



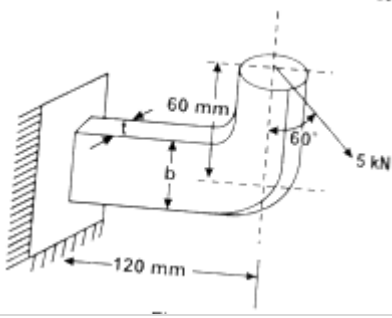
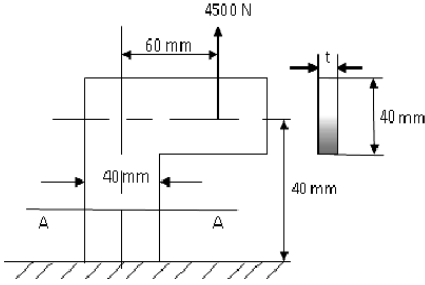
## End Semester Examination – Nov/Dec – 2016

Code : **14ME2029**  
Sub. Name : **Design of Machine Elements**

Semester : **2016-17 ODD**  
Duration : **3hrs**  
Max. marks : **100**

Note: Use of DESIGN DATA book & Approved data sheets are permitted. Necessary data may be suitably assumed.

### ANSWER ALL QUESTIONS (5 x 20 = 100 Marks)

Q. No.	Sub Div.	Questions	Course Outcome	Marks
1.	a.	Define factor of safety.	1	2
	b.	List the factors affecting machine design process.	1	4
	c.	A wall bracket of uniform rectangular cross section as shown in figure is subjected to a pull of 5 kN acting at 60° to the vertical. Determine the dimensions of width and depth of the bracket taking the depth of the section as thrice the width. The strength of materials of materials of the bracket is limited to 28 N/mm <sup>2</sup> . 	2	14
(OR)				
2.	a.	Draw the stress-strain curve for ductile and brittle materials and briefly explain	1	4
	b.	Write the classification of stresses and mention an example for each.	1	2
	c.	A steel bracket is loaded as shown in the Fig 1. The section at A-A is rectangular whose width is 40 mm and thickness 't' mm. The permissible tensile stress of the material of the bracket is 60 N/mm <sup>2</sup> . Determine the thickness of the bracket. 	1	14
Fig 1				
3.	a.	What are the factors affecting endurance limit?	1	2
	b.	Write short note on notch sensitivity (q).	1	2
	c.	Design a Helical compression spring to carry a load of 1.5kN with a deflection of 40mm, spring index is 5, allowable shear stress is 400 N/mm <sup>2</sup> and modulus of rigidity is 8x10 <sup>10</sup> N/m <sup>2</sup> .	2	16
(OR)				PTO

4.	a.	State Rankine's theory and its application.	1	4
	b.	A round bar of diameter 40 mm has smooth ground surface, is made of steel. The ultimate strength is 500 N/mm <sup>2</sup> , yield strength is 400 N/mm <sup>2</sup> and endurance limit is 250 N/mm <sup>2</sup> . Determine the factor of safety of the bar, when it is subjected to alternating bending stress in a symmetric cycle. The maximum bending moment in the cycle is 640 Nm.	1	12
	c.	A bolt is subjected to a tensile load of 25kN and a shear load of 10kN. Determine the diameter of the bolt according to Maximum principal stress theory. Assume factor of safety as 2.5, yield point stress in simple tension is 300 N/mm <sup>2</sup> . Poisson's ratio is 0.25.	1	4
5.	a.	Distinguish between shaft and an axle.	1	2
	b.	A shaft running at 500rpm transmits a power of 10kW. Assume allowable shear stress as 40 N/mm <sup>2</sup> , Find the diameter of the shaft.	1	4
	c.	A shaft transmits 30 KW at 710 rpm is 40mm in diameter. The shaft is supported in bearings 500 mm apart. Calculate, 1. Stress due to bending, if the armature weighing 10 kN acts vertically at the center 2. Stress due to torsion 3. Equivalent shear stress and tensile stress due to bending moment and torque.	1	14 (5+ 5+ 4)
(OR)				
6.	a.	What are the types of couplings? How are shaft couplings classified?	1	4
	b.	Design a bush 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 used: Shear stress for shaft, bolt and key materials 40 MPa, Crushing stress for bolt and key 80 MPa, Shear stress for cast iron 8 MPa	2	16
7.	a.	Classify weld joints with simple sketches.	1	4
	b.	Design a Knuckle Joint for a tie rod of a circular section to sustain a maximum pull of 70 kN. The ultimate strength of the material of the rod against tearing is 420 MPa. The ultimate tensile and shearing strength of the pin material are 510 MPa and 396 MPa respectively.	2	16
(OR)				
8.	a.	The connecting rod of a petrol engine is to be designed for the following data. Piston diameter 80mm, stroke 120mm, weight of reciprocating parts 15N, length of connecting rod 240mm, maximum speed 2800 rpm, explosion pressure corresponding to 10° of crank angle is 3MPa, factor of safety 6. If the connecting rod is to be made of 40Cr1 steel, find the dimensions of the I-section connecting rod.	2	20
<b><u>Compulsory:</u></b>				
9.	a.	Design a CI piston for a single acting four stroke I.C. engine for the following specifications. Cylinder bore 100mm, stroke length 120mm, maximum gas pressure 6MPa, Brake mean effective pressure 0.7MPa, Fuel consumption 0.24kg/kW/hr, Speed 2200rpm	2	20

ALL THE BEST

**Course outcome (CO):**

Ability to

1. Identify the working principles of various kinds of commonly used mechanical components.
2. Apply suitable theories and basic engineering principles and procedures to perform mechanical design calculations.