

Register Number: .....

**B.E DEGREE EXAMINATIONS: APRIL/MAY 2014**

(Regulation 2009)

Fifth Semester

**MECHANICAL ENGINEERING**

MEC113: Dynamics Of Machinery

**Time: Three Hours**

**Maximum Marks: 100**

**Answer all the Questions:-**

**PART A (10 x 1 = 10 Marks)**

1. Principle of super position has a limitation that it cannot be applied for
  - a) Linear system
  - b) Non – linear system
  - c) Flexible system
  - d) Fixed system
2. When the connecting rod is large, the piston executes..... motion
  - a) Linear motion
  - b) Simple harmonic motion
  - c) Angular motion
  - d) Circular motion
3. The product of rotating mass and the perpendicular distance between the rotating mass and the reference plane is called as
  - a) Turning moment
  - b) Mass moment
  - c) moment of inertia
  - d) Bending moment
4. The resultant unbalanced force due to the two cylinders along the line of stroke is known as.....
  - a) Swaying couple
  - b) Hammer blow
  - c) Piston effort
  - d) Tractive force
5. The damping force per unit velocity is known as.....
  - a) Amplitude
  - b) Damping co-efficient
  - c) Frequency
  - d) Natural frequency
6. A shaft supported in long bearing is assumed to have ..... for solving transverse vibration problems.
  - a) Both ends simply supported
  - b) Both ends fixed
  - c) Both ends flexibly fixed
  - d) Both ends are extended
7. A torsion vibratory system having three rotors connected by a shaft has
  - a) one node
  - b) two node
  - c) three node
  - d) no node
8. The factor which affects the critical speed of the shaft is

- a) diameter of the disc
  - b) span of shaft
  - c) eccentricity
  - d) all of these
9. The left hand side of the ship when viewed from stern is called as .....
- a) Bow
  - b) Star Board
  - c) Port
  - d) Yacht
10. The governor with zero range of speed is known as.....
- a) Porter governor
  - b) Proell Governor
  - c) Isochronous governor
  - d) Hunting governor

**PART B (10 x 2 = 20 Marks)**

11. What is meant by equivalent offset inertia force?
12. Why turning moment diagram of single cylinder four stroke I.C engine transfer from negative to positive during (suction stroke) the crank angle  $\pi/2$ ?
13. Write the conditions for complete balancing.
14. What is the effect of hammer blow and what is the cause of it?
15. What is meant by critical Speed of shaft?
16. Define damping ratio.
17. Define magnitude factor.
18. What is Gyroscope?
19. What is meant by hunting?
20. Define Steering.

**PART C (5 x 14 = 70 Marks)**

21. a) (i) Define coefficient of fluctuation of speed and coefficient of fluctuation of energy. (4)
- (ii) The radius of gyration of a fly wheel is 1 meter and fluctuation of speed is not to exceed 1% of the mean speed of the flywheel. If the mass of the flywheel is 3340kg and the steam develops 150KW at 135rpm, then find, (10)
- i. Maximum fluctuation of energy
  - ii. Coefficient of fluctuation of energy
- (OR)
- b) The length and connecting rod of a horizontal reciprocating engine are 200mm and 1 meter respectively. The crank is rotating at 400rpm. When the crank has turned  $30^\circ$  from the inner dead center, the difference of pressure between cover end and piston rod is  $0.4 \text{ N/mm}^2$ . If the mass of the reciprocating parts is 100Kg and a cylinder bore is 0.4meters. Calculate
- (i) Inertia force
  - (ii) Force on piston
  - (iii) Piston effort
  - (iv) Crank effort.
  - (v) Thrust on the side of the cylinder walls
  - (vi) Thrust in the connecting rod

22. a) A, B, C and D are four masses carried by a rotating shaft at radii 100mm, 125mm, 200mm and 150mm respectively. The planes in which the masses revolve are spaced 600mm apart and the masses of B, C and D are 10kg, 5kg and 4kg respectively. Find the required mass A and relative angular setting of the four masses so that the shaft be in complete balance.

(OR)

- b) A four cylinder vertical engine has cranks 150mm long. The plane of rotation of the first, third and fourth cranks are 400 mm, 200mm and 200mm respectively from that of the second crank, and their reciprocating masses are 50kg, 60kg and 50kg respectively. Find the mass of the reciprocating parts for the second cylinder and relative angular position of the cranks in order that the engine may be in complete balance.
23. a) (i) A cantilever shaft 50mm diameter and 300mm long has a disc of mass 100kg at its free end. The young's modulus for the shaft material is  $200\text{GN/m}^2$ . Determine the frequency of longitudinal and transverse vibration of the shaft. (10)
- (ii) Explain the sketches different cases of damped vibrations. (4)

(OR)

- b) A steel shaft 100mm in diameter is loaded and support in shaft bearing 0.4m apart. The shaft carries three loads: first mass 12kg at the centre, second mass 10kg at a distance 0.12m from the left bearing and third mass of 7kg at a distance 0.09m from the right bearing. Find the value of the critical speed by using Dunker ley's method. Take  $E=2 \times 10^{11}\text{N/m}^2$
24. a) A harmonic exciting force of 25 N is acting on a machine part, which is having a mass of 2 kg and is vibrating in a viscous medium. This exciting force causes a resonant amplitude of 12.5 mm with a period of 0.20sec. Determine the damping coefficient.

(OR)

- b) A single- cylinder reciprocating engine of total mass 250 kg is to be installed on an elastic support which permits vibratory motion only in vertical direction. The mass of piston is 3.75 kg and it reciprocates vertically with SHM with a stroke of 150 mm. The maximum vibratory force transmitted through the elastic

support to the foundation must be limited to 500 N when the engine runs at 750 rpm and less than 500 N at all higher speeds. Find the necessary stiffness of the elastic support and the amplitude of vibration at 800 rpm. If the engine speed is reduced below 750 rpm, at what speed will the transmitted force again becomes 500 N.

25. a) Calculate the range of speed of a porter governor which has equal arms of each 200mm long and pivoted on the axis of rotation. The mass of each ball is 4kg and the central load of the sleeve is 20kg. The radius of rotation of the ball is 100mm when the governor being to lift and 130mm when the governor is at maximum speed.

(OR)

- b) The turbine rotor of a ship has a mass of 20 tones and a radius of gyration 0.75. Its speed is 2000rpm. The ship pitches  $6^\circ$  above and below the horizontal position. One complete oscillation takes 18 seconds and the motion is simple harmonic. Determine
- The maximum couple tending to shear the holding down bolt of the turbine
  - The maximum angular acceleration of the ship during pitching
  - The direction in which the bow will tend to turn while, if the rotation of the rotor is clockwise when looking from rear.

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