

Day : Saturday  
Date : 24/11/2018

**W-2018-2421**

Time : 02.30 PM TO 05.30 PM  
Max. Marks : 60

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**N. B. :**

- 1) All questions are **COMPULSORY**.
  - 2) Figures to the right indicate **FULL** marks.
  - 3) Draw neat and labeled diagram **WHEREVER** necessary.
  - 4) Assume suitable data, if necessary.
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**Q. 1** Two gear wheels mesh externally and are to give a velocity ratio of 3 to 1. **(10)**  
The teeth are of involute form, module = 6 mm. addendum = one module, pressure angle =  $20^\circ$ . The pinion rotates at 90 r.p.m.  
Determine:

- i) The number of teeth on the pinion to avoid interference on it and the corresponding number of teeth on the wheel.
- ii) The length of path and arc of contact.
- iii) The number of pairs of teeth in contact.
- iv) The maximum velocity of sliding.

**OR**

The mating gear wheels have 20 and 40 involute teeth of 10 mm module and  $20^\circ$  pressure angles. The addendum on each wheel is to be made of such a length that the line of contact on each side of the pitch point has half the maximum possible length. Determine the addendum height for each gear wheel and the length of the line of contact. If the smaller wheel rotates at 250 rpm. Find the velocity of point of contact along the surface of each tooth at the instant when the tip of a tooth on a smaller wheel is in contact. **(10)**

**Q. 2** The angle between two meshing spiral gears is  $90^\circ$  and centre distance is 150 mm approximately. The normal circular pitch of the gears is 10 mm and gear ratio is 2.5. The frictional angle is  $6^\circ$  and efficiency of the drive is maximum. **(10)**  
Determine:

- i) Spiral angles of the teeth.
- ii) Circular pitches of the gears.
- iii) The number of teeth on each wheel.
- iv) The exact centre distance and pitch circle diameters of the two wheels.
- v) The efficiency of the drive.

**OR**

Derive an expression for the centre distance of helical gears in terms of number of teeth of the gears, normal module and helix angle. **(10)**

**Q. 3** The lead screw of a lathe has right hand single thread of pitch 6 mm. The smallest change wheel has 20 teeth, the largest 120 teeth and number of teeth on intermediate sizes increase in the step of 5. Find the gear train suitable for connecting the spindle and lead screw when: **(10)**

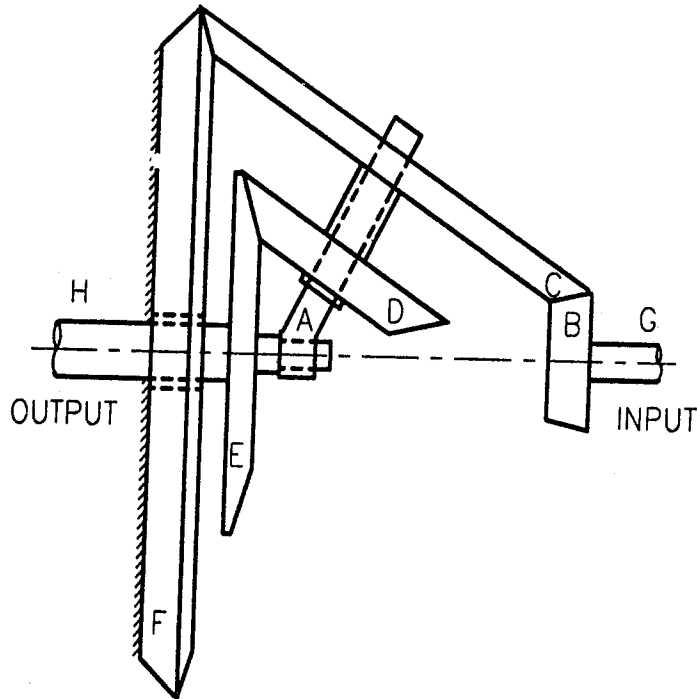
- i) Right hand screw with 1.25 mm pitch is to be cut
- ii) Left hand screw with 1.5 mm pitch is to be cut. Also draw the sketches to support the answer.

**OR**

**P. T. O.**

Fig. shows a bevel epicyclic gear train used in a lathe headstock. The number of teeth on the wheels B, C, D, E and F are 19, 57, 20, 40 and 76 respectively. If the input shaft on which gear B is mounted rotates at 300 r.p.m., what will be the speed of the output shaft when: (10)

- i) Gear F is fixed.
- ii) Gear F is rotated at 500 r.p.m. opposite to the input shaft.



Q. 4 Explain with neat sketch, principle of working of centrifugal clutch. Derive (10)  
an expression for the torque transmitted by the clutch.

OR

A band and block brake is lined with 12 equal blocks each subtending an angle of  $15^\circ$  at the centre of the brake drum of 480 mm diameter. The radial thickness of the block is 60 mm. The coefficient of friction between the block and drum is 0.40 and the two ends of the band are attached to the pins on opposite sides of the fulcrum of the brake lever at 200 mm and 50 mm. Find the least force to be applied at the end of brake lever at a distance of 400 mm from fulcrum to absorb 200 kw at 25 rad/sec. (10)

Q. 5 Draw the cam profile for the data given below: (10)

- i) Base circle radius of cam = 50 mm
- ii) Lift = 40 mm
- iii) Angle of ascent =  $60^\circ$
- iv) Angle of dwell =  $40^\circ$
- v) Angle of descent =  $90^\circ$
- vi) Speed of cam = 300 rpm
- vii) Motion of follower = SHM
- viii) Type of follower = Knife edge

Also calculate the maximum velocity and acceleration during ascent and descent.

OR

Draw a cam profile with following specification cam shaft diameter = 40 mm, (10)  
least radius of cam = 25 mm diameter of roller = 25 mm, Angle of lift =  $120^\circ$ ,  
Angle of fall =  $150^\circ$ . Lift of the follower = 40 mm, No. of pauses are two of  
equal interval between motion.

During the lift the motion is S.H.M. during the fall the motion is uniform  
acceleration and deceleration. The speed of the cam shaft is uniform. The line  
of stroke of the follower is off-set 12.5 mm from the centre of the cam.

**Q. 6** The wheel of a motor cycle have a total mass moment of inertia of  $2.5 \text{ kg-m}^2$  (10)  
and engine parts have a mass moment of inertia of  $0.14 \text{ kg-m}^2$ . The gear ratio  
is 5 to 1 and the axis of the rotation of the engine crank shaft is parallel to that  
to rear wheel, which have a diameter of 65 cm. Determine the magnitude and  
direction of the gyroscopic couple when motor cycle rounds a curve of 25 m  
radius at a speed of 50 km per hour. Total mass of the system is 180 kg and  
 $h = 0.6\text{m}$

**OR**

What is meant by terms sensitiveness, stability and isochronisms in governor (10)  
mechanism.

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