Total No. of Questions : 12]

SEAT No. :

P2390

[Total No. of Pages : 5

[5153]-13
T.E. (Mech./Auto)
THEORY OF MACHINES - II
(2008 Course) (Semester - I)

Time : 3 Hours] *[Max. Marks : 100*

Instructions to the candidates:

1) ***Answer 3 questions from Section I and 3 questions from Section II.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Use of logarithmic tables, electronic pocket calculator and steam tables is allowed.***
5) ***Assume suitable data, if necessary.***

SECTION - I

Q1) a) Derive an expression for the friction torque in a multi collar pivot bearing with uniform pressure conditions. **[4]**

b) A single plate clutch is required to transmit 8 kW at 1000 rpm. The axial pressure is limited to 70 kN/m^2. The mean radius of the plate is 4.5 times the radial width of friction surface. if both the sides of the plate are effective and coefficient of friction is 0.25, find the **[12]**

i) Inner and outer diameter of the plate and the mean radius.

ii) Width of the friction lining.

OR

Q2) a) Obtain the expression for the torque transmitted by a centrifugal clutch.**[6]**

b) Define friction circle and friction axes. Explain the importance of friction circle and friction axis in case of slider crank mechanism. **[6]**

c) Derive an expression for the effort required to overcome thread friction while the load is being lifted. **[4]**

P.T.O.

Q3) a) Design a cam profile to operate an inline roller follower using following data **[16]**

- Base circle of the cam : 30 mm
- Radius of the roller: 10mm
- Maximum lift of the follower: 40 mm
- Angle of ascent: 120º
- Angle of dwell: 30º
- Angle of descent : 80º
- Motion of follower during Ascent: Uniform velocity
- The follower immediately falls by 10 mm at the end of dwell in highest position and further descents with SHM motion by 30 mm.

The cam rotaes at uniform speed in clockwise direction. Determine the maixmum velocity and acceleration during outstroke and return stroke.

b) Explain what is Undercutting of cams? **[2]**

OR

Q4) a) Explain the following advanced cam curves. Mention the application of each: **[6]**

- Simple polynomial cam
- 3-4-5 polynomial cam

b) Derive and expression for the cam jump of an eccentric cam operating a flat faced follower. **[6]**

c) Explain the effect on the cam profile by varying **[6]**

i) Base Circle Diameter and

ii) Pressure angle

Q5) a) What is gyroscopic effect? Explain with example of aeroplane. **[4]**

b) Each arm of a porter governor is 200mm long and is hinged at a distance of 40 mm from the axis of the rotation. The mass of each ball is 1.5 kg and the sleeve is 25 kg. When the links are at 30º to the vertical, the sleeve begins to rise at 260 rpm. Assuming that the friction force is constant, find the maximum and minimum speeds of rotation when the inclination of arms to the vertical is 45º. **[12]**

OR

Q6) a) The turbine rotor of a ship has a mass of 1000 kg and rotates at 2200 rpm clockwise when viewed from the aft. The radius of gyration of the rotor is 220 mm. Determine the gyroscopic couple and its effect when the **[12]**

i) Ship turns right at a radius 250 m with a speed of 25 km/hour.

ii) Ship pitches with bow rising at an angular velocity 0.8 rad/s

iii) Ship rolls at an angular velocity of 0.1 rad/s.

b) Explain what is controlling force in centrifugal governors? **[4]**

SECTION - II

Q7) a) The addendum on each wheel of two mating gears is to be such that the line of contact on each side of the pitch point is half the maximum possible length. The number of teeth on the two gears is 24 and 48. The teeth are of 20º pressure angle involute with a module of 12 mm. Determine: **[12]**

- The addendum for the pinion and gear.
- Angle of contact on gear and pinion.
- The contact ratio.

b) What is interference? Explain the methods to avoid interference. **[6]**

OR

Q8) a) Describe significance of the following terms for a spur gear. **[6]**

i) Pressure angle

ii) Contact ratio

iii) Path of contact

b) The involute gears in mesh have a module of 8 mm and pressure angle of 20º. The larger gear has 57 while the pinion has 23 teeth. If the addenda on pinion and gear is one module, determine, **[12]**

i) Contact ratio

ii) Angle of action of pinion and wheel

iii) Ratio of sliding to rolling velocity at start of engagement, pitch point and at end of engagement

Q9) a) What is the significance of helix angle in the worm gears? Derive an expression for efficiency of worm gears. **[8]**

b) Explain the force analysis of bevel gears. **[4]**

c) Obtain an expression for formative number of teeth. **[4]**

OR

Q10)a) A drive is made up of two spiral gears of same hand, same diameter and of normal pitch 14 mm. The centre distance between the axes of the shafts is approximately 130 mm. The velocity ratio is 1.6 and the angle between the shafts is 75º. Assuming a friction angle of 6º, determine**[12]**

i) Spiral angle of each wheel

ii) Number of teeth on each wheel

iii) Efficiency of the drive

iv) Maximum efficiency

b) Determine the condition for maximum efficiency of spiral gears. **[4]**

Q11)a) Figure 1 shows a gear train in which gears D-E and F-G are compound gears. D gears with A and B; E gears with F; G gears with C. The numbers of teeth on each gear are A = 60, B = 120, C = 135, D = 30, E = 75, F = 30, G = 60. If the wheel A is fixed and arm makes 20 revolutions clockwise, find the revolutions of B and C. If arm is applied a turning moment of 1 kN-m, determine the turning moment on the shaft supporting the wheel C. **[12]**

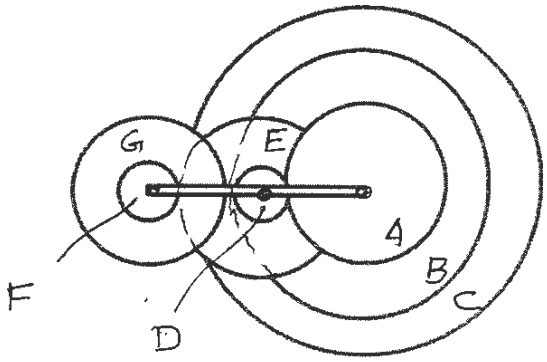

Figure 1: Q. 11

b) Compare simple and epicyclic gear train. Give examples of each. **[4]**

OR

Q12)a) An epicyclic gear train consists of two gears A and B having 30 and 40 teeth respectively. The arm rotates about the centre of the gear A at a speed of 80 rpm counterclockwise. Determine the speed of the gear B if **[12]**

i) The gear A is fixed

ii) Gear A rotates at 240 rpm clockwise instead of being fixed

b) What is the equivalent moment of inertia of a geared system? **[4]**