Hall Ticket Number :										

R-11/R-13

Code: 1G554

III B.Tech. I Semester Supplementary Examinations Nov/Dec 2017

Design of Machine Elements-I

(Mechanical Engineering)

Max. Marks: 70 Time: 3 Hours

Answer any **five** questions

All Questions carry equal marks (**14 Marks each**)

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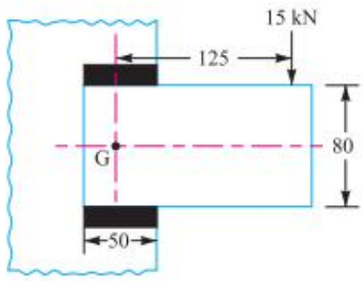
1. a) What is the general procedure adopted in the design of machine elements? 7M
   b) Explain the important mechanical properties of engineering materials? 7M
2. a) Define stress. Explain various types of stresses induced in machine elements subjected to (i) Direct load (ii)Bending moment (iii)Torque (iv)Tangential load and (v) Eccentric load 7M
   b) A hollow shaft of 40 mm outer diameter and 25 mm inner diameter is subjected to a twisting moment of 120 N-m, simultaneously, it is subjected to an axial thrust of 10 KN and a bending moment of 80 N-m. Calculate the maximum compressive and shear stresses 7M
3. a) What is stress concentration factor? What are the reasons for stress concentration? 6M
   b) Determine the diameter of circular rod made of ductile material with a fatigue strength (completely stress reversal) = 280MPa and a tensile yield strength of 350 MPa. The member is subjected to a varying axial load from 700KN to-300KN. Assume =1.8 and F.S =2. 8M
4. a) Design a double riveted chain type butt joint for plates having 10 mm thickness. Find the efficiency of the joint. Assume the allowable stress is 95 N/mm^2 in tension, 80 N/mm^2 in shear and 155 N/mm^2 in compression. 7M
   b) The cylinder head of a steam engine is subjected to a steam pressure of 0.7 N/mm^2. It is held in position by means of 12 bolts. A soft copper gasket is used to make the joint leak-proof. The effective diameter of cylinder is 300 mm. Find the size of the bolts so that the stress in the bolts is not to exceed 100 MPa. 7M
5. A bracket carrying a load of 15 KN is to be welded as shown in Fig. 1. Find the size of weld required if the allowable shear stress is not to exceed 80 MPa



14M

6. Two rods having 30 mm x 30 mm square cross-section are connected using a gib and cotter. Calculate the leading dimensions of the joint so as to have the strength of the joint same as the strength of the rods in tension. For all the parts of the joint take the allowable stresses as follows:
   Tensile Strength = 120 N/mm^2 Shear Strength = 70 N/mm^2 and Compression strength = 240 N/mm^2. 14M
7. a) Explain about various types of stresses acting on a rotating shaft. 6M
   b) A steel spindle transmits 4 kW at 800 r.p.m. The angular deflection should not exceed 0.25° per metre of the spindle. If the modulus of rigidity for the material of the spindle is 84 GPa, find the diameter of the spindle and the shear stress induced in the spindle. 8M
8. Design a muff coupling to connect two shafts transmitting 40Kw at 120 rpm. The permissible shear and crushing stress for the shaft and key material (mild steel) are 30MPa and 80MPa respectively. The material of muff is cost-Iron with permissible shear stress of 15MPa. Assume that the maximum torque transmitted is 25percent greater than mean torque. 14M

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Hall Ticket Number :										

R-11 / R-13

Code: 1G552

III B.Tech. I Semester Supplementary Examinations Nov/Dec 2017

Dynamics of Machinery

(Mechanical Engineering)

Max. Marks: 70 Time: 3 Hours

Answer any **five** questions

All Questions carry equal marks (**14 Marks each**)

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1. A four wheeled motor car of mass 2000 kg has a wheel base 2.5 m, track width 1.5 m and height of centre of gravity 500 mm above the ground level and lies at 1 metre from the front axle. Each wheel has an effective diameter of 0.8 m and a moment of inertia of 0.8 kg-m2. The drive shaft, engine flywheel and transmission are rotating at 4 times the speed of road wheel, in a clockwise direction when viewed from the front, and is equivalent to a mass of 75 kg having a radius of gyration of 100 mm. If the car is taking a right turn of 60 m radius at 60 km/h, find the load on each wheel. 14M

