

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

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

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  
EIGHTH SEMESTER B.TECH DEGREE EXAMINATION(S), OCTOBER 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 Design a dry single plate clutch having both sides effective to transmit 19 kW at 1500 rpm. The ratio of mean radius to radial width is 4.5. The axial thrust is provided by 6 springs. Take, coefficient of friction = 0.2 and allowable pressure = 0.245 M Pa. Assume, spring index,  $C = 6$ , shear stress = 420 MPa and  $G = 84$  GPa. Find (i) mean radius and width of friction surfaces, (ii) dimensions of clutch plate and (iii) dimensions of springs. (15)
- 2 Design a full hydrodynamic journal bearing operating at 1200 rpm and carrying a load of 6 k N. The journal material is hardened steel and bearing is of babbit material. The bearing is lubricated with SAE 30 oil and the operating temperature of oil is  $69^{\circ}$  C. Assume ambient temperature as  $30^{\circ}$ . (15)
- 3 a) Explain the significance of bearing characteristic number in the design of sliding contact bearing. (5)
- b) Explain the mechanism of fluid film lubrication. (5)
- c) What is Sommerfeld number? Explain its significance in the design of hydrodynamic bearing. (5)

**PART B**

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

- 4 A compressor receives power through a pair of spur gears. The compressor shaft runs at 350 rpm while the motor shaft runs at 1450 rpm, delivering 40 kW power. The power transmission is with moderate shock and the drive is to operate 10 hours per day. Pinion is made of steel C-40 heat treated and gear is made of cast steel. Design the spur gear set. (15)
- 5 A pair of straight tooth bevel gears at right angles is to transmit 5 kW at 1200 rpm of the pinion. The diameter of the pinion is 80 mm and the speed reduction is 3.5:1. The tooth form is  $20^{\circ}$  full depth involute. Both the pinion and gear are (15)

made of cast iron with allowable stress of 55 MPa. Determine module and face width from the standpoint of strength. And also check the design from the standpoint of dynamic load and wear.

- 6 a) Derive Lewis Equation for beam strength of a gear tooth and also state the assumptions. (7)
- b) What is pressure angle? Discuss its significance. (4)
- c) What are the commonly used tooth profiles for spur gear? Explain the characteristics of each. (4)

### PART C

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

- 7 a) Design a connecting rod for four stroke petrol engine with the following data; (16)  
Diameter of piston-8.8 cm, Stroke-12.5 cm, Weight of reciprocating parts-1.6 Kg, Length of connecting rod (centre to centre)-30 cm, RPM-2200 with possible over speed of 3000, Compression ratio-6.8:1, Maximum explosion pressure-35 Kg/cm<sup>2</sup>. The maximum allowable bearing pressure at big end and the small end are respectively 12 N/mm<sup>2</sup> and 16 N/mm<sup>2</sup>. The density of material of the rod may be taken as 8000 kg/m<sup>3</sup> and allowable stress in the bolts as 80 N/mm<sup>2</sup> and in the cap as 75 N/mm<sup>2</sup>.
- b) What is the effect of centrifugal tension in belt on power transmission? (4)
- 8 a) Enumerate the advantages and disadvantages of a flat belt drive. (4)
- b) Design a V-belt drive for the following specifications. Power transmitted is 22 kW, speed of the driving wheel is 1450 rpm, speed of the driven wheel is 400 rpm, centre distance should not exceed 2500 mm, and the service of the equipment is 15 hrs/day. (16)
- 9 a) Differentiate between a thin and thick pressure vessel. (4)
- b) Explain the various types of ends used for pressure vessel giving practical application of each. (4)
- c) A cast iron cylinder of internal diameter 200 mm and thickness 50 mm is subjected to a pressure of 5 MPa. Calculate the tangential and radial stresses at the inner, middle (radius-125 mm) and outer surfaces. (12)

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