

GUJARAT TECHNOLOGICAL UNIVERSITY
PDDC SEMESTER VIII– EXAMINATION – SUMMER 2017

Subject Code: X81902**Date: 01/05/2017****Subject Name: Machine Design - II****Time: 10.30AM to 01.00PM****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Illustrate your answer with neat sketches wherever required.
4. Figures to the right indicate full marks.
5. Use of PSG Design Data Book is permitted in exam.

- Q.1** (a) Give the classification of gears. **07**
 (b) List and explain the different causes of gear tooth failures and suggest possible remedies to avoid such failures. **07**

- Q.2** (a) State the piston materials. **04**
 (b) The following particulars of a single reduction spur gear are given : **10**
 Gear ratio = 10 : 1; Distance between centers = 660 mm approximately; Pinion transmits 500 kW at 1800 r.p.m.; Involute teeth of standard proportions (addendum = m) with pressure angle of 22.5°; Permissible normal pressure between teeth = 175 N per mm of width. Find :
 1) The nearest standard module if no interference is to occur;
 2) The number of teeth on each wheel;
 3) The necessary width of the pinion; and
 4) The load on the bearings of the wheels due to power transmitted.

OR

- (b) Design a cast iron piston for a single acting four stroke engine for the following **10**
 data:
 Cylinder bore = 100 mm ; Stroke = 125 mm ; Maximum gas pressure = 5 N / mm² ; Indicated mean effective pressure = 0.75 N / mm² ; Mechanical efficiency = 80 % ; Fuel consumption = 0.15 kg per brake power per hour ; Higher calorific value of fuel = 42 × 10³ kJ / kg ; Speed = 2000 r.p.m.
 Any other data required for the design may be assumed.

- Q.3** A six speed gear box is to be designed for a machine tool drive. The spindle **14**
 speeds range between 150 r.p.m. and 1000 r.p.m. If the gear box is driven by 5 kW, 1000 r.p.m. electric motor through the belt drive ;
 1) Draw the possible structure diagrams ;
 2) Select the optimum structure diagram ;
 3) Draw the speed diagram ;
 4) Draw the gearing diagram ;
 5) Select the diameters of pulleys for the belt drive ; and
 6) Determine the number of teeth on gears ;
 The standard pulley diameters are : 80, 90, 100, 112, 125, 140, 160, 180, 200, 224, 250, 280, 290, 300, 310, 355, 375, 400, 450, 500 mm
 Assume same module for all gears.

OR

- Q.3** The single cylinder four – stroke diesel engine has the following specifications : **14**

 Brake power = 7.5 kW
 Engine speed = 1500 r.p.m.

Indicated mean effective pressure	=	0.29 N / mm ²
Maximum gas pressure	=	4 N / mm ²
Mechanical efficiency	=	80 %
Stroke to bore ratio	=	1.35
Compression ratio	=	11.1
Reboring factor, C ₁	=	3.5 mm
Cylinder head thickness constant, k ₁	=	0.35

The cylinder liner and head are made of grey cast iron FG260 (Poisson's ratio = 0.25). The studs are made of plain carbon steel 40C8 ($S_{yt} = 380 \text{ N / mm}^2$). If the required factor of safety is 6, determine :

- 1) The bore and length of the cylinder liner ;
- 2) The thickness of the cylinder liner ;
- 3) The stresses in cylinder liner ;
- 4) The thickness of the cylinder head ; and
- 5) The number, size and pitch of the studs.

Q.4 A pair of bevel gears connect two shafts at right angles and transmits 9 kW. Determine the required module and gear diameters for the following specifications : **14**

Particulars	Pinion	Gear
Number of teeth	21	60
Material	Semi-steel	Gray cast iron
Brinell Hardness Number	200	160
Allowable static stress	85 MPa	550MPa
Speed	1200 r.p.m.	420 r.p.m.
Tooth profile	14 ½ ° composite	14 ½ ° composite

Check the gears for dynamic and wear loads.

OR

Q.4 (a) A pair of helical gears are to transmit 15 kW. The teeth are 20° stub in diametral plane and have a helix angle of 45°. The pinion runs at 10 000 r.p.m. and has 80 mm pitch diameter. The gear has 320 mm pitch diameter. If the gears are made of cast steel having allowable static strength of 100 MPa; determine a suitable module and face width from static strength considerations and check the gears for wear, given $\sigma_{es} = 618 \text{ MPa}$. **10**

(b) What are the advantages of helical gears over spur gears? **04**

Q.5 (a) A worm drive transmits 15 kW at 2000 r.p.m. to a machine carriage at 75 r.p.m. The worm is triple threaded and has 65 mm pitch diameter. The worm gear has 90 teeth of 6 mm module. The tooth form is to be 20° full depth involute. The coefficient of friction between the mating teeth may be taken as 0.10. **06**

Calculate: 1. tangential force acting on the worm; 2. axial thrust and separating force on worm; and 3. efficiency of the worm drive.

(b) A single point crane hook is made from a 50 mm mild steel bar with a bed diameter of 84 mm. The permissible stress for the hook is limited to 160 N / mm². If the cross-section of the hook is triangular, calculate the load carrying capacity of hook. **08**

OR

Q.5 (a) Explain Wire ropes with its designation. What are the advantages of wire ropes? Explain selection of wire ropes. **07**

(b) Classify the conveyors. Explain the construction and working of any one conveyor. **07**