2. a) What is meant by the expression 'friction circle'? Deduce an expression for the radius of friction circle in terms of the radius of the journal and the angle of friction. 7M

   b) A turn buckle, with right and left hand threads is used to couple two railway coaches. The threads which are square have a pitch of 10 mm and a mean diameter of 30 mm and are of single start type. Taking the coefficient of friction as 0.1, find the work to be done in drawing the coaches together a distance of 200 mm against a steady load of 20 kN. 7M

3. a) A conical friction clutch is used to transmit 90 kW at 1500 r.p.m. The semicone angle is 20^o and the coefficient of friction is 0.2. If the mean diameter of the bearing surface is 375 mm and the intensity of normal pressure is not to exceed 0.25 N/mm2, find the dimensions of the conical bearing surface and the axial load required. 7M

   b) Describe with the help of a neat sketch the principles of operation of an internal expanding shoe. Derive the expression for the braking torque. 7M

4. The turning moment diagram of a four stroke engine may be assumed for the sake of simplicity to be represented by four triangles in each stroke. The areas of these triangles are as follows: Suction stroke = 5 × 10–5 m2; Compression stroke = 21 × 10–5 m2; Expansion stroke =85 × 10–5 m2; Exhaust stroke = 8 × 10–5 m2. All the areas excepting expression stroke are negative. Each m2 of area represents 14 MN-m of work. Assuming the resisting torque to be constant, determine the moment of inertia of the flywheel to keep the speed between 98 r.p.m. and 102 r.p.m. Also find the size of a rim-type flywheel based on the minimum material criterion, given that density of flywheel material is 8150 kg/m3 ; the allowable tensile stress of the flywheel material is 7.5 MPa. The rim cross-section is rectangular; one side being four times the length of the other. 14M

5. a) A Hartnell governor has two rotating balls, of mass 2.7 kg each. The ball radius is 125 mm in the mean position when the ball arms are vertical and the speed is 150 r.p.m. with the sleeve rising. The length of the ball arms is 140 mm and the length of the sleeve arms 90 mm. The stiffness of the spring is 7 kN/m and the total sleeve movement is 12 mm from the mean position. Allowing for a constant friction force of 14 N acting at the sleeve, determine the speed range of the governor in the lowest and highest sleeve positions. Neglect the obliquity of the ball arms. 10M

   b) Describe clearly how you would determine from the controlling force curve whether a governor is stable, unstable or isochronous. Show also how the effect of friction may be indicated on the curve. 4M

6. a) A, B, C and D are four masses carried by a rotating shaft at radii 100 mm, 150 mm, 150 mm and 200 mm respectively. The planes in which the masses rotate are spaced at 500 mm apart and the magnitude of the masses B, C and D are 9 kg, 5 kg and 4 kg respectively. Find the required mass A and the relative angular settings of the four masses so that the shaft shall be in complete balance. 10M

   b) Elucidate clearly the terms ‘static balancing’ and ‘dynamic balancing’. State the necessary conditions to achieve them. 4M

7. a) Explain the ‘direct and reverse crank’ method for determining unbalanced forces in radial engines. 7M

   b) A three cylinder radial engine driven by a common crank has the cylinders spaced at 120°. The stroke is 125 mm, length of the connecting rod 225 mm and the mass of the reciprocating parts per cylinder 2 kg. Calculate the primary and secondary forces at crank shaft speed of 1200 r.p.m. 7M

8. a) The mass of an electric motor is 120 kg and it runs at 1500 r.p.m. 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 : 1. stiffness of each spring; 2. dynamic force transmitted to the base at the operating speed; and 3. natural frequency of the system. 7M

   b) Derive the differential equation characterising the motion of an oscillation system subject to viscous damping and no periodic external force. Assuming the solution to the equation, find the frequency of oscillation of the system. 7M

