GITAM INSTITUTE OF TECHNOLOGY
GITAM UNIVERSITY
(Estd.u/s 3 of UGC Act, 1956)
Accredited by NAAC with 'A'Grade
Rushikonda, Visakhapatnam-530 045(AP)

GITAM Ph.D. Admission Test - 2017

Department of Mechanical Engineering
and
Industrial Engineering
Syllabus

Part A: Research Methodology

What is Research; Definitions, Research Process, Reasons for doing research, Outcome of Research, Sources of Research Ideas, Innovative Research, steps in Developing and Refining Research Problems, Basic vs applied research, Literature survey. Experimental Research, Experimental skills; Data analysis; Modeling skills Technical writing; Technical Presentations; Creativity in Research; Group discussion on Ethics in Research

Part B:

FLUID MECHANICS AND THERMAL SCIENCES

Fluid Mechanics: Fluid properties; fluid statics, manometry, buoyancy, forces on submerged bodies, stability of floating bodies; control-volume analysis of mass, momentum and energy; fluid acceleration; differential equations of continuity and momentum; Bernoulli's equation; dimensional analysis; viscous flow of incompressible fluids, boundary layer, elementary turbulent flow, flow through pipes, head losses in pipes, bends and fittings.

Heat-Transfer: Modes of heat transfer; one dimensional heat conduction, resistance concept and electrical analogy, heat transfer through fins; unsteady heat conduction, lumped parameter system, Heisler's charts; thermal boundary layer, dimensionless parameters in free and forced convective heat transfer, heat transfer correlations for flow over flat plates and through pipes, effect of turbulence; heat exchanger performance, LMTD and NTU methods; radiative heat

transfer, Stefan-Boltzmann law, Wien's displacement law, black and grey surfaces, view factors, radiation network analysis.

Thermodynamics: Thermodynamic systems and processes; properties of pure substances, behaviour of ideal and real gases; zeroth and first laws of thermodynamics, calculation of work and heat in various processes; second law of thermodynamics; thermodynamic property charts and tables, availability and irreversibility; thermodynamic relations.

Applications: *Power Engineering*: Air and gas compressors; vapour and gas power cycles, concepts of regeneration and reheat.

I.C. Engines: Air-standard Otto, Diesel and dual cycles.

Refrigeration and air-conditioning: Vapour and gas refrigeration and heat pump cycles; properties of moist air, psychrometric chart, basic psychrometric processes.

Turbomachinery: Impulse and reaction principles, velocity diagrams, Pelton-wheel, Francis and Kaplan turbines.

INDUSTRIAL ENGINEERING

Syllabus: Production Planning and Control: Forecasting models, aggregate production planning, scheduling, materials requirement planning.

Inventory Control: Deterministic models; safety stock inventory control systems.

Operations Research: Linear programming, simplex method, transportation, assignment, network flow models, simple queuing models, PERT and CPM.

Applied Mechanics 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; impulse and momentum (linear and angular) and energy formulations, collisions.

Mechanics of Materials: Stress and strain, elastic constants, Poisson's ratio; Mohr'scircle 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; energy methods; thermal stresses; straingauges and rosettes; testing of materials with universal testing machine; testing of hardness and impact strength.

Theory of Machines: Displacement, velocity and acceleration analysis of planemechanisms; dynamic analysis of linkages; cams; gears and gear trains; flywheels and governors; balancing of reciprocating and rotating masses; gyroscope.

Vibrations: Free and forced vibration of single degree of freedom systems, effect of damping; vibration isolation; resonance; critical speeds of shafts.

Machine Design: Design for static and dynamic loading; failure theories; fatiguestrength and the S-N diagram; principles of the design of machine elements such as bolted, riveted and welded joints; shafts, gears, rolling and sliding contact bearings, brakes and clutches, springs.

Materials, Manufacturing and Industrial Engineering

Engineering Materials: Structure and properties of engineering materials, phasediagrams, heat treatment, stress-strain diagrams for engineering materials.

