Hall Ticket Number:

Code No. : 14516 N/O

VASAVI COLLEGE OF ENGINEERING (Autonomous), HYDERABAD
B.E. (Mech. Engg. : CBCS) IV-Semester Main & Backlog Examinations, May-2019

Design of Machine Elements

Time: 3 hours

Max. Marks: 60

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

Q.No.	Stem of the question	M	L	CO	PO
	Part-A (10 × 2 = 20 Marks)				
1.	Compare strength and stiffness using a stress strain curve for ductile materials?	2	2	1	1
2.	What are the advantages of preferred numbers used in design?	2	1	1	1
3.	Why stress concentration is not that much important for ductile materials subjected to static loading when compared to dynamic loading?	2	2	2	1
4.	What are the various methods to reduce stress concentration in bolts?	2	2	2	1
5.	What are the differences between saddle keys and sunk keys?	2	2	3	1
6.	Highlight advantages of flexible coupling.	2	2	3	1
7.	Though cotter joints and couplings are used to connect members, Under what loading conditions each of them is used?	2	2	4	1
8.	What are the possible failures of cotter if it is perfectly tightened?	2	1	4	1
9.	Why metric V threads are generally not used in power transmission?	2	2	5	1
10.	Define parallel fillet and transverse fillet weld	2	1	5	1
	Part-B (5 × 8 = 40 Marks)				
11. a)	How are plain carbon steels designated according to BIS?	2	1	1	1
b)	The stress induced at a critical point in a machine component having yield strength 380 MPa are σ_x=100 MPa, σ_y= 40 MPa, τ_{xy}= 80 MPa. Calculate factor of safety by i) Maximum shear stress theory ii) Maximum principal stress theory. iii) Distortion energy theory.	6	3	1	2
12.	A steel cantilever is 200 mm long shown in figure. It is subjected to an axial load which varies from 150 N (compression) to 450 N (tension). The cantilever is of circular cross-section. It is of diameter 2d for the first 50 mm and of diameter d for the remaining length. Determine its diameter taking a factor of safety of 2. Assume the following values: Yield stress = 330 Mpa, Endurance limit in reversed loading = 300 Mpa, Correction factors = 0.7 in reversed axial loading.	8	4	2	2

13. a)	Explain the effect of keyway on the strength of a shaft.	2	2	3	1
b)	Design and sketch 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 assumed: Shear stress for shaft, key and bolt material = 40MPa, Crushing stress for bolt and key = 80MPa, Shear stress for cast iron material = 8MPa.	6	4	3	3
14. a)	Explain bolt of uniform strength with the help of sketches.	2	2	4	1
b)	Design a knuckle joint to connect two tension rods subjected to an axial load of 15 KN. Consider σ_{yt} = 65 MPa, τ = 50 MPa and σ_c = 80 MPa.	6	4	4	3

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15.	A rectangular steel plate is welded as a cantilever to a vertical column and supports a single concentrated load P, as shown in Fig. Calculate the weld size if shear stress in the same is not to exceed 140MPa.	8	3	5	2

16. a)	An unknown weight falls through 15 cm on a collar rigidly attached to the lower end of a vertical bar 3.2 m long and 6 cm^2 in section. if the maximum instantaneous extension is known to be 2.1 mm. what is the corresponding stress and the value of unknown weight? Given E=200 GPa.	4	3	1	2

b)	The work cycle of a mechanical component (50C4) subjected to completely reversed bending stresses consists of the following 3 elements.
	
	    a. ±550MPa for 87% of time
	    b. ±400MPa for 10% of time
	    c. ±500MPa for 3% of time
	
	Ultimate strength of the material is 660MPa, Corrected endurance strength is 280 Mpa. Determine the life of the component.
		4	2	2	2

17.	Answer any *two* of the following:				
a)	The standard cross section for a flat key, which is fitted on a 50 mm diameter shaft, is 16 X10mm. The key is transmitting 475 N-m torque from the shaft to the hub. The key is made of commercial steel (yield strength in tension = yield strength in compression = 230 N/mm^2). Determine the length of the key, if the factor of safety is 3.	4	2	3	2
b)	A steel plate subjected to a force of 5 kN and fixed to a channel by means of 3 identical bolts is shown in fig. below. The bolts are made from plain carbon steel 45C8 (σ_{yt} = 380 N/mm^2) and the factor of safety is 3. Specify the size of bolts.	4	3	4	3

c)	Deduce an expression for the efficiency of square threaded screw? $$\eta = \frac{\tan \alpha}{\tan(\emptyset + \alpha)}$$	4	3	5	2

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

S. No.	Criteria for questions	Percentage
1	Fundamental knowledge (Level-1 & 2)	42.5%
2	Knowledge on application and analysis (Level-3 & 4)	57.5%
3	*Critical thinking and ability to design (Level-5 & 6) (*wherever applicable, subject to a maximum of 10%)	NIL

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