Code : 1G554

R-11

III B.Tech. I Semester Regular Examinations Nov/Dec 2014

Design of Machine Elements-I

(Mechanical Engineering)

Max. Marks: 70 **Time: 03 Hours**

Answer *any five* questions

All Questions carry equal marks (14 Marks each)

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1. a) What are the important properties of engineering materials? 7M

   b) Briefly explain various manufacturing considerations in design. 7M

2. a) A machine member is subjected to a bending moment of 3 kNm and a twisting moment of 1.5 kNm. Find suitable diameter of the member taking the allowable normal and shear stresses as 120 MPa and 75 MPa respectively. 7M

   b) A steel rod 1.2 meters long has to resist longitudinally an impact of 3 kN that falls on to it from a height of 30 mm. The maximum computed stress is to be limited to 150 MPa. Determine the suitable diameter of the rod. 7M

3. a) What is stress concentration? Give two examples with sketches how to minimize the stress concentration. 4M

   b) A cantilever beam of rectangular cross section has a span of 900 mm. The depth of the beam is 200 mm. The free end of the beam is subjected to a transverse load that fluctuates between 50 kN upward to 80 kN downward. It is made of steel having normal yield stress of 420 MPa and normal endurance stress of 300 MPa. Find proper width of the section taking factor of safety as 2.1. The size and surface factors may be taken as 0.85 and 0.9 respectively. 10M

4. a) Explain various strengths of riveted joints. 4M

   b) Find the size of the bolt for a joint loaded as shown in Fig Q 4(b). The allowable shear stress for the bolts may be taken as 60 MPa.

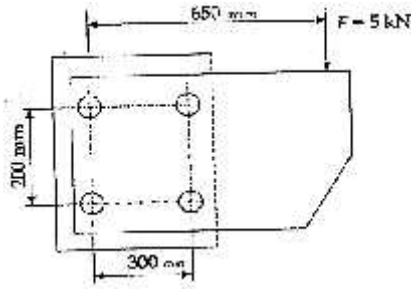

Fig Q4(b) 10M

5. a) Explain with sketch the strengths of transverse and parallel fillet welds. 4M

   b) An angle 100 mm x 90 mm x 10 mm is welded to a steel plate along the broader side (100 mm side) of the angle. The angle carries a tensile load of 180 kN along its CG axis. The allowable stress in the weld is 75 MPa and size of weld used is 10 mm. Find the lengths of welds required at the top and bottom. Assume an extra length of 10 mm for start and stop of weld. 10M

6. a) What are the nature of stresses induced in the rods and knuckle pin in a knuckle joint subjected to a tensile load? 4M

   b) Design a cotter joint to connect two round rods and to carry an axial load of 90 kN. The permissible stresses for the material of rods and cotter are 90 MPa in tension, 60 MPa in shear and 150 MPa in crushing. 10M

7. A shaft transmits 9 kW at 1200 rpm and at the same time is subjected to a bending moment of 1.8 kNm. Determine the diameter of a solid shaft limiting the shear stress to 60 MPa. What is the % saving in material if it is replaced by a hollow shaft of the same material with diameters' ratio of 2? 14M

8. a) Give four examples of types of couplings? 4M

   b) Design a bushed pin type flexible coupling to transmit 15 kW at 2000 rpm. Allowable shear stress for shafts, keys and bolts = 55 MPa. Allowable bearing stress for bolts and keys = 110 MPa. Allowable bearing pressure for rubber bush= 1 MPa. 10M

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Code : 1G552

R-11

III B.Tech. I Semester Regular Examinations Nov/Dec 2014

Dynamics of Machinery

(Mechanical Engineering)

Max. Marks: 70 **Time: 03 Hours**

Answer *any five* questions

All Questions carry equal marks (14 Marks each)

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1 Each wheel of a four-wheeled, rear engine automobile has a moment of inertia of 2.4 kg-m^2 and an effective diameter of 660mm. The rotating parts of the engine have a moment of inertia of 1.2 kg-m^2. The gear ratio of the engine to the back wheel is 3 to 1. The engine axis is parallel to the rear axle and the crankshaft rotates in the same sense as the road wheels. The mass of the vehicle is 2200 kg and the center of the mass is 550 mm above the road level. The track width of the vehicle is 1.5m. Determine the limiting speed of the vehicle around a curve with 80m radius so that all the wheels maintain contact with the road surface. 14M

2 Determine the couple forces F that must be applied to the handle of the machinist's vise shown in Figure 2 in order to create a compressive force of 400 N in the block. Neglect the friction at the bearing A. the guide at B is smooth so that the axial force on the screw is 400 N. The single square threaded screw has a mean radius of 6 mm and a lead of 8 mm and the coefficient of static friction is μ_c = 0.27.

