



B.E DEGREE EXAMINATIONS: MAY 2017

(Regulation 2014)

Sixth Semester

MECHANICAL ENGINEERING

U14MET601: Design of Transmission Systems

COURSE OUTCOMES

CO1: Select suitable belt, chain drives for given applications

CO2: Design spur and helical gears

CO3: Design bevel and worm gears for power transmission

CO4: Decide the layout and design the gear box

CO5: Design a CAM and clutches for desired application

Time: Three Hours

Maximum Marks: 100

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. Matching type item with multiple choice code

CO2 [K₁]

List I	List II
A. Helical gears	i). Non-interchangeable
B. Herring bone gears	ii). Zero axial thrust
C. Worm gears	iii). Quiet motion
D. Hypoid Gears	iv). Extreme speed reduction

A B C D

- a) i ii iii iv
 b) iii ii i iv
 c) iii i iv ii
 d) iii ii iv i

2. Consider the following statements regarding a centrifugal clutch: It need not be unloaded before engagement.

CO5 [K₁]

- a) It enables the prime mover to start up under no-load conditions. b) It picks up the load gradually with the increase in speed
 c) It will not slip to the point of destruction d) It is very useful when the power unit has a low starting torque

10. A 50 kW motor using six V belts is used in a pulp mill. If one of the belts breaks after a month of continuous running, then CO1 [K₁]
- a) The broken belt is to be replaced by a similar belt b) All the belts are to be replaced
- c) The broken belt and two adjacent belts are to be replaced d) The broken belt and one adjacent belt are to be replaced

PART B (10 x 2 = 20 Marks)

(Answer not more than 40 words)

11. List the factors upon which the coefficient of friction between the belt and pulley depends? CO1 [K₁]
12. When a split pulley is used and how it is tightened on a shaft? CO1 [K₃]
13. What condition must be satisfied in order that a pair of spur gears may have a constant velocity ratio? CO2 [K₂]
14. Why is a gear tooth subjected to dynamic load? CO2 [K₄]
15. State the advantages of herringbone gear. CO2 [K₁]
16. Discuss virtual number of teeth in bevel gears? CO3 [K₄]
17. What is step ratio? Name the series in which speeds of multi-speed gear box are arranged. CO4 [K₅]
18. Sketch the kinematics layout of gears for 3 speeds between two shafts. CO4 [K₂]
19. In which applications, self-locking differential band brakes are used? CO5 [K₃]
20. If a multidisc clutch has 6 discs in a driving shaft and 7 discs in driven shaft, then how many number of contact surfaces it will have? CO5 [K₆]

Answer any FIVE Questions:-

PART C (5 x 14 = 70 Marks)

(Answer not more than 300 words)

Q.No. 21 is Compulsory

21. A pulley of 0.9m diameter revolving at 200rpm is to transmit 7.5kW. Find the width of leather belt if the maximum tension is not to exceed 145 N in 10mm width. The tension in the tight side is twice that in the slack side. Determine the diameter of the shaft and the dimensions of the various parts of the pulley, assuming it to have six arms. Maximum shear stress is not to exceed 63 MPa CO1 [K₂]

22. A pair of helical gears consists of an 18 teeth pinion meshing with a 45 teeth gear. 7.5 kW power at 2000 rpm is supplied to the pinion through its shaft. The normal module is 6mm, while the normal pressure angle is 20°. The helix angle is 23°. Determine the tangential, radial and axial components of the resultant tooth force between the meshing teeth. CO2 [K₃]
23. A pair of bevel gear is to be used to transmit 10kW from a pinion rotating at 420rpm to a gear mounted on a shaft which intersects the pinion shaft at an angle of 70°. Assuming that the pinion is to have an outside pitch diameter of 180mm, a pressure angle of 20°, a face width of 45mm, and the gear shaft is to rotate at 140rpm, determine (i) the pitch angle for the gears; (ii) the forces on the pinion and gear; and (iii) the torque produced about the shaft axis. CO3 [K₃]
24. A nine speed gear box, used as a head stock gear box of a turret lathe, is to provide a speed range of 180rpm to 1800rpm. Using standard step ratio, draw the speed diagram, and the kinematic layout. Also find and fix the number of teeth on all gears. CO4 [K₃]
25. Design a worm and gear speed reducer to transmit 12kW at a speed of 1440rpm. The speed of the worm wheel should be 60±3% r.p.m. An efficiency of at least 85% is desired. Assume that the worm is made of hardened steel and the gear of phosphor bronze. CO3 [K₃]
26. Design a differential band brake for a crane lifting a load of 50kN through a rope wound round a barrel of 550mm diameter. The brake drum to be keyed to the same shaft is to be 650mm in diameter and the angle of lap of the brake band over the drum is 240°. Operating arms of the brake are 45mm and 210mm. operating lever is 1.5m long take $\mu=0.25$. CO5 [K₃]
27. A power of 20kW is to be transmitted through a cone clutch at 500rpm. 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. CO5 [K₃]
