

TME-503

1065

**Odd Semester Examination 2018-19**

**B. TECH (ME) (SEMESTER-V)**

**DYNAMICS OF MACHINE**

**Time: 03:00 Hours**

**Max Marks :100**

**Note:** Attempt **ALL** the questions. Marks are shown against each question. Assume any missing data suitably.

1. Attempt **any FOUR** of the following : (5x4=20 Marks)
  - (a) What is meant by self-locking and self-energised brake?
  - (b) Explain the working of Prony brake dynamometer.
  - (c) What is meant by a tractive resistance in case of wheeled vehicle? What are its main components?
  - (d) What is meant by piston effort and crank effort? Also explain dynamical equivalent system.
  - (e) Explain how a single revolving mass is balanced by two masses revolving in different planes.
  - (f) Explain the working of inertia governor.
  
2. Attempt **any FOUR** of the following : (5x4=20 Marks)
  - (a) Explain the stability of a two-wheel vehicle while taking a right turn.
  - (b) What is meant by friction circle? Deduce an expression for the radius of friction circle in terms of the radius of the journal and the angle of friction.
  - (c) Explain the stability, instability and isochronous condition of governor using controlling force diagram.

- (d) What is meant by mean resisting torque?
- (e) Explain the working of cone clutch.
- (f) Which side of flat belt drive is kept tight and why?

3. Attempt any TWO of the following : (10x2=20 Marks)

- (a) Explain the primary and secondary unbalanced force of reciprocating masses? How primary unbalanced force is balanced?
- (b) Each wheel of a four- wheeled rear engine automobile has a moment of inertia of  $3.4 \text{ kg-m}^2$  and an effective diameter of 560 mm. The rotating parts of the engine have a moment of inertia of  $1.2 \text{ kg-m}^2$ . The gear ratio of engine to the back wheel is 3 to 1. The engine axis is parallel to the rear axle and the crankshaft rotates in the same sense as the road wheels. The mass of the vehicle is 2500 kg and the centre of mass is 570 mm above the road level. The track width of the vehicle is 1.7 m. Determine, the limiting speed of the vehicle around a curve with 70 m radius so that all the four wheels maintain contact with the road surface.
- (c) Four masses A, B, C, and D as shown below are to be completely balanced:

	A	B	C	D
Mass (kg)	-	30	50	40
Radius (mm)	180	240	120	150

The plane containing masses B and C are 300 mm apart. The angle between planes containing Band C is  $90^\circ$ , B and C makes an angle of  $210^\circ$  and  $120^\circ$  respectively with D in the same sense. Find:

- (i) The magnitude and angular position of mass A
- (ii) Positions of planes A and D.

4. Attempt any **TWO** of the following :

(10x2=20 Marks)

- (a) The piston diameter of an internal combustion engine is 130 mm and the stroke is 250 mm. The connecting rod is 4.5 times the crank length and has a mass of 55 kg. The mass of reciprocating parts is 40 kg. The centre of mass of connecting rod is 160 mm from the crank pin centre and the radius of gyration about an axis passing through the centre of mass is 152 mm. The engine runs at 420 rpm. Find the magnitude and the direction of the inertia force and the corresponding torque on the crankshaft when the angle turned by the crank is  $130^\circ$  from the inner dead centre.
- (b) A 100 mm wide and 10 mm thick belt transmits 5 kw of power between two parallel shafts. The distance between the shaft centres is 1.5 m and the diameter of the smaller pulleys is 440 mm. The driving and driven shafts rotate at 60 rpm and 150 rpm respectively. The coefficient of friction is 0.25. Find the stress in the belt if the two pulleys are connected by
- an open belt, and
  - A cross belt. (Take  $\mu = 0.25$ )
- (c) In a spring-loaded governor of the Hartnell type, the lengths of the horizontal and the vertical arms of the bell crank lever are 50 and 85 mm respectively. The mass of each ball is 2.5 kg. The extreme radii of rotation of the balls are 80 mm and 120 mm. The distance of the fulcrum of each bell crank lever is 90 mm from the axis of rotation of the governor. The minimum equilibrium speed is 440 rpm and the maximum equilibrium speed is 5 % higher than this. Neglecting the obliquity of the arms, determine the
- spring stiffness
  - initial compression and
  - equilibrium speed corresponding to radius of rotation of 92 mm.

5. Write short notes on **any FOUR** of the following : (5x4=20 Marks)
- (a) Describe the working of a band and block brake with the help of a neat sketch.
  - (b) What is the role of correction couple while considering the inertia of connecting rod?
  - (c) Explain the method of direct and reverse cranks to determine the unbalance forces in radial engines.
  - (d) Explain the effect of gyroscopic couple on naval ships.
  - (e) Deduce the relation for ratio of tight and slack side tensions for flat belt drive.
  - (f) Derive the relationship between density and velocity for the design of flywheel rim.

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