Reg. No. : .....

Name : .....

(Pages : 4)

C – 2711

Sixth Semester B.Tech. Degree Examination, June 2017
(2013 Scheme)
13.602 : DYNAMICS OF MACHINERY (MP)

Time : 3 Hours

Max. Marks : 100

PART – A

Answer **all** questions. **Each** question carries **2** marks.

1. Discuss on the principle of virtual work.
2. What do you mean by equivalent offset inertia force ? Explain.
3. Sketch a Hartnell governor and describe its function.
4. Define the terms : Sensitiveness and hunting relating to governors.
5. Explain the terms applied torque and reaction torque in a gyroscope.
6. How static and dynamic balancing is done in machinery ?
7. What do you mean by balancing machines ?
8. What are turning moment diagrams ? Why are they drawn ?
9. Discuss on the effect of damping on vibratory system.
10. Describe Dunkerley's method to find the natural frequency of a shaft carrying several loads. **(10×2=20 Marks)**

PART – B

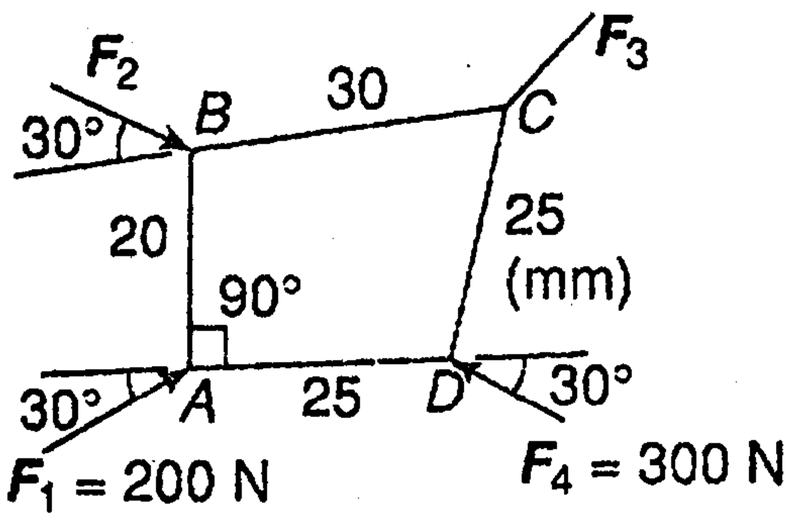
Answer **any one** question from **each** Module; **each** question carries **20** marks.

Module – 1

11. a) Discuss on the static equilibrium of a four-force members. **6**

P.T.O.

b) Figure shows a quaternary link ABCD under the action of forces F_1, F_2, F_3 and F_4 acting at A, B, C and D respectively. The link is in static equilibrium. Determine the magnitude of the forces F_2 and F_3 and the direction of F_3. **14**



OR

12. In a vertical double-acting steam engine, the connecting rod is 4.5 times the crank. The weight of the reciprocating parts is 120 kg and the stroke of the piston is 440 mm the engine runs at 250 rpm. If the load on the piston due to steam pressure is 25 kN when the crank has turned through an angle of 120° from the top dead centre, determine :

i) thrust on the connecting rod,

ii) pressure on slide bars,

iii) tangential force on the crank pin,

iv) thrust on the bearings,

v) turning moment on the crank shaft.

Module – 2

13. In a spring-loaded governor of the Hartnell type, the lengths of the horizontal and vertical arms of the bell-crank lever are 40 mm and 80 mm respectively. The mass of each ball is 1.2 kg. The extreme radii of rotation of the balls are 70 mm and 105 mm. The distance of the fulcrum of each bell-crank lever is 75 mm from the axis of rotation of the governor. The minimum equilibrium speed is 420 rmp and the maximum equilibrium speed is 4% higher than this. Neglecting the obliquity of the arms, determine the :

i) spring stiffness,

ii) initial compression and

iii) equilibrium speed corresponding to radius of rotation of 95 mm.

OR

14. An aeroplane flying at 240 km/h turns towards the left and completes a quarter circle of 60 m radius. The mass of the rotary engine and the propeller of the plane is 450 kg with a radius of gyration of 320 mm. the engine speed is 2000 rpm clockwise when viewed from the rear. Determine the gyroscopic couple on the aircraft and state its effect. In what way is the effect changed when the :

i) aeroplane turns towards right,

ii) engine rotates clockwise when viewed from the front (nose end) and the aeroplane turns a) left and b) right ?

Module – 3

15. The axes of three cylinder air compressor are at 120° to one another and their connecting rods are coupled to a single crank. The length of each connecting rod is 240 mm and the stroke is 160 mm. The reciprocating parts have a mass of 2.4 kg per cylinder. Determine the primary and secondary forces if the engine runs at 2000 rpm.

OR

16. A three-cylinder single-acting engine has its cranks at 120°. The turning-moment diagram for each cycle is a triangle for the power stroke with a maximum torque of 60 N.m at 60° after the dead centre of the corresponding crank. There is no torque on the return stroke. The engine runs at 400 rpm. Determine :

i) power developed,

ii) coefficient of fluctuation of speed if the mass of the flywheel is 10 kg and radius of gyration is 88 mm,

iii) coefficient of fluctuation of energy.

Module – 4

17. A machine weighs 18 kg and is supported on springs and dashpots. The total stiffness of the springs is 12 N/mm and the damping is 0.2 N/mm/s. The system is initially at rest and a velocity of 120 mm/s is imparted to the mass. Determine

    i) displacement and velocity of mass as a function of time,

    ii) displacement and velocity after 0.4s.

OR

18. The following data relate to a shaft held in long bearings. Length of shaft = 1.2 m, diameter of shaft = 14 mm, mass of a rotor at midpoint = 16 kg, eccentricity of centre of mass of rotor from centre of rotor = 0.4 mm, modulus of elasticity of shaft material = 200 GN/m^2, permissible stress in shaft material = 70×10^6 N/m^2. Determine the critical speeds of the shaft and the range of speed over which it is unsafe to run the shaft. Assume the shaft to be massless.