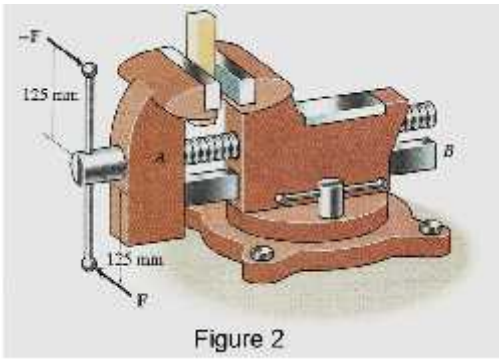


Figure 2

14M

3. a) For the brake configuration shown in Figure 3(a), derive the condition for self-locking and find the braking torque in the self-locking condition. Assume that the coefficient of friction at braking contact surface is μ.

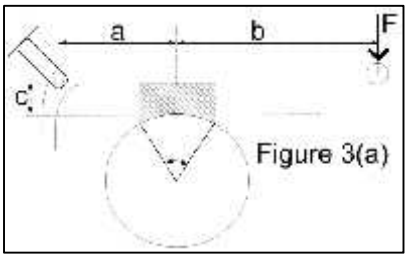


Figure 3(a)

7M

b) Single plate clutch is employed to transmit 40 kW at speed of 2000 rpm. Maximum intensity of pressure at any point of contact is 0.8 bar. The coefficient of friction is 0.30. If the outside diameter of the friction plate is 300 mm, and has both sides effective, determine: (i) the inside diameter of the friction plate and (ii) the axial thrust with which the frictional surfaces are held together. 7M

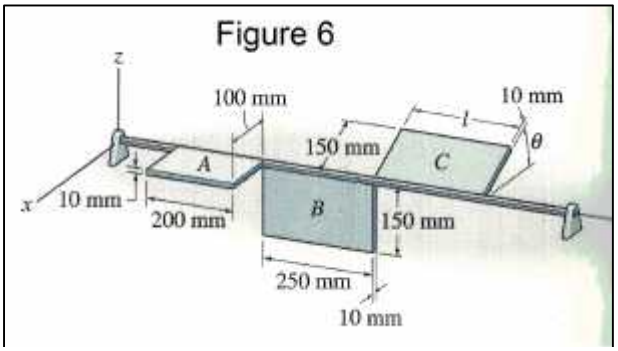
4. The effective turning moment exerted by two stroke engine at crank shaft is represented by: T (θ) = 8000 + 1000 sin (2θ) – 2000 cos (2θ) where T (θ) is in N-m and θ is inclination of the crank to the inner dead center. The mass of the flywheel is 500 kg and its radius of gyration is 75 cm. The engine speed is 300 rpm. Assuming external resistance as constant, determine
   (a) The power developed,
   (b) The total percentage fluctuations in speed, and
   (c) The maximum angular retardation of the flywheel. 14M

5. a) Show that the height of a Watt governor is inversely proportional to the square of the speed and comment on the applicability of Watt governor. 7M

   b) What is isochronism in governors? Comment on whether Porter governor can exhibit isochronism. Derive necessary equations. 7M

6. Each of the three homogeneous plates welded to the shaft shown in Figure 6 has a density of 6 Mg/m^3 and a thickness of 10 mm. Find the length l of the plate C and the angle of placement θ so that the center of mass of the assembly lies on the y-axis. Plates A and B lie in the x-y and z-y planes respectively.

Figure 6



14M

7. a) Explain the terms in the context of balancing in locomotives:
   (a) Hammer-blow (b) Variation in Tractive force, (c) swaying couple. 6M

   b) The following data refer to a two cylinder uncoupled locomotive: Rotating mass per cylinder = 280 kg, Reciprocating mass per cylinder = 300 kg, distance between wheels = 1400 mm, distance between cylinder centers = 600 mm, diameter of treads of driving wheels = 1800 mm, crank radius = 300 mm, radius of center of balance mass = 620 mm, locomotive speed = 50 km/hr, angle between cylinder cranks = 90°, dead load on each wheel = 3.5 tons. Determine the balancing mass required in the planes of driving when if whole of the revolving and two-third of the reciprocating mass are to be balanced. 8M

