Hall Ticket Number :										

R-15

Code: 5G552

III B.Tech. I Semester Supplementary Examinations Nov/Dec 2022

Dynamics of Machinery

(Mechanical Engineering)

Max. Marks: 70 Time: 3 Hours

Answer *any five full questions* by choosing one question from each unit (5x14 = 70 Marks)

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		Marks	CO	Blooms Level
	UNIT–I			
1.	Derive an expression for frictional torque required for flat pivot bearing considering i) Uniform Pressure theory ii) Uniform wear theory.	14M	1	L5
	OR			
2.	The mean diameter of the screw jack having pitch of 10mm is 50 mm. A load of 20 kN is lifted through a distance of 170 mm. Find the work done in lifting the load and efficiency of the screw jack when 1. The load rotates with the screw, and 2. The load rests on the loose head which does not rotate with the screw. The external and internal diameter of the bearing surface of the loose head are 60 mm and 10 mm respectively. The coefficient of friction for the screw as well as the bearing surface may be taken as 0.08	14M	1	L3
	UNIT–II			
3. a)	Explain about the various planes and axes of gyroscopic couple	7M	2	L2
b)	An airplane makes a complete half circle of 50 meters radius, towards left, when flying at 200 km per hr. The rotary engine and the propeller of the plane has a mass of 400 kg and a radius of gyration of 0.3 m. The engine rotates at 2400 r.p.m. clockwise when viewed from the rear. Find the gyroscopic couple on the aircraft and state its effect on it	7M	2	L3
	OR			
4.	The turbine rotor of a ship has a mass of 3500 kg. It has a radius of gyration of 0.45 m and a speed of 3000 r.p.m. clockwise when looking from stern. Determine the gyroscopic couple and its effect upon the ship: 1. when the ship is steering to the left on a curve of 100 m radius at a speed of 36 km/h. 2. When the ship is pitching in a simple harmonic motion, the bow falling with its maximum velocity. The period of pitching is 40 seconds and the total angular displacement between the two extreme positions of pitching is 12 degrees	14M	2	L3

UNIT–III

5.	A loaded Porter governor has four links each 250 mm long, two revolving masses each of 3 kg and a central dead weight of mass 20 kg. All the links are attached to respective sleeves at radial distances of 40 mm from the axis of rotation. The masses revolve at a radius of 150mm at minimum speed and at a radius of 200mm at maximum speed. Determine the range of speed.	14M	3	L3

OR

6.	The turning moment diagram for a multicylinder engine has been drawn to a scale 1 mm = 600 N-m vertically and 1 mm = 3° horizontally. The intercepted areas between the output torque curve and the mean resistance line, taken in order from one end, are as follows: +52, –124, +92, –140, +85, –72 and +107 mm^2, when the engine is running at a speed of 600 r.p.m. If the total fluctuation of speed is not to exceed ± 1.5% of the mean, find the necessary mass of the flywheel of radius 0.5 m	14M	3	L3

UNIT–IV

7.	Explain the 'direct and reverse crank' method for determining unbalanced forces in radial engines	14M	4	L2

OR

8.	A shaft carries four masses A, B, C and D of magnitude 200 kg, 300 kg, 400 kg and 200 kg respectively and revolving at radii 80 mm, 70 mm, 60 mm and 80 mm in planes measured from A at 300 mm, 400 mm and 700mm. The angles between the cranks measured anticlockwise are A to B 45°, B to C 70° and C to D 120°. The balancing masses are to be placed in planes X and Y. The distance between the planes A and X is 100 mm, between X and Y is 400 mm and between Y and D is 200mm. If the balancing masses revolve at a radius of 100 mm, find their magnitudes and angular positions	14M	4	L3

UNIT–V

9.	Develop an expression for Natural Frequency of Free Transverse Vibrations of a Shaft Subjected to a Number of Point Loads by Dunkerly's method.	14M	5	L5

OR

10.	A shaft of length 0.75 m, supported freely at the ends, is carrying a body of mass 90 kg at 0.25 m from one end. Find the natural frequency of transverse vibration. Assume E = 200 GN/m2 and shaft diameter = 50 mm	14M	5	L3

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Code: 5G555

III B.Tech. I Semester Supplementary Examinations Nov/Dec 2022

Heat Transfer

(Mechanical Engineering)

Max. Marks: 70 Time: 3 Hours

Answer *any five full questions* by choosing one question from each unit (5x14 = 70 Marks)

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Marks

UNIT–I

1. a) Define heat transfer? Briefly explain three modes of heat transfer with examples? 10M

   b) A hot plate of area =0.2m^2 at 59^{o}C loses heat to a room at temperature 20^{o}C. Given the heat transfer coefficient acting on the hot plate =6.277W/m2K find out the rate of heat transfer. 4M

OR

2. a) Asbestos layer of 5mm thickness (k=0.115W/mK) is used as insulation material over a boiler wall. Consider an area of 1.0m^2 and find out the rate of heat flow as well as the heat flux over this area if the temperatures on either side of the insulation are 400^{0}C and 40^{0}C. 8M

   b) Explain Fourier's law of heat conduction. 6M

UNIT–II

3. Derive the temperature distribution equation for a lumped heat system in terms of Fourier and Biot numbers. 14M

OR

4. a) Derive the temperature distribution equation for a lumped system in terms of Fourier and Biot numbers. 7M

   b) The temperature at the inner and outer surfaces of a boiler wall made of 20 mm thick steel and covered with an insulating material of 5 mm thickness are 300^{0}C and 50^{0}C respectively. If the thermal conductivities of steel and insulating material are 58W/m^{0}C and 0.116 W/m^{0}C respectively, determine the rate of flow through the boiler wall. 7M