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Hall Ticket Number :										

R-11 / R-13

Code: 1G555

III B.Tech. I Semester Supplementary Examinations Nov/Dec 2017

Heat Transfer

(Mechanical Engineering)

Max. Marks: 70 Time: 3 Hours

Answer any **five** questions

All Questions carry equal marks (**14 Marks each**)

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1. a) Explain various modes of heat transfer 4M

   b) Derive the heat conduction equation in cylindrical coordinates. 10M

2. a) Derive the expression for critical thickness of insulation of a pipe 6M

   b) A turbine blade 6 cm long and having a cross-sectional area 4.65 cm^2 and perimeter 12 cm is made of stainless steel (k = 23.3 W/mK). The temperature at the root is 500^0C. The blade is exposed to a hot gas at 870^0C. The heat transfer coefficient between the blade surface and gas is 442 W/m^2K. Determine the temperature distribution and rate of heat flow at the root of the blade. Assume the tip of the blade to be insulated. 8M

3. a) A chromel-alumel thermocouple (diameter 0.71 mm) is used to measure the temperature of a gas steam for which h = 600 W/m^2K. Estimate the time constant of the thermocouple. What is the time period after which an acceptable reading of temperature can be recorded. [c = 420 J/kgK and ρ = 8600 kg/m^3] 6M

   b) A long steel cylinder 12 cm in diameter and initially at 20^0C is placed in a furnace at 820^0C with the heat transfer coefficient h = 140 W/m^2K. Calculate the time required for the axis temperature to reach 800^0C. Also corresponding temperature at a radius 5.4 cm at that time. The physical properties of steel are $\alpha = 6.11 \times 10^{-6}$ m^2/s, k = 21 W/mK 8M

4. a) Obtain a correlation for rate of heat transfer in forced convection in terms of dimensionless parameters using dimensional analysis 10M

   b) Explain the significance of Reynolds Number, Prandtl Number and Grashoff Number 4M

5. a) Water at 50^0C enters a 1.5 cm diameter and 3 m long tube with a velocity 1 m/s. The tube wall is maintained at a constant temperature of 90^0C. Calculate the heat transfer coefficient and total amount of heat transferred if the exit water temperature is 64^0C. 7M

   b) A vertical plate is at 96^0C in an atmosphere of air at 20^0C. Estimate the local heat transfer coefficient at a distance of 20 cm from the lower edge and average value over the 20 cm length. 7M

6. a) Water is boiled at a rate of 30 kg/h in a copper pan, 30 cm diameter, at atmospheric pressure. Estimate the temperature of the bottom surface of the pan assuming nucleate boiling conditions. 10M

   b) Sketch the filmwise condensation on vertical wall showing film thickness, velocity and temperature profiles 4M

7. a) Derive an expression for LMTD of a parallel flow heat exchanger 7M

   b) In a parallel flow heat exchanger, the data available about the two fluids is as follows

Fluid	Inlet temp.	Exit temp.
Engine Oil	150^0C	80^0C
Cooling Water	30^0C	65^0C

   If the fluid flow rates and inlet conditions are unchanged, find the exit temperatures of each fluid in counter flow mode. 7M

8. a) Explain the terms (i) shape factor (ii) theorem of reciprocity (ii) radiation shield 6M

   b) Derive the expression for effective emissivity of two long parallel plates with emissivities ε_1 and $\varepsilon 2$. 8M

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Hall Ticket Number :										

R-11/R-13

Code: 1G553

III B.Tech. I Semester Supplementary Examinations Nov/Dec 2017

Machine tools

(Mechanical Engineering)

Max. Marks: 70 Time: 3 Hours

Answer any **five** questions

All Questions carry equal marks (**14 Marks each**)

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1. a) List out the assumptions made by merchant in orthogonal cutting process? Draw the merchant's circle diagram and label the various cutting forces on it. 7M
   b) What do you understand by economics of machining? How do you evaluate machining cost? 7M

2. a) Explain with neat sketch how thread cutting operation is done on lathe. 7M
   b) Define tool layout? Differentiate between Capstan and turret lathe? 7M

