

**GUJARAT TECHNOLOGICAL UNIVERSITY****BE - SEMESTER-VII (NEW) EXAMINATION – WINTER 2018****Subject Code: 2170202****Date: 26/11/2018****Subject Name: Automobile Component Design****Time: 10:30 AM TO 01:30 PM****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1** (a) What do you mean by standardization? **03**  
 (b) Write a detailed note on selection of gear materials. **04**  
 (c) Explain the design for manufacturing and design for assembly. **07**
- Q.2** (a) Explain various factors affecting fatigue strength. **03**  
 (b) What is preloading of the rolling contact bearing? Why it is necessary? **04**  
 (c) A single-row deep groove ball bearing has a dynamic load capacity of 40500 N and operates on the following work cycle: **07**
1. Radial load of 5000 N at 500 rpm for 25% of the time;
  2. Radial load of 10000 N at 700 rpm for 50% of the time;
  3. Radial load of 7000 N at 400 rpm for the remaining 25% of the time.
- Calculate the expected life of the bearing in hours.
- OR**
- (c) A ball bearing is operating on a work cycle consisting of three parts- **07**
1. Radial load of 3000 N at 1440 rpm for one quarter cycle
  2. Radial load of 5000 N at 720 rpm for one half cycle
  3. Radial load of 2500 N at 1440 rpm for the remaining cycle
- The expected life of bearing is 10000 hour. Calculate the dynamic load carrying capacity of the bearing.
- Q.3** (a) What are the advantages of hydrostatic bearings? **03**  
 (b) Write advantages and disadvantages of worm gears. **04**  
 (c) A pair of parallel helical gears consists of 30 teeth pinion rotating at 4000 rpm and supplying 10 KW power to a gear. The speed reduction is 4.5:1. The normal pressure angle and helix angle are 20° and 45° respectively. Both gears are made of hardened steel ( $S_{ut} = 600 \text{ N/mm}^2$ ). The service factor and the factor of safety are 1.5 and 2; respectively. **07**
1. Assume that the velocity factor accounts for the dynamic load and that the face width is ten times the normal module. Assuming the pitch line velocity to be 10m/s, estimate the normal module.
  2. Select the first preference value of the normal module and calculate the main dimensions of the gears.
  3. What is the correct factor of safety for bending?
- OR**
- Q.3** (a) Explain principle types of failure of gear tooth due to wear. **03**  
 (b) Derive the expression for beam strength of a spur gear tooth. **04**  
 (c) A pair of spur gears consists of a 20 teeth pinion meshing with a 120 teeth gear. The module is 4 mm. calculate: **07**
1. The centre distance
  2. Pitch circle diameter of the pinion and the gear
  3. The addendum & dedendum
  4. Tooth thickness
  5. Bottom clearance
  6. Gear ratio.

- Q.4** (a) What do you understand by “fluctuation of energy”. **03**  
 (b) Explain the piston materials. **04**  
 (c) A pair of bevel gears, with 20 pressure angle, consists of a 20 teeth pinion meshing with a 30 teeth gear. The module is 4 mm, while the face width is 20 mm. the material for the pinion and gear is steel 50C4 ( $S_{ut} = 750 \text{ N/mm}^2$ ). The gear teeth are lapped and ground (class-3) and the surface hardness is 400 BHN. The pinion rotates at 500 rpm and receives 2.5 KW power from the electric motor. The starting torque of the motor is 150% of the rated torque. Determine the factor of safety against bending failure and against pitting failure. **07**

**OR**

- Q.4** (a) Why I section is more preferred for connecting rod? **03**  
 (b) Give the detailed classification of the gearboxes. **04**  
 (c) Explain the working of valve gear mechanism for a given I.C.Engine with neat sketch. **07**

- Q.5** (a) What are the advantages and disadvantages of wet liner and Dry liner in I C Engines? **03**  
 (b) Why is the design of exhaust valve more critical than that of inlet valve? **04**  
 (c) Following Data is given for the piston of a 4-stroke diesel engine: **07**  
 Cylinder bore = 250 mm, Max. gas pressure = 4 Mpa, Bearing pressure at small end of connecting rod= 15 Mpa, length of piston pin in bush of small end= 0.45 D, ratio of inner to outer diameter of piston pin = 0.6, mean diameter of piston boss= 1.4 X outer diameter of piston pin, allowable bending stress for piston pin =  $84 \text{ N/mm}^2$ . Calculate:  
 1. Outer diameter of piston pin  
 2. Inner diameter of piston pin  
 3. Mean diameter of piston boss;  
 4. Check the design for bending stresses.

**OR**

- Q.5** (a) State the function of following for an I C Engine piston: **03**  
 1. Piston rings 2. Piston skirts 3. Piston pin  
 (b) Explain design consideration of piston and selection of piston material in I C Engine. **04**  
 (c) Following data is given for the piston of a 4-stroke diesel engine: **07**  
 Cylinder bore =250 mm; material of piston rings = grey cast iron; allowable tensile stress =  $100 \text{ N/mm}^2$ ; allowable radial pressure on cylinder wall = 0.03 Mpa; thickness of piston head = 42 mm; No. of piston rings = 4.  
 Calculate: 1. Radial width of piston rings 2. Axial thickness of piston rings 3. Gap between the free ends of piston rings before assembly 4. Gap between the free ends after assembly 5. Width of the top land 6. Width of ring grooves.

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