

GUJARAT TECHNOLOGICAL UNIVERSITY
ME Semester –I Examination Feb. - 2012

Subject code: 710801N**Date: 11/02/2012****Subject Name: Advanced Machine Design****Time: 10.30 am – 01.00 pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Use of PSG Design Data Book is permitted.

- Q.1** (a) Distinguish Technological Development Cycle and Product Development Cycle for a new product development. **07**
- (b) What is Wear? Explain the Mechanisms of Wear in journal bearings. **07**

- Q.2** (a) What is creep? Explain Creep Relaxation, Creep Damage and Creep Fracture with Mathematical Expressions and Graphs. **07**
- (b) A rotating shaft subjected to a non-rotating force of 5 kN and simply supported between two bearings A and E as shown in figure 1. The shaft is machined from plain carbon steel 30C8 ($S_{ut} = 500 \text{ N/mm}^2$) and expected reliability is 90 %. The equivalent notch radius at the fillet section can be taken as 3 mm. What is the life of the shaft? **07**

OR

- (b) A 60 mm diameter cold drawn steel bar is subjected to a completely reversed torque of 100 Nm and an applied bending moment that varies between 400 Nm and ± 200 Nm. The shaft has a machined finish and has a 6 mm diameter hole drilled transversely through it. If the ultimate tensile stress σ_u and yield stress σ_y of the material are 600 MPa and 420 MPa respectively, find the factor of safety. **07**
- Q.3** (a) Explain the design procedure of Rotating Disc with Uniform Thickness assuming usual notations. Show the stress Distribution Curves. **07**
- (b) A thin disc is to be used as a rotating cutter. It is of uniform thickness except at the periphery where it is sharpened. The outer diameter of the disc may be taken as 250 mm. the disc is mounted on a 50 mm diameter shaft. Ignoring clamping force, calculate the safe speed for the disc if the maximum stress is not to exceed 200 MN/m^2 . **07**

OR

- Q.3** (a) What is customer requirement? How customer requirements are correlated into product design specification for New Product Development? **07**
- (b) A cylinder with external diameter 300mm and internal diameter 200mm is subjected to an internal pressure of 25 MPa. Compare the relative merits of a single thick walled cylinder and a composite cylinder with the inner cylinder whose internal and external diameters are 200mm and 250 mm respectively. **07**

A tube of 250 mm internal diameter and 300mm external diameter is shrunk on the main cylinder. The safe tensile yield stress of the material is 110 MPa and the stress set up at the junction due to shrinkage should not exceed 10 MPa.

- Q.4 (a)** What is Mechanical Reliability? Explain Hazard Rate, Mean Time Between Failures (MTBF) and System Reliability with mathematical expression. **07**
- (b)** Explain the Design procedure for Rotating Long Cylinder assuming the ends of cylinder are fixed with usual notations. **07**

OR

- Q.4 (a)** What is profile correction of gears? Explain S_0 and S corrected gears with characteristics of corrected gears. **07**
- (b)** A machine journal bearing has a journal diameter of 150 mm and length of 120 mm. The bearing diameter is 150.24 mm. It is operating with SAE 40 oil at 65°C. The shaft is carrying a load of 8 kN and rotates at 960 rpm. Estimate the bearing coefficient of friction and power loss using Petroff's equation. **07**

- Q.5 (a)** What is rigidity? Explain how the rigidity of Mechanical Structure can be improved? **07**
- (b)** The boom AB of crane as shown in figure 2 is a uniform steel bar of length 10 m and area of cross section 2500 mm². A weight W is suspended while the crane is stationary. The cable CDEBF is made of steel and has a cross section area of 100 mm². Neglecting the effect of the cable CDEB, find the equivalent spring constant of the system in vertical direction. **07**

OR

- Q.5 (a)** Explain the design procedure for Main Girder Design with usual notations. **07**
- (b)** I-section girder, 200mm wide by 300 mm depth flange and web of thickness is 20 mm is used as simply supported beam for a span of 7 m. The girder carries a distributed load of 5 kN /m and a concentrated load of 20 kN at mid-span. Determine **07**
- The second moment of area of the cross-section of the girder.
 - The maximum stress set up.

