Model Question Paper-1 with effect from 2019-20 (CBCS Scheme)

USN | | | | | | | | | | |

Fifth Semester B.E. Degree Examination

Design of Machine Elements - I

TIME: 03 Hours **Max. Marks: 100**

Note: 01. Answer any **FIVE** full questions, choosing at least **ONE** question from each **MODULE**.
02. Missing data if any must be assumed suitably.

Module – 1			
Q.1	**(a)**	With flow diagram, Explain phases of design.	**05 Marks**
	(b)	List and explain the factors to be considered for selection of material for a machine component	**05 Marks**
	(c)	A 1mm thick Steel hacksaw Blade is bent into a circular arc of radius 500 mm. Determine the bending moment applied and the self-induced. The stress induced in the is 15mm. Modulus of elasticity 200 GPa.	**10 Marks**
OR			
Q.2	**(a)**	What is stress concentration explain with neat sketches any three methods to reduce stress concentration in machine elements	**10 Marks**
	(b)	A round rod of 60mm diameter is subjected to bending moment of 900 N-m and a twisting moment of 1200 N-m. Determine the maximum normal and shear stresses induced in the rod.	**10 Marks**
Module – 2			
Q.3	**(a)**	Derive an expression for impact strength in the axial bar of cross section 'A' and length 'l' due to an impact load 'W' falling from a height 'h' on the bar	**10 Marks**
	(b)	A cantilever beam of rectangular cross section has a span of 800mm, the rectangular cross section of the beam has a depth of 200mm the free end of the beam is subjected to a transverse load that fluctuates between 8kN down to 5kN up. The material for the beam is steel with an yi was off to 94 mph entrance strength of 275 MP and factor of safety is 2.5 determine the width of the rectangular protection taking surface finish factor as 0.95 size factor as zero point 90 and stress concentration factor 1.65	**10 Marks**
OR			
Q.4	**(a)**	Derive the Goodman equation for designing the member subjected to fatigue loading	**10 Marks**
	(b)	A hot rolled steel shaft is subjected to a torsional load varying from 330 N-m clockwise to 110 N-m counterclockwise and an applied bending moment varies from + 440 N-m to -220 N-m. Determine the required shaft diameter. The ultimate strength of the material is 550 MPa and yield stress is 410 MPa, factor of safety as 1.5, endurance limit as half the ultimate strength and the size factor as 0.85. Neglect the effect of stress concentration.	**10 Marks**
Module – 3			
Q.5		A steel shaft C45 transmitting 15kw at 210 rpm is supported between two bearings mounted 1000 mm apart. On this two spur gears are mounted the gear having a teeth of module 6 mm is located 100 mm to the left of the right bearing and receive power from a driving gear such that the tangential force acts vertical the pinion having 24 teeth and 6 mm module located 200mm to the right of the left bearing and delivers power to a gear mounted behind it. Taking combined shock and fatigue factor 1.75 in bending and 1.25 in torsion and determine the diameter of the shaft	**20 Marks**

