Reg. No. : | | | | | | | | | | |

Question Paper Code: 41761

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2022

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)

1. The power transmitted by belt drive depends on

   (a) belt velocity (b) initial belt tension (c) arc of contact (d) all of the above

2. In order to have smooth operation, the minimum number of teeth on the smaller sprocket, for moderate speeds should be

   (a) 15 (b) 17 (c) 21 (d) 25

3. The backlash for spur gears depends upon

   (a) module
   (b) pitch line velocity
   (c) tooth profile
   (d) both (a) and (b)

4. In helical gears, the distance between similar faces of adjacent teeth along a helix on the pitch cylinders normal to the teeth, is called

   (a) normal pitch
   (b) axial pitch
   (c) diametric pitch
   (d) module

5. When bevel gears having equal teeth and equal pitch angles connect two shafts whose axes intersect at right angle, then they are known as

(a) angular bevel gears (b) crown bevel gears
(c) miter gears (d) internal bevel gears

6. The number of starts on the worm for a velocity ratio of 40 should be

(a) single (b) double
(c) triple (d) quadruple

7. Which of the following is not a type of gearbox?

(a) Linear mesh gearbox (b) Sliding mesh gearbox
(c) Constant mesh gearbox (d) Synchromesh gearbox

8. The contact ratio for gears is

(a) zero (b) less than one
(c) greater than one (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. For a block brake with long shoe, the equivalent coefficient of friction is

(a) $\mu \left[\frac{4 \text{ Sin } \theta}{2\theta + \text{Sin } 2\theta}\right]$ b) $\mu \left[\frac{2 \text{ Sin } \theta}{2\theta + \text{Sin } 2\theta}\right]$ c) $\mu \left[\frac{4 \text{ Sin } 2\theta}{2\theta + \text{Sin } 2\theta}\right]$ d) $\mu \left[\frac{4 \text{ Sin } \theta}{4\theta + \text{Sin } 2\theta}\right]$

PART - B (5 x 2 = 10 Marks)

11. What do you understand by simplex, duplex and triplex chain?

12. Specify the types of gears-failures.

13. Under what situation, bevel gears are used?

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) 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)

Or

(b) 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)

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) A pair of helical gears are to transmit 15 *kW*. The teeth are 20° stub in diametric plane and have a helix angle of 45°. The pinion runs at 10,000 *r.p.m*. and has 80 *mm* pitch diameter. The gear has 320 *mm* pitch diameter. If the gears are made of cast steel having allowable static strength of 100 *MPa*; determine a suitable module and face width from static strength considerations and check the gears for wear, given σ_{es} = 618 *MPa*. (16)

18. (a) A pair of 20° full depth involute teeth bevel gear connects two shafts at right angles having a velocity ratio of 3.2: 1. The gear is made of cast steel with an allowable static stress as 72 *N/mm*², and the pinion is made of steel having a static stress of 100 *N/mm*². The pinion transmits 40 *kW* and at 840 *rpm*. Find the module, face width, and pitch diameter from the stand point of the beam strength, and check the design from the stand point of wear. (16)

Or

(b) Design a pair of bevel gears is to be transmitting 10KW from pinion at a speed 1440rpm. Required transmission ratio is 4. Material for gears is 15Ni 2Cr 1 Mo 15/steel. The tooth profiles of the gear are 20^o composite form. (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) Design a nine-speed gear box for a machine to provide speeds ranging from 31.5 to 1050 *rpm*. The input is from a motor of 5 *kW* at 1440 *rpm*. Assume any alloy steel for the gear. (16)

20. (a) A power of 20 KW is to be transmitted through a cone clutch at 500 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 MPa and take the design stress for the shaft material as 40 MPa. (16)

Or

(b) A rope drum of an elevator having 650 *mm* diameter is fitted with a brake drum of 1 *m* diameter. The brake drum is provided with four cast iron brake shoes each subtending an angle of 45°. The mass of the elevator when loaded is 2000 *kg* and moves with a speed of 2.5 *m/s*. The brake has a sufficient capacity to stop the elevator in 2.75 metres. Assuming the coefficient of friction between the brake drum and shoes as 0.2, find: (i) Width of the shoe, if the allowable pressure on the brake shoe is limited to 0.3 N/mm^2; and (ii) Heat generated in stopping the elevator. (16)