PANDIAN SARASWATHI YADAV ENGINEERING COLLEGE

(Approved by AICTE & Affiliated to Anna University, Chennai)

Madurai - Sivagangai Highway, Arasanoor, Thirumansolai Post, Sivagangai Dt - 630 561, Tamilnadu
Mobile 9842102628, 7373002628 Email info@psyec.edu.in Website www.psyec.edu.in

City Office : 10, Pandian Saraswathi St, Sivagami Nagar, Narayanapuram, Madurai - 625 014. Telefax- 0452 2682338, Mobile : 98423-02628

Department of Mechanical Engineering,

Academic Year 2022-23

Internal Assessment Test I

Sub Code: **ME8593** Sub Name: **Design of Machine Elements**

Year /SEM: **III / V** Date:04.03.2023

Max. Marks: 50 Marks Duration: 11.20 am- 01.00 pm (90 Minutes)

Part-A (7×2=14)

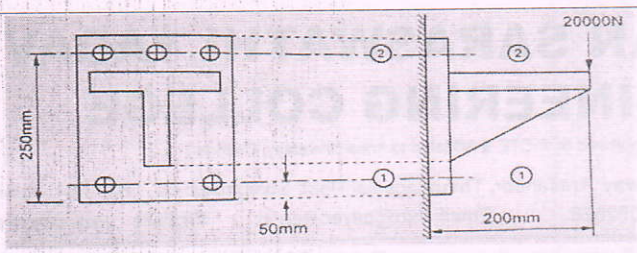
Answer all the questions

Q. No.	Question	M	CO	BTL
1	Give Classification of Couplings 2.197 -38	2	2	2
2	Difference between keys and splines?2.195-28	2	2	1
3	State different types of keys. (2.194-22)	2	2	2
4	Give advantages of threaded joints(3.220-16)	2	3	2
5	State two types of eccentric welded connections.(3.227-57)	2	3	4
6	Determine the safe tensile load for bolt M20 assuming a safe tensile stress of 40MPa(3.219-12)	2	3	2
7	How is a bolt designated? Give examples(3.218-8)	2	3	2

Part-B (3×12=36)

Answer all the questions

Q. No	Question	M	CO	BTL
8.	A rigid type of coupling is used to connect two shafts transmitting 15 kW at 200 rpm. The shaft, keys and bolts are made of C45 steel and the coupling is of cast iron. Design the couplings.2.90	**12**	**2**	**4**
9.	A bracket is shown in figure is fitted to a wall with 5 bolts, three at the top and two at the bottom with all the bolts equally spaced. A load of 20000N is acting at an eccentricity of 200mm. Vertical distances of first and second rows from the hinge point are 50 mm and 250 mm respectively. Select a suitable bolt size for this application.3.39	**12**	**3**	**3**

				
10	Design a knuckle joint for tie rod of circular section for a maximum pull of 70 kN. The ultimate strength of material against tearing is 420 N/mm^2. The shearing strength of material is 396 N/mm^2. Take FOS=6.(unit -3 Problem 6)	12	3	4

Prepared by

HOD

Principal

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Max. Marks: 50 Marks Duration: 11.20 am- 01.00 pm (90 Minutes)

Part-A (7×2=14)

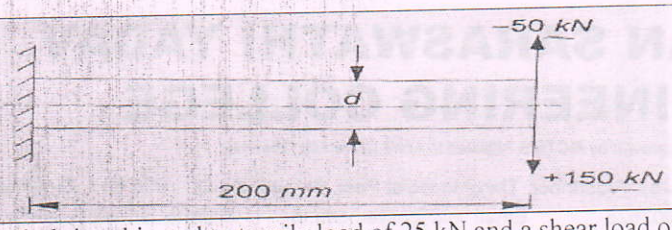
Answer all the questions

Q. No	Question	M	CO	BTL
1	Write down the factors influencing machine Design (1.216-4)	2	1	1
2	Describe the material properties of Hardness, Stiffness and Resilience (1.217-9)	2	1	1
3	Define Stress Concentration factor (1.216-59)	2	1	2
4	Draw the Goodman and Soderberg diagrams and locate the safe design regions (1.216-74)	2	1	3
5	What is the main use of woodruff key? (1.216-4)	2	2	3
6	Define Equivalent bending moment (2.190-6)	2	2	3
7	A shaft of 70 mm long is subjected to shear stress of 40MPa and has an angle of twist equal to 0.017 radian. determine the diameter of the shaft? (2.191-9)	2	2	4