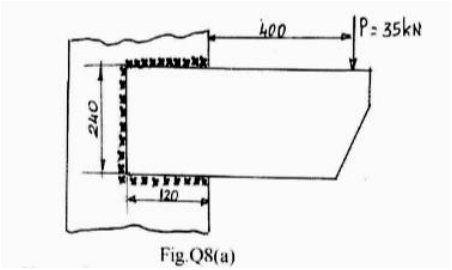
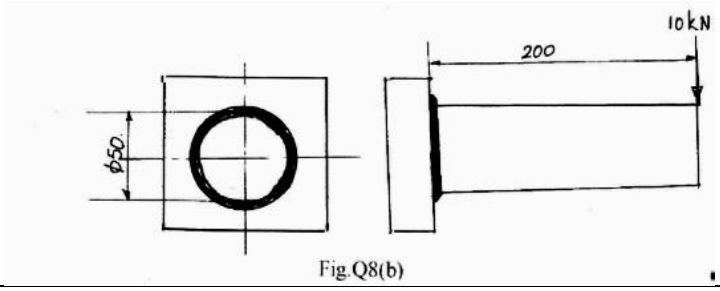
		OR	
Q.6	**(a)**	Design a socket and spigot type cotter joint to sustain an axial load of 100 kN. The material selected for the joint has the following design stresses 80 MPa in tension, 60 MPa in shear and 150 MPa in compression.	**10 Marks**
	(b)	A cast iron flange coupling is used to connect two shafts of 80 mm diameter. The shafts run at 250 RPM and transmit a torque of 4300 N-m and the permissible shear stress for bolt material is 50 MPa and permissible shear stress for flange is 8MPa. Design bolts and the coupling.	**10 Marks**
		Module – 4	
Q.7	**(a)**	Explain in brief the failures of riveted joints.	**10 Marks**
	(b)	Design a double riveted butt joint with equal width cover plates to join two plates of thickness 10mm. The allowable stress for plate and rivets are 80 MPa in tension, 60 MPa in shear and 120 MPa in crushing.	**10 Marks**
		OR	
Q.8	**(a)**	Steel plate is welded by fillet weld to structure and is loaded as shown in figure 8 a. Calculate the size of the weld if the load is 35 kN and allowable shear stress for the weld material is 90 MPa.  Fig.Q8(a)	**10 Marks**
	(b)	A circular beam 50 mm in diameter is welded to a support by means of a fillet weld as shown in figure 8 (b). Determine the size of weld, if the permissible shear stress in the weld is limited to 100 Mpa.  Fig.Q8(b)	**10 Marks**
		Module – 5	
Q.9	**(a)**	Explain the stresses induced in screw fastening subjected to static and impact loading	**10 Marks**
	(b)	A cylinder head of a steam engine is subjected to a steam pressure of 0.8 MPa. It is held in position by means of 12 bolts. A soft copper gasket is used to make the joint leak proof. The bore diameter of the cylinder is 250 mm. Find the size of bolts so that the stress in the bolt is not exceed 110 MPa.	**10 Marks**
		OR	
Q.10	**(a)**	Derive an expression for torque required to lift the load on a square threaded screw.	**10 Marks**
	(b)	A square threaded power screw has a nominal diameter of 30 mm and a pitch 6mm with double start. Load on the screw is 6 kN and the mean diameter of the thrust collar is 40 mm. The coefficient of friction for the screw is 0.1 and for collar is 0.09. Determine (i) Torque required to rotate the screw against the load. (ii) Torque required to rotate the screw with the load. (iii) Overall efficiency. (iv)is the screw self locking?	**10 Marks**

Table showing the Bloom's Taxonomy Level, Course Outcome and Programme Outcome				
Question		**Bloom's Taxonomy Level attached**	**Course Outcome**	**Programme Outcome**
Q.1	(a)	**L1**	**CO 1**	**PO 1**
	(b)	**L1**	**CO 1**	**PO 1**
	(c)	**L3**	**CO 2**	**PO 2**
Q.2	(a)	**L2**	**CO 1**	**PO 1**
	(b)	**L3**	**CO 2**	**PO 2**
Q.3	(a)	**L1**	**CO 1**	**PO 1**
	(b)	**L3**	**CO 3**	**PO 2**
Q.4	(a)	**L1**	**CO 1**	**PO 1**
	(b)	**L3**	**CO 3**	**PO 3**
Q.5	(a)	**L3**	**CO 4**	**PO 4**
Q.6	(a)	**L3**	**CO 3**	**PO 3**
	(b)	**L3**	**CO 3**	**PO 3**
Q.7	(a)	**L1**	**CO 3**	**PO 1**
	(b)	**L3**	**CO 3**	**PO 3**
Q.8	(a)	**L3**	**CO 4**	**PO 3**
	(b)	**L3**	**CO 4**	**PO 3**
Q.9	(a)	**L1**	**CO 1**	**PO 1**
	(b)	**L3**	**CO 4**	**PO 3**
Q.10	(a)	**L1**	**CO 1**	**PO 1**
	(b)	**L3**	**CO 4**	**PO 4**