3. a) Differentiate between shaping and slotting machine? 7M
   b) List out the Different types table drive mechanisms in planner? Explain any one with neat sketch? 7M

4. a) Show with neat sketch a twist drill and label the important elements 7M
   b) Explain the working of fine boring machine. What are its applications? 7M

5. a) With the help of a sketch, explain the working of a universal dividing head. 7M
   b) Draw neat sketch of horizontal milling machine and label the parts. 7M

6. a) Differentiate between cylindrical and surface grinding. 7M
   b) Define
      i) loading
      ii) glazing
      iii) dressing
      iv) truing 7M

7. a) Draw the broach tool and indicate broach elements on it? 7M
   b) What is honing process? Explain the methods of honing process? 7M

8. a) Write the design principles of jigs and fixtures. 7M
   b) Explain the following with neat sketches
      i) Drill jig
      ii) Milling fixtures 7M

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Hall Ticket Number :										

R-11 / R-13

Code: 1G551

III B.Tech. I Semester Supplementary Examinations Nov/Dec 2017

Thermal Engineering–II

(Mechanical Engineering)

Max. Marks: 70 Time: 3 Hours

Answer any **five** questions

All Questions carry equal marks (**14 Marks each**)

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1. Steam is the working fluid in an ideal Rankine cycle. Saturated vapor enters the turbine at 8.0 MPa and saturated liquid exits the condenser at a pressure of 0.008 MPa. The net power output of the cycle is 100 MW. Determine for the cycle (a) the thermal efficiency, (b) the back work ratio, (c) the mass flow rate of the steam, in kg/h, (d) the rate of heat transfer, *Q*in, into the working fluid as it passes through the boiler, in MW, (e) the rate of heat transfer, *Q*out, from the condensing steam as it passes through the condenser, in MW. The turbine and the pump each have an isentropic efficiency of 85%. 14M

2. a) Explain with the help of a neat sketch the working of Cochran boiler. 8M

   b) Compare fire tube and water tube boilers. 6M

3. a) Calculate the mass of flue gases flowing through the chimney when the draught produced is equal to 1.9 cm of water. Temperature of the flue gases is 290^{o}C and ambient temperature is 20^{o}C. The flue gases formed per kg of fuel burnt are 23 kg. Neglect the losses and take the diameter of the chimney as 1.8 m. 10M

   b) List the advantages of artificial draught over natural draught 4M

4. a) In a steam nozzle, dry and saturated steam is expanded from 10 bar to 0.1 bar. Calculate (i) dryness fraction of steam at exit (ii) heat drop (iii) the velocity of steam at exit from the nozzle when initial velocity is 135 m/s. 10M

   b) What is meant by supersaturated flow? 4M

5. a) Derive the expression for maximum blade efficiency in a single stage impulse turbine. 8M

   b) Discuss various methods of compounding of steam turbines. 6M

6. a) In a De-Laval turbine steam issues from the nozzle with a velocity of 1200 m/s. The nozzle angle is 20^{0}, the mean blade velocity is 400 m/s, and the inlet and outlet blade angles are equal. The mass of steam flowing through the turbine per hour is 1000 kg. Calculate blade angles, relative velocity of steam entering the blades, tangential force on the blades, power developed, blade efficiency. Take blade velocity co-efficient as 0.8. 10M

   b) Write short note on bleeding of steam turbines. 4M

7. a) The following observations were recorded during a test on a steam condenser:

   Barometric reading : 764 mm of Hg

   Vacuum reading : 680 mm of Hg

   Mean condenser temperature = 36.2^{o}C

   Hot well temperature = 30^{o}C

   Condensate formed per hour = 1780 kg

   Temperature of inlet cooling water : 20^{o}C

   Temperature of outlet cooling water : 32^{o}C

   Quantity of cooling water = 1250 kg/min

   Determine

   (a) Vacuum efficiency (b) Condenser vacuum corrected to standard barometer

   (c) undercooling of condensate (d) condenser efficiency 10M

   b) Explain the sources of air in the condensers 4M

8. Using neat sketches enumerate and explain the various parts of a reciprocating steam engine. 14M

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