Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

B. E. - SEMESTER – VI • EXAMINATION – WINTER 2012

Subject code: 160201 Date: 02/01/2013

Subject Name: Automobile Component Design

Time: 02.30 pm - 05.00 pm Total Marks: 70

Instructions:

1. **Attempt any five questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Explain CREEP and its considerations while designing the automobile engine cylinder. **07**

(b) Describe the design steps to decide the break mean effective pressure of a given C.I. engine (Power and CC of engine are specified) **07**

Q.2 **(a)** A 6310 deep groove ball bearing is operated at 1800 r.p.m. It is subjected to aradial load of 5KN and an axial load of 3.5 KN. Determine the average life of the bearing in the following cases: **07**

1) When inner race rotates at steady and continuous load .

2) When outer race rotates at shock condition.

Take Co=36 KN , C=47.5 KN

Fa/Co	Fa/Cr > e		e
	X	Y	
0.07	0.56	1.6	0.27
0.13		1.4	0.31
0.25		1.2	0.37
0.5		1.0	0.44

(b) Following data refer to a four stroke diesel engine: **07**

Bore = 300 mm , Stroke=330 mm , Maximum explosion pressure =4.2MPa , Allowable stress for cylinder and cover material = 45 MPa ,Allowable stress for bolt material = 60 MPa. Find: 1) Thickness of cylinder wall , 2) Thickness of flange , 3) Thickness of cylinder head , 4) Size and number of bolts required to connect cylinder head with cylinder.

OR

(b) Differentiate between dry and wet liner. Describe the ideal properties required for engine cylinder material. **07**

Q.3 **(a)** Design a spur gear drive to drive a pump impeller from a 5 KW ,600 r.p.m. motor with as small centre distance as possible, with a reduction ratio of 4.5 **:** 1. Use following materials for the gears: **07**

Gear	Material	Static stress	BHN
Pinion	Forged steel	160 MPa	200
gear	Cast steel	100 MPa	180

Use 20º full depth involute profile and check the design for interefence. Take Ks=1.25 , velocity factor Kv=4.5/4.5+V and Lewis factor , y=0.154- 0.912/Z for 20º full depth teeth.

(b) Design a 90º straight bevel gear pair to transmit 7.5 KW from the motor running at 1440 r.p.m. from following data: **07**

Speed reduction ratio=4 **:** 1,Pressure angle =20º full depth involute , No. of teeth on pinion =18 , static stress for C.I. gears =55 MPa , Stress

concentration factor =1.1 , Service load factor =1.5 ,f_{es} = 550 MPa , Ep =Eg = 1 x 10^5 MPa.
Find:1) Module , face width and pitch circle diameter of gears. 2) Check the gears for dynamic load and wear load.

OR

Q.3 **(a)** Design apair of helical gears to transmit 125 Kw between two parallel shafts 600 mm apart. The helix angle is 35º and pressure angle is 20º full depth involute profile. Both gears are made of plain carbon steel with a static stress of 140 MPa. The pinion speed is 960 r.p.m. and that of gear is 320 r.p.m., Take Kv =15/15+V , Assume wear factor K=0.285 and deformation factor C =268 N/mm. Calculate 1) Normal module , face width and number of teeth on gears. 2) Check for dynamic load and wear load. **07**

(b) A triple threaded worm rotating at 1200 r.p.m. drives a worm gear having 36 teeth and transmits 15 KW power . The teeth are of 20º full depth involute profile .The axial pitch of the worm is 30 mm and pitch diameter of 60 mm. The co-efficient of friction is 0.03. Calculate 1)Helix angle of worm 2) Speed ratio 3) Centre distance between two shafts , 4) Apparent stress in the worm gear. 5) Efficiency of drive. **07**

Q.4 **(a)** Following data refers to 4-stroke 4-cylinder petrol engine: **07**
Cylinder bore =100 mm ,Stroke length =125 mm , Maximum explosion pressure=2.5 MPa , Power developed = 80 KW ,Specific fuel consumption = 180 gm/kwh , speed=2500 r.p.m. , Permissible tensile stress for material of piston = 40 MPa , Permissible bending stress for piston pin =120 MPa .Determine 1) Piston crown thickness based on strength and heat dissipation point of view 2) piston pin size

(b) Describe the procedure to find out the size of opening of suction and exhaust valve for given I.C. engine. **07**

OR

Q.4 **(a)** Determine the size of cross section of a connecting rod of 4-stroke diesel engine having I section from the following data: Brake power =10 Kw , Mechanical efficiency=80% , Maximum explosion pressure =3.75 MPa , Indicated mean effective pressure =0.5 MPa , Maximum engine speed =1200 r.p.m. , Angularity of connecting rod for constant explosion pressure = 5º , Stroke/bore ratio =1.2 , Length of connecting rod = 2 x stroke. **07**

Q.4 **(b)** Explain the working of valve gear mechanism for a given I.C. engine with neat sketch. **07**

Q.5 **(a)** Design a suitable speed gear box for a head stock of a lathe that has a variation of speed from 105 r.p.m. to 690 r.p.m. in 9 steps. The power is supplied by an electric motor of 10 KW capacity running at 1000 r.p.m. and having driving the input shaft through a V-belt drive having speed ratio of
2 **:** 1 . Draw the structural diagram , speed chart and determine the number of teeth on each gears. **07**

(b) Explain the step by step procedure to design the flywheel of an given I.C. engine. **07**

OR

Q.5 **(a)** How the 4-cylinder , 4-stroke in-line engine can be balanced for primary , secondary unbalance force and couple? **07**

(b) Differentiate between involute and cycloidal profile of the gears. **07**

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