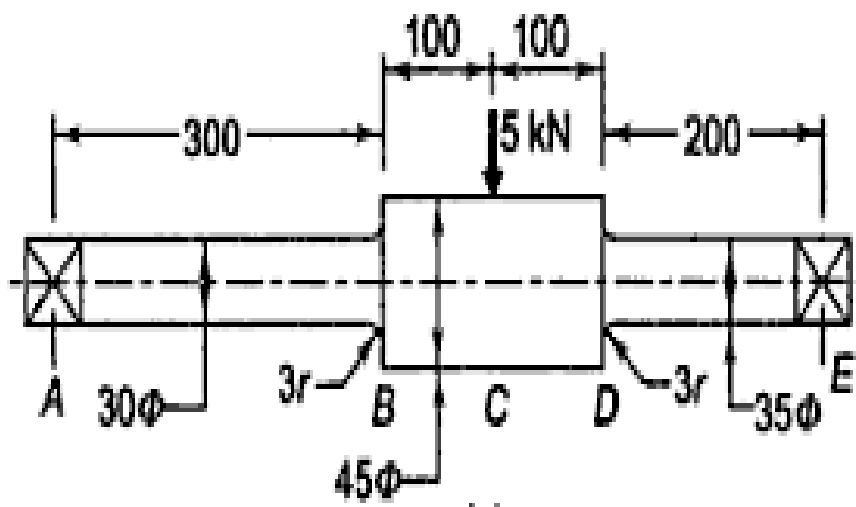


Figure 1

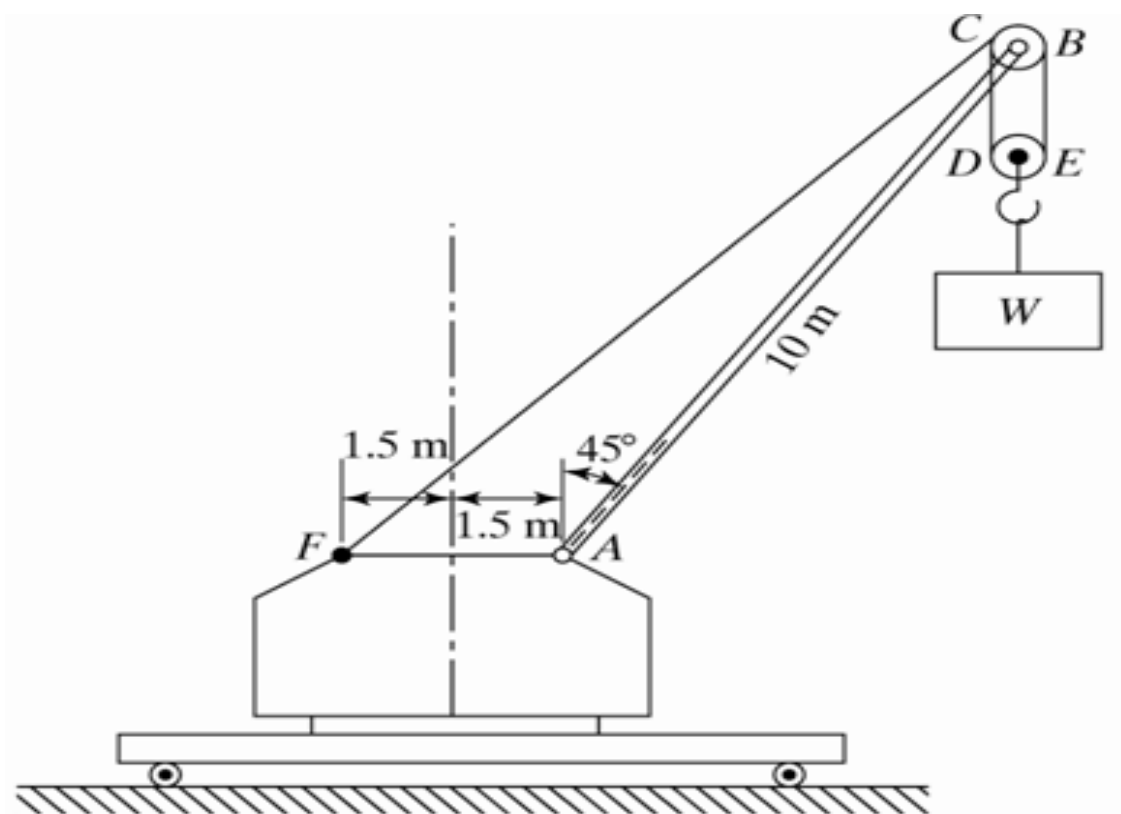


Figure 2
