B.TECH DEGREE EXAMINATIONS: NOV / DEC 2010

Third Semester

TEXTILE TECHNOLOGY

U07TT302: Theory of Machines

Time: Three Hours   **Maximum Marks: 100**

Answer ALL Questions:-

PART A (10 x 1 = 10 Marks)

1. The unit of mass moment of inertia in S.I. units is

    (a)m^4 (b) kgf-m-s^2 (c) kg-m^2 (d)N-m

2. The relation between the number of pairs (p) forming a kinematic chain and the number of

    links (l) is

    (a) $l = 2p – 2$ (b) $l = 2p – 3$ (c) $l = 2p – 4$ (d) $l = 2p – 5$

3. For low and moderate speed engines, the cam follower should move with

    (a) uniform velocity   (b) simple harmonic motion

    (c) uniform acceleration and retardation   (d) cycloidal motion

4. The size of a cam depends upon

    (a) base circle   (b) pitch circle   (c) prime circle   (d) pitch curve

5. The size of a gear is usually specified by

    (a) pressure angle   (b) circular pitch   (c) diametral pitch   (d) pitch circle diameter

6. In single helix, the axial pitch is equal to

    (a) lead   (b) one half of the lead   (c) one third of lead   (d) two third of lead

7. The velocity ratio of two pulleys connected by an open belt or crossed belt is

    (a) directly proportional to their diameters

    (b) inversely proportional to their diameters

    (c) directly proportional to the square of their diameters

    (d) inversely proportional to the square of their diameters

8. The centrifugal tension in belts

    (a) increases power transmitted

    (b) decreases power transmitted

    (c) have no effect on the power transmitted

    (d) increases power transmitted upto a certain speed and then decreases

9. The ratio of the maximum displacement of the forced vibration to the deflection due to the static force, is known as

(a) damping factor   (b) damping coefficient

(c) logarithmic decrement   (d) magnification factor

10 When a body is subjected to transverse vibrations, the stress induced in a body will be

(a) shear stress   (b) tensile stress   (c) compressive stress   (d) transverse stress

PART B (10 x 2 = 20 Marks)

11. What is meant by inversion of a mechanism?

12. Define: Grashof's law.

13. Write down the main application of roller follower.

14. Define the term pressure angle as applied to cams.

15. Enumerate the advantages of gear drive over belt drive.

16. Which condition to be satisfied before designing the profile of the gear teeth?

17. Classify the types of chains.

18. What is meant by creep of the belt?

19. When will be the resonance takes place in the system?

20. Define logarithmic decrement.

PART C (5 x 14 = 70 Marks)

21 a) (i) Sketch and explain the crank and slotted link quick return mechanism   (8)

     (ii) Differentiate between machine and structure   (6)

(OR)

b) (i) Define Degree of Freedom. Obtain the degrees of freedom for the following simple mechanisms having no higher pair.   (6)
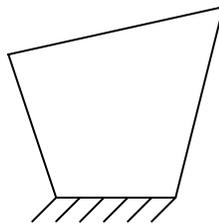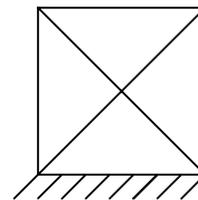
Four bar Mechanism   Six Bar Mechanism

    (ii) Discuss any two double slider crank mechanism with neat sketch.   (8)

22. a) Enumerate in detail about the different classification of cam follower with neat sketches.

(OR)

b) A cam, with a minimum radius of 25 mm, rotating clockwise at a uniform speed is to be designed to give a roller follower, at the end of a valve rod, motion described below: To raise the valve through 50 mm during 120° rotation of the cam

To keep the valve fully raised through next 30°

To lower the valve during next 60° and

To keep the valve closed during rest of the revolution i.e. 150°;

The diameter of the roller is 20 mm and the diameter of the cam shaft is 25 mm. Draw the profile of the cam when the line of the stroke is offset 15 mm from the axis of the cam shaft. The displacement of the valve, while being raised and lowered, is to take place with simple harmonic motion. Determine the maximum acceleration of the valve rod when the cam shaft rotates at 100 r.p.m. Draw the displacement, the velocity and the acceleration diagrams for one complete revolu tion of the cam.

23. a) (i) Define the term   (6)

- Pitch circle
- Module
- Length of path of contact

(ii) A pinion having 30 teeth drives a gear having 80 teeth. The profile of the gears is involute with 20° pressure angle, 12 mm module and 10 mm addendum. Find the length of path of contact, arc of contact and the contact ratio.   (8)

(OR)

b) (i) Determine the minimum number of teeth required on a pinion, in order to avoid interference which is to gear with 1. a wheel to give a gear ratio of 3 to 1 and b 2. an equal wheel. The pressure angle is 20° and a standard addendum of 1 module for the wheel may be assumed.   (6)

(ii) A pair of involute spur gears with 16° pressure angle and pitch of module 6 mm is in mesh. The number of teeth on pinion is 16 and its rotational speed is 240 r.p.m. When the gear ratio is 1.75, find in order that the interference is just avoided   (8)

- ➢ The addenda on pinion and gear wheel
- ➢ The length of path of contact
- ➢ The maximum velocity of sliding of teeth on either side of the pitch point.

24. a) (i) An engine, running at 150 r.p.m., drives a line shaft by means of a belt. The engine pulley is 750 mm diameter and the pulley on the line shaft being 450 mm. A 900 mm diameter pulley on the line shaft drives a 150 mm diameter pulley keyed to a dynamo shaft. Find the speed of the dynamo shaft, When 1. There is no slip 2. There is a slip of 2% at each drive. (6)

(ii) Obtain an expression for the length of belt in open belt drive. (8)

(OR)

b) A shaft rotating at 200 r.p.m. drives another shaft at 300 r.p.m. and transmits 6 kW through a belt. The belt is 100 mm wide and 10 mm thick. The distance between the shafts is 4m. The smaller pulley is 0.5 m in diameter. Calculate the stress in the belt, if it is 1. an open belt drive, 2. a cross belt drive. Take $\mu = 0.3$.

25. a) (i) Briefly discuss the different classification of forced vibration. (6)

(ii) A cantilever shaft 50 mm diameter and 300 mm long has a disc of mass 100 kg at its free end. The Young's modulus for the shaft material is 200 GN/m^2. Determine the frequency of longitudinal and transverse vibrations of the shaft. (8)

(OR)

b) (i) Using equilibrium method, obtain an expression for finding the natural frequency of free vibrations. (8)

(ii) A vibrating system consists of a mass of 200 kg, a spring of stiffness 80 N/mm and a damper with damping coefficient of 800 N/m/s. Determine the frequency vibration of the system. (6)

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