UNIT–III

5. State and explain the Buckingham's – π Theorem for dimensional analysis 14M

OR

6. a) Air at 27^{0}C and 1 atm flows over a flat plate at a speed of 2m/s. calculate the boundary layer thickness at a distance of 20cm and 40 cm from the leading edge of the plate. 7M

   b) Illustrate the development of hydrodynamic boundary layer inside a pipe. 7M

UNIT–IV

7. a) Water at atmospheric pressure is to be boiled in polished copper pan. The diameter of the pan is 380 mm and is kept at 115^{0}C. calculate the following:

   (i) Power required to boil the water. (ii) Rate of evaporation. (iii) Critical heat flux. 10M

   b) Discuss about Planck's law of Radiation 4M

OR

8. Explain pool boiling with neat sketch showing different regimes. 14M

UNIT–V

9. Derive an expression for the LMTD method of Counter flow heat exchangers? 14M

OR

10. a) Obtain the expression for LMTD of a Parallel flow heat exchanger. 8M

    b) Discuss briefly on Fouling factor. 6M

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Hall Ticket Number :										

R-15

Code: 5G554

III B.Tech. I Semester Supplementary Examinations Nov/Dec 2022

Design of Machine Elements-I

(Mechanical Engineering)

Max. Marks: 70 Time: 3 Hours

Answer *any five full questions* by choosing one question from each unit (5x14 = 70 Marks)

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UNIT–I

1. a) What are the manufacturing considerations to be considered by design? 7M

   b) An unknown weight falls through 10 mm on a collar rigidly attached to the lower end of a vertical bar 3 m long and 600 mm^2 in section. If the maximum instantaneous extension is known to be 2 mm, what is the corresponding stress and the value of unknown weight? Take E = 200 kN/mm^2. 7M

OR

2. a) Enumerate any four most commonly used engineering materials and state at least one important property and one application of each. 7M

   b) Find out the numbers of R10 basic series from 1 to 10. 7M

UNIT–II

3. a) Define endurance limit? Discuss the factors which affect the endurance limit of the material. 7M

   b) Determine the size of a piston rod subjected to a total load having cyclic fluctuation from 150 kN (tension) to 25 kN (compression). The endurance limit is 360 MPa and yield strength is 400 MPa. Take factor of safety = 1.5; surface finish factor = 0.88 and stress concentration factor = 2.25. 7M

OR

4. a) Describe Soderberg's criteria And derive the equation for designing of machine members subjected to dynamic load. 7M

   b) Determine the diameter of a circular rod made of ductile material with a fatigue strength (complete stress reversal), σ_e =265MPa and a tensile yield strength of 350MPa. The member is subjected to a varying axial load from W_{min}=– 300 × 10^3N to W_{max}=700×10^3N and has a stress concentration factor = 1.8. Use factor of safety as 2.0. 7M

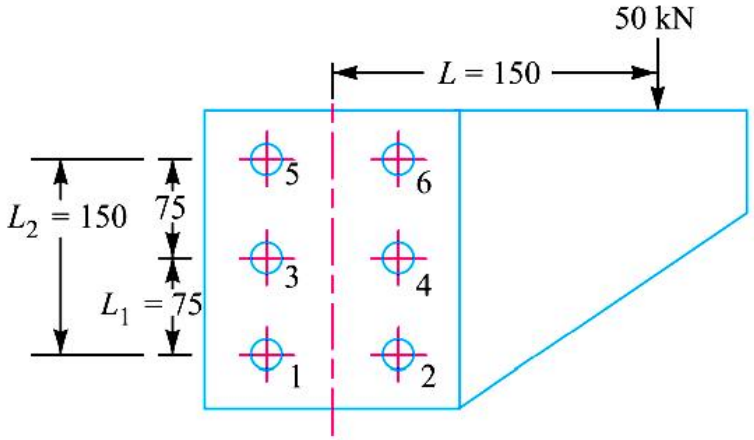
UNIT–III

5. a) List out the advantages and disadvantages of screw joints. 7M

b) An electric motor weighing 10 kN is lifted by means of an eye bolt. The eye bolt is screwed into the frame of the motor. The eye bolt has coarse threads. It is made of plain carbon steel 30C8 (S_{yt}=400 N/mm^2) and the factor of safety is 6. Determine the size of the bolt. 7M

OR

6. a) A bracket is bolted to a column by 6 bolts of equal size as shown in Fig. It carries a load of 50 kN at a distance of 150 mm from the centre of column. If the maximum stress in the bolts is to be limited to 150MPa, determine the diameter of bolt.



14M

UNIT–IV

7. a) Design a sleeve and cotter joint to resist a tensile load of 60 kN. All parts of the joint are made of the same material with the following allowable stresses: σ_t = 60 MPa ; τ = 70 MPa ; and σ_c = 125 MPa 14M

OR

8. a) What are the applications of knuckle joint? 4M

b) Design a knuckle joint to transmit 140 kN, with permissible stresses in tension; shear and compression are 75 Mpa; 60 Mpa and 150 Mpa respectively. 10M

UNIT–V

9. a) How the shaft is designed when it is subjected to twisting moment and bending moment? 6M

b) A shaft is transmitting 100 kW at 180 r.p.m. If the allowable shear stress in the material is 60 MPa, find the suitable diameter for the shaft. The shaft is not to twist more than 1° in a length of 3 m. Take C = 80 GPa. 8M

OR

10. a) Classify the shaft coupling. 6M

b) Design of a muff coupling which is used to connect two steel shafts transmitting 40 kW at 350 r.p.m. The material for the shafts and key is plain carbon steel for which allowable shear and crushing stresses may be taken as 40 MPa and 80 MPa respectively. The material for the muff is cast iron for which the allowable shear stress may be assumed as 15 MPa. 8M

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