8. a) Explain Dunkerly's method of finding natural frequency of a shaft using a suitable example. 5M

   b) The mass of an electric motor is 120 kg and it runs at 1500 rpm. The armature mass is 35 kg and its C.G. lies 0.5 mm from the axis of rotation. The motor is mounted on five springs of negligible damping so that the force transmitted is one-eleventh of the impressed force. Assume that the mass of the motor is equally distributed among the five springs. Determine:
   (a) Stiffness of each spring
   (b) Dynamic force transmitted to the base at the operating speed, and
   (c) Natural frequency of the system 9M

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Code : 1G555

R-11

III B.Tech. I Semester Regular Examinations Nov/Dec 2014

Heat Transfer

(Mechanical Engineering)

Max. Marks: 70 **Time: 03 Hours**

Answer *any five* questions

All Questions carry equal marks (14 Marks each)

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1. a) Starting from fundamentals derive the general heat conduction equation in polar coordinate system. 10M

   b) Describe the mechanism of heat conduction in solids, liquids and gases. 4M

2. a) A 15 cm O.D steam pipe carrying wet stream at 3600 kPa (3.6 MN/m^2) is covered with two layers of lagging each 4 cm thick. The coefficients of thermal conductivity for the two layers are 0.07 and 0.1 W/mK, respectively. This ambient temperature is 27^0C and the heat transfer coefficient on outer surface is 3 W/mK. Find the heat lost per hour for 100 mm length of the pipe. Also find the surface temperature of the lagging. Neglect thermal conductivity effect of the pipe material. 10M

   b) Derive expression for critical thickness of insulation for cylinder? 4M

3. a) What are the assumptions made in lumped analysis system? 4M

   b) A boiler furnace has the effective dimensions 4m x 3m x 3m high. The walls are constructed from an inner firebrick wall 25cm thick (k = 0.4 W/mK), a layer of ceramic blanket insulation (k = 0.2 W/mK), 8cm thick and a steel protective layer (k = 54 W/mK) 2mm thick. The inside temperature of the fireback layer was measured as 600^0C. Determine the rate of heat loss through the vertical walls of the furnace. Also calculate the temperature drop across the steel layer. 10M

4. a) Why is an analytical solution of a free convection heat transfer problem more difficult than that of forced convection problem? 4M

   b) Water at 25^0C flows through a tube of 50mm diameter. Determine the flow rate that will result in Reynolds number of 1600. The tube is provided with a nichrome heating element on its surface and receives a constant heat flux of 800 W/m length of the tube. Determine the average heat transfer coefficient between the water and tube wall, assuming fully developed conditions. Also determine the length of the tube for the bulk temperature of water to rise from 25^0C to 50^0C. 10M

5. A vertical plate 0.205m high is maintained at a temperature of 70^0C in a still atmosphere of air at 25^0C. Compute the boundary layer thickness at the trailing edge of the plate. What would be this boundary layer thickness if this plate were placed in an air stream flowing at a velocity of 5 m/s over the plate? 14M

6. a) What do you mean by pool boiling? How does it differ from forced connection boiling? 4M

   b) A wire having 1mm diameter and 15cm long carrying electric current is submerged horizontally in water at 7 bar. The voltage drop in the wire is 2.15V and a current of 131.5 Amp flows. Determine the heat flux and boiling heat transfer coefficient if the surface temperature is to be maintained at 180^0C. 10M

7. a) Differentiate between LMTD and NTU methods? 4M

   b) Saturated steam at 120^0C is condensing on the outer tube surface of a single pass heat exchanger. The heat transfer coefficient is U_0 = 1800 W/m^2K. Determine the surface area of a heat exchanger capable of heating 1000 kg/h of water from 20^0C to 90^0C. Also compute the rate of condensation of steam h_{fg} = 2200 kJ/kg. 10M

8. a) State and explain the Stefan-Boltzmann law of radiation heat transfer, giving the nomenclature involved in it. 5M

   b) Consider a 20-cm diameter spherical ball at 800 K suspended in air. Assuming the ball closely approximates a blackbody; determine

      (i) The total blackbody emissive power,

      (ii) The total amount of radiation emitted by the ball in 5 min, and

      (iii) The spectral blackbody emissive power at a wavelength of 3 μm. 9M

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Code : 1G553

R-11

III B.Tech. I Semester Regular Examinations Nov/Dec 2014

Machine tools

(Mechanical Engineering)

Max. Marks: 70 **Time: 03 Hours**

Answer *any five* questions

All Questions carry equal marks (14 Marks each)

