- Various manipulators - Sensors - work cell - Programming languages.

THERMAL ENGINEERING:

1. Thermodynamics- Laws of thermodynamics, thermodynamic system and processes, 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.
2. Heat Transfer- Modes of heat transfer, steady & unsteady heat conduction, dimensionless parameters in free and forced convective heat transfer, thermal boundary layer; effect of turbulence; radiative heat transfer, heat exchanger performance, LMTD and NTU methods.
3. Fluid mechanics- Fluid properties; fluid statics, manometry, buoyancy; control-volume analysis of mass, momentum and energy, 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.
4. Power Plant Engineering: Steam Tables, Rankine, Brayton cycles with regeneration and reheat.
5. I.C. Engines: air-standard Otto, Diesel and dual cycles.
6. Refrigeration and air-conditioning: Vapour refrigeration cycle, heat pumps, gas refrigeration, Reverse Brayton cycle; moist air: psychrometric chart, basic psychrometric processes.
7. Turbo machinery: Pelton-wheel, Francis and Kaplan turbines - impulse and reaction principles, velocity diagrams. Centrifugal, Reciprocating pumps and compressor.