

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER-VI • EXAMINATION – WINTER • 2014

Subject Code: 160201**Date: 26-11-2014****Subject Name: Automobile Component Design****Time: 02:30 pm - 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.

- Q.1** (a) Explain types of rolling contact bearing. **07**
 (b) Explain the design consideration of Gear Drive. **07**
- Q.2** (a) A shaft rotating at constant speed is subjected to variable load. The bearings supporting the shaft are subjected to stationary equivalent radial load of 3kN for 10 percent of time, 2 kN for 20 percent of time, 1 kN for 30 percent of time and no load for remaining time of cycle. If the total life expected for the bearing is 20×10^6 revolutions at 95 percent reliability, calculate dynamic load rating of the ball bearing. **07**
 (b) Explain design of piston with neat sketch. **07**
- OR**
- (b) Why are helical gears preferred over spur gears at higher speeds? **07**
- Q.3** (a) Explain the importance of manufacturing considerations in machine design. **07**
 (b) Sketch a valve gear mechanism, name different parts in it and list materials of Valve and rocker arm. **07**
- OR**
- Q.3** (a) Explain terminology of bevel gears with neat sketch. **07**
 (b) A helical cast steel gear with 30° helix angle has to transmit 35 kW at 1500 r.p.m. 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 56MPa. 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 $0.154 - \frac{0.912}{T_E}$, where T_E represents the equivalent number of teeth. Take Velocity factor $C_v = \frac{15}{15+v}$. **07**
- Q.4** (a) Explain the balancing of single and multi cylinder engine. **07**
 (b) Explain strength rating and wear rating of worm gears. **07**
- OR**
- Q.4** (a) Explain Design Criteria of intake manifold and exhaust manifold. **07**

- (b) A gear drive is required to transmit a maximum power of 22.5kW. The velocity ratio is 1:2 and r.p.m. of the pinion is 200. The approximate centre distance between the shafts may be taken as 600 mm. The teeth has 20° stub involute profiles. The static stress for the gear material (which is cast iron) may be taken as 60 MPa and face width as 10 times the module. Find the module, face width and number of teeth on each gear. Take service factor $C_s = 1$, $C_v = \frac{3}{3+v}$ and tooth form factor is $0.175 - \frac{0.841}{T}$.

- Q.5 (a) Explain the design of connecting rod with neat sketch. 07
 (b) Design a cast iron piston for a single acting four stroke engine for the following 07

Cylinder bore = 100mm

Stroke = 125 mm

Maximum gas pressure = 5 N/mm²

Indicated mean effective pressure = 0.75 N/mm²

Mechanical efficiency = 80%

Fuel consumption = 41.7×10^{-6} kg/BP/s

Higher calorific value of fuel = 42×10^3 kJ/kg

Speed = 2000 r.p.m.

Determine: (1) piston crown thickness (2) piston rings.

Take permissible bending stress is 38 MPa.

Allowable bending stress is 90 MPa

Pressure of gas on the cylinder wall is 0.035 N/mm².

Any other data required for the design may be assumed.

OR

- Q.5 (a) Explain design consideration of gear box. 07

- (b) A pair of cast iron bevel gears connect two shafts at right angles. The pitch diameters of the pinion and gear are 80 mm and 100 mm respectively. The tooth 07

profiles of the gears are of $14\frac{1}{2}^\circ$ composite form. The allowable static stress for both the gears is 55 MPa. If the pinion transmits 2.75 kW at 1100 r.p.m. Find module and number of teeth on each gear from the stand point of strength and check the design from the stand point of wear. Take surface endurance limit as 630 MPa and modulus of elasticity for cast iron as 84 kN/mm².

Take velocity factor $C_v = \frac{6}{6+v}$.

Take face width as 1/3rd of the slant height of the pitch cone.
