

**GUJARAT TECHNOLOGICAL UNIVERSITY**  
**BE - SEMESTER-VII(NEW) • EXAMINATION – WINTER 2016**

**Subject Code:2170202****Date:23/11/2016****Subject Name:Automobile Component Design****Time:10.30 AM to 1.30 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) Write a detailed note on selection of gear materials. **05**  
 (b) Justify “In multispeed gearbox, geometric progression ratio is selected in the range of 1 to 2”. Explain the procedure of designing multi speed automobile gear box. **09**

- Q.2** (a) What do you mean by standardization? Describe its significance and explain role of preferred numbers in standardization. **06**  
 (b) Explain the design for manufacturing and design for assembly. **08**

**OR**

- (b) Answer the following:  
 1. Explain various factors affecting fatigue strength. **04**  
 2. What do you mean by creep? Explain wear considerations in design. **04**
- Q.3** (a) Explain different modes of gear teeth failures, stating their reasons and remedies. **05**  
 (b) The following particulars refer to a pair of precision cut bevel gears connect two shafts at right angles. **09**

Particulars	Pinion	Gear
Material	40 Cr 1	35 Ni 1 Cr 60
Number of Teeth	21	84
Yield strength	700 MPa	600 MPa
BHN	280	250
Speed	1200 rpm	----
Module	2 mm	2 mm
Tooth Profile	20° Full depth involute	

Factor of safety = 3

Service Factor ( $K_s$ )=1.5Wear factor ( $k$ )=0.92Lewis form factor:  $Y = 0.154 - (0.912/Z_f)$ Velocity Factor ( $K_v$ ) =  $3.5 / (3.5 + \sqrt{V})$ Face width =  $R/3$ ,  $R$  = Pitch cone distance,Dynamic factor ( $C$ ) = 280 N/mm,

Find KW capacity of the unit.

**OR**

- Q.3** (a) A pair of accurately cut spur gears with 20° stub teeth has 18 teeth on pinion and 72 teeth on gear. The gears are machined to meet the specifications of grade-10 and heat treated to surface hardness of 250 BHN and has static stress of 180 MPa. Find Maximum power transmitted at an optimum speed of 2497 rpm. Take Wear factor ( $K$ )=0.16  $[BHN/100]^2$  N/mm<sup>2</sup>, Module ( $m$ ) =3 mm and face width 30 mm. **07**

- (b) A triple threaded worm rotating at 1200 r.p.m. drives a worm gear having 30 teeth. The teeth are of  $20^\circ$  full depth involute profile. The module is 10 mm and velocity ratio is 10. Find 1. Power transmission capacity based on beam strength if allowable static stress for gear material is 70 MPa, 2. Power lost in friction, if  $\mu=0.045$ . Take Lewis form factor:  $Y=0.154 - (0.912/Z)$ , where  $Z =$  Number of teeth and Face width  $(b) = 0.7 D_w$ . **07**
- Q.4 (a)** Explain the important parameters affecting the design of journal bearing and State the materials used for the bearings. **07**
- (b)** Explain Design Criteria of intake manifold and exhaust manifold. **07**
- OR**
- Q.4 (a)** A 6310 SKF deep groove ball bearing is subjected to a following work cycle: **07**  
 Radial load of 600 N, Axial Load=250 N at 800 rpm for 25 % of the time.  
 Radial load of 700 N, Axial Load=200 N at 1000 rpm for 55 % of the time.  
 Radial load of 300 N, Axial Load=150 N at 1200 rpm for 30 % of the time.  
 Determine the rating life of bearing in hours. Also Find the life that 50 % of the bearing will exceed before fatigue failure. Take Dynamic capacity of bearing= 47.5 kN, Static capacity of bearing= 36 kN, Radial load factor = 0.56 and Axial Load factor =2. Assume inner race rotates at steady load condition.
- (b)** Answer the following:
1. What is preloading of rolling contact bearing? Why it is necessary? **03**
  2. Explain design considerations for ergonomic. **04**
- Q.5 (a)** Why I section is more preferred for connecting rod? **04**
- (b)** Design an aluminium alloy piston for 4-stroke petrol engine from the following data: Cylinder bore=100 mm; Stroke=125 mm; Maximum explosion pressure=2.5 MPa ;Power developed = 80 kW; Fuel consumption=180 gm/kwh; Higher calorific value of fuel= $45 \times 10^3$  kJ/kg; Speed = 2500 rpm; Allowable stress for C.I. Piston=40 MPa; Allowable bearing pressure for piston pin of steel=120 MPa; Allowable bearing pressure for small end of bearing=25 MPa; Take three compression rings and one scrapper ring, Take Thermal Conductivity  $k = 175 \text{ w/ m}^2 \text{ } ^\circ\text{c. m}$  and  $[T_c - T_e] = 55^\circ \text{ C}$  for Aluminium alloy. Any other data required for the design may be assumed. **10**
- OR**
- Q.5 (a)** Explain the working of valve gear mechanism for a given I.C. engine with neat sketch. **07**
- (b)** The cylinder of a four stroke diesel engine has the following specifications: **07**  
 Bore: 250 mm; Maximum gas pressure = 3 MPa; Allowable stress for C.I. Cylinder=42 MPa, Allowable stress for Bolt=65 MPa, Calculate:
1. Thickness of the cylinder wall and flange  
(Take, Reboring factor  $(k) = 7.5 \text{ mm}$ )
  2. Thickness of the cylinder head
  3. Size of bolt and pitch of bolt.

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