

**GUJARAT TECHNOLOGICAL UNIVERSITY****BE - SEMESTER-VIII (OLD) EXAMINATION – SUMMER 2019****Subject Code: 181902****Date: 09/05/2019****Subject Name: Machine Design -II****Time: 10:30 AM TO 01:00 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)** Answer the following questions. **07**
- (i) What are the basic considerations in design of multi speed gear box?  
(ii) Which conditions should be satisfied by optimum structure diagram of multi speed gear box?
- (b)** Explain the types of designation of steel wire ropes with neat sketches and discussed about various types of stresses induced in a wire rope. Also mention desirable material properties of wire rope. **07**
- Q.2 (a)** Explain the different causes and remedies for various gear tooth failures. **07**
- (b)** A pair of spur gears with  $20^\circ$  full-depth involute teeth consists of a 20 teeth pinion meshing with a 41 teeth gear. The module is 3 mm while the face width is 40 mm. The material for pinion as well as gear is steel with an ultimate tensile strength of  $600 \text{ N/mm}^2$ . The gears are heat treated to a surface hardness of 400 BHN. The pinion rotates at 1450 rpm and the service factor for the application is 1.75. Assume that velocity factor accounts for the dynamic load and the factor of safety is 1.5. Determine the rated power that the gears can transmit. **07**
- OR**
- (b)** A pair of parallel helical gears consists of a 20 teeth pinion meshing with a 100 teeth gear. The pinion rotates at 720 rpm. The normal pressure angle is  $20^\circ$ , while the helix angle is  $25^\circ$ . The face width is 40 mm and the normal module is 4 mm. The pinion as well as the gear is made of steel 40C8 ( $S_{ut} = 600 \text{ N/mm}^2$ ) and heat treated to a surface hardness of 300 BHN. The service factor and the factor of safety are 1.5 and 2 respectively. Assume that the velocity factor accounts for the dynamic load and calculate the power transmitting capacity of gears. **07**
- Q.3 (a)** Define following terminology. **07**
- (i) Pressure angle (ii) Backlash (iii) Herringbone gear (iv) Miter gear (v) Hypoid gear (vi) Crown gear (vii) Lewi's tooth form factor
- (b)** A pair of bevel gears transmitting 7.5 kW at 300 rpm having diameters of pinion and gear are 150 mm and 200 mm and face width 20 mm. The pressure angle is  $20^\circ$ . Determine the components of the resultant gear tooth force and draw a free-body diagram of forces acting on the pinion and the gear. **07**
- OR**
- Q.3 (a)** What are the advantages and drawbacks of worm gear drives? Why efficiency of worm gear drive is low? Also explain self-locking and reversible drive. **07**
- (b)** A worm gear 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  $20^\circ$  full depth involute. The coefficient of friction between the mating teeth may be taken as 0.10. Calculate: **07**
1. Tangential force acting on the worm;
  2. Axial thrust and separating force on worm;

3. Efficiency of the worm drive.

- Q.4 (a)** Explain in detail design procedure of following parts of Piston with neat sketch. **07**  
(i) Piston head (ii) Piston barrel (iii) Piston Pin.
- (b)** Determine the dimensions of standard cross-section (4t X 5t) of the connecting rod for a diesel engine with the following data: **07**  
Cylinder bore = 100 mm  
Length of connecting rod = 350 mm  
Maximum gas pressure = 4 MPa  
Factor of safety = 6  
Rankine constant = 1 / 7500

**OR**

- Q.4 (a)** 1) Why an I-section is usually preferred to round section in case of connecting rods? **03**  
2) What are the merits and demerits of wet and dry cylinder liners? **04**
- (b)** A four-stroke diesel engine has the following specifications: **07**  
Brake power=5 kW; Speed=1200 r.p.m.; Indicated mean effective pressure= 0.35 N / mm<sup>2</sup>; Mechanical efficiency = 80 %.  
Determine: 1. bore and length of the cylinder; 2. thickness of the cylinder head; and 3. diameter of studs for the cylinder head.

- Q.5 (a)** Explain in detail the standard design procedure of single crane hook with neat sketch. **07**
- (b)** For a multi speed gearbox of a milling machine, the speed steps of 12 are having structure as 2x3x2. Briefly explain (a) how different structure diagrams are possible for 2x3x2 formula. (b) Out of various possibilities, how to select the optimum Version? Draw at least four structure diagrams. **07**

**OR**

- Q.5 (a)** With neat sketches, explain the different types of idler used in conveyors. **07**
- (b)** (i) Differentiate between screw conveyor and vibratory conveyor. **04**  
(ii) Write basic objectives of material handling system. **03**

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