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Code No. : 15549 S N/O

VASAVI COLLEGE OF ENGINEERING (*AUTONOMOUS*), HYDERABAD

Accredited by NAAC with A++ Grade

B.E. (Mech. Engg.) V-Semester Supplementary Examinations, June-2023

Design of Machine Elements

Time: 3 hours

Max. Marks: 60

Note: Answer all questions from Part-A and any FIVE from Part-B

Part-A (10 × 2 = 20 Marks)

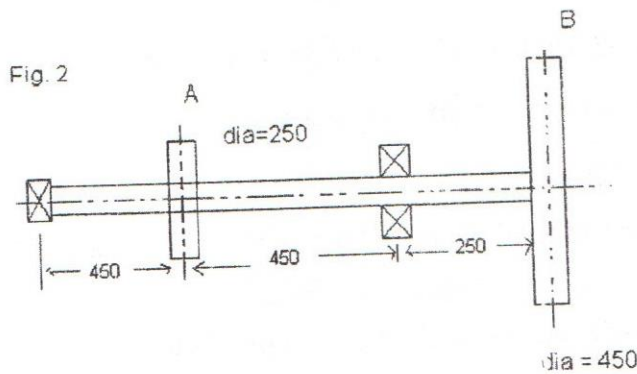
Q. No.	Stem of the question	M	L	CO	PO
1.	How are steels designated?	2	1	1	1
2.	What are preferred numbers? Explain with example.	2	1	1	1
3.	What is stress concentration? Define stress concentration factor?	2	2	2	1
4.	Draw S-N diagram for ferrous and nonferrous materials	2	3	2	2
5.	State the uses of flexible coupling.	2	1	3	1
6.	Mention the advantages and limitations of hollow shaft over solid shaft.	2	1	3	1
7.	Differentiate between through bolt and stud. Draw simple sketches.	2	3	4	1
8.	Mention different types of locking devices. Sketch one locking device neatly	2	1	4	2
9.	When do you prefer a compound screw? Give its applications?	2	1	5	1
10.	Explain the term efficiency of a riveted point.	2	1	5	1
<b>Part-B (5 × 8 = 40 Marks)</b>					
11. a)	What are the factors in which factor of safety depends?	2	1	1	1
b)	The load on bolt consists of an axial pull of 10 kN together with a transverse shear force 5kN . find the diameter of the bolt required according to a) Tresca theory. B) Rankine theory. C) Von-Mises theory. Assume yield strength as 100MPa Factor of safety 2.5 and $\mu=0.25$ .	6	2	1	4
12. a)	Define fatigue strength and what factors effect fatigue strength.	2	2	2	1
b)	A shaft of 800mm length is simply supported at its ends. It is subjected to a central concentrated load that varies from 40 to 60 kN. Determine the diameter of the shaft taking a factor of safety as 2, the size correction factor of 0.8 and the surface correction factor of 0.9. the material properties are: ultimate strength = 600MPa; yield strength = 350 MPa and the endurance limit = 300 MPa. Take the fatigue stress concentration factor as 1.5.	6	3	2	4

13. a) Sketch muff coupling to connect two shafts of diameter 50mm and show their dimensions.

2 2 3 1

b) A line shaft is supporting two pulleys A and B as shown in fig.2. Power is supplied to the shaft by means of a vertical belt on pulley A, which is then transmitted to pulley 'B' which is carrying a horizontal belt. The ratio of belt tensions on tight and loose sides is 3:1 and the maximum in either belt is limited to 3KN. The shaft material has  $S_{ut} = 650\text{N/mm}^2$  and  $S_{yt} = 380\text{N/mm}^2$ . The pulleys are keyed to the shaft. Determine the diameter according to A.S.M.E.code. All dimensions are in mm.

5 3 3 4

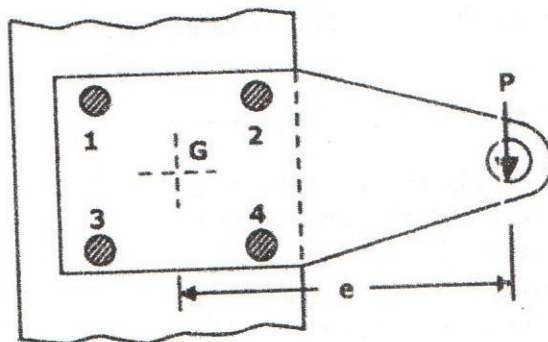


14. a) Name the various types of standard thread profiles used in mechanical industry.

2 2 4 2

b) A bracket is supported by means of 4 bolts of same size as shown in fig. Determine the nominal diameter of the bolt if the shear stress is limited to  $100\text{N/mm}^2$ . Load 'P' acting on the bolt is 50 kN, eccentricity 'e' is 250mm, gap between each bolt in both horizontal and vertical direction is 100 mm.

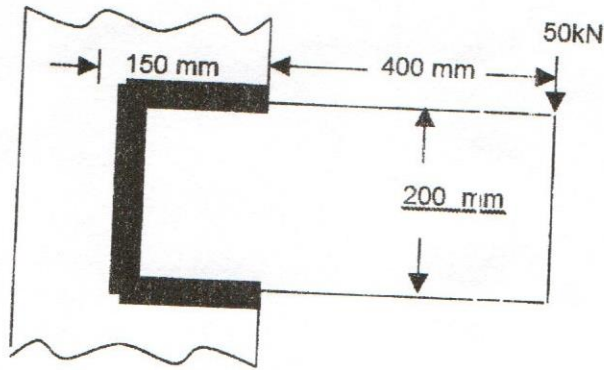
6 4 4 4



15. a) Define the term pitch, back pitch, and diagonal pitch. show them for a double riveted single cover butt joint.

2 2 5 1

b) Determine the fillet weld size required for a flat plate loaded as shown in figure below. Allowable shear stress is not to exceed  $100 \text{ N/mm}^2$ .



6 4 5 4

16. a) Design socket and cotter in socket and spigot joint to connect two tension rods subjected to an axial load of 15 KN. Consider  $\sigma_t = 65 \text{ MPa}$ ,  $\tau = 50 \text{ MPa}$  and  $\sigma_c = 80 \text{ MPa}$ .

4 2 1 4

b) Explain Miner's cumulative fatigue damage.

4 2 2 1

17. Answer any *two* of the following:

a) Design a cast iron protective type flange coupling to transmit 15KW at 900 RPM from an electric motor to a compressor. The service factor may be assumed as 1.35. The following permissible stresses may be used: Shear stress for shaft, bolt and key material = 40MPa, Crushing stress for bolt and key = 80MPa, Shear stress for cast iron = 8 MPa, Take suitable assumptions

4 2 3 4

b) Write a short note on Bolt of uniform strength.

4 2 4 1

c) A triple riveted lap joint with zig-zag riveting is used to connect 2 plates of 20 mm thickness. Draw the sketch and find the efficiency of the joint. Take  $\sigma_t = 120 \text{ MPa}$ ,  $\tau = 100 \text{ MPa}$  and  $\sigma_c = 150 \text{ MPa}$ .

4 2 5 4

M : Marks; L: Bloom's Taxonomy Level; CO; Course Outcome; PO: Programme Outcome

i)	Blooms Taxonomy Level - 1	20%
ii)	Blooms Taxonomy Level - 2	40%
iii)	Blooms Taxonomy Level - 3 & 4	40%

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