Code: ME5T1

III B.Tech - I Semester – Regular/Supplementary Examinations October 2019

DYNAMICS OF MACHINERY
(MECHANICAL ENGINEERING)

Duration: 3 hours   Max. Marks: 70

PART – A

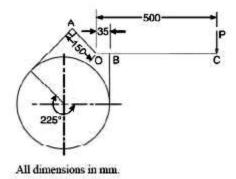Answer *all* the questions.   All questions carry equal marks

11x 2 = 22 M

1.

a) What is meant by friction circle?

b) What is friction? Is it a blessing or curse? Justify your answer giving examples?

c) What is meant by uniform pressure theory for the friction torque of a bearing?

d) What is gyroscopic effect and write an expression for gyroscopic couple?

e) What is the effect of gyroscopic couple on rolling of ship and why?

f) How governors are classified?

g) What is meant by turning moment diagram or crank effort diagram?

h) What is meant by balancing of rotating masses?

i) Define dynamic balancing.

j) What are the basic features of a vibrating system?

k) State different methods of finding natural frequency of a system.

PART – B

Answer any ***THREE*** questions.   All questions carry equal marks.

$$3 \times 16 = 48 \text{ M}$$

2. a) A truncated conical pivot of cone angle, α rotating at speed, N supports a load W. The smallest and largest diameter of pivot over the contact area 'd' and 'D' respectively. Assuming uniform wear, derive the expression for frictional torque.   8 M

   b) A differential band brake, as shown in figure, below has an angle of contact of 225°. The band has a 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 the coefficient of friction between the band and the drum is 0.3. Find i)The necessary force (P) for the clockwise and anticlockwise rotation of the drum; and ii) The value of 'OA' for the brake to be self locking, when the drum rotates clockwise.   8 M

All dimensions in mm.

3. a) Explain the effect of Gyroscopic couple on a Naval ship during pitching. 4 M
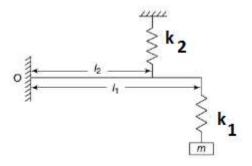
b) Explain the effect of Gyroscopic couple on a Aeroplane. 8 M

c) Explain the concept of equivalent dynamic system. 4 M

4. a) What is the function of a flywheel? How does it differ from that of a governor? 4 M

b) The torque delivered by a two –stroke engine is represented by T= (1000 + 300 Sin 2ø-500 Cos 2ø) N-m, where ø is the angle turned by the crank from the inner-dead centre. The engine speed is 250 rpm. The mass of the flywheel is 400 kg and radius of gyration is 400 mm. Determine (i) The power developed (ii) The total percentage fluctuation of speed (iii) The angular acceleration of flywheel when the crank has rotated through an angle of 60° from the inner-dead centre and (iv) The maximum angular acceleration and retardation of the flywheel. 12 M

5. a) Four masses M1, M2, M3 and M4 are 200kg, 300kg, 240kg and 260kg respectively. The corresponding radii of rotation are 0.2m, 0.15m, 0.25m and 0.3m respectively and the angle between successive masses are 45°, 75° and 135°. Find the position and magnitude of balance mass required if its radius of rotation is 0.25m. 8 M

b) Discuss the balancing of primary and secondary forces of a multi-cylinder in-line engines. **8 M**

6. a) Determine the natural frequency of a vibrating system shown in fig. **8 M**

b) Find the natural frequency of oscillation of the system shown in fig. Assume the roller rolls on the surface without slipping. **8 M**