

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-VII (NEW) - EXAMINATION – SUMMER 2017****Subject Code: 2170202****Date: 04/05/2017****Subject Name: Automobile Component Design****Time: 02.30 PM to 05.30 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) Explain the design considerations for machining and assembly consideration in design. **07**
- (b) It is required to design a pair of spur gears with 20° full depth involute teeth consisting of a 20 teeth pinion meshing with 50 teeth gear. The pinion shaft is connected to a 22.5kW, 1450 r.p.m electric motor. The starting torque of motor is 150% of rated torque. The material for pinion is Fe410 with $S_{ut}=410\text{N/mm}^2$, while gear is made of grey cast iron with $S_{ut}=200\text{N/mm}^2$. Assume a factor of safety of 1.5. Design the gears based on Lewis equation considering the velocity factor into account for the dynamic load. [Lewis form factor for 20 and 50 teeth are 0.32 and 0.408 respectively] **07**

- Q.2** (a) Explain the principles that can be adapted to obtain maximum benefit from forged components. Also discuss the design requirement of forged parts. **07**
- (b) A ball bearing operates on the following work cycle **07**

Element No.	Radial Load(N)	Speed(r.p.m)	Element Time (%)
1	3000	720	30
2	7000	1440	50
3	5000	900	20

The dynamic load carrying capacity of the bearing is 16.6kN. Calculate

1. The average speed of rotation.
2. The equivalent radial load.
3. The bearing life in hrs.

OR

- (b) Narrate the advantages and disadvantages of worm gears. **07**
- Q.3** (a) 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° , while the helix angle is 25° . The face width is 40mm and the normal module is 4mm. The pinion as well as the gear are made of steel 40C8 ($S_{ut}=600\text{N/mm}^2$) and heat treated to surface hardness of 300BHN. The service factor and factor of safety are 1.5 and 2 respectively. Assume the velocity factor accounts for dynamic load, calculate the power transmitting capacity of gears. Take $Y=0.3475$. **07**
- (b) Explain in detail the principal types of failure of gear tooth due to wear **07**

OR

- Q.3** (a) Derive the expression for beam strength of bevel gear. **07**

- (b) A worm drive transmitting 15kW at 2000 rpm to a machine carriage at 75rpm. 07
 The worm is triple threaded and has 65mm pitch diameter. The worm gear has 90 teeth of 6mm module. The tooth form is to be 20° full depth involute the coefficient of friction between the mating teeth may be taken as 0.10. Calculate 1.) Tangential force acting on the worm 2.) Axial thrust and separating force on worm and 3) efficiency of the worm drive.
- Q.4** (a) Why thin piston rings preferred then broad piston rings in I.C engine piston design. Also discuss the piston materials. 07
 (b) The following data is given for the piston of a four –stroke petrol engine. 07
 Cylinder bore = 250 mm, material of piston rings = aluminum alloy, allowable tensile stress = 90 N/mm², allowable radial pressure on cylinder wall = 0.03MPa, Thickness of piston head = 42 mm, Number of piston rings = 4
 Calculate:
 1) Radial width of the piston rings,
 2) Axial thickness of the piston rings.
 3) Gap between the free ends of the piston ring before assembly.
 4) Gap between the free ends of the piston ring after assembly.
 5) Width of the top land.
 6) Width of the ring grooves
- OR**
- Q.4** (a) Explain synchromesh Gear box with neat sketch 07
 (b) What do you understand by “fluctuation of energy”? Draw a turning moment diagram for a four stroke internal combustion engine and explain. 07
- Q.5** (a) The bore of a cylinder of a four stroke engine is 150mm. The maximum gas pressure inside the cylinder is limited to 3.5 MPa. The cylinder head is made of grey cast iron FG200 ($S_{ut} = 200\text{N/mm}^2$) and the factor of safety is 5. Determine the thickness of the cylinder head Studs are used to fix the cylinder head to the cylinder and obtain a leak proof joint. They are made of steel FeE250 ($S_{yt} = 250\text{N/mm}^2$) and the factor of safety is 5. Assume $K = 0.162$. Calculate 07
 1) Number of studs.
 2) Nominal diameter of studs.
 3) Pitch of studs.
 (b) Explain design method for connecting rod in internal combustion engine. 07
- OR**
- Q.5** (a) Why is the design of exhaust valve more critical than that of inlet valve? Also Explain characteristics of the material used for making valves. 07
 (b) Explain the concept of preferred numbers and series in design. Also give some examples 07
