Total No. of Questions : 12]

SEAT No. :

P1368

[Total No. of Pages : 5

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T.E. (Mechanical / Automobile Engg./ Mech-SW)

THEORY OF MACHINES - II

(2008 Pattern) (Semester - I)

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

Instructions to the candidates:

1) ***Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8, Q.9 or Q.10, Q.11 or Q.12.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Use of Nonprogrammable calculator is allowed.***
5) ***Assume suitable data, if necessary.***

SECTION - I

Q1) a) Explain Friction in four bar mechanism. **[4]**

b) Derive an expression for frictional torque of a truncated conical pivot bearing assuming uniform pressure & uniform wear theory. **[6]**

c) A single plate clutch, effective on both sides, is required to transmit 25 kW at 3000 r.p.m. Determine the outer and inner radii of frictional surface if the coefficient of friction is 0.255, the ratio of radii is 1.25 and the maximum pressure is not to exceed 0.1 N/mm^2. Also determine the axial thrust to be provided by springs. Assume the theory of uniform wear **[8]**

OR

Q2) a) Write short note on belt transmission Dynamometer. **[4]**

b) Explain centrifugal clutch with the help of neat sketch. **[4]**

c) A band and block brake, having 14 blocks each of which subtends an angle of 15° at the centre, is applied to a drum of 1 m effective diameter. The drum and flywheel mounted on the same shaft has a mass of 2000 kg and a combined radius of gyration of 500 mm. The two ends of the band are attached to pins on opposite sides of the brake lever at distances of 30 mm and 120 mm from the fulcrum. If a force of 200 N is applied at a distance of 750 mm from the fulcrum, find : **[10]**

P.T.O.

i) Maximum braking torque,

ii) Angular retardation of the drum, and

iii) Time taken by the system to come to rest from the rated speed of 360 r.p.m.

The coefficient of friction between blocks and drum may be taken as 0.25.

Q3) a) Draw a cam profile to drive an oscillating roller follower to the specifications given below : **[16]**

i) Follower to move outwards through an angular displacement of 20° during the first 120° rotation of the cam;

ii) Follower to return to its initial position during next 120° rotation of the cam;

iii) Follower to dwell during the next 120° of cam rotation.

The distance between pivot centre and roller centre 120 mm; distance between pivot centre and cam axis 130 mm; minimum radius of cam = 40 mm; radius of roller = 10 mm; inward and outward strokes take place with simple harmonic motion.

OR

Q4) a) Write short note on cam jump phenomenon. **[4]**

b) What do you mean by advanced cam curves? Explain. **[4]**

c) Derive expressions for displacement, velocity and acceleration for circular are cam operating a flat faced follower : **[8]**

i) When the contact has on the nose.

Q5) a) Write short note on : **[8]**

i) Hunting of governor and

ii) Governor effort & Governor power.

b) A ship propelled by a turbine rotor which has a mass of 5 tonnes and a speed of 2100 r.p.m. The rotor has a radius of gyration of 0.5 m and rotates in a clockwise direction when viewed from the stern. Find the gyroscopic effects in the following conditions : **[8]**

i) The ship sails at a speed of 30 km/h and steers to the left in a curve having 60 m radius.

ii) The ship pitches 6 degree above and 6 degree below the horizontal position. The bow is descending with its maximum velocity. The motion due to pitching is simple harmonic and the periodic time is 20 seconds.

iii) The ship rolls and at a certain instant it has an angular velocity of 0.03 rad/s clockwise when viewed from stern.

Determine also the maximum angular acceleration during pitching. Explain how the direction of motion due to gyroscopic effect is determined in each case.

OR

Q6) a) Derive from the first principles an expression of the gyroscopic couple. **[8]**

b) A Porter governor has equal arms each 250 mm long and pivoted on the axis of rotation. Each ball has a mass of 5 kg and the mass of the central load on the sleeve is 25 kg. The radius of rotation of the ball is 150 mm when the governor begins to lift and 200 mm when the governor is at maximum speed. Find the minimum and maximum speeds and range of speed of the governor. **[8]**

SECTION - II

Q7) a) Derive an expression for minimum number of teeth on a pinion to avoid interference in terms of addendum of the gear, module, gear ratio and pressure angle. **[6]**

b) Two involute gears in a mesh have a module of 6 mm and a pressure angle of 20°.The larger gear has 56 while the pinion has 24 teeth. If the addenda on pinion and gear have wheels are equal to one module, find the **[10]**

i) contact ratio(the number of pairs of teeth in contact)

ii) angle of action of the pinion and the gear wheel

iii) ratio of the sliding to rolling velocity at the

1) beginning of contact

2) pitch point

3) end of contact.

