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

Subject Code: 160201   **Date: 19-05-2014**

Subject Name: Automobile Component Design

Time: 10:30 am - 01:00 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)** What is herringbone helical gear? What is the difference between double helical gear and herringbone helical gear?   **04**

(b) A pair of straight teeth spur gears, having 20^0 involute full depth teeth is to transmit **10** 12.5 kW at 300 r.p.m. of the pinion. The speed ratio is 3:1. The allowable static stresses for gear of cast iron and pinion of steel are 65 MPa and 110 MPa respectively. Assume the following:

No. of teeth of pinion = 18, Face width = 14 times module,

velocity factor $C_v = \frac{4.5}{4.5+V}$, V = pitch line velocity in m/s,

and tooth form factor $(y) = 0154 - \frac{0.912}{No.of\ teeth}$

σ_{es} = 600 MPa, E_p = 200 kN/mm^2 and E_g = 200 kN/mm^2.

Wear load = d_p . f . KW . Q

Determine the module, face width and pitch circle diameter of gears. Check the gears for wear.

Q.2 **(a)** A ball bearing operates on the following work cycle.   **07**

Element No.	Radial load (N)	Speed (rpm)	Element time (%)
1	3000	720	30
2	7000	1440	50
3	5000	900	20

The dynamic load capacity of the bearing is 16.6 kN. Calculate
  i.   The average speed of rotation,
  ii. The equivalent radial load and
  iii. The bearing life in hrs.

(b) State and explain design consideration of casting with figure.   **07**

OR

(b) Explain the procedure of designing multi speed automobile gear box.   **07**

Q.3 **(a)** What is the objective of preloading of rolling contact bearing? Where do you use **04** preloaded rolling contact bearings?

(b) A pair of bevel gears connects two shafts at right angles and transmits 9 kW. Determine **10** the required module and gear diameters for the following specifications. Check the gears for wear load.

Particulars	Pinion	Gear
No. of teeth	22	60
Material	Semi steel	Grey cast iron
Allowable static stress	85 MPa	55 MPa
Speed (rpm)	1145	420
Tooth profile	$14\frac{1}{2}^{0}$ composite	$14\frac{1}{2}^{0}$ composite
BHN	200	160

OR

Q.3 **(a)** What is creep? How will you design the parts subjected to creep? Give the practical **07** applications of the components designed for creep.

(b) A pair of worm and worm wheel is designated as 3/60/10/6. The worm is transmitting **07** 5.5 kW power at 1440 rpm to the worm wheel. The coefficient of friction is 0.1 and the normal pressure angle is 20^{0}. Determine the components of the gear tooth force acting on the worm and the worm wheel.

Q.4 **(a)** What are the advantages and disadvantages of "Wet Liner" and "Dry Liner" in I.C. **07** engines? What are the desirable properties of cylinder materials?

(b) The cylinder of a four-stroke diesel engine has the following specification. **07**
Brake power = 7 kW, Speed = 1000 rpm, Indicated mean effective pressure = 0.35 MPa, Mechanical efficiency = 80%,
Max. gas pressure = 3.5 MPa. The cylinder head is made of grey cast iron FG260 (S_{ut} = 260 N/mm^2 and μ = 0.25). The studs are made of plain-carbon steel 40C8 (S_{yt} = 380 N/mm^2). The factor of safety for all parts is 6. Calculate
  i.   Bore and length of the cylinder liner.
  ii. Thickness of the cylinder head
  iii. Size, number and pitch of studs.

OR

Q.4 **(a)** Explain the piston materials. **04**

(b) Design a cast iron piston for a single acting four stroke engine for the **10**
following data:

Cylinder bore = 300 mm; Stroke = 1.5D; Speed = 300r.p.m.

Indicated mean effective pressure = 0.85 N/mm^2,

Maximum gas pressure = 5 N/mm^2

Fuel consumption = 0.30 kg per BP per hour;

Mechanical efficiency = 80%;

Higher calorific value of fuel = 46000 KJ/kg;

Taking Permissible bending or tensile stress for C.I = 40 N/mm^2;

Heat conductivity factor k for C.I. = 46.6 W/m/°C, and Temperature difference at the centre of the piston head and temperature at the edges piston head is = 220°C; C = Constant representing that portion of the heat supplied to the engine which is absorbed by the piston is 0.05;

The allowable radial Pressure of the gas on cylinder wall is 0.035;

The allowable tensile or bending stress for C.I ring is 90 N/mm^2 ;

The number of compression rings is 3 and there is one oil ring.

The allowable bearing pressure on skirt portion of the piston is 0.45 MPa;

The ratio of side thrust on liner to maximum gas load on piston (μ) is = 0.1;

Bearing pressure at small end of connecting rod is 30 MPa;

Bending stress for piston pin is 140 N/mm^2; The length of the piston pin in the bush of the small end of the connecting rod is (0.45 D).

Q.5 **(a)** Why do inlet and exhaust valves have conical heads and seats? **04**

(b) Explain with neat sketch, the design procedure for the connecting rod for an I.C. engine. **10**

OR

Q.5 **(a)** What is the difference between centre and overhung crankshafts? Where do you use them? Name the materials for crankshaft. **07**

(b) Explain different modes of gear teeth failures, stating their reasons and remedies. **07**

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