Printed Pages:03 **Sub Code: RME 602**

Paper Id: 140275 **Roll No.**

B. TECH.

(SEM-VI) THEORY EXAMINATION 2018-19

THEORY OF MACHINES

Time: 3 Hours ***Total Marks: 70***

Note: **1.** Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt *all* questions in brief. **2 x 7 = 14**

a. Differentiate between lower pair and higher pair with an example.

b. What is redundant degree of freedom of a mechanism?

c. State 'Law of Gearing.

d. What are turning moment diagrams? Why are they drawn?

e. Define D' Alembert's principle.

f. What do you mean by primary and secondary unbalance in reciprocating engine?

g. Give various classifications of transmission dynamometers.

SECTION B

2. Attempt any *three* of the following: **7 x 3 = 21**

a. Determine no. of binary links, no. of ternary links, no. of quaternary links, total no. of links, no. of loops, no. of pairs/joints and degree of freedom for the following figure 1.

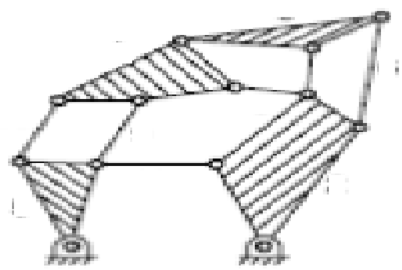

Fig. 1

b. The number of teeth on each of the two equal spur gears in mesh is 40. The teeth have 20 ° involute profiles and the module is 6 mm. If the arc of contact is 1.75 times the circular pitch, find the addendum.

c. The arms of a Porter governor are 300 mm long. The upper arms are pivoted on the axis of rotation. The lower arms are attached to a sleeve at a distance of 40 mm from the axis of rotation. The mass of the load on the sleeve is 70 kg and the mass of each ball is 10 kg. Determine the equilibrium speed when the radius of rotation of the balls is 200 mm. If the friction is equivalent to a load of 20 N at the sleeve, what will be the range of speed for this position?

d. Find the relation for the coefficient of fluctuation of speed in terms of maximum fluctuation of energy and the kinetic energy of the flywheel at mean speed.

e. A band brake acts on the 3/4th of the circumference of a drum of 450 mm diameter which is keyed to the shaft. The band brake provides a braking torque of 225 Nm. One end of the band is attached to the fulcrum pin of the lever and the other end to the pin 100 mm from the fulcrum. If the operating force is applied at 500 mm from the fulcrum and the coefficient of friction is 0.25, find the operating force when the drum rotates in the

(i) Anticlockwise direction, and (ii) Clockwise direction.

SECTION C

3. Attempt any *one* part of the following: **7 x 1 = 7**

(a) PQRS is a four bar chain with link PS fixed as shown in figure 2. The lengths of the links are PQ= 62.5 mm ; QR = 175 mm ; RS = 112.5 mm ; and PS = 200 mm. The crank PQ rotates at 10 rad/s clockwise. Draw the velocity and acceleration diagram when angle QPS = 60° and Q and R lie on the same side of PS. Find the angular velocity and angular acceleration of links QR and RS.

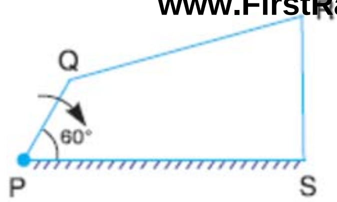

Fig. 2

(b) Derive an expression for the magnitude and direction of Coriolis component of acceleration.

4. Attempt any *one* part of the following: 7 x 1 = 7

(a) A cam is to be designed for a knife edge follower with the following data:

i. Cam lift= 40 mm during 90º of cam rotation with SHM.
ii. Dwell for the next 30º
iii. During the next 60º of cam rotation, the follower returns to its original position with SHM
iv. Dwell during the remaining 180º.

Draw the profile of the cam when the line of stroke of the follower passes through the axis of the cam shaft.
The radius of the base circle of the cam is 40 mm. Determine the maximum velocity and acceleration of the follower during its ascent and descent, if the cam rotates at 240 rpm.

(b) Define the terms pitch circle diameter, pressure angle, addendum, dedendum, circular pitch, module and backlash related to gear.

5. Attempt any *one* part of the following: 7 x 1 = 7

(a) The crank and connecting rod of a vertical petrol engine, running at 1800 rpm are 60 mm and 270 mm respectively. The diameter of the piston is 100 mm and the mass of the reciprocating partsis 1.2 kg. During the expansion stroke when the crank has turned 20° from the top dead centre, the gas pressure is 650 KN/m^2. Determine the (i) net force on the piston (ii) net load on the gudgeon pin (iii) thrust on the cylinder walls (iv) speed at which the gudgeon pin load is reversed in direction.

(b) What is the function of flywheel? Derive the expression for maximum fluctuation of energy.

6. Attempt any *one* part of the following: 7 x 1 = 7

(a) Four masses A, B, C and D are attached to a shaft and revolve in the same plane. The masses are 12 kg, 10 kg, 18 kg and 15 kg respectively and their radii of rotations are 40 mm, 50 mm, 60 mm and 30 mm. The angular position of the masses B, C and D are 60º, 135º and 270º from mass A. Find the magnitude and position of the balancing mass at a radius of 100 mm. Analytically and graphically both.

(b) With a help of a neat sketch, explain the working of a porter governor and derive the formula for the speed of the governor.

7. Attempt any *one* part of the following: 7 x 1 = 7

(a) What is the advantage of a self- expanding shoe brake? Drive the relation for the friction torque for such a brake.

(b) Differentiate between brake and dynamometer. With a help of a neat sketch, explain the working of a rope brake dynamometer.