

GUJARAT TECHNOLOGICAL UNIVERSITY
BE – SEMESTER – VIII. EXAMINATION – WINTER 2016

Subject Code: 181902**Date: 20/10/2016****Subject Name: Machine Design II****Time: 02:30 PM to 05:00 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 in exam.

- Q.1 (a)** Explain scuffing of piston rings and cylinder liners. **04**
- (b)** Design a cast iron piston for single cylinder four stroke engine using following **10**
 data:
 Cylinder bore = 120 mm, Stroke = 150 mm, Engine speed = 2200 rpm, Thermal conductivity for CI = 46 W/m °C, Maximum gas pressure = 5 MPa, Indicated mean effective pressure = 0.75 MPa, Mechanical efficiency = 80 %, Fuel consumption = 0.22 kg/kWh, HCV = 44000 kJ/kg, Temperature difference = 220° C, Permissible tensile stress for piston = 40 MPa, Permissible tensile stress for piston rings = 100 MPa, Permissible tensile stress for piston pin = 150 MPa.

- Q.2 (a)** What is the effect of stroke bore ratio on the design of an IC engine? Also **07**
 suggest some suitable values of stroke bore ratio for different applications.
- (b)** Design a cylinder, cylinder head and studs for an IC engine having following **07**
 data:
 Cylinder bore = 200 mm, Maximum gas pressure = 4.5 MPa, Permissible stress for cylinder = 42 MPa, Permissible stress for cylinder head = 45 MPa, Permissible stress for studs = 100 MPa, Stroke bore ratio = 1.2, Compression ratio = 8.

OR

- (b)** Write down steps for design of connecting rod. **07**
- Q.3 (a)** Write a short note on pitting failure of gear tooth. **04**
- (b)** Design a 20° full depth involute spur gear pair using velocity factor and check **10**
 the design by Buckingham's equation for dynamic load with following data:
 Power to be transmitted = 8 kW, Pinion speed = 1500 rpm, Gear speed = 500 rpm, No. of teeth on pinion = 20, Ultimate strength of steel pinion & gear = 600 MPa, Service factor, $K_a = 1.25$, Factor of safety = 1.5, Face width = 10 times module, IS Grade of machining = Grade 7, Surface hardness = 400 BHN,

$$F_{tmax} = K_a * F_t, \quad e = (11.0 + 0.9\phi) * 10^{-3}, \quad C = 11500 * e,$$

$$Y = 0.484 - \frac{2.87}{Z}, \quad K_v = \frac{3}{3 + V}, \quad K = 0.16 \left[\frac{BHN}{100} \right]^2 \text{ N/mm}^2,$$

$$F_{eff} = \frac{F_{tmax}}{K_v}, \quad F_d = \frac{21V (bC + F_{tmax})}{21V + \sqrt{(bC + F_{tmax})}}.$$

OR

- Q.3 (a)** Compare effect of different pressure angles on bending strength of involute spur **04**
 gear tooth.

- (b) The following data given for a pair of helical gears made of steel: 10
 Normal module = 4 mm, Face width = 40 mm, No of teeth on pinion = 20,
 Pinion speed = 1000 rpm, Centre distance = 132 mm, Normal pressure angle =
 20°, Ultimate strength = 450 MPa, Surface hardness = 300 BHN, Service factor,
 $K_a = 1.5$, Factor of safety = 2,

$$K_V = \frac{5.6}{5.6 + \sqrt{V}}, \quad Y' = 0.484 - \frac{2.87}{Z'}, \quad K = 0.16 \left[\frac{BHN}{100} \right]^2 \text{ N/mm}^2$$

Determine the power transmitting capacity using velocity factor for dynamic load.

- Q.4 (a)** Explain limitations of worm gears. 04

- (b) A 20° full depth involute straight bevel gear pair mounted on shafts, which are intersecting at right angle, consists of 24 teeth pinion meshing with 32 teeth gear. The pinion shaft is connected to 5 kW, 1000 rpm motor. The service factor is 1.25. The gear is to be made of cast iron ($S_{ut} = 350$ MPa), while the pinion is to be made of steel ($S_{ut} = 580$ MPa). If the factor of safety required against bending failure is 3, design the gear pair by using the velocity factor and if the factor of safety required against pitting failure is 2, find the surface hardness required on gears. 10

$$K_V = \frac{5.6}{5.6 + \sqrt{V}}, \quad Y' = 0.484 - \frac{2.87}{Z'}, \quad K = 0.18 \left[\frac{BHN}{100} \right]^2 \text{ N/mm}^2$$

$$F_w = \frac{0.75 d_p b Q' K}{\cos \gamma_p}$$

OR

- Q.4 (a)** Give the advantages of geometric progression ratio used in machine tool drives. 04

- (b) Design a two stage six speed gear box having 250 rpm minimum speed and 800 rpm maximum speed. The gear box is connected to a 1440 rpm electric motor through a belt drive. The speed at input shaft of gear box is 800 rpm. 10

- Q.5 (a)** Give the detail classification of material handling equipments. 07

- (b) Explain the purpose of using different types of idler in conveyors. 07

OR

- Q.5 (a)** What are the basic principles in selecting the type of material handling equipment? 07

- (b) Explain design procedure of wire rope drum. 07