OR

Q8) a) Compare the cycloidal and involute gear tooth profiles. **[4]**

b) A pair of involute spur gears with 20°pressure angle and pitch of module 8 mm in mesh. The number of teeth on pinion is 18 and its rotational speed is 240 rpm when the gear ratio is 1.8. Find : **[12]**

i) The addenda on pinion and gear wheel which are equal and larger possible while avoiding interference

ii) The length of path of contact.

iii) The maximum velocity of sliding of teeth on either side of the pitch point.

Q9) a) Derive the relation for virtual number of teeth of helical gear. **[4]**

b) A two-start worm rotating at 600 rpm drives a 26 tooth worm gear. The worm has a pitch diameter of 60 mm and a pitch of 20 mm. If the coefficient of friction (μ) is 0.06,find the **[12]**

i) helix angle of the worm

ii) speed of the gear

iii) centre distance

iv) lead angle for maximum efficiency

v) efficiency

vi) maximum efficiency

OR

Q10) a) Define the terms related to bevel gears. **[6]**

i) Pitch cone angle

ii) Base cone angle

iii) Shaft angle

iv) Face width with neat sketch.

b) The following data relate to two spiral gears in mesh : Shaft angle = 90°, centre distance = 180 mm (approx.), Normal circular pitch = 6 mm, Gear ratio = 3, Friction angle = 5°. For maximum efficiency of the drive, determine the **[10]**

i) Spiral angles of the teeth

ii) Number of teeth

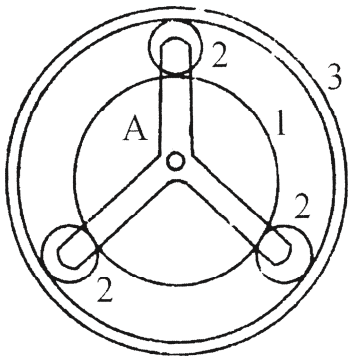
iii) Centre distance (exact)

iv) pitch diameters

v) Efficiency.

Q11) a) Explain inertia of geared system. **[6]**

b) The pitch circle diameter of the annular gear in the epicyclic gear train shown in fig. Q.11 (B) is 425 mm and the module is 5 mm.When the annular gear 3 is stationary; the spindle A makes one revolution in the same sense as the sun gear 1 for every 6 revolutions of the driving spindle carrying the sun gear. All the planet gears are of the same size. Determine the number of teeth on all the gears. **[12]**



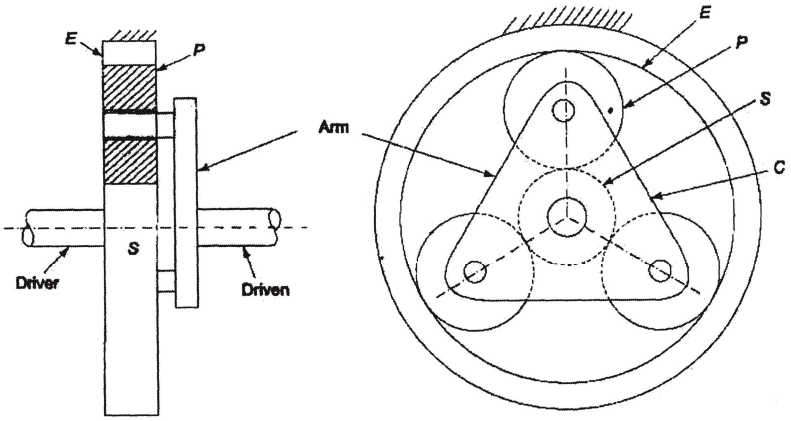
OR

Q12) a) Explain working of Epicyclic gear train with neat sketch. Also give its applications. **[6]**

b) An epicyclic gear train consists of a sun wheel S, a stationary annular wheel E and three identical planet wheels P carried on s star – shaped carrier C, as shown in fig.Q.12 (B).The size of the different toothed wheels is such that the planet carrier C rotates at $1/5^{th}$ of the speed of the sun wheel S. The minimum number of teeth on any wheel is 18. The driving torque on the sun wheel is 120N-m. Determine **[12]**

i) number of teeth on different wheels of the train, and

ii) torque necessary to keep the internal gear stationary.



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