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**Question Paper Code: 46701**

B.E. / B.Tech. DEGREE EXAMINATION, APRIL 2019

Sixth Semester

Mechanical Engineering

14UME601 - DESIGN OF TRANSMISSION SYSTEMS

(Regulation 2014)

(Approved Design Data Book is Permitted)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

- The material suitable for the belts used in agricultural equipments is
  - cotton
  - rubber
  - leather
  - balata gum
- Design of power transmission shafting is based on
  - Maximum shear stress theory
  - St. Venant theory
  - Rankine's theory
  - Heigh's theory
- The gears are termed as medium velocity gears, if their peripheral velocity is
  - 1–3 m/s
  - 3–15 m/s
  - 15–30 m/s
  - 30–50 m/s
- A spur gear with pitch circle diameter  $D$  has number of teeth  $T$ . The module  $m$  is defined as
  - $m = d / T$
  - $m = T / D$
  - $m = \pi D / T$
  - $m = D.T$
- The number of starts on worm for a velocity ratio of 40 is
  - single
  - double
  - triple
  - quadruple
- If  $b$  denotes the face width and  $L$  denotes the cone distance, then the bevel factor is written as
  - $b / L$
  - $b / 2L$
  - $1 - 2 b.L$
  - $1 - b / L$

7. The contact ratio for gears is
- (a) zero (b) less than one  
(c) greater than one (d) none of these
8. If the centre distance of the mating gears having involute teeth is increased, then the pressure angle
- (a) increases (b) decreases  
(c) remains unchanged (d) none of these
9. In case of a multiple disc clutch, if  $n_1$  are the number of discs on the driving shaft and  $n_2$  are the number of the discs on the drive shaft, then the number of pairs of contact surfaces will be
- (a)  $n_1 + n_2$  (b)  $n_1 + n_2 - 1$   
(c)  $n_1 + n_2 + 1$  (d) none of these
10. A brake commonly used in motor cars is
- (a) shoe brake (b) band brake  
(c) band and block brake (d) internal expanding brake

PART - B (5 x 2 = 10 Marks)

11. What is meant by the ply of belt?
12. Specify the types of gears-failures.
13. Differentiate the Crown gear and Mitre Gear.
14. What is the function of spacers in a gear-box?
15. What are the materials used for lining of friction surfaces in clutches?

PART - C (5 x 16 = 80 Marks)

16. (a) Design a chain drive to actuate a compressor from 15 kW electric motor running at 1000 r.p.m., the compressor speed being 350 r.p.m. The minimum centre distance is 500 mm. The compressor operates 16 hours per day. The chain tension may be adjusted by shifting the motor on slides. (16)

Or

- (b) A flat belt drive is to design to drive a flour mill. The driving power requirement of the mill is 22.5 Kw at 750rpm with a speed reduction of 3.0. The distance between the shaft is 3m. Diameter of the mill pulley is 1.2m. Design and make a neat sketch of the drive. (16)

17. (a) A motor shaft rotating at 1500 rpm has to transmit 15 kW to a low speed shaft with a speed reduction of 3:1. Assume starting torque to be 25% higher than the running torque. The teeth are 20° involutes with 25 teeth on the pinion. Both the pinion and gear are made of C45 steel. Design a spur gear drive to suit the above conditions and check for compressive and bending stresses and plastic deformations. (16)

Or

- (b) In a spur gear drive for a stone crusher, the gears are made of C40 steel. The pinion is transmitting 30 KW at 1200 rpm. The gear ratio is 3. Gear is to work 8 hrs. per day, six days a week and for 3 years. Design the drive. (16)

18. (a) A pair of straight tooth bevel gears has a velocity ratio of 4/3. The pitch diameter of the pinion is 150 mm. The face width is 50 mm. The pinion rotates at 240 rev/min. The teeth are 5 mm module, 14 and 1/2° involute. If 6 KW is transmitted, determine (i) the tangential force at the mean radius, (ii) the pinion thrust force, (iii) the gear thrust force and Draw the free body diagrams indicating the forces. (16)

Or

- (b) A steel worm running at 240 rpm, receives 1.5 kW from its shaft. The speed reduction is 10:1, design the drive so as to have an efficiency of 80 %. Also determine the cooling area required, if the temperature rise is restricted to 45° C, and take overall heat transfer coefficient as 10 W / m<sup>2</sup> ° C.. (16)

19. (a) Design the layout of a 12 speed gear box for a lathe. The minimum and maximum speeds are 100 and 1200 rpm. Power is 5 kW from 1440 rpm induction motor. Construct the speed diagram using a standard speed ratio. Calculate the number of teeth in each gear wheel and sketch the arrangement of the gear box (16)

Or

- (b) In a drilling machine, 12 different speeds in the range of 100 rpm to 355 rpm are required. Design a three stage gear box with a standard step ratio. Sketch the layout of the gear box, indicating the number of teeth on each gear. The gear box receives 5 KW from an electric motor running at 360 rpm. Sketch also the speed diagram. (16)

20. (a) A multi plate disc clutch is to be designed for a machine tool driven by an electric motor of  $12.455 \text{ kW}$  running at  $1400 \text{ rpm}$ . Velocity ratio is 24:1, Space restriction limit the outside diameter to  $100 \text{ mm}$ . Determine approximate values for disc diameter, total number of discs, and clamping force. (16)

Or

- (b) A power of  $20 \text{ KW}$  is to be transmitted through a cone clutch at  $500 \text{ rpm}$ . For uniform wear condition, find the main dimensions of clutch and shaft. Also determine the axial force required to engage the clutch. Assume coefficient of friction as  $0.25$ , the maximum normal pressure on the friction surface is not to exceed  $0.08 \text{ MPa}$  and take the design stress for the shaft material as  $40 \text{ MPa}$ . (16)

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