CBCS SCHEME

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BME602

Sixth Semester B.E./B.Tech. Degree Examination, June/July 2025
Machine Design

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Use of Design data hand book is permitted.
3. Missing data can be assumed.
3. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	List and explain theories of material failure.	10	L2	CO2
	b.	A 50 mm diameter steel rod supports 9 KN load and in addition it is subjected to a torsion moment of 100 N-m as shown in Fig. Q1 (b). Identify maximum tensile and maximum shear stress.	10	L2	CO2

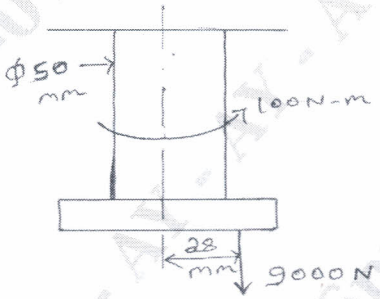


Fig. Q1 (b)

OR

Q.2	a.	Derive Soderberg's and Goodman equation for designing member subjected to fatigue loading.	10	L2	CO2
	b.	A notched flat plate shown in Fig. Q2 (b) is subjected to bending moment of 10 N-m. Identify the maximum stress induced in the member by taking the stress concentration into account.	10	L3	CO1

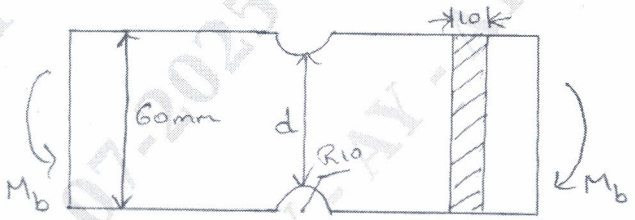
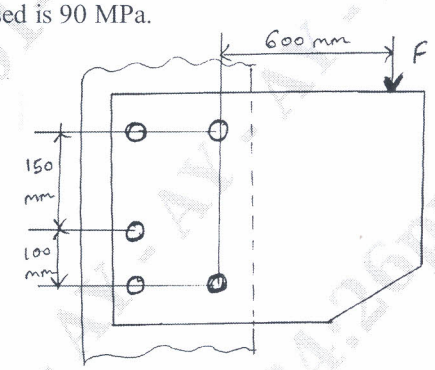


Fig. Q2 (b)

Module – 2

Q.3		Design the shaft of armature of a motor. If the magnetic poll on the shaft is equivalent to a uniformly distributed load of 10 N per mm length over the middle one third of 600 mm length of shaft between bearings. The motor transmits a power of 15 kW @ 1200 rpm. The allowable shear stress is 50 MPa. Take $C_m = 1.5$ and $C_t = 1.25$.	20	L3	CO3

		OR			
Q.4	**a.**	Show that the squeeze key is equally strong in shear and compression.	**4**	**L4**	**CO3**
	b.	A rectangular C/S key 8*7*36 is used to transmit 6 kW @ 1200 rpm. The shaft diameter is 30 mm. If the allowable shear and crushing stress for key material are 60 MPa and 135 MPa respectively and find whether key is safe or not.	**6**	**L4**	**CO3**
	c.	Design a rigid flange coupling to transmit 18 kW @ 1440 rpm. The allowable shear stress for CI flange is 4 MPa. The shafts, keys and bolts are made of annealed steel having allowable shear stress of 93 MPa. Allowable crushing stress for key is 186 MPa. Assume key way factor as 0.75.	**10**	**L4**	**CO3**
		Module – 3			
Q.5	**a.**	A double riveted butt joint with two cover plates for the longitudinal seam of a boiler shell 1.5 m in diameter subjected to a pressure of 0.95 MPa. Assume an efficiency of 75%, allowable tensile strength in the plate 90 MPa, allowable crushing stress 140 MPa and allowable shear stress 56 MPa. Design and interpret efficiency of the joint.	**10**	**L4**	**CO3**
	b.	Calculate the safe load that can be applied to an eccentrically loaded riveted bracket as shown in Fig. Q5 (b). The allowable shear stress for 25 mm diameter rivets used is 90 MPa.  Fig. Q5 (b)	**10**	**L3**	**CO3**
		OR			
Q.6		Investigate the design requirements for a pair of spur gears to transmit a power of 18 kW from a shaft running @ 1000 rpm to a parallel shaft running @ 250 rpm, maintaining a centre distance of 160 mm between the shaft centres. Suggest suitable surface hardness for the gear pair.	**20**	**L4**	**CO4**
		Module – 4			
Q.7		Analyze the requirements for designing a pair of helical gears to transmit power of 15 kW @ 3200 rpm with a speed ratio of 4 : 1. Given that the pinion is made of cast steel with 0.4 % carbon content untreated and gear is made of high grade cast iron, with a helix angle of 26° and a minimum of 20 teeth on each gear. Suggest suitable surface hardness for gear and pinion.	**20**	**L4**	**CO4**
		OR			
Q.8		A pair of 20° FDI gear are to be designed to connect two shafts @ right angles having a velocity ratio 4:1, the gear is made of cast steel 0.2% untreated and the pinion is made up of C30 steel heat treated, the pinion has 20 teeth and transmit power of 40 kW @ 720 rpm. Design the bevel gears completely.	**20**	**L4**	**CO4**

		Module – 5			
Q.9	a.	Derive Petrofit equation for Journal bearing.	10	L3	CO5
	b.	A simple band brake of drum diameter 600 mm has a band passing over it with an angle of contact of 225°, while one end is connected to fulcrum, the other end is connected to the brake lever at a distance of 400 mm from the fulcrum. The brake lever is 1 m long. The brake is to absorb a power of 15 kW @ 720 rpm. Design the brake lever of rectangular C/S, assuming depth to be thrice the width. Take allowable stress 80 MPa.	10	L4	CO3
		OR			
Q.10	a.	Write a short note on Hydrodynamic theory of lubrication, showing pressure distribution and a graph of friction (Vs) speed.	10	L3	CO5
	b.	A 75 mm long full journal bearing of diameter 75 mm supports a radial load of 12 kN at the shaft speed of 1800 rpm. Assume the ratio of diameter to the radial clearance as 1000. The viscosity of oil 0.01 PaS at the operating temperature. Determine the following : (i) Sommerfeld number. (ii) The coefficient of friction based on Mckee's equation. (iii) Amount of heat generated.	10	L4	CO5

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