KINGS

COLLEGE OF ENGINEERING

DIN EN ISO 9001:2000 Certificate: 01 100 058608

DEPARTMENT OF MECHANICAL ENGINEERING

QUESTION BANK

Sub Code/Name: ME 1352 – DESIGN OF TRANSMISSION SYSTEMS Year/Sem: III / VI

UNIT-I
PART-A (2 Marks)

1. Give the relationship of ratio of tensions in a V-belt drive.
2. Define maximum tension in a belt.
3. Explain the term “Crowning of Pulley”.
4. In what way silent chain is better than ordinary driving chain?
5. What is the effect of centre distance and diameter of pulley on the life of belts?
6. What are the various losses in the power transmission by belts?
7. In what way the timing belt is superior to ordinary belt?
8. What do you understand by simplex, duplex and triplex chain?
9. Why V belts are preferred than flat belts?
10. Define creep in belts.
11. What is the advantage of V belt over flat belt?
12. Define slip.
13. Distinguish regular lay and long lay ropes.
14. Give some application of wire ropes.
15. Explain the chordal action of chain drive.

UNIT-I
PART-B (16 Marks)

1. Designs a chain drive to actuate a compressor from a 12 kW electric motor at 900 rpm, the compressor begin 250 rpm. Minimum centre distance should be 500 mm, the chain tension may be adjusted by shifting the motor on rails. The compressor is to work 8 hours/day. (16)

2. Design a chain drive to actuate a compressor from 15kW electric motor running at 1,000 r.p.m, the compressor speed being 350 rpm. The minimum centre distance is 500 mm. the compressor operates 15 hours per day. The chain tension may be adjusted by shifting the motor (16)

3. Design a V-belt drive and calculate the actual belt tension and average stress for the following data. Driven pulley diameter, D= 500 mm, driver pulley diameter, d=150 mm, center distance C=925 mm, speed N1 = 1000 rpm, N2 = 300 rpm and power, P = 7.5 kW. (16)

4. A crane is lifting a load of 18 KN through a wire rope and a hook. The weight of the hook etc., is 10kN. The load is to be lifted with an acceleration of 1m/sec$^{2.}$ Calculate the diameter of the wire rope. The rope diameter may be taken as 30 times the diameter of the rope. Take a factor of safety of 6 and Young’s modulus for the wire rope 0.8 x 10N/mm^{2}The ultimate stress may be taken as 1800 N/mm^{2}The cross-sectional area of the wire rope may be taken as 0.38 times the square of the wire rope diameter. (16)

5. A 15 kW squirrel cage motor, 1250 r.p.m. is driving a centrifugal pump at 550r.p.m. The centrifugal pump is located at 700 mm form the motor. Design a chain drive. (16)

UNIT-II
PART-A (2 Marks)

1. Define the term back lash.
2. What are the forms of gear tooth profile?
3. State some materials used for gear materials.
4. What are the conditions required for interchangeability?
5. Where do we use skew gears?
6. What are the advantages of helical gear over spur gear?
7. Why dedendum value higher than addendum value?
8. What is helix angle?
9. What are the applications of spur gear?
10. What is herring bone gear and its application?

UNIT II
PART-B (16 Marks)

1. Design a pair of helical gears to transmit 30kW power at a speed reduction ratio of 4:1. The input shaft rotates at 2000 rpm. Take helix and pressure angles equal to 25° and 20° respectively. The number of teeth on the pinion may be taken as 30. (16)

2. Design a straight spur gear drive to transmit 8 kW. The pinion speed is 720 rpm and the speed ratio is 2. Both the gears are made of the same surface hardened carbon steel with 55RC and core hardness less than 350 BHN. Ultimate strength is 720 N/mm^2 and yield strength is 360 N/mm^2. (16)

3. A motor shaft rotating at 1500 rpm has to transmit 15kW 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. Also sketch the spur gear drive. (16)

4. A helical gear with 30° helix angle has to transmit 35kW at 1500 rpm. With a speed reduction ratio 2.5. If the pinion has 24 teeth, determine the necessary module, pitch diameter and face width for 20° full depths the teeth. Assume 15Ni 2Cr 1 Mo 15 material for both pinion and wheel. (16)

5. A pair of helical gears subjected to moderate shock loading is to transmit 37.5kW at 1750 r.p.m. of the pinion. The speed reduction ratio is 4.25 and the helix angle is 15°. The service is continuous and the teeth are 20° FD in the normal plane. Design the gears, assuming a life f 10,000 hours . (16)

6. A compressor running at 300 rpm is driven by a15 Kw, 1200 rpm motor through a 14½ ° full depth spur gears .The centre distance is 375 mm .The motor pinion is to be of C30 forged steel hardened and tempered, and the driven gear is to be of cast iron. Assuming medium shock condition, design the gear drive. (16)

UNIT III
PART-A(2 Marks)

1. In which gear drive, self locking is available?
2. State the use of bevel gears.
3. What is irreversibility in worm gears?
4. How can you specify a pair of worm gear?
5. What are the materials commonly used for worm gears?
6. List out the main types of failure in worm gears.
7. What are the various losses in worm gear?
8. What are forces acting on bevel gears?

