

Enrollment No: \_\_\_\_\_

Exam Seat No: \_\_\_\_\_

# C.U.SHAH UNIVERSITY

## Summer Examination-2018

Subject Name: Automobile Component Design

Subject Code: 4TE06ACD1

Branch: B.Tech (Automobile)

Semester: 6

Date: 27/04/2018

Time: 02:30 To 05:30

Marks: 70

Instructions:

- (1) Use of Programmable calculator & any other electronic instrument is prohibited.
- (2) Instructions written on main answer book are strictly to be obeyed.
- (3) Draw neat diagrams and figures (if necessary) at right places.
- (4) Assume suitable data if needed.
- (5) Use of PSG Design data book is permitted in exam

- Q-1 Attempt the following questions: (14)**
- a) What are zero film bearings? **01**
  - b) Why pinion is weaker than the gear made of same material? **01**
  - c) Give any one application of 180 or 120° bearings? **01**
  - d) A spur gear has a module of 3 mm, number of teeth 16, a face width of 36mm and a pressure angle of 20°. It is transmitting a power of 3 kW at 20 rev/s. taking a velocity factor of 1.5, and a form factor of 0.3, the stress in the gear tooth is about..... **01**
  - e) What is  $L_{50}$  life? **01**
  - f) To make a worm drive reversible, it is necessary to increase..... **01**
  - g) What is the optimum value of face width in terms of module? **01**
  - h) The velocity ratio between pinion and gear drive is 2.3, the module of teeth is 2.0 mm and sum of number of teeth on pinion and gear is 99. What is the centre distance between pinion and the gear? **01**
  - i) In full depth 14.5° degree involute system, the smallest number of teeth in a pinion which meshes gear without interference is..... **01**
  - j) At what angle of crank, is the crankshaft subjected to maximum torque in petrol Engine? **01**
  - k) Define Semi-floating type wrist pin **01**
  - l) What is the interference angle between the valve seat and valve-seating surface? **01**
  - m) Suggest the appropriate materials for the following applications **01**
    - a. Industrial engine
    - b. Aero engine
  - n) What is a multi-throw crankshaft? **01**

**Attempt any four questions from Q-2 to Q-8**

- Q-2 Attempt all questions (14)**
- a) Explain the term “Bearing Characteristic Number”. Draw the graph of Bearing Characteristics Number and Co-efficient of friction, and explain the same in brief. **05**
  - b) Draw the Structural diagram, Rays diagram and Speed chart for machine tool **09**



speed box for a speed range of 45 to 500 rpm with  $\phi = 1.41$ . Also find the percentage speed variation. The permissible variation of speed is to be  $6[\phi-1]$ .

- Q-3** **Attempt all questions** (14)
- a) A 6310 SKF Deep Groove Ball Bearing is subjected to a following loading cycle: 07
- (i) For 25% of the time,  $F_r = 600$  N,  $F_a = 250$  N at 800 rpm
  - (ii) For 55% of the time,  $F_r = 700$  N,  $F_a = 200$  N at 1000 rpm
  - (iii) For 30% of the time,  $F_r = 300$  N,  $F_a = 150$  N at 1200 rpm.
- Determine the rating life of the bearings in hours. Also find the life that 50% of the bearing will exceed before fatigue failure. Assume steady load condition. Take  $C = 47.5$  kN,  $C_o = 36$  kN.
- b) Explain the step by step design procedure for piston in IC Engine. 07
- Q-4** **Attempt all questions** (14)
- a) Explain Wedge film lubrication in detail with neat sketch. 07
- b) Two parallel shafts 320 mm apart are to be connected by helical gears. The pinion is to have 30 teeth and rotates at 800 rpm. The speed reduction is 4: 1. The helix angle is  $35^\circ$ , and gears are of  $20^\circ$  full depth involute teeth. The gears are made of carbon steel having ultimate strength of 450 MPa and the surface hardness is 300 BHN. Take service factor of 1.25 and FOS of 3. Determine on the static strength basis 07
- (i) Standard normal module
  - (ii) Width of face, Assume face width = 12 m.
  - (iii) Power transmission capacity on the basis of static load, if  $K_s = 1.25$ .
- Q-5** **Attempt all questions** (14)
- a) A Pair of bevel gears are used for  $90^\circ$  shaft, to transmit 12.5 kW at 1500 rpm. The module is 5 mm. the pinion and gear; both are made of steel, having allowable static stress of 210 MPa and have surface hardness of 240 BHN. It has surface endurance limit of 620 MPa. The pinion has 30 teeth and the gear has 90 teeth, with  $20^\circ$  full depth involute profile. The gears are cut carefully. The gear drive is used for 8 hours per day with a steady load condition. Assuming face width as 03 times the pitch cone distance, determine, 10
- (i) Magnitude of induced bending stress.
  - (ii) Magnitude of dynamic tooth load.
  - (iii) Magnitude of wear load
- b) Explain important factors to be considered in the selection of bearing material in detail 04
- Q-6** **Attempt all questions** (14)
- a) Design a connecting rod I- Section for an Four stroke cycle engine with the 10
- following specifications:
- Brake power = 8.6 kW
  - Engine speed = 2200 r.p.m
  - indicated mean pressure = 0.4 MPa
  - Mechanical Efficiency = 80%
  - Length of connecting rod = 280 mm
  - Mass of reciprocating parts = 1.1 kg



Assume suitable data. Determine the whipping stresses. Take  $L/D = 1.2$

- b)** Explain modes of gear tooth failure **04**
- Q-7** **Attempt all questions** **(14)**
- a)** State the limitations of Lewis equation for gear design **04**
- b)** Write a short note on Thermal Considerations in worm gear **04**
- c)** Explain with neat sketch Valve Gear Mechanism for horizontal engine **06**
- Q-8** **Attempt all questions** **(14)**
- a)** Explain with neat sketch the force analysis of Centre Crank shaft by considering shaft at angle of  $25$  to  $35^\circ$  **10**
- b)** Explain with neat sketch the generation of Involute and Cycloidal tooth profile **04**