Part-B (3×12=36)

Answer all the questions

Q. No	Question	M	CO	BTL
8.	A Cantilever rod of length of 120mm with circular cross section is subjected to a cyclic transverse load varying from -50N to 150N at its free end. Determine the diameter of the rod, by (i) Goodman and (ii) Soderbeg method using the following data, FOS=2, theoretical stress Concentration factor=1.4, Notch sensitive factor=0.9, Ultimate strength =550MPa, Yield strength is 320 MPa, Endurance limit is 275 MPa, Size correction factor=0.85 and Surface Correction factor=0.9(1.197)	**12**	**1**	**4**

				
9.	A bolt is subjected to tensile load of 25 kN and a shear load of 10kN. The yield strength of the bolt material is 300 MPa. Considering a FOS 2.5. Determine the diameter of the bolt using (i) Maximum normal stress theory (ii) Maximum shear Stress theory (iii) Maximum principal strain theory. Take poisson ratio as 0.25. **(1.117-1.119)**	12	1	3
10	Design rigid flange couplings to transmit a torque of 250 N-m between two coaxial shafts. The shaft is made of alloy steel, flanges are of cast iron and bolts are of steel. Four bolts are used to couple the flanges. The shafts are keyed to the flange hub. The permissible stresses are given below (a) Shear stress on shaft = 100 MPa (b) Bearing or crushing stress on shaft = 250MPa (c) Shear stress on keys = 100 MPa (d) Bearing stress on keys =250MPa (e) Shearing stress on cast iron =200MPa (f) Shear stress on bolts =100MPa After designing the various elements, make a neat sketch of the assembly indicating the important dimensions. Check stresses developed in the various members, if thumb rules are used for fixing the dimensions. (unit Notes1- last question)	12	3	4

R. P.
Prepared by

M. Radha
HOD

Principal

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Department of Mechanical Engineering,

Academic Year 2022-23

Model Exam

Sub Code: **ME8593** Sub Name: **Design of Machine Elements**

Year /SEM: **III / V** Date:04.03.2023

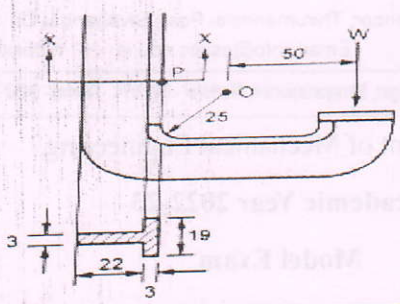
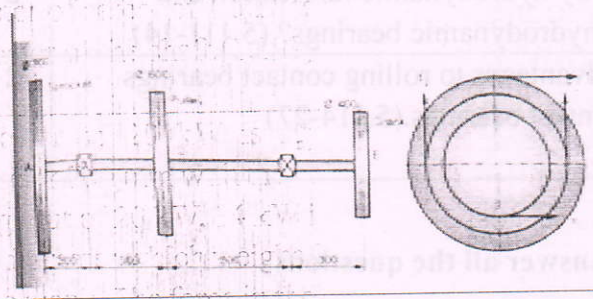
Max. Marks: 50 Marks Duration: 01.00 pm- 04.00 pm (3 Hours)

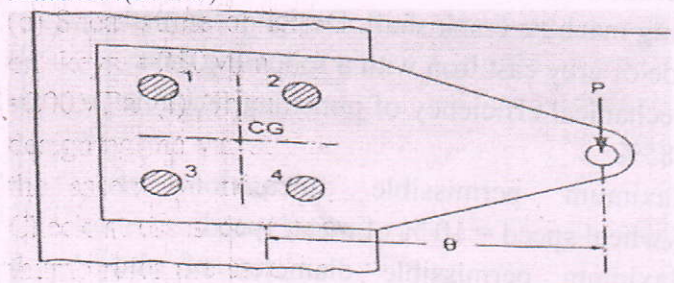
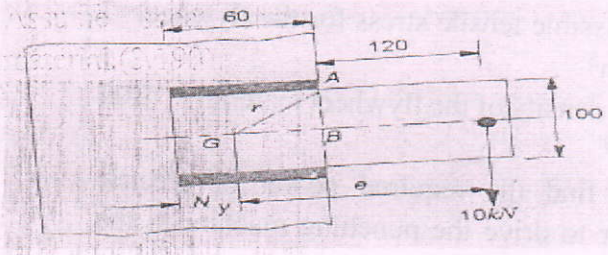
Part-A **Answer all the questions** **(10×2=20)**

