

**GUJARAT TECHNOLOGICAL UNIVERSITY**  
**PDDC - SEMESTER– VIII • EXAMINATION – SUMMER 2015**

**Subject Code: X81902****Date: 11/05/2015****Subject Name: Machine Design – II****Time: 10:30 am - 01:00 pm****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 Standard Design Data Book is permitted in exam.

- Q.1** (a) List and explain the different causes of gear tooth failures and suggest possible remedies to avoid such failures. **07**
- (b) Explain Wire ropes with its designation. State the advantages of wire ropes. How will you select the wire ropes ? **07**

- Q.2** (a) Give the classification of gears. **04**
- (b) The following particulars of a single reduction spur gear are given : **10**  
Gear ratio = 10 : 1; Distance between centres = 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) A helical cast steel gear with 30° helix angle has to transmit 35 kW at 1500 r.p.m. **10**  
If the gear has 24 teeth, determine the necessary module, pitch diameter and face width for 20° full depth teeth. The static stress for cast steel may be taken as 56 MPa. The width of face may be taken as 3 times the normal pitch. What would be the end thrust on the gear? The tooth factor for 20° full depth involute gear may be taken as  $0.154 - 0.912 / T_E$  where  $T_E$  represents the equivalent number of teeth.
- Q.3** (a) What are the different modes of bevel gear tooth failures ? State their causes and remedies. **04**
- (b) A pair of straight bevel gears consists of 24 teeth pinion meshing with 40 teeth gear. The module at the large end of the teeth is 5 mm, while the face width is 40 mm. If the axes of the connecting shafts are at right angles to each other, calculate the following : **10**  
1) The pitch circle diameters of the pinion and gear ;  
2) The pitch cone distance ;  
3) The pitch cone angles of the pinion and gear ;  
4) The mean radii of the pinion and gear ;  
5) The back cone radii of the pinion and gear.

**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 <sup>2</sup>
Maximum gas pressure	=	4 N / mm <sup>2</sup>
Mechanical efficiency	=	80 %
Stroke to bore ratio	=	1.35
Compression ratio	=	11.1
Reboring factor, C <sub>1</sub>	=	3.5 mm
Cylinder head thickness constant, k <sub>1</sub>	=	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 multi-speed gear box is to be designed for a small-size, general purpose machine tool for spindle speeds varying between 56 r.p.m. and 1000 r.p.m. If the recommended geometric progression ratio is as per R4 series : **14**

- 1) Draw the candidate structure diagrams for machine tool gear box ;
- 2) Select the optimum structure diagram ;
- 3) Draw the speed diagram ;
- 4) If the gear box is to be driven by 720 r.p.m., three-phase A.C. motor through a belt drive, determine the ratio of the belt pulley diameters.

**OR**

**Q.4** 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  $160 \text{ N / mm}^2$ . If the cross-section of the hook is triangular, calculate the load carrying capacity of hook. If the hook section is changed to trapezoidal from triangular, determine the load carrying capacity. Draw necessary diagrams for both cases. **14**

**Q.5 (a)** State and explain the objectives of material handling system. **07**  
**(b)** Classify the conveyors. Explain the construction and working of any one conveyor with necessary sketch. **07**

**OR**

**Q.5** Design  $20^\circ$  involute worm and gear to transmit 10 kW with worm rotating at 1400 r.p.m. and to obtain a speed reduction of 12 : 1. The distance between the shafts is 225 mm. **14**

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