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1. a) Explain Orthogonal cutting with a neat sketch
   b) Define the terms shear plane and shear zone
2. a) Define speed, feed and depth of cut in plain turning
   b) How are the sizes of Turret and Capstan lathes specified
3. a) Explain the basic operations that are done on a shaper
   b) Briefly give the differences between a planner and a shaper
4. a) Draw and describe various types of reamers
   b) What are the different tool holding devices used in a drilling machine
5. a) What is an Indexing?
   b) Classify the various types of milling cutters
6. a) Sketch and explain tool and cutter grinder
   b) List different types of abrasives and bonds used in a grinding wheel
7. a) Briefly compare broaching and grinding
   b) Explain any two lapping operations
8. a) Explain jigs and fixtures
   b) Explain 3-2-1 principle of location

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Code : 1GA51

R-11

III B.Tech. I Semester Regular Examinations Nov/Dec 2014

Managerial Economics and Financial Analysis

(Common to CE,ME and ECE)

Max. Marks: 70 **Time: 03 Hours**

Answer *any five* questions

All Questions carry equal marks (14 Marks each)

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1. Discuss the salient and significance of managerial economics.
2. Explain the concept of cross elasticity of demand. How would you measure such elasticity?
3. You are given the following information

	Rs
Selling price per unit	20
Variable cost	12
Total fixed cost	96,000

Calculate:

(i) Break-even units and value.

(ii) Profit and margin of safety when sales would be Rs.4,00,000.

4. Explain the effect of government intervention in market price behavior.
5. a) What is technical imperative? What is its implication for organization design?

   b) Explain the importance and role of forms of business organization?
6. a) State the features of capital budgeting decisions.

   b) Define accounting rate of return (ARR).How is it calculated?
7. Prepare the Trial Balance from the following

	Rs		**Rs**
Outstanding expenses	1,500	Machinery	3,000
Purchase return	3,000	Capital	30,000
Purchases	42,000	Sales	16,000
Office expenses	9,000	Reserve fund	2,000
Creditors	3,000	Cash in hand	6,000
Loan	4,500		

8. Define ratio analysis. State its limitations.

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Code : 1G551

R-11

III B.Tech. I Semester Regular Examinations Nov/Dec 2014

Thermal Engineering II

(Mechanical Engineering)

Max. Marks: 70 **Time: 03 Hours**

Answer *any five* questions

All Questions carry equal marks (14 Marks each)

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1.		A steam power plant operating in an ideal Rankine cycle has a high pressure of 5 MPa and a low pressure of 15 kPa. The turbine exhaust state should have a quality of at least 0.9, and the turbine power generated should be 7.5MW. Find the necessary boiler exit temperature, the total mass flow rate and thermal efficiency of the cycle if condenser exit is saturated liquid	14M
2.	a)	Explain the unique features of high pressure boilers and list the advantages of the same	6M
	b)	Describe working of LaMont boiler with a neat sketch	8M
3.	a)	Define Boilers horse power and equivalent of evaporation?	6M
	b)	How much air is used per kg of coal burnt in a boiler having chimney of 32.3 m height to create a draught of 19 mm of water column when the temperature of flue gases in the chimney is 370^0C and the temperature of the boiler house is 29.5^0C?	8M
4.	a)	Define critical pressure ratio of a nozzle and obtain its value in terms of the index of expansion	8M
	b)	The dry saturated steam is expanded in a nozzle from 10 bar to 4 bar pressure if expansion is supersaturated find i) The degree of Super saturation. ii) The degree of Undercooling.	6M
5.		What do you mean by compounding of steam turbines? Discuss various methods of compounding steam turbines with suitable diagrams	14M
6		A reaction steam turbine runs at 300 rev/min and its steam consumption is 16500 kg/hr. The pressure of steam at a certain pair is 1.765 bar and its dryness fraction is 0.9. The power developed by the pair is 3.31 kW. The discharge blade tip angel both for fixed and moving blade is 20° and the axial velocity of flow is 0.72 of the mean moving blade velocity. Find the drum diameter and blade height. Take the tip leakage as 8%, but neglect area blocked by blade thickness	14M
7.	a)	Give the basic classification of steam condensers and explain the working of any two with neat sketch	7M
	b)	A steam turbine discharges 4000 kg of steam per hr at 40^0C and 0.85 dry. The estimated air leakage in to the condenser is 16 kg per hr. The temperature of air pump suction is 32^0C and the temperature of condensate is 35^0C. Find the capacity of the dry air pump if its volumetric efficiency is 80%.	7M
8.	a)	Give the basic classification of steam engines	6M
	b)	Write short notes on four major steam engine parts?	8M

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