Q. No	Question	M	CO	BTL
1	Describe the material properties of Hardness, Stiffness and Resilience (1.217-9)	2	1	1
2	What are the unilateral and bilateral tolerances?1.220-25	2	1	1
3	Differentiate between rigid coupling and flexible coupling 2.195-28	2	2	2
4	Define the term critical speed of a shaft?2.193-18	2	2	3
5	State the disadvantages of welding 3.223-36	2	3	3
6	List out three conditions where tap bolts are used (3.219-10)	2	3	2
7	Define the term of fluctuation speed and Energy (4.302-59)	2	4	2
8	Distinguish between close coiled and open coiled springs. (4.292-7)	2	4	4
9	What is meant by hydrodynamic lubrication and advantages of hydrodynamic bearings? (5.111-14)	2	5	4
10	List are four advantages to rolling contact bearings over sliding contact bearings.(5.114-27)	2	5	2

Part-B **Answer all the questions** **(5×13=65)**

Q. No	Question	M	CO	BTL

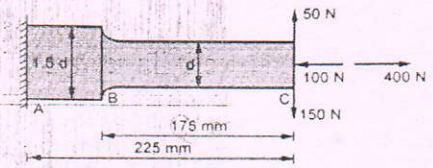
11.(a)	A C clamp is subjected to a maximum load of W, as shown in fig. If the maximum tensile stress in the clamp is limited to 130 MPa. Find value of W(1.106)  	**13**	**1**	**4**
	OR			
11.(b)	A transmission shaft made of C45 steel is subjected to a fluctuating torque varying from 100N-m to 500N-m. Also a fluctuating bending moment acts on the shafts which varies from 500N-m to -50 N-m. let the stress concentration factor to be2. The shaft is machined , for a factor of safety of 1.5.Determine the required diameter of the shaft.(1.199)	**13**	**1**	**3**
12.(a)	A power of 20 kW is supplied to the sprocket of diameter 700 mm with the help of chain drive as shown in fig. out of 20 kW, 14 kW is taken off at pulley of 600 mm diameter which weighs 3 KN and remaining power at the crank. The force in the chain is represented by Tc. Ratio of belt tensions in the pulley is 4:1. The shaft is rotating at 280 rpm. Take K_b= 2 and K_t= 1.5. Design the shat if Sys= 60 N/mm^2 by assuming that the sprocket and pulley are keyed to the shaft (unit 2 notes problem 7) 	**13**	**2**	**4**
	OR			
12.(b)	Design rigid flange couplings to transmit a torque of 250 N-m between two coaxial shafts. The shaft is made	**13**	**2**	**3**

	of alloy steel, flanges are of cast iron and bolts are of steel. Four bolts are used to couple the flanges. The shafts are keyed to the flange hub. The permissible stresses are given below (a) Shear stress on shaft = 100 MPa (b)Bearing or crushing stress on shaft = 250MPa (c) Shear stress on keys = 100 MPa (d)Bearing stress on keys =250MPa (e)Shearing stress on cast iron =200MPa (f) Shear stress on bolts =100MPa After designing the various elements, make a neat sketch of the assembly indicating the important dimensions. Check stresses developed in the various members, if thumb rules are used for fixing the dimensions (unit 2 notes problem 11)			
13.(a)	A structural connection shown in figure is subjected to an eccentric force P of 10kN wit an eccentricity of 500 mm. The centre distance between bolts 1 and 2 is 200 mm and 1 and 3 is 150 mm. all the bolts are identical. Assume shear stress 80 N/mm^2 for the bolt material.(3.190)  	**13**	**3**	**4**
	OR			
13.(b)	A bracket shown figure carries a load of 10kN. Find the size of the weld if the allowable shear stress is not exceed 75 N/mm^2(3.116)  	**13**	**3**	**4**
	OR			
14.(a)	It is required to design a helical compression spring of circular wire, subjected to an axial load, which varies from 2.5 kN to 3.5 kN . For this range of load, the	**13**	**4**	**4**

