Sub Code: R2322035

R23

Set No. 1

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY-GURUJADA VIZINAGARAM
II B. TECH II SEMESTER SUPPLIMENTRY EXAMINATIONS NOV -2025
DESIGN OF MACHINE MEMBERS
(DEPARTMENT OF ME)

Time: 3 hours **Max. Marks: 70**

The Question paper consists of Part A & Part B.
Part A is compulsory, Answer all questions. Part B Answers any one question from each unit.
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1		PART-A	(20Marks)
	a)	What is fatigue life?	[2]
	b)	Explain the modified Goodman diagram for torsional shear stresses.	[2]
	c)	What is bolt of uniform strength?	[2]
	d)	What are the disadvantages welded joints?	[2]
	e)	What types of stresses are induced in shafts?	[2]
	f)	What is universal coupling? Give its applications.	[2]
	g)	What is the difference between the clutch and the brake?	[2]
	h)	What is nip of leaf spring?	[2]
	i)	In a gear speed reducer, why is the diameter of an output shaft greater than input shaft?	[2]
	j)	What are the applications of sliding-contact bearing?	[2]
		PART-B	(50Marks)
		Unit - I	
2	a)	Discuss about various theories of failures.	[5]
	b)	What is notch sensitivity? Discuss about notch sensitivity factor.	[5]
		(OR)	
3	a)	A plate made of steel 20C8 (S_{ut}=420 N/mm^2) in hot rolled and normalized condition is shown in Fig. 1. It is subjected to a completely reversed axial load of 25kN. The notch sensitivity factor q can be taken as 0.8 and the expected reliability is 90%. The factor of safety is 2. The surface finish factor 0.6, size factor 0.8 and the theoretical stress concentration factor is 2.51. Determine the plate thickness for infinite life.	[10]

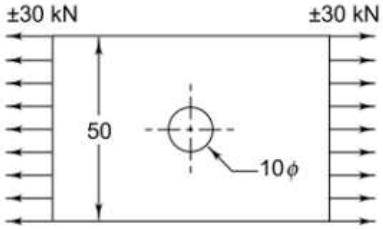

Fig. 1

Unit - II

4	a)	A bracket for supporting the travelling crane is shown in Fig. 2. The bracket is fixed to the steel column by means of four identical bolts, two at A and two at B. The maximum load that comes on the bracket is 5 kN acting vertically downward at a distance of 250 mm from the face of the column. The bolts are made of steel 40C8 (S_{yt} = 380 N/mm^2) and the factor of safety is 5. Determine the major diameter of the bolts on the basis of maximum principal stress. Assume (d_c = 0.8d)	[10]

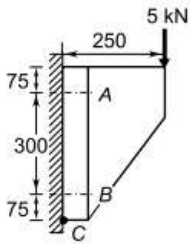

Fig. 2

(OR)

5 a) A steel plate, 100 mm wide and 10 mm thick, is welded to another steel plate by means of double parallel fillet welds as shown in Fig. 3. The plates are subjected to a static tensile force of 50 kN. Determine the required length of the welds if the permissible shear stress in the weld is 94 N/mm^2. [5]

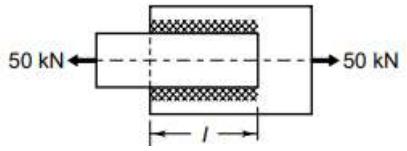

Fig. 3

b) A circular shaft, 50 mm in diameter, is welded to the support by means of circumferential fillet weld as shown in Fig. 4. It is subjected to torsional moment of 2500 N-m. Determine the size of the weld, if the permissible shear stress in the weld is limited to 140 N/mm^2. [5]

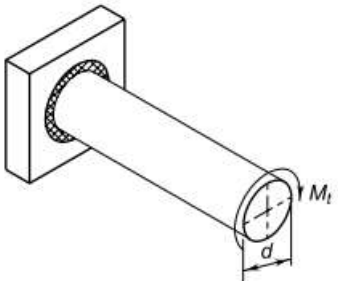

Fig. 4

Unit - III

6 a) A line shaft supporting two pulleys A and B is shown in Fig. 5. Power is supplied to the shaft by means of a vertical belt on the pulley A, which is then transmitted to the pulley B carrying a horizontal belt. The ratio of belt tension on tight and loose sides is 3:1. The limiting value of tension in the belts is 2.7 kN. The shaft is made of plain carbon steel 40C8 (S_{ut} = 650 N/mm^2 and S_{yt} = 380 N/mm^2). The pulleys are keyed to the shaft. Determine the diameter of the shaft. [10]

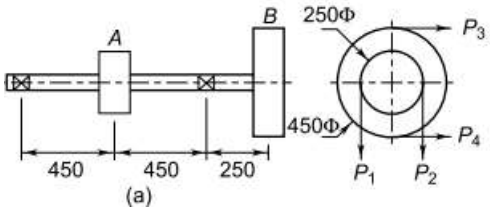

Fig. 5

(OR)

7 a) Explain the design procedure for rigid flange coupling. [10]

Unit - IV

8 a) A plate clutch consists of one pair of contacting surfaces. The inner and outer diameters of the friction disk are 100 and 200 mm respectively. The coefficient of friction is 0.2 and the permissible intensity of pressure is 1 N/mm^2. Assuming uniform-wear theory, calculate the power-transmitting capacity of the clutch using uniform pressure theory at 750 rpm. [5]

b) Differentiate self-energizing and self-locking brake. [5]

(OR)

9 a) It is required to design a helical compression spring subjected to a maximum force of 1250 N. The deflection of the spring corresponding to the maximum force should be approximately 30 mm. The spring index can be taken as 6. The spring is made of patented and cold-drawn steel wire. The ultimate tensile strength and modulus of rigidity of the spring material [10]

are 1090 and 81 370 N/mm2 respectively. The permissible shear stress for the spring wire should be taken as 50% of the ultimate tensile strength. Design the spring and calculate: (i) wire diameter; (ii) mean coil diameter; (iii) number of active coils; (iv) total number of coils; (v) free length of the spring; and (vi) pitch of the coil. Draw a neat sketch of the spring showing various dimensions. Assume a gap of 1 mm between adjacent coils under maximum load condition. The spring has square and ground ends. The number of inactive coils is 2.

Unit - V

10 a) In a particular application, the radial load acting on a ball bearing is 5 kN and the expected life for 90% of the bearings is 8000 h. Calculate the dynamic load carrying capacity of the bearing, when the shaft rotates at 1450 rpm. [5]

b) Explain failures in sliding contact bearings. [5]

(OR)

11 a) A pair of spur gears consists of a 20 teeth pinion meshing with a 120 teeth gear. The module is 4 mm. Calculate (i) the centre distance; (ii) the pitch circle diameters of the pinion and the gear; (iii) the addendum and dedendum; (iv) the tooth thickness; (v) the bottom clearance; and (vi) the gear ratio [10]

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