

Seat  
No.

--	--	--	--	--	--



मठ - 038

## Theory of Machine - II (1040)

P. Pages : 4

Time : Three Hours

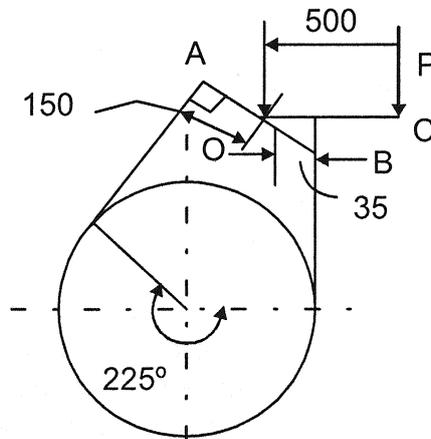
Max. Marks : 100

Instructions to Candidates :

1. Do not write anything on question paper except Seat No.
2. Answersheet should be written with blue ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. All questions are compulsory.
5. Attempt **any two** subquestion out of a, b & c.
6. Figures to the right indicate full marks.
7. Draw figures wherever necessary.

1. a) A differential band brake as shown in figure has an angle of contact of  $225^\circ$ . The band has compressed woven lining and bears against a cast iron drum of 350 mm diameter. The brake is to sustain a torque of 350 N-m and coefficient of friction is 0.3 find :
- i) The necessary force (P) for the clockwise and anticlockwise rotation of the drum.
  - ii) The value of OA for the brake to be selflocking when the drum rotates clockwise.

10



- b) A car moving on a level road at a speed 50 km/h has a wheel base 2.8 meters, distance of C.G. from ground level 600 mm and the distance of C.G. from rear wheels 1.2 meters. Find the distance travelled by the car before coming to rest when brakes are applied.
- to the rear wheels
  - to the front wheel
  - to all the four wheels
- The coefficient of friction between the tyres and the road may be taken as 0.6. 10

- c) What is dynamometer ? Give the classification of dynamometer. Explain in detail epicyclic train dynamometer. 10

2. a) A cam with a minimum radius of 50 mm rotating clockwise at a uniform speed is required to give a knife edge follower the motion as described below.
- To move outwards through 40 mm during  $100^\circ$  rotation of the cam
  - To dwell for next  $80^\circ$
  - To return to its starting position during next  $90^\circ$  and
  - To dwell for the rest period of a revolution is  $90^\circ$ .
- Draw the profile of the cam : when the line of stroke of the follower is offset by 15 mm. 10

- b) A symmetrical circular cam operating a flat faced follower has the following particulars : minimum radius of cam = 30 mm total lift = 20 mm, Angle of lift =  $75^\circ$  Nose radius = 5 mm, speed = 600 rpm :
- Find :
- The principal dimensions of the cam and
  - The acceleration of the follower at the beginning of the lift and at the end of contact with circular flanks, at the beginning of contact with nose and at the apex of the nose. 10

- c) Explain in detail :
- Turning moment diagram for a four stroke cycle internal combustion engine.
  - What is -
    - Coefficient of fluctuation of energy.
    - Coefficient of fluctuation of speed. 10

3. a) A loaded porter governor has four links each 250 mm long, two revolving masses each of 3 kg and a central dead weight of mass 20 kg. All the links are attached to respective sleeves at radial distance of 40 mm from the axis of rotation. The masses revolve at a radius of 150 mm at minimum speed and at a radius of 200 mm at maximum speed. Determine the range of speed. 10

- b) Explain the term : 10
- i) Sensitive ness of governor.
  - ii) Stability of Governor
  - iii) Isochronous governor.
  - iv) Hunting of Governor
- c) A ship is propelled by a turbine rotor which has a mass of 5 tonnes and a speed of 2100 rpm. 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.
- i) The ship sails at a speed of 30 km/hr and steers to the left in a curve having 60 m radius.
  - ii) The ship pitches 6 degrees above and 6 degrees below the horizontal position. The bow is descending with its maximum velocity. The motion due to pitching is simple harmonic motion and the periodic time is 20 seconds.
  - iii) The ship rolls and at a certain instant it has a 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. 10

4. a) A pinion having 30 teeth drives a gear having 80 teeth. The profile of the gears is involute with  $20^\circ$  pressure angle, 12 mm module and 10 mm addendum find the length of path of contact, arc of contact and the contact ratio. 10
- b) Explain : 10
- i) Law of gearing
  - ii) Formation of cycloidal teeth of a gear.

- c) An epicyclic gear consist of a three gears A, B and C as shown in fig. The gear A has 72 internal teeth and gear C has 32 external teeth. The gear B meshes with both A & C and is carried on an arm EF which rotates about the centre of A at 18 rpm. If the gear A is fixed determine the speed of gears B & C.

10

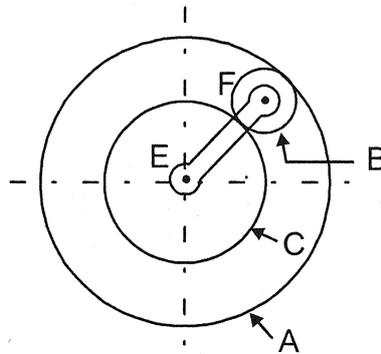


Fig.Q. 4 (c)

5. a) A, B, C & D are four masses carried by a rotating shaft at radii 100, 125, 200 and 150 mm respectively. The planes in which the masses revolve are spaced 600 mm apart and the mass of B, C & D are 10 kg, 5 kg and 4 kg respectively. Find the required mass of A and the relative angular settings of the four masses so that the shaft shall be in complete balance.
- b) The following data refer to two cylinder locomotive with cranks at  $90^\circ$   
 Reciprocating mass per cylinder = 300 kg crank radius = 0.3 m, Driving wheel diameter = 1.8 m, Distance between cylinder centre lines = 0.65 m, distance between the driving wheel central planes = 1.55 m.  
 Determine :  
 i) The fraction of the reciprocating masses to be balanced, if the hammer blow is not to exceed 46 kN at 96.5 km/hr.  
 ii) The variation in tractive effort.  
 iii) The maximum swaying couple.
- c) Derive the following expressions, for an uncoupled two cylinder locomotive engine :  
 a) Variation in tractive force.  
 b) Swaying couple.  
 c) Hammer blow.

10

10

10

\*\*\*\*\*