VIT

Vellore Institute of Technology

Final Assessment Test – November 2025

Course: **BMEE404L - Design of Transmission Systems**

Class NBR(s): **2336** Slot: **D1+TD1**

Time: **Three Hours** Max. Marks: **100**

- **KEEPING MOBILE PHONE/ANY ELECTRONIC GADGETS, EVEN IN 'OFF' POSITION IS TREATED AS EXAM MALPRACTICE**
- **DON'T WRITE ANYTHING ON THE QUESTION PAPER**

General Instructions:

i) **PSG design data book is permitted.**

Ii) **Assume suitable data wherever necessary**

COs	CO Statements
CO1	Design flexible power transmission systems such as belt drives, chain drives and wire ropes.
CO2	Examine the selection of rolling and sliding contact bearings in power transmission systems.
CO3	Recommend suitable materials and design gears using manufacturer's catalogue.
CO4	Analyze forces acting on the gear tooth and design based on strength and wear considerations
CO5	Construct the layout of multispeed gearbox used in machine tools.
CO6	Design different types of clutches and brakes used in the mechanical drives.

BL – Blooms Taxonomy Level (1 – Remember, 2 – Understand, 3 – Apply, 4 – Analyse, 5 – Evaluate, 6 – Create)

PART – A (5 X 12 = 60 Marks)

Answer ALL Questions

1. It is required to design a chain drive to connect a 10 kW, 900 rpm petrol engine to a conveyor. The driving sprocket is mounted on engine shaft. The driven sprocket is mounted on conveyor shaft. The conveyor shaft should run between 225 to 245 rpm. The service conditions involve moderate shocks. **CO1 BL3**

(i) Select a proper roller chain and give a list of its dimensions.

(ii) Determine the pitch circle diameters of the driving and driven sprockets.

(iii) Determine the number of chain links.

(iv) Specify the correct centre distance between the axes of sprockets.

2. The following data is given for a 360° hydrodynamic bearing: **CO2 BL3**

radial load = 10 kN

journal speed = 1440 rpm

unit bearing pressure = 1000 kPa

length to diameter ratio = 1

clearance ratio (r/c) = 800

viscosity of lubricant = 30 mPa s

Assuming that the total heat generated in the bearing is carried by the total oil flow in the bearing, calculate:

(i) dimensions of bearing;
(ii) coefficient of friction;
(iii) power lost in friction;
(iv) total flow of oil;
(v) side leakage; and
(vi) temperature rise.

3. Design the teeth of a pair of bevel gears to transmit 18.75 kW at 600 rpm of the pinion. The velocity ratio should be about 3 and the pinion should have about 20 teeth which are full depth 20^0 involute. Both the pinion and gear are made of C15 steel. Determine the cone distance, module, face width, diameter of the gears and pitch angle for both gears. **CO4 BL4**

4. 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. Select suitable materials for the worm and wheel. Determine all parameters of the designed gear drive and give details of the drive in a tabular form. Also determine the cooling area required, if the temperature rise is restricted to 40^0C. **CO4 BL4**

5. A power of 20 kW, is to transmit 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 the design stress for the shaft material as 40 MPa. **CO6 BL3**

PART – B (2 X 20 = 40 Marks)

Answer ALL Questions

6. Design a 12 speed gear box for an all geared headstock of a lathe. Maximum and minimum speeds are 600 rpm and 25 rpm respectively. The drive is from an electric motor giving 2.25 kW at 1440 rpm. Construct the speed diagram using a standard speed ratio. Calculate the number of teeth in each gear wheel and sketch the arrangement of gear box. **CO5 BL5**

7.a) Design a spur gear drive to transmit 22 kW at 900 rpm, speed reduction is 2.5. Materials for pinion and wheel are C15 steel and Cast Iron grade 30 respectively. Take pressure angle of 20^0 and working life of the gear as 10,000 hours. **CO3 BL4**

OR

7.b) A pair of helical gears subjected to moderate shock loading is to transmit 40 kW at 1440 rpm of the pinion. The speed reduction is 4.5 and the helix angle is 15^0. The service is continuous and teeth are 20^0 full depth in the normal plane. Selecting suitable materials design the gear, assuming a life of 10,000 hours. Determine all parameters of the designed gear pair and compile the results in a tabular format. **CO3 BL4**

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