9. What is a crown gear?
10. Where do we use worm gears?

UNIT III
PART-B (16 Marks)

1.Design a pair of bevel gears for two shafts whose axes are at right angles. The power transmitted is 25kW. The speed of the pinion is 300 rpm and the gear is 120 rpm. (16)

2.A 2 kW power is applied to a worm shaft at 720 rpm. The worm is of quadruple start with 50mm as pitch circle diameter. The worm is of quadruple start type with 50mm as pitch circle diameter. The worm gear has 40 teeth with 5mm module. The pressure angle in the diametral plane is 20°. Determine (i) the lead angle of the worm, (ii) velocity ratio, and (ii) centre distance. Also, calculate efficiency of the worm gear drive, and power lost in friction. (16)

3. 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 50mm. The pinion rotates at 240 rev/min. The teeth are 5mm module, 14 1/2°involutes. If 6 kW is transmitted, determine (i) the tangential force at the Mean radius (ii) the pinion thrust force (iii) the gear thrust force. Draw the free body diagrams indicating the forces. (16)

4. A 90°degree straight bevel gear set is needed to give a 3:1 reduction. Determine the pitch cone angle, pitch diameter, and gear forces if the, 25 degree pressure angle pinion ahs 15 teeth of pitch circle diameter, 4, and the transmitted power is 8 HP at 550 pinion rpm. (16)

5. Design a worm gear drive to transmit 22.5 kW at a worm speed of 1440 rpm. Velocity ratio is 24:1. An efficiency of at least 85% is desired. The temperature rise should be restricted to 40°C. Determine the required cooling area. (16)

6. Design a bevel gear drive to transmit 3.5 kW with the following specifications: speed ratio = 4; driving shaft speed = 200 r.p.m.; drive is non-reversible; material for pinion is steel; material for wheel is cast iron; and life 25000 hours. (16)

7. Design a worm gear drive to transmit a power of 22.5 kW. The worm speed is 1440 r.p.m. and the speed of the wheel is 60 r.p.m. The drive should have a minimum efficiency of 80% and above. Select suitable materials for worm and wheel and decide upon the dimensions of the drive. (16)

UNIT IV
PART-A (2 Marks)

1. What does the ray diagram of a gear box indicates?
2. What are preferred numbers?
3. List any two methods used for changing speeds in gear box.
4. What situation demands the use of gear box?
5. State any three basic rules followed in designing a gear box.
6. What is the purpose of ray diagram?
7. What is the purpose of kinematic diagram?
8. Draw the ray diagram of 6 speed gear box.
9. What are the application of gear box?

UNIT IV
PART-B (16 Marks)

1. Sketch the arrangements of a six speed gear box. The minimum and maximum speeds required are around 460 and 1400 rpm. Drove speed is 1440 rpm. Construct speed diagram of the gear box and obtain various reduction ratios. Use standard output speeds and standard step ratio. Calculate

number of teeth in each gear and verify whether the actual output speeds are within + 2% of standard speeds. (16)

2. Design the layout of a 12 speed gear box for a milling machine having an output of speeds ranging from 180 to 2000 rpm. Power is applied to the gear box from a 6 kW induction motor at 1440 rpm. Choose standard step ratio and construct the speed diagram. Decide upon the various reduction ratios and number of teeth on each gear wheel sketch the arrangement of the gear box. (16)

3 .Design a nine – speed gear box for a machine to provide speeds ranging from 100 to 1500 rpm. The input is from a motor of 5 kW at 1440 rpm. Assume any alloy steel for the gear. (16)

4 .A machine tool gear box is to have 9 speeds. The gear box is driven by an electric motor whose shaft rotational speed is 1400 r.p.m. The gear box is connected to the motor by a belt drive. The maximum and minimum speeds required at the gear box output are 1000 r.p.m. and 200 r.p.m. respectively. Suitable speed reduction can also be provided in the belt drive. What is the step ratio and what are the values of 9 speeds? Sketch the arrangement. Obtain the number of teeth on each gear and also the actual output speeds. (16)

5 .A six speed gear box is required to provide output speeds in the range of 125 to 400 r.p.m. with a step ratio of 1.25 and transmit a power of 5 kW at 710 r.p.m. Draw the speed diagram and kinematics diagram. Determine the number of teeth module and face width of all gears, assuming suitable materials for the gears. Determine the length of the gear box along the axis of the gear shaft. (16)

UNIT V
PART-A (2 Marks)

1. State the advantage of cam over other reciprocating mechanisms.
2. How the “uniform rate of wear” assumption is valid for clutches?
3.. What is meant by a self – energizing brake?
4.. What are the desirable properties of friction material to be used for clutches?
5. Sketch a cone clutch.
6 .What are the effects of temperature rise in clutches?
7.. Name four materials used for lining of friction surfaces in clutches
8. What is the function of a clutch?

PART-B (16 Marks)

1. A multi – disk clutch consists of five steel plates and four bronze plates. The inner and outer diameters of friction disks are 75mm and 150mm respectively. The coefficient of friction is 0.1 and the intensity of pressure is limited t 0.3 N/mm^2. Assuming the uniform wear theory, calculate (i) the required operating force, and (ii) power transmitting capacity at 750 rpm. (16)

2. A leather faced conical clutch has cone angle of 30°.The pressure between the contact surfaces is limited to .35N/mm^2 and the breath of the conical surface is not to exceed 1/3 of the mean radius. Find the dimensions of the contact surface to transmit 22Kw at 2000 rpm .Also calculate the force required to engage the clutch. .Take μ =0.15. (16)

3.A single plate clutch, both side being effective is required to connect a machine shaft to a driver shaft which runs at 500rpm .The moment of inertia of the rotating parts of the machine is 1Kgm^2.The inner and the outer radii of the friction discs are 50mm&100mm respectively .Assuming uniform pressure of 0.1N/mm^2 and μ =0.25 , determine the time taken for the machine to reach full speed when the clutch is suddenly engaged . Also determine the power transmitted by the clutch , the energy dissipated during the clutch slip and the energy supplied to the machine during engagement. (16)