Bihar Engineering University, Patna
VIII[th] Semester Examination - 2023

Course: B.Tech. | **Time: 03 Hours**

Code: 102802 | **Subject: Design of Transmission Systems** | **Full Marks: 70**

Instructions:-

(i) The marks are indicated in the right-hand margin.
*(ii) There are **NINE** questions in this paper.*
*(iii) Attempt **FIVE** questions in all.*
*(iv) Question No. **1** is compulsory.*
(v) Standard data book is allowed.

Q.1 ***Choose the correct answer of the following (Any seven question only):*** **[2 x 7 = 14]**

(a) The width of the pulley should be
(i) equal to the width of belt (ii) less than the width of belt
(iii) greater than the width of belt (iv) none of the above

(b) The included angle for the V-belt is usually lies in the range of
(i) 20° - 30° (ii) 30° - 40°
(iii) 40° - 60°. (iv) 60° - 80°

(c) A brake commonly used in motor cars is
(i) shoe brake (ii) band brake
(iii) band and block brake (iv) internal expanding brake

(d) The size of gear is usually specified by
(i) pressure angle (ii) pitch circle diameter
(iii) circular pitch (iv) diametral pitch

(e) The wire rope makes contact at
(i) bottom of groove of the pulley (ii) sides of groove of the pulley
(iii) sides and bottom of groove of the pulley (iii) anywhere in the groove of the pulley

(f) Which one of the following is a positive drive?
(i) Crossed flat belt drive (ii) Rope drive
(iii) V-belt drive (iv) Chain drive

(g) In case of a multiple disc clutch, if **n1** are the number of discs on the driving shaft and **n2** are the number of the discs on the driven shaft, then the number of pairs of contact surfaces will be
(i) n1+ n2 (ii) n1+ n2 - 1
(iii) n1+ n2 + 1 (iv) none of these

(h) In helical gears, the distance between similar faces of adjacent teeth along a helix on the pitch cylinders normal to the teeth, is called
(i) normal pitch (ii) axial pitch
(iii) diametral pitch (iv) module

(i) The root angle of a bevel gear is equal to:
(i) pitch angle – addendum angle (ii) pitch angle + addendum angle
(iii) pitch angle – dedendum angle (iv) pitch angle + dedendum angle

(j) In worm gears, the angle between the tangent to the thread helix on the pitch cylinder and the plane normal to the axis of worm is called
(i) pressure angle (ii) lead angle
(iii) helix angle (iv) friction angle

Q.2 (a) Two pulleys, one 400 mm diameter and the other 200 mm diameter, on parallel shafts 2 m apart are connected by a crossed belt. Find the length of the belt required and the angle of contact between the belt and each pulley. What power can be transmitted by the belt when the large pulley rotates at 200 rev/min, if the maximum permissible tension in the belt is 2 kN, and the coefficient of friction between the belt and pulley is 0.25? **[7]**

(b) Discuss the different types of belts and their material used for power transmission in detail. [7]

Q.3 Answer the following: [3.5x4=14]

(i) How does the function of a brake differ from that of a clutch?
(ii) Why it is necessary to dissipate the heat generated when clutches operate?
(iii) What do you mean by self energizing brake and self locking brake?
(iv) Discuss in short about internal expanding brake.

Q.4 Define the following terms with respect to bevel gears: [2 x 7=14]

(i) Pitch angle
(ii) Pitch diameter
(iii) Cone distance
(iv) Addendum angle
(v) Dedendum angle
(vi) Outside or addendum cone diameter
(vii) Inside or dedendum cone diameter

Q.5 A pair of bevel gears connect two shafts at right angles and transmits 9 kW. Determine the required module and gear diameters for the following specifications: [14]

Particulars	Pinion	Gear
Number of teeth	21	60
Material	Semi-steel	Grey cast Iron
Brinell hardness	200	160
Allowable static stress	85 MPa	55 MPa
Speed	1200 r.p.m	420 r.p.m
Tooth profile	14.5° composite	14.5° composite

Check the gears for dynamic and wear loads.

Q.6 Define the following term with respect to worm gear: [2 x 7=14]

(i) Axial pitch
(ii) Lead angle
(iii) Tooth pressure angle
(iv) Normal pitch
(v) Velocity ratio
(vi) Helix angle
(vii) Efficiency of worm gearing

Q.7 Write short notes on the following: [3.5x4=14]

(i) Discuss the purpose of housing of gear box
(ii) Discuss why geometric progression is selected in machine tool drives
(iii) What is ray-diagram of gear box? Explain in detail.
(iv) What is step ratio? Explain in detail.

Q.8 (a) Design a nine speed gearbox for a machine to provide speeds ranging from 100 r.p.m to 1500 r.p.m. The input is from a motor of 5 kW at 1440 r.p.m. Assume any alloy steel for gear. [7]

(b) A multiple disc clutch employs 3 steel and 2 bronze discs having outer diameter 300 mm and inner diameter 200 mm. For a coefficient of friction of 0.22, find the axial pressure and the power transmitted at 750 r.p.m., if the normal unit pressure is 0.13 N/mm^2. Also find the axial pressure of the unit normal pressure, if this clutch transmits 22 kW at 1500 r.p.m [7]

Q.9 Define the following terms related to cams: [2 x 7=14]

(i) Base circle
(ii) Pressure angle
(iii) Pitch point
(iv) Trace point
(v) Pitch circle
(vi) Prime circle
(vii) Lift or stroke