Name: Enrolment No:	UPES UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, December 2019

Programme Name: B.Tech. Mechanical **Semester : V**

Course Name : Design of Machine Elements

Time: 03 hrs **Max. Marks: 100**

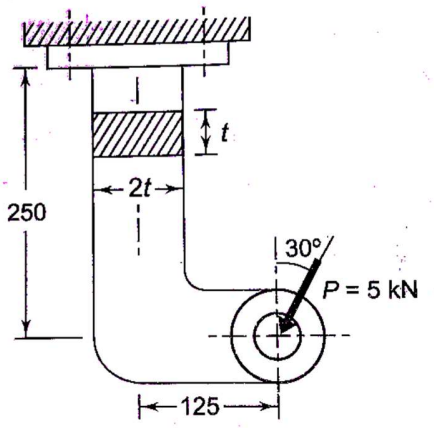
Course Code : MECH 3001

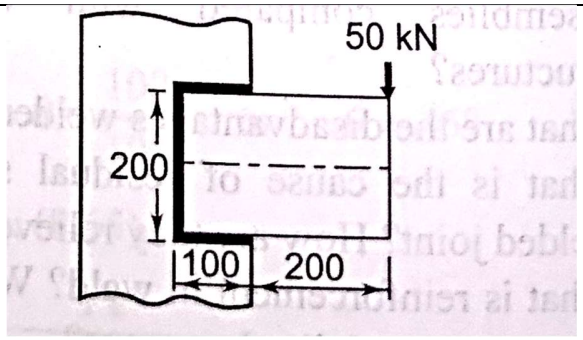
Nos. of page(s) : 3

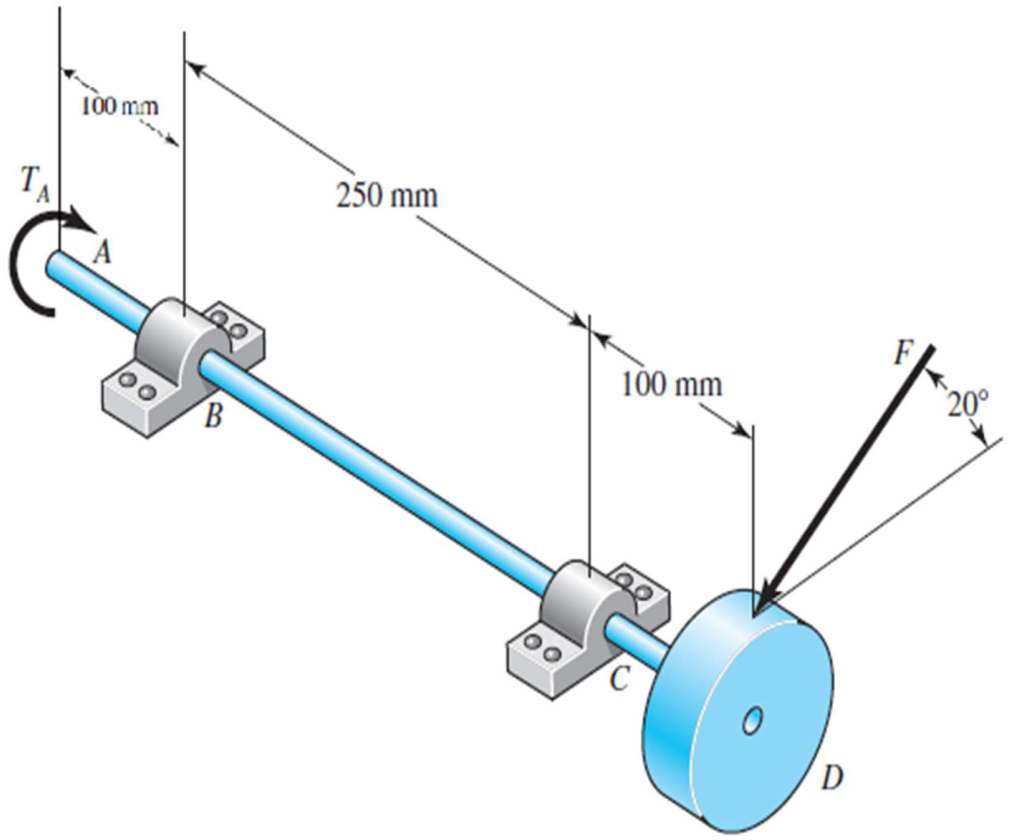
Instructions: ***Read the questions carefully and attempt as per section. Use of Design Data handbook is allowed. Assume suitable data if required/ missing.***

