Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VIII • EXAMINATION – SUMMER • 2014

Subject Code: 181902 Date: 31-05-2014

Subject Name: Machine Design-II

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.**
4. **Design data book is permitted.**

Q1(a) Explain Pitting and Scoring for gear tooth failure. **4**

(b) A spur gear having 22 teeth to be made of plain carbon steel 40C8 (Sut=580N/mm^2) is to be mesh with a gear having 88 teeth to be made of grey cast iron FG260(Sut=260N/mm^2).The pinion shaft is connected to 12KW,1440 rpm electric motor. The starting torque of the motor is approximately twice the rated torque. The tooth system is 20° full depth involute. The face width is 10 times module for which the load distribution factor is 1.4. The gear are to be machined to met the specifications of grade 7 for which deformation factor is 240 N/mm. **10**

(I) If factor of safety require against bending failure 1.0 , design the gear pair by using velocity factor Velocity factor =  and Buckingham's equation for dynamic load.

(ii) if the factor of safety required against pitting failure is 1.5 , specify surface hardness.

Y= 0.484 - 2.87/Z

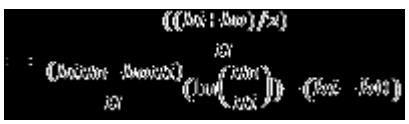
Buckingham's equation Fd= Ft + 

K= 0.18(BHN/100)^2 for steel pinion and cast iron

Standard module are 4,5,6,8,10,12,16 , Service factor =2, Load concentration factor=1.4

Q2(a) A elevator is designed to carry workers and materials to height of 40 meter. It is estimated that at least 10 workers with material load of 12 KN should be hoisted at a speed of 0.5m/sec which should be attained in the first 0.4s. The recommended steel wire rope is 6x19 with wire diameter 2.5mm. Determine factor of safety. Assume E = 84GPa, for 6x19 rope wire diameter dw=0.063d, cross sectional area =0.38d^2, ultimate tensile strength for the wire rope is 435d^2 **7**

(b) Design a crane hook for lifting capacity of 5 tones. Take permissible tensile stress 80N/mm^2 for forged steel. Assume a triangular section for hook design **7**

Rn 

R= Ri + H(bi+2bo)/3(bi+bo)

OR

(b) Explain deign procedure for 6 speed reduction gear box. **7**

Q3(a) What is formative number of teeth in helical gear? Derive the expression for formative number of teeth in helical gears. **4**

(b) Design a gear pair of helical gear **10**

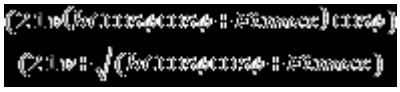
	Gear	Pinion
Material	$50C_4$	$60C_4$
Ultimate strength MPa	660	750
BHN	241	255
Pressure Angle in degree	20°	20°
Number of teeth	70	35
Normal module in mm	5	5
Face width in normal plane, mm	50	50
Modulus of elasticityGPa	205	200

Assume service factor 1.5 and factor of safety 3. Check wear and dynamic strength of gear. Helix angle is 25° , speed of pinion is 720 rpm.

Material	Error 0.02	Error 0.04
Steel steel 20degree involute	228	456

Velocity factor =  , Fw = DpbQK/COS^2

K=((σes)^2 sin(ϕn)/1.4)(1/Ep+1/Eg) , σes = 2.75(BHN) - 70

Fd= Ft + 

OR

Q3(a) Explain thermal consideration while designing worm and worm wheel drive. **4**

(b) A pair of high grade cast iron bevel gears having shaft at right angle are to have an angular velocity ratio of driver to driven of 2 to3. The driver is to rotate at 175 rev/min and is to transmit 10 KW. It is 0.4 meter in pitch diameter. Take the width of face as about one third of the length of pitch element and determine the pitch of the gear. Assume 24 hr/day operation. **10**

Velocity factor =  , Levis factor = π(0.154-(0.921/no. of teeth))

Beam strength = f_{ef} m Y(1-F/L)

High grade cast iron f_{ef} = 84MPa, fes for cast iron =630 MPa., Ep = Eg= 105MPa

Q4(a) Discuss about various section of connecting rod. **4**

(b) Design a cast iron piston for single acting four stroke engine for following specification **10**
Cylinder Bore = 110 mm, Stroke = 130 mm, Maximum gas pressure = 5N/mm^2
Brake mean effective pressure = 0.5 N/mm^2 , Fuel consumption = 0.2 kg/kw/hr,
speed =2000rev/min. Assume suitable data for C.I permissible tensile stress is 40 N/mm^2, HCV=41870 KJ/kg, K for C.I. = 46.6
Permissible tensile stress or piston ring is 100 N/mm^2, permissible tensile stress for pin is 150 N/mm^2

OR

Q4(a) Explain about material for piston. **4**

(b)	Design a connecting rod for four stroke petrol engine for following data. Piston diameter =0.1 m Stroke=0.14 m, Length of C.R. =0.315 m Weight of reciprocating part =18.2 N Speed = 1500 rpm with over speed 2500 Compression ratio 4:1 Maximum explosion pressure = 2.45 MPa. F.O.S. =5 , For connecting rod σyield 380 N/mm^2 , σultimate= 580 N/mm^2	**10**
Q5(a)	Explain the design procedure of screw conveyor	**7**
(b)	Explain design of flat belt conveyor.	**7**
	OR	
Q5(a)	Explain design procedure of wire rope drum.	**7**
(b)	What do you understand by 6 x 37 ropes? Explain with neat sketch the different rope section.	**7**

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