Casting, Forming and Joining Processes: Different types of castings, design ofpatterns, moulds and cores; solidification and cooling; riser and gating design.Plastic deformation and yield criteria; fundamentals of hot and cold workingprocesses; load estimation for bulk (forging, rolling, extrusion, drawing) and sheet(shearing, deep drawing, bending) metal forming processes; principles of powder metallurgy. Principles of welding, brazing, soldering and adhesive bonding.

Machining and Machine Tool Operations: Mechanics of machining; basic machine tools; 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, design of jigs and fixtures.

Metrology and Inspection: Limits, fits and tolerances; linear and angular measurements; comparators; gauge design; interferometry; form and finish measurement; alignment and testing methods; tolerance analysis in manufacturing and assembly.

Computer Integrated Manufacturing: Basic concepts of CAD/CAM and theirintegration tools.

Mechanical Engineering
and
Industrial Engineering

Model Question Paper - 2017

Part – A: Research Methodology

Max Marks: 80

Summary, Writing and Citation Style   **20 Marks**
Given checklist about Typographical, Plagiarism, References and Technical Content guidelines, write a summary (in 200 words) about your proposed research area of interest.

Multiple Choice Questions   **20 Questions with 3 Marks Each**   **60 Marks**

Sample Questions
Q1) Assuming no modelling error, what is the effect of SNR on the quality of parameter estimates?
   a) High value leads to poor estimates
   b) High value leads to good estimates
   c) Low value leads to poor estimates
   d) None

Q2) In general, which of the following is used for linearizing a non-linear function?
   a) Taylor's series expansion
   b) Power series expansion
   c) Fourier series expansion.
   d) None of the above

Q3) Identify the methods for doing research
   a) Transformation of facts
   b) To test or disprove a theory
   c) To come out with a better way
   d) Information gathering

Part – B: Mechanical Engineering and Industrial Engineering

Max Marks: 80

Twenty Questions: Marks = 1 x 20 = 20   **20 Marks**

1)The velocity distribution of a pipe is parabolic for

a)Uniform turbulent flow

b)Non uniform turbulent flow

c)Uniform laminar flow

d) Neither laminar nor turbulent flow

2).The main cutting force acting on a tool during the turning (orthogonal cutting) operation of a metal is 400 N. The turning was performed using 2 mm depth of cut and 0.1 mm/rev feed rate. The specific cutting pressure (in N/mm²) is

(A) 1000

(B) 2000

(C) 3000

(D) 4000

3) The force acting on the sleeve for a governor running at constant speed is

a) Zero

b) Minimum

c) Maximum

d) Depends on the speed

4)For a product layout the material handling equipment must

(a) Have full flexibility

(b) Employ conveyor belts, trucks, tractors etc.

(c) Be a general purpose type

(d) Be designed as special purpose for a particular application

Twenty Questions: Marks = 3 x 20 = 60   **60 Marks**

1).A series combination of two Carnot's engines operate between the temperatures of 180^0C and 20^0C . What is the intermediate temperature if the engines produce equal amounts of work

a) 80^0C

b) 90^{0}C
c) 100^{0}C
d) 120^{0}C

2). A two start external square thread of 10mm pitch outside diameter of 62mm is to be cut on a centre lathe which has a 6mm pitch lead screw. Calculatei) Depth of thread to give 0.12mm clearance ii) Lead of thread iii) Core diameteriv) Helix angle at Core diameter v) Helix angle of thread.

3)Consider a simply supported beam of length 50h with a rectangular cross section of depth 'h'and width '2h', the load carried at midpoint. Find the ratio of the maximum shear stress to the maximum bending stress in the beam.

(A) 0.02
(B) 0.10
(C) 0.05
(D) 0.01

4)A company purchases an item at the rate of Rs.40 from a manufacturer. 2000 units of the item are required per year. What should be the order quantity per order if the cost per order is Rs. 15 and the inventory carrying charges per unit per year are 20%?