

Reg No.: \_\_\_\_\_

Name: \_\_\_\_\_

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  
**EIGHTH SEMESTER B.TECH DEGREE EXAMINATION, MAY 2019**

**Course Code: ME402**

**Course Name: Design of Machine Elements-II**

Max. Marks: 100

Duration: 3 Hours

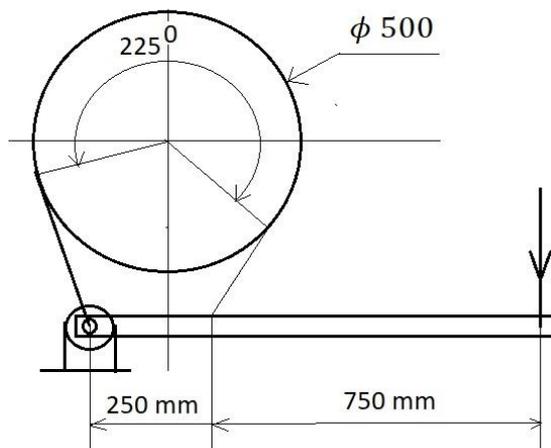
*Use of design data book is permitted*  
*Missing data may be suitably assumed*

**PART A**

*Answer any two full questions, each carries 15 marks.*

Marks

- 1 a) A simple band brake as shown in figure below is to be designed to absorb a power of 32 kW at a rated speed of 850 rpm. Assume  $\mu = 0.25$ . Determine, (i) The effort required to stop clockwise rotation of the brake drum, (ii) The effort required to stop counter clockwise rotation of the brake drum, (iii) The dimensions of the rectangular cross-section of the brake lever assuming its depth to be twice the width, and (iv) the dimensions of the cross-section of the band assuming its width to be ten times the thickness. (11)



- b) What are the advantages and disadvantages of band brake? (4)
- 2 a) A single row deep groove ball bearing has a dynamic load capacity of 40210 N and operates on the work cycle consists of radial load of 2000 N at 1000 rpm for 25 % of the time, radial load of 5000 N at 1500 rpm for 50 % of time, and radial load of 3000 N at 700 rpm for the remaining 25 % of time. Calculate the expected life of the bearing in hours. (10)
- b) Define static and dynamic load carrying capacity of ball bearing. (5)

- 3 A  $360^\circ$  hydrodynamic journal bearing operates at 1200 rpm and carries a load of 5.5 k N. The journal diameter is 55 mm and length is 55 mm. The bearing is lubricated with SAE 20 oil and the operating temperature of oil is  $79^\circ\text{C}$ . Assume radial clearance as 0.025 mm and the attitude angle as  $60^\circ$ . Determine: (i) bearing pressure, (ii) Attitude, (iii) minimum film thickness, (iv) heat generated, (v) heat dissipated, if the ambient temperature is  $25^\circ\text{C}$ , and (vi) amount of artificial cooling if necessary. (15)

### PART B

*Answer any two full questions, each carries 15 marks.*

- 4 A motor shaft rotating at 1440 rpm has to transmit 15 kW power to a low speed shaft running at 500 rpm. A  $20^\circ$  pressure angle full depth involute system of gear tooth is used. The pinion has 25 teeth. Both gear and pinion are made of cast iron having allowable static strength of 55 MPa. Design a suitable spur gear drive and check the design for dynamic load and wear. (15)
- 5 a) State and explain law of gearing with a neat sketch. (7)  
b) Give an account on different modes of failure of gear tooth. (4)  
c) Explain why dynamic factors need to be considered in the design of gears. (4)
- 6 A helical gear speed reducer is to be designed. The rated power of the speed reducer is 75 kW at a pinion speed of 1200 rpm. The speed ratio is 3:1. For medium shock conditions and 24 hr operation, design the gear pair. The teeth are  $20^\circ$  full depth involute in the normal plane and helix angle is  $30^\circ$ . (15)

### PART C

*Answer any two full questions, each carries 20 marks.*

- 7 a) Design a connecting rod of I cross section for an IC engine running at 1800 rpm and developing a maximum pressure of  $3.15 \text{ N/mm}^2$ . The diameter of the piston is 100 mm, mass of the reciprocating parts per cylinder is 2.25 kg, length of the connecting rod is 380 mm, stroke of the piston is 190 mm and compression ratio is 6:1. Take a factor of safety of 6 for the design. The maximum allowable bearing pressure at big end and the small end are respectively  $10 \text{ N/mm}^2$  and  $15 \text{ N/mm}^2$ . The density of material of the rod may be taken as  $8000 \text{ kg/m}^3$  and allowable stress in the bolts as  $85 \text{ N/mm}^2$  and in the cap as  $80 \text{ N/mm}^2$ . (16)
- b) Explain why I section is usually preferred in the case of a connecting rod? (4)

- 8 a) Explain the main functions of the piston in an internal combustion engine? (4)
- b) Make out a systematic classification of pressure vessels and discuss the role of statutory regulations. (4)
- c) A seamless cylinder with a storage capacity of  $0.025 \text{ m}^3$  is subjected to an internal pressure of 8 MPa. The length of the cylinder is twice its internal diameter. The cylinder is made of plain carbon steel 20C8. (Ultimate stress is 380 MPa and Factor of safety is 2.5) Determine the dimensions of the cylinder. (12)
- 9 a) Enumerate the various types of flat belt drives. (3)
- b) Explain galling of Roller chains. (3)
- c) Design a flat belt drive for a compressor running at 670 rpm, which is driven by a 25 kW, 1340 rpm motor. Space is available for a centre distance of 3 m. The belt is open type. (14)

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