Bloom's Taxonomy Levels	**Lower order thinking skills**		
	Remembering(knowledge):L_1	Understanding Comprehension): L_2	Applying (Application): L_3
	Higher order thinking skills		
	Analyzing (Analysis): L_4	Valuating (Evaluation): L_5	Creating (Synthesis): L_6

Model Question Paper-2 with effect from 2019-20 (CBCS Scheme)

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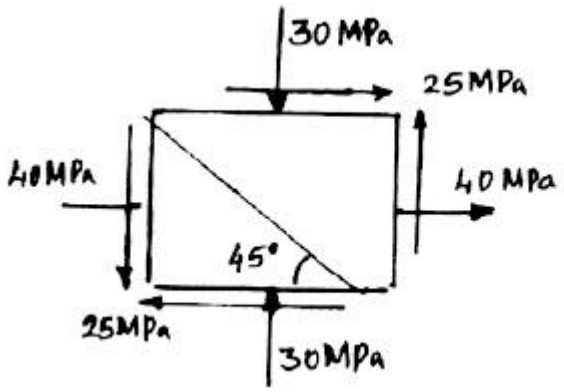
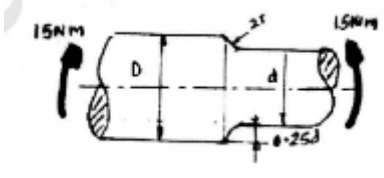
Fifth Semester B.E. Degree Examination

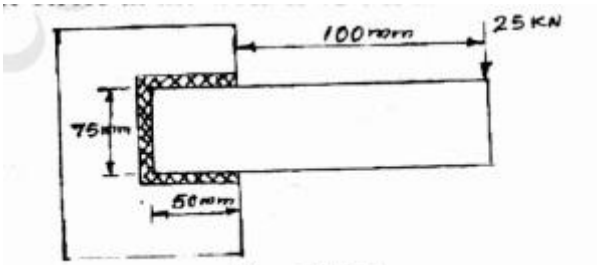
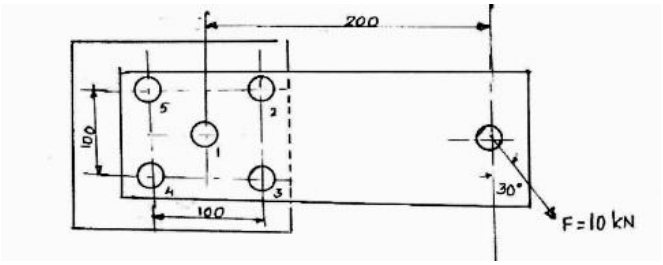
Design of Machine Elements - I

TIME: 03 Hours **Max. Marks: 100**

Note: 01. Answer any **FIVE** full questions, choosing at least **ONE** question from each **MODULE**.
02. Missing data if any must be assumed suitably.

		Module – 1	
Q.1	**(a)**	Define standards and codes.	**5 Marks**
	(b)	Draw the stress strain diagram for a ductile material and show the Talent points on them	**5 Marks**
	(c)	A point in a structural member is subjected to plane stress as shown in figureQ1(c). Determine the following i) Normal and tangential stress on a plane inclined at 45°. ii) Principal stresses and directions iii) Maximum shear stress  Fig. Q1 (c)	**10 Marks**
		OR	
Q.2	**(a)**	Steel shaft having yield strength of 328.6 MPa subjected to the following stresses σx = 90MPa, σy = 60 MPa and τxy = 30 MPa. Find the factor of safety according to the following theories of failure (i) Rankine's theory (ii) Guest's theory	**10 Marks**
	(b)	A round shaft made of grey cast iron FG 200 with ultimate strength 200MPa is subjected to a bending moment of 15 N-m is as shown in figure 2(b) the theoretical stress concentration factor at fillet is 1.5. Determine the diameter 'd' and maximum stress at the fillet.  Fig. Q2 (b)	**10 Marks**
		Module – 2	
Q.3	**(a)**	Derive the soderberg equation for designing the member subjected to fatigue loading	**10 Marks**
	(b)	A simply supported beam of span 1000 mm is subjected to a central role of 20 kN that falls from a height of 20 mm. The Beam has a rectangular cross section of width 60 mm	