	deflection of the spring should be limited to 5mm.The spring index is 5. The spring has square and ground ends. For spring wire material ultimate strength 1050 MPa and G=81370 MPa. The permissible shear stress for the spring wire should be taken as 50% of the ultimate strength. Calculates (i)Wire diameter and mean coil diameter (ii) Number of active coils and total number of coils (iii) Solid length of spring (iv) Free length of spring (v) Required spring rate and Actual spring rate(unit 4 notes problem 4)			
	OR			
14.(b)	A punching machine, with a capacity to punch 30 holes of 20 mm diameter per minute in a steel plate of 15 mm thickness and having ultimate shear stress of 250 N/mm2 is powered by a flywheel through a gear reducer having reduction ratio of 10:1. The actual punching operation last for 1/5 of the angular rotation of the punching machine crank shaft. Design a rimmed flywheel made of grey cast iron with a following data: (i) Mechanical efficiency of punching machine = 85% (ii) Maximum permissible fluctuation of flywheel speed = 10 % of mean speed (iii) Maximum permissible diameter of the flywheel =1.0 m (iv) Contribution of the rim to the flywheel effect =90% (v) Flywheel rim width to thickness ratio=2.0 (vi) Number of arms =6 (vii) Permissible tensile stress for the flywheel=7 N/mm^2 (viii) Mass density of the flywheel material = 7200 kg/m^3 (ix) Also find the required power of electric motor to drive the punching machine if the mechanical efficiency of transmission system is 90% (unit 4 notes problem 9)	**13**	**4**	**3**
	OR			
15.(a)	The following data is given for a 360° hydrodynamic bearing: Radical load =3.2 kN, journal speed =1490	**13**	**5**	**4**

	rpm. Journal diameter=50 mm, Bearing length =50 mm, Radial clearance=0.05 mm, Viscosity of lubricant=25cP Assuming that the total heat generated in the bearing is carried by the total oil flow in the bearing, Calculate (i) Co efficient of friction (ii) Power lost in friction (iii) Minimum oil film thickness (iv) flow requirements in litres /min and (v) Temperature rise.(unit 5 notes problem-1)			
	OR			
15.(b)	A shaft of length 1.2 m is supported on two identical deep groove ball bearings. The shaft is fixed with a gear at its centre which is rotating at 720 rpm. The tangential and radial force components for the gear are 1kN and 0.8 kN respectively. Expected life of the bearings is 15000 hours with a reliability of 80%. Neglecting the effect of axial force (if any) calculate the dynamic load rating for the bearings so that they can directly be selected from manufacturer's catalogue. Use following data: Load factor 1.25, $L=6.8441\ L10[\log_e(1/R)]^{0.8547}$.(unit 5 notes problem-7)	**13**	**5**	**3**

Part C Answer all the questions **(1×15=15 marks)**

Q. No	Question	M	CO	BTL
16.(a)	A cantilever beam made of cold draw steel 35C8 (Sut = 550 MPa and Syt=320 MPa) is subjected to transverse loading at its end. It varies from 50N (up) to 150 N (down) and an axial load varies from 100N (Compressive) to 400N (tensile). The surface finish factor and size factor are 0.9 and 0.85 respectively. The load factor is 0.923 and modifying factor for stress concentration is 0.68. If FOS = 2, Determine the required diameter of the section for infinite life of the beam  	15	1	4
	OR			

16.(b)	An engine runs at a constant load at a speed of 480 rpm. The crank effort diagram is drawn to a scale 1mm= 200 N-m torque and 1mm=3.60 crank angle. The areas of the diagram above and below the mean torque line in sq.mm are in the following order: +110,- 132, +153,-166,+197,-162. Design the flywheel if the total fluctuation of speed is not to exceed 5 MPa. Assume that the rim breadth is approximately 2.5 times the rim thickness and 90% of the moment of inertia is due to rim. The density of the material of the flywheel is 7250 kg/m3	15	2	4

Prepared by

HOD

Principal