

Enrollment No: _____

Exam Seat No: _____

C.U.SHAH UNIVERSITY

Summer Examination-2018

Subject Name: Machine Design - II

Subject Code: 4TE07MDE1

Branch: B.Tech (Mechanical)

Semester: 7

Date: 26/03/2018

Time: 10:30 To 01:30

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
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- Q-1 Attempt the following questions: (14)**
- a) What is design by Craft evolution? **01**
 - b) Recommend a suitable class of fit between idler gear & spindle **01**
 - c) Why the radial component of gear tooth force is called 'separating' component? **01**
 - d) What is the relationship between number of teeth on pinion & gear, module & center distance? **01**
 - e) Why permissible bending stress for gear tooth is taken as one third ultimate tensile strength? **01**
 - f) Why is worm gear reduction units not preferred over other types of gearboxes for transmitting large powers? **01**
 - g) Twenty degree full depth involute profiled 19-tooth pinion and 37-tooth gear are in mesh. If the module is 5 mm, the centre distance between the gear pair will be..... **01**
 - h) A spur gear has a module of 3 mm, number of teeth 16, a face width of 36 mm 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**
 - i) Two mating spur gears have 40 and 120 teeth respectively. The pinion rotates at 1200 rpm and transmits a torque of 20 Nm. The torque transmitted by the gear is..... **01**
 - j) What is Reboring allowance? **01**
 - k) What do you understand by containerization? **01**
 - l) State any one goal of material handling? **01**
 - m) Why geometric progression is preferred in gear box design? **01**
 - n) Define optimum design **01**

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

- Q-2 Attempt all questions (14)**
- a) Design a tensile rod of 300 mm length to suitable an axial tensile load of 7.5 kN, for minimum cost, from the following materials: **07**



Material	Mass density kg/m ³	Material cost Rs per kg	Yield strength σ_y MPa
30C8 Steel	7800	26	400
4 Cr1 Steel	7680	30	520
Titanium	4800	560	90

Consider FOS of 4.

- b) Explain the purpose of using different types of idler in conveyors. 07

Q-3

Attempt all questions

(14)

- a) Why trapezoidal cross section is preferred in design of crane hook? Also Draw the neat sketch of single crane hook and show the critical cross section on it. 04

- b) As shown in fig. 1.1 the arrangement of a worm and gear drive. Calculate the bearing reactions for the set, from the following data: 10

Input power = 20 kw at 900 rpm

PCD OF WORM = 60 MM

No. of starts = 4

Lead angle = 25°

Normal pressure angle = 20° (full depth)

PCD of gear = 170 mm

Co-efficient of friction = 0.045

Also find the drive efficiency, and V.R

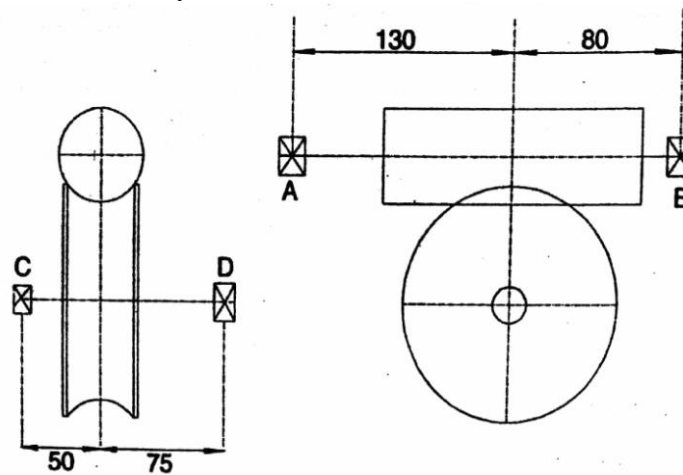


fig. 1.1

Q-4

Attempt all questions

(14)

- a) Design a single throw crankshaft for a 4-stroke diesel engine from the following data: 10

- Cylinder bore = 100 mm
- Stroke length = 130 mm
- Power developed at 400 rpm = 10 kw
- Maximum explosion pressure = 2.5 MPa
- Crank position for maximum torque = 25° from T.D.C
- Center distance between main bearings of crankshaft = 350 mm
- Weight of flywheel = 36 kN
- Flywheel is located at mid span between main bearing 2 & 3, which are



400 mm apart.

- Flywheel is used as pulley to transmit power, and has horizontal belt tension 1700 N on tight side and 800 N on slack side of belt.

Find,

1. Diameter of crankpin and length of crankpin.
2. Shaft diameter of bearings.

b) Draw a neat sketch for valve gear mechanism for horizontal engine. **04**

Q-5 **Attempt all questions** **(14)**

a) Prepare a neat kinematic arrangement of Sliding gear box for the following data: **07**

- Between shaft I & II ($i_1 = 24/38$, $i_2 = 20/42$)
- Between shaft II & III ($i_3 = 35/35$, $i_4 = 27/43$, $i_5 = 20/50$)
- Between shaft III & IV ($i_6 = 40/20$, $i_6 = 20/40$)

b) Determine the thickness of cylinder, cylinder head, number of bolts, size of bolt and pitch of bolt for 4-stroke diesel engine cylinder of 250 mm bore and allowable stress of 42 MPa. Take maximum explosive pressure of 3 N/mm^2 . **07**

Take $\sigma_t = 65 \text{ MPa}$ for Ni-steel bolts.

Also find outer diameter of cylinder flange.

Q-6 **Attempt all questions** **(14)**

a) Explain in detail various tooth form profile with neat sketch? **06**

b) The thrust on a drill press spindle is 15 kN. A 16 teeth, 20° full depth pinion drives the rack, collared on the spindle for drill feed in the work. The pinion and rack are made of semi steel, having a static stress of 84 MPa. Assuming the face width of pinion as 50 mm, determine the standard module. **08**

Take $K_s = 1$, and Lewis factor, $y = 0.154 - 0.912/T$

What will be module if the pinion is of 14.5° full depth?

Q-7 **Attempt all questions** **(14)**

a) Compare straight bevel gear, spiral bevel gear and hypoid gear with sketch? **04**

b) Explain vertical gravity take-up mechanism in detail with neat sketch? **04**

c) Give the classification of wire rope and its construction with neat sketches. How does the flexibility of wire rope influenced by its construction? **06**

Q-8 **Attempt all questions** **(14)**

a) An inclined conveyor handles an ore having a density of 1.5 t/m^3 . The material has to be conveyed over a distance of 2 kms and a height of 450 m. if the belt speed is to be 120 m/min, then determine the standard width of the four ply belt so that the material can be conveyed at rate of 3 tonnes/hr. For the inclined belt use the following data for the flowability factor. **07**

Conveyor Inclination	10 - 15°	16 - 20°	21 - 25°	26 - 30°	31 - 35°
Flowability Factor, C_i	2.65×10^{-4}	2.50×10^{-4}	2.35×10^{-4}	2.20×10^{-4}	2.05×10^{-4}

Also determine the diameter and width of the drive pulley and the gear reduction ration for the motor, if the motor speed is 1440 rpm. Assume the material for the ply of belt has a material factor $k_1 = 2.5$ and the belt tension and arc of contact factor, $k_2 = 80$. The effective width b (in meter), of the material carried by the belt safety is given by the following equation:

$$b = 0.9 B - 0.05 \quad (B = \text{Belt width, m})$$



- b) Prepare a block diagram showing the general layout of EOT and give names of each assembly? **07**