		and depth 200mm.The material of the beam has a modulus of elasticity of 207 GPa. Determine (i) Impact factor (ii) Instantaneous deflection (iii) Impact load	**10 Marks**
		OR	
Q.4	**(a)**	Explain with neat sketches the different types of varying stresses	**7 Marks**
	(b)	A steel cantilever beam of rectangular cross section is loaded 400 mm from the support. The width of the beam is 15 mm and depth is 20 mm. Determine the maximum bending stress in the beam when a weight of 100 N is dropped on the beam through a height of 5 mm. Take E = 100 GPa.	**13 Marks**
		Module – 3	
Q.5		A shaft mounted between bearing 1.2 metre apart receives a power of 20kw at 8000 rpm through a pulley 600 mm diameter located 400 mm from the left bearing from another pulley directly below it. The power is delivered through a gear of 200 mm diameter located 700 mm from the left bearing to another gear in front of it. The shaft rotates counterclockwise when viewed through the left bearing. The belt has a ratio of tension of 2.5 and the gear is of 20 degree pressure angle. Determine the shaft diameter assuming the shaft to be made of steel with an yield shear stress of 180MPa and factor of safety as 3 take correction factor 1.5 and 1.0.	**20 Marks**

		OR	
Q.6	**(a)**	Design a socket and spigot type of cotter joint for an axial load of 50 kN which alternately changes from tensile to compressive, assuming allowable stresses in the components under tension and compression as 52.5 MPa, bearing stress as 63 MPa and shearing stress as 35 MPa.	**10 Marks**
	(b)	Design a Knuckle joint to connect two mild steel rods to sustain an axial pull of 150 kN. The pin and the rod are made of the same material. Take working stresses in the material as 110 MPa in tension, 40 MPa in shear and 120 MPa in crushing.	**10 Marks**
		Module – 4	
Q.7	**(a)**	Write advantages and disadvantages of welded joint over riveted joint	**08 Marks**
	(b)	Determine the size of weld required for an eccentrically loaded weld as shown in figure 7b. The allowable stress in the weld is 75 MPa.  Fig. Q7 (b)	**12 Marks**
		OR	
Q.8	**(a)**	Determine the size of a rivet required for the bracket as shown in figure 8(a). Take permissible shear stress for the rivet material as 100 MPa.  Fig 8(a)	**10 Marks**
	(b)	Two lengths of a flat tie bar of 18mm thick are connected by a butt joint with equal cover plates on either side. If a load of 400 kN is acting on the bar. Design the joints such that the section of the bar is not weakened by more than one rivet hole. The working stresses for the material of a bar is 100 MPa in tension, for the material of the rivet 70 MPa in shear and 160 MPa in crushing.	**10 Marks**
		Module – 5	
Q.9	**(a)**	Explain various types of stresses in threaded fasteners.	**10 Marks**
	(b)	A cylinder head is fastened to the cylinder of a compressor using 6 bolts of M20 size. Bolt material is C20 Steel. The maximum fluid pressure is 3.5 MPa, cylinder diameter is 75 mm. A soft gasket is used. Assuming initial tension in each bolt is 40 kN, determine the factor of safety	**10 Marks**
		OR	
Q.10	**(a)**	The lead screw of a lathe has single start ISO trapezoidal threads of 30mm outside diameter and 6 mm pitch. It drives a tool carriage and exerts an axial load of 1.5 kN on a thrust collar of 30 mm inside diameter and 50 mm outside diameter. If the lead screw rotates at 40 rpm, find the power required to drive the screw. Take the coefficient of friction for power screw as 0.14 and for the collar as 0.09.	**10 Marks**
	(b)	A power screw for a Jack has square threads of proportion 50 X 42 X 8. The coefficient of friction at the threads is 0.1 and at the colar is 0.12. Determine the weight that can be lifted by	

		the Jack through a human effort of 400 N, through a hand lever of span 400mm.	**10 Marks**

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