

Model Question Paper-1 with effect from 2022-23 (CBCS Scheme)

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6th Semester B.E. Degree Examination

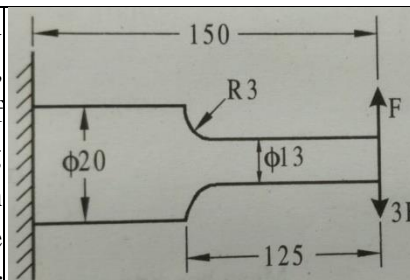
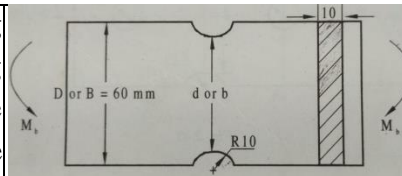
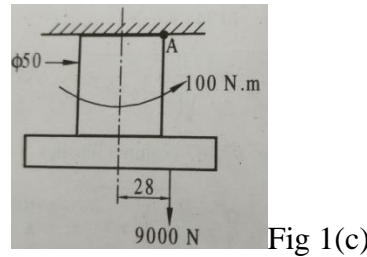
Machine Design (21ME63)

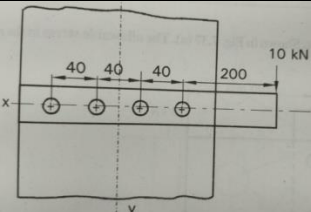
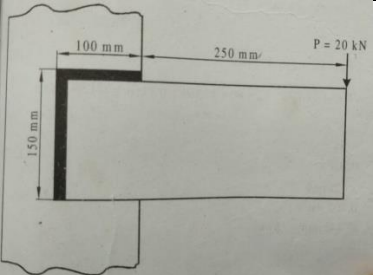
TIME: 03 Hours

Max.Marks:100

- Note: 01. Answer any **FIVE** full questions, choosing at least **ONE** question from each **MODULE**.
 02. Use of Machine Design Data Hand Book is permitted.
 03. Missing data may be suitably assumed.

Module-1			*Bloom's Taxonomy Level	Marks
Q.01	a	Enumerate important mechanical properties of engineering materials	L1	4
	b	A steel saw blade 1 mm thick is bent into an arc of a circle of 500 mm radius. Determine the flexural stress induced and bending moment required to bend the blade, which is 15mm wide. Take $E = 210$ GPa.	L3	8
	c	A 50 mm diameter steel rod supports a 9.0 kN load and in addition is subjected to a torsional moment of 100 N-m as shown in Fig.1(c). Determine the maximum tensile and the maximum shear stress.	L3	8
OR				
Q.02	a	A notched flat plate shown in Fig 2(a) is subjected to bending moment of 10 N-m. Determine the maximum stress induced in the member by taking the stress concentration into account.	L3	7
	b	Derive an expression for instantaneous stress due to axial impact	L2	6
	c	A cantilever beam made of cold drawn carbon steel ($\sigma_u = 550$ MPa, $\sigma_y = 470$ MPa, $\sigma_{-1} = 275$ MPa) of circular cross-section shown in Fig 2(c) is subjected to load which varies from $-F$ to $3F$. Determine the maximum load that the cantilever can withstand for an infinite life, using a factor of safety of 2.	L3	7



		Module-2			
Q.03	a	Design the shaft of the armature of a motor, if the magnetic pull on the shaft is equivalent to a uniformly distributed load of 10N per mm length over the middle one third of the 600 mm length of the shaft between bearings. The motor transmits a power of 15 kW at 1200 rpm. The allowable shear stress is 50 MPa. Take $C_m = 1.5$ and $C_t = 1.25$.		L3	16
	b	Mention the design steps for flange coupling		L1	4
		OR			
Q.04	a	Design a Flange Coupling to connect the shafts of a motor and centrifugal pump for the following specifications: Pump output = 3000 liters/minute; Total head = 20 m; Pump speed = 600 rpm; Pump efficiency = 70 %. Select C40 steel ($\sigma_y = 328.6$ MPa) for shaft and C35 steel ($\sigma_y = 304$ MPa) for bolts with factor of safety 2. Use allowable shear stress in cast iron flanges equal to 15 N/mm ² .		L3	16
	b	What are the types of springs?		L1	4
		Module-3			
Q.05	a	A double riveted lap joint is to be made between 9 mm plates. If the safe working stresses in tension, crushing and shear are 80 N/mm ² and 60 N/mm ² respectively, design the riveted joint.		L3	12
	b	A riveted bracket is supported by means of four rivets of same size as shown in Fig. Q5 (b). Determine the diameter of the rivet if the maximum shear stress in the rivet is 90 N/mm ² .		L3	8
		OR			
Q.06	a	A plate of 80 mm wide and 10 mm thick is to be welded to another plate by means of two parallel fillet welds. The plates are subjected to a load of 50 kN. Find the length of weld so that maximum stress does not exceed 50 N/mm ² . Consider the joint under static loading and then under dynamic loading.		L3	10
	b	A 16 mm thick plate is welded to a vertical support by two fillet welds as shown in Fig. 6 (b). Determine the size of weld, if the permissible shear stress for the weld material is 75 MPa.		L3	10
		Module-4			
Q.07		A pair of carefully cut spur gears with 20° full depth involute profile is used to transmit 12 kW at 1200 revolutions per minute of pinion. The gear has to rotate at 300 revolutions per minute. The material used for both pinion and gear is medium carbon steel whose allowable bending stress may be taken as 230 MPa. Determine the module and face width		L3	20

		of the spur pinion and gear. Suggest suitable hardness. Take 24 teeth on pinion. Modulus of elasticity may be taken as 210 GPa.		
OR				
Q.08		Design a pair of helical gears to transmit a power of 20kW from a shaft running at 1500 rpm to a parallel shaft to be run at 450 rpm. Suggest suitable hardness for the gear pair.	L3	20
Module-5				
Q.09	a	Design a single plate clutch consists of two pairs of contacting surfaces for a torque capacity of 200 Nm. Due to space limitations the outside diameter of the clutch is to be 250 mm.	L3	10
	b	A simple band brake of drum diameter 600 mm has a band passing over it with a angle of contact of 225° , while one end is connected to the fulcrum, the other end is connected to the brake lever at a distance of 400mm from the fulcrum. The brake lever is 1 m long. The brake is to absorb a power of 15 kW at 720 rpm. Design the brake lever of rectangular cross-section, assuming depth to be trice the width. Take allowable stress 80 MPa.	L3	10
OR				
Q.10	a	Write short note on Hydrodynamic Theory of lubrication, showing pressure distribution and a graph of friction v/s speed.	L2	10
	b	Explain the types of rolling contact bearings and their applications	L2	10