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**Question Paper Code: 41761**

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2017

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)

- When the speed of belt increases
  - the coefficient of friction between the belt and pulley increases
  - the coefficient of friction between the belt and pulley decreases
  - the power transmitted will decrease
  - the power transmitted will increase
- In order to have smooth operation, the minimum number of teeth on the smaller sprocket, for moderate speeds should be
  - 15
  - 17
  - 21
  - 25
- The backlash for spur gears depends upon
  - module
  - pitch line velocity
  - tooth profile
  - both (a) and (b)
- In helical gears, the distance between similar faces of adjacent teeth along a helix on the pitch cylinders normal to the teeth, is called
  - normal pitch
  - axial pitch
  - diametric pitch
  - 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. Ratio of two spindle speeds is constant in which of the following progression.
- (a) Arithmetic                                      (b) Geometric  
(c) Harmonic                                      (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. Why is it necessary to dissipate the heat generated during a clutch operation?

PART - C (5 x 16 = 80 Marks)

16. (a) Two shafts whose centres are 1 metre apart are connected by a V-belt drive. The driving pulley is supplied with 95 kW power and has an effective diameter of 300 mm. It runs at 1000 r.p.m. while the driven pulley runs at 375 r.p.m. The angle of groove on the pulleys is 40°. Permissible tension in 400 mm<sup>2</sup> cross-sectional area belt is 2.1 MPa. The material of the belt has density of 1100 kg/m<sup>3</sup>. The driven pulley is overhung, the distance of the centre from the nearest bearing being 200 mm. The coefficient of friction between belt and pulley rim is 0.28. Estimate: (i) The number of belts required and (ii) Diameter of driven pulley shaft, if permissible shear stress is 42 MPa. (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  $\sigma_{es} = 618 \text{ MPa}$ . (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<sup>2</sup>, and the pinion is made of steel having a static stress of 100 N/mm<sup>2</sup>. 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) A steel worm running at  $240 \text{ rpm}$ , receives  $1.5 \text{ kW}$  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  $45^\circ \text{ C}$ , and take overall heat transfer coefficient as  $10 \text{ W/m}^2 \text{ }^\circ \text{ C}$ . (16)
19. (a) Sketch the arrangements of a twelve speed gear box. The minimum and maximum speeds required are around 100 and  $355 \text{ rpm}$ . 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  $5 \text{ kW}$  from an eccentric, running at  $360 \text{ rpm}$ . Also draw the speed diagram. (16)

Or

- (b) Design a nine-speed gear box for a machine to provide speeds ranging from 31.5 to  $1050 \text{ rpm}$ . The input is from a motor of  $5 \text{ kW}$  at  $1440 \text{ rpm}$ . 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  $12.455 \text{ kW}$  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 rope drum of an elevator having  $650 \text{ mm}$  diameter is fitted with a brake drum of  $1 \text{ m}$  diameter. The brake drum is provided with four cast iron brake shoes each subtending an angle of  $45^\circ$ . The mass of the elevator when loaded is  $2000 \text{ kg}$  and moves with a speed of  $2.5 \text{ m/s}$ . 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  $0.3 \text{ N/mm}^2$ ; and (ii) Heat generated in stopping the elevator. (16)
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