Reg. No. :

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2018

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. When the speed of belt increases

   (a) the coefficient of friction between the belt and pulley increases
   (b) the coefficient of friction between the belt and pulley decreases
   (c) the power transmitted will decrease
   (d) the power transmitted will increase

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 gears are termed as medium velocity gears, if their peripheral velocity is

   (a) 1–3 m/s   (b) 3–15 m/s   (c) 15–30 m/s   (d) 30–50 m/s

4. A spur gear with pitch circle diameter D has number of teeth T. The module m is defined as

   (a) $m = d/T$ (b) $m = T/D$ (c) $m = \pi D/T$ (d) $m = D.T$

5. The number of starts on worm for a velocity ratio of 40 is

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

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. 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. The torque developed by a disc clutch is given by

    (a) $T = 0.25\ \mu.W.R$ (b) $T = 0.5\ \mu.W.R$

    (c) $T = 0.75\ \mu.W.R$ (d) $T = \mu.W.R$

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PART - B (5 x 2 = 10 Marks)

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

12. State the advantages of herringbone gear

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?

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PART - C (5 x 16 = 80 Marks)

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16. (a) Design a V – belt drive and calculate the actual belt tensions and average stress for the following data. Driven pulley diameter 500mm, driver pulley diameter, 150 mm, center distance 925 mm, Speeds n_1 = 1000 rpm, n_2 = 300 rpm and power, P= 7.5 Kw.

(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) 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 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 $1/2^o$ 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) 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° 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.

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

Or

(b) A hydraulically operated clutch is to be designed for an automatically operated lathe. Determine number of plates and the operating force required for a clutch which is to transmit a torsional moment of 35 Nm under normal operating conditions. The clutch is to be designed to slip under 300 percent of rated torsional moment to protect the gears and other parts of the drive. The limits for the diameters of the friction surface due to space limitations are 100 mm and 62.5 mm. This clutch is used to operate in an oily atmosphere. (16)

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