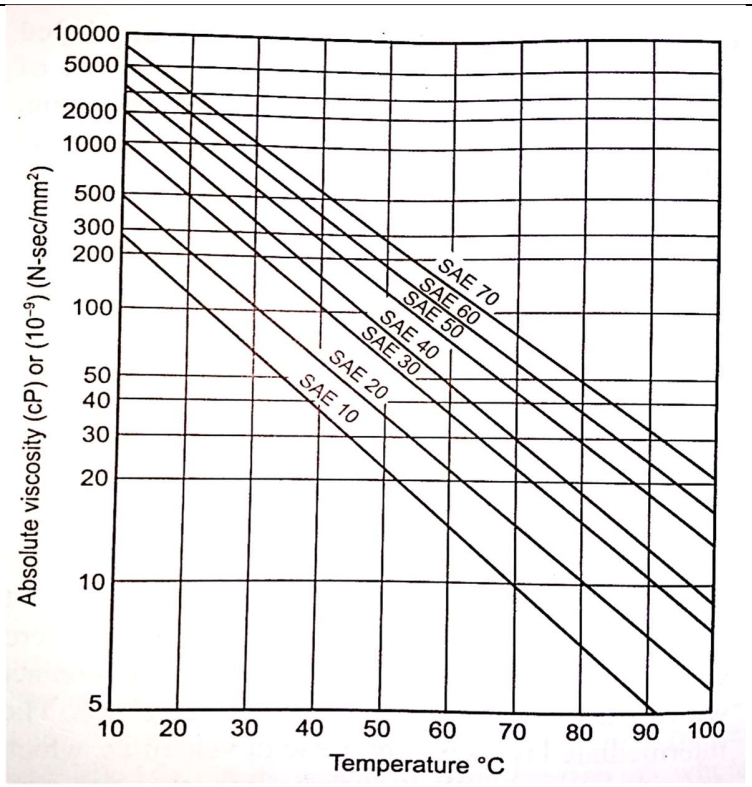
SECTION A (30)

Attempt all questions.

S. No.	Statement of Problem	Marks	CO
Q 1	Explain the design standard procedure adopted to design the machine components with help of flow chart and suitable example.		**CO1**
Q 2	A bracket as shown in figure is made of the steel FeE 200 (σ_y = 200 MPa) and subjected to a force of 5 kN acting at an angle of 30^0 to the vertical. Consider a factor of safety 4, determine the cross section of the bracket. Dimensions are in mm.  	**10**	**CO2**
Q 3	A welded connection of steel plate is shown in figure. It is subjected to an eccentric load of 50 kN . Determine the size of weld, if permissible shear stress in weld section is not to exceed 70 N/mm^2.		**CO3**

			
	SECTION B (45) **Attempt all questions. There is internal choice in Q. No. 5 & 6.**		
Q 4	Design a longitudinal riveted joint for boiler shell the following data; Diameter of boiler shell = 1800 m Maximum internal pressure = 2.1 N/mm^2 Strength of plate in tension = 85 MPa Crushing strength of plate = 120 MPa Shearing strength of rivet = 60 MPa Assume the relevant data from DDHB. Select a suitable riveted joint to be designed. Suggest the diagram for designed joint.	**15**	**CO3**
Q 5	A protected type flanged coupling is required to transmit 60 kw power at 1440 rpm. Design the coupling with following materials, Material for shaft material for shaft as 40C8 (σy= 380 MPa), material for bolts is 30C8 (400 MPa) and flanges are made up of cast iron FG 150 (σut =150 MPa). Take factor of safety as 2.5 for all components **OR** The rotating shaft is simply supported by bearings at points B and C and is driven by a gear (not shown) which meshes with the spur gear at D, which has a 200 mm pitch diameter. Consider the mass of gear as 5 kg. The force F from the drive gear acts at a pressure angle of 20°. The shaft transmits a torque to point A of T_A = 500 Nm. Using a factor of safety of 4, determine diameter of the shaft. Consider appropriate material of the shaft.	**15** **15**	**CO4**

			
Q 6	Select a suitable bearing (with explanation of selection) for an axial flow compressor having a radial load of 2500 N and an axial thrust of 1500 N. Shaft is running at 720 rpm and the desired life is 20000 hours. **OR** Design a journal bearing to be used in a centrifugal pump having diameter of 150 mm running at 1200 rpm. Consider the radial load on bearing as 22.70 KN. Assume the suitable lubricating oil and suggest whether cooling is required or not. ***Use the following Viscosity diagram for selecting the lubricating oil for journal bearing design at operating temperature.***	**15**	**CO2/CO4**

		**15**	**CO2/CO4**
SECTION-C (25) **There is internal choice in Q. No. 7**			
Q 7	In a reduction unit for a centrifugal pump, the pinion shaft is connected to a standard 25 KW of motor. The motor has no load speed of 1200 rpm. If the gear ratio is 2, design the pair of spur gear completely (static & Dynamic) by taking appropriate assumptions. Design can be done by assuming either pitch line velocity or fixing the center distance. **OR** In a reduction unit for a centrifugal pump, the pinion shaft is connected to a standard 25 KW of motor. The motor has no load speed of 1200 rpm. If the gear ratio is 3, design the pair of Helical gear completely (static & Dynamic) by taking appropriate assumptions. Assume the minimum no. of teeth on pinion as 30. Select the suitable material and helix angle as per requirement.	**25**	**CO2/CO4**