C 22607 (Pages : 2) Name.....

Reg. No.....

SIXTH SEMESTER B.TECH. (ENGINEERING) DEGREE [2014 SCHEME] EXAMINATION, APRIL 2017

Mechanical Engineering

ME 14 603—DYNAMICS OF MACHINERY

Time : Three Hours Maximum : 100 Marks

Part A

Answer any **eight** *questions.*
Each question carries 5 *marks.*

1. State Newton's law of motion.
2. Define principle of superposition and virtual work.
3. Write the importance of balancing and why rotating masses are to be dynamically balanced.
4. Define Dalby's method of balancing masses. Whether grinding wheels are balanced of not ? If so why ?
5. What for the balancing machines are used ? Write the different types.
6. Differentiate between the unbalanced force caused due to rotating and reciprocating masses.
7. What are the various types of damping ? What is the limit beyond which damping is unfavourable and why ?
8. How force analyses are carried out for spur, helical and bevel gears ?
9. What are the factors that affect the critical speed of a shaft ?
10. Write short notes on Seismometer.

(8 × 5 = 40 marks)

Part B

Answer **all** *questions.*
Each question carries 15 *marks.*

11. (a) For reciprocating engine, derive the expression for :

    (i) Velocity and acceleration of the piston.

    (ii) Angular velocity and angular acceleration of the connecting rod.

Or

Turn over

(b) In a reciprocating engine mechanism, if the crank and connecting rod and 300 mm. and 1 m. long respectively and the crank rotates at a constant speed of 200 r.p.m. Determine analyticaly :

(i) The crank angle at which the maximum velocity occurs;

(ii) Maximum velocity of piston.

(iii) Derive the relevant equations.

12. (a) A shaft is rotating at a uniform angular speed. Four masses M1, M2, M3 and M4 of magnitudes 300 kg., 450 kg., 360 kg., 390 kg. respectively are attached rigidly to the shaft. The masses are rotating in the same plane. The corresponding radii of rotation are 200 mm., 150 mm., 250 mm. and 300 mm. respectively. The angle made by these masses with horizontal are 0°, 45°, 120° and 255° respectively. Find (i) the magnitude of balancing mass ; (i) the position of balancing mass if its radius of rotation is 200 mm.

Or

(b) (i) Explicate the effect of Gyroscopic couple on a Naval ship during pitching.

(ii) Explain the effect of gyroscopic couple on a aeroplane.

13. (a) Derive an expression for the natural frequency of the free longitudinal vibration by (i) Equilibrium method ; (ii) Energy method ; and (iii) Rayleigh's method.

Or

(b) Between a solid mass of 10 kg. and the floor are kept two slabs of isolates, natural rubber and felt in series. The natural rubber slab has a stiffness of 3000 N/m and equivalent viscous damping coefficient of 100 N-sec/m. The felt has a stiffness of 12000 N/m and equivalent viscous damping coefficient of 330 N-sec/m. Determine undamped and the damped natural frequencies of the system in vertical direction.

14. (a) a body having a mass of 15 kg. is suspended from a spring which deflects 12 mm. under the weight of the mass. Determine the frequency of the free vibrations. What is the viscous damping force needed to make the motion a periodic at a speed of 1 mm./s ? If, when damped to this extend a disturbing force having a maximum value of 100 N and vibrating at 6 Hz is made to act on the body, determine the amplitude of the ultimate motion.

Or

(b) A steel shaft 100 mm. in diameter is loaded and support in shaft bearing 0.4 m. apart. The shaft carries three loads : first mass 12 kg. at the centre, second mass 10 kg. at a distance 012 m. from the left bearing and third mass of 7 kg. at a distance 0.09 m. from the right bearing. Find the value of the critical speed by using Dunkerley's method. $E = 2 \times 10$ N/m.

(4 × 15 = 60 marks)