KUMARAGURU
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Register Number: ……

B.E DEGREE EXAMINATIONS: NOV/DEC 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. In an engine,the workdone by inertia forces in a cycle is

   a) positive b) zero

   c) negative d) none of the these

2. In turning moment diagram, the variation of energy above and below the mean resisting torque line is called

   a) fluctuation of energy b) Maximum fluctuation of energy

   c) Coefficient of fluctuation of energy d) none of the above

3. If the lines of action of three force members not meet at a single point, the members are in

   a) Equilibrium state b) Non Equilibrium state

   c) point of concurrency d) Complete balance

4. Multi cylinder engine is desirable because

   a) Balancing problems are reduced b) Flywheel size is reduced

   c) Both a) and b) d) None of the above.

5. If the mass of a body increases 9 times , the frequency of body will

   a) increases b) decreases

   c) Not change d) Zero

6. A Shaft carrying three rotors will have

   a) 3 Nodes b) 2 Nodes

   c) No node d) 6 Nodes

7. Which of the following exhibits forced vibration

   a) Electric Calling bell b) Hoppers

c) Both a) and b) d) None of the above.

8. The following can be used for vibration isolation

a) Cork b) Wood

c) Glass d) Aluminum sheets

9. For high speed engines, the following governor is not preferred

a) Proell governor b) Porter governor

c) Watt governor d) Hartnell governor

10. The engine of an aero plane rotates in clockwise direction when seen from the tail end and aero plane takes a turn to the left. The effect of gyroscopic couple on the aero plane will be

a) To raise the nose and dip the tail b) To raise the nose and tail

c) To dip the nose and raise the tail d) To dip the nose and tail

PART B (10 x 2 = 20 Marks)

11. What is meant by inertia torque?
12. Differentiate between flywheel and governor?
13. Differentiate between static and dynamic balancing.
14. What condition is to be satisfied to avoid the lift of wheels from rail?
15. In a spring mass system, when the mass is attached to the midpoint of the spring, the natural frequency of longitudinal vibration will be maximum or minimum? Justify your answer.
16. Name the types of vibrations.
17. Define magnification factor?
18. In vibration isolation system, if frequency is less than $\sqrt{2}$ for all values of damping factor, what will be value of transmissibility?
19. Isochronism is possible in which type of governor? Why?
20. What do you mean by gyroscopic couple?

PART C (5 x 14 = 70 Marks)

21. a) The turning moment diagram for a petrol engine is drawn to the following scales: Turning moment, 1mm= 5N-m; crank angle, 1mm=1°. The turning moment diagram repeats itself at every half revolution of the engine and the areas above and below the mean turning moment line taken in order are 295, 685, 40, 340, 960, 270 mm^2. The rotating parts are equivalent to a mass of 36 Kg at a radius of gyration of 150 mm. Determine the coefficient of fluctuation of speed when the engine runs at 1800 r.p.m.

(OR)

b) The torque delivered by a two-stroke engine is represented by T= (1000+ 30 sin 2 θ -500 sin 2 θ)N.m. where θ is the angle turned by the crank from the inner dead centre. The engine speed is 250 rpm. The mass of the flywheel is 300 kg and the radius of gyration 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 a angle of 60° from inner dead centre.

22. a) A rotating shaft carries four masses A,B,C and D which are radially attached to it. The mass centres are 30mm,38 mm, 40mm and 35 mm respectively from the axis of rotation. The masses A,C and D are 7.5kg,5kg and 4 kg respectively. The axial distances between the planes of rotation of A and B is 400mm and between B and C is 500mm. The masses A and C are at right angles to each other. Find for a complete balance,

i) The angles between the masses B and D from mass A,

ii) The axial distance between the planes of rotation of C and D

iii) The magnitude of mass B.

(OR)

b) A four crank engine has the two outer cranks set at 120 degrees to each other and their reciprocating masses are each 400 kg. The distance between the plane of rotation of adjacent cranks are 450 mm, 750 mm and 600 mm. If the engine is to be in complete primary balance, find the reciprocating mass and relative angular position for each of the inner cranks.

If the length of each connecting rod is 1.2 m and the speed of rotation is 240 r.p.m., what is the secondary unbalanced force?

23. a) (i) The mass of a single degree damped vibrating system is 7.5kg makes 24 free oscillations in 14 seconds when disturbed from its equilibrium position. The amplitude of vibration reduces to 0.25 of its initial value after five oscillations. Determine: (7)

(ii) 1) stiffness of the spring 2) logarithmic decrement, and 3) Damping factor. (7)

A beam of length 10m carries two loads of mass 200kg at distances of 3m from each end together with a central load of mass 1000 kg. Calculate the frequency of transverse vibrations. Neglect the mass of the beam and take I = 109 mm^4 and E=205x10^3 N/mm^2 .

(OR)

b) A shaft is simply supported at its ends and is of 40 mm in diameter and 2.5 m in length. The shaft carries three point loads of masses 30 kg,70 kg, 50 kg at 0.5 m,1 m and 1.7 m respectively from left support. The weight of shaft per meter length is given as 74N. The Young's modulus of the shaft is 200 GN/m^2. Find the critical speed of shaft.

24. a) A machine part of mass 2 kg vibrates in a viscous medium. Determine the damping coefficient when a harmonic exciting force of 25 N results in a resonant amplitude of 12.5 mm with a period of 0.2 second. If the system is excited by a harmonic force of frequency 4 Hz, what will be the percentage increase in the amplitude of vibration when damper is removed as compared with damping?

(OR)

b) A machine of mass one tonne is acted upon by an external force of 2450 N at a frequency of 1500 rpm. To reduce the effects of vibration, isolator of rubber having a static defection of 2mm under the machine load and an estimated damping ϵ = 0.2 are used. Determine:
(i) The force transmitted to the foundation,
(ii) The amplitude of vibration of machine
(iii) The phase lag.

25. a) All arms of the porter governor are 178 mm long and are hinged at a distance of 38 mm from the axis of rotation. The mass of each ball is 1.15 kg and the mass of the sleeve is 20 kg. The governor sleeve begins to rise at 280 rpm when the links are at an angle of 30° to the vertical. Assuming the friction to be constant, Determine the minimum and maximum speed of rotation when the inclination of the arms to the vertical is 45°.

(OR)

b) A ship is propelled by a turbine rotor which has a mass of 5 tonnes and a speed of 2200 r.p.m.The rotor has a radius of gyration of 0.5m and rotates in a clockwise direction when viewed from stern. Find the gyroscopic effects in the following conditions:
(i) The ship sails at a speed of 30km/hr and steers to the left in a curve having 60 m radius.
(ii) The ship pitches 6 degree below the horizontal position. The bow is descending with its maximum velocity. The motion due to pitching is simple harmonic and the periodic time is 20 seconds.
(iii) The ship rolls and at a certain instant it has an angular velocity of 0.03 rad/s clockwise when viewed from stern.

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