TE MTRX | SEM-VI | CBSGS | DT- 26/05/2017.

Q.P. Code :13527

[Time: Three Hours] **[Marks:80]**

Please check whether you have got the right question paper.

N.B:
1. **Question.No.1** is **compulsory.**
2. From **Question No.2 to 6** attempt **any three** Questions.
3. Figures to the right indicate full marks.
4. Draw a suitable diagram wherever necessary.
5. Assume suitable data if necessary and mention clearly.

Q.1 **a)** Explain the terms sensitiveness, hunting and stability relating to governors. **04**

b) Explain the gyroscopic effect on four wheeled vehicle **04**

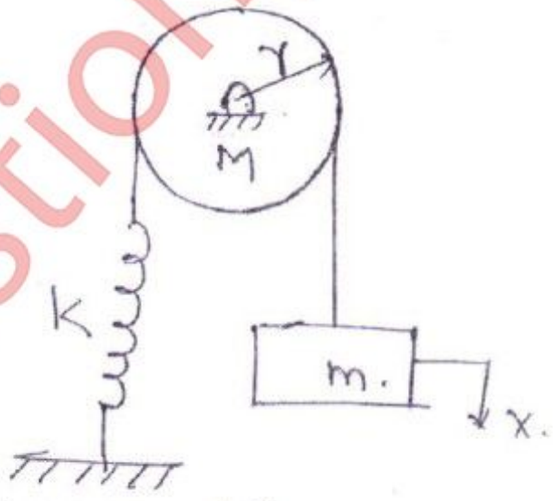
c) What do you meant by degree of freedom? Explain with examples. **04**

d) Draw the plot of magnification factor Vs. frequency ratio for various damping ratio. **04**

e) A mass of 1 Kg is attached to a spring having stiffness of 3920 N/m.The mass slide on horizontal surface, the coefficient of friction between mass and surface being 0.1.Determine the frequency of vibration of the system and amplitude after one cycle. If the initial amplitude is 0.25 cm.Determine final rest position. **04**

Q.2 **a)** Each ball of a porter governor has a mass of 6 Kg and the mass of the sleeve is 40 Kg.The upper arm are 300 mm long and are pivoted in the axis of rotation whereas the lower arm are 250 mm long and are attached to the sleeve at a distance of 40 mm from the axis. Determine the equilibrium speed of the governor for a radius of rotation of 150 mm for 1% change in speed Also, find the effort and the power for the same speed change. **10**

b) Find the natural Frequency of system shown in Fig(I) **06**



Fig(I)

c) A Spring-mass system has spring stiffness K N/m and mass of M kg. It has Natural frequency of vibration as 12Hz. An extra 2kg mass is coupled to M and the natural frequency reduced by 2Hz. Find K & M. **04**

[P.T.O]

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Q.3 **a)** Explain the follwing terms: 08
i) Resonance
ii) Forced vibration
ii) Peak-Amplitude & Peak Frequency
iv) Discrete and continuous system

b) A Refrigerator unit of mass 30 kg is to be supported by three spring of stiffness K N/cm each. If the unit operates at 580 r.p.m; what should be the value of spring constant K; If only 10% of the shaking force of the unit is to be transmitted to the supporting structure? 06

c) Explain the principle of accelerometer with suitable diagram. 06

Q.4 **a)** The mass of a turbine rotor of a ship is 8 tonnes and has a radius of gyration 0.6 m. It rotates at 1800 r.p.m. clockwise when looking from the stern. Determine the gyroscopic effects in following cases: 10
i) if the ship travelling at 100 km/h steer to the left in a curve of 75m radius,
ii) If the ship is pitching and the bow in descending with maximum velocity. The pitching is simple harmonic, the periodic time being 20 seconds and the total angular movement between the extreme positions is 10°, and
iii) If the ship is rolling and at a certain instant has an angular velocity of 0.03 rad/s clockwise when looking from stern. In each case, explain clearly how you determine the direction in which the ship tends to move as a result of the gyroscopic action.

b) A vertical single stage air compressor having a mass o 500 kg ius mounted on spring having a stiffness of 19.6×10^5N/m and dashports with a damping factor of 0.2. The rotating parts are completely balanced and the equivalent reciprocating parts weigh 20 kg. The stroke is 0.2 m. Determine the dynamic amplitude of vertical motion and the phase difference between motion and the excitation force if the compressor is operated at 200 r.p.m. 10

Q.5 **a)** A Machine mounted on spring and fitted with a dashpot has mass of 60 kg. There are three springs, each of stiffness 12N/mm. The amplitude of vibration reduces from 45 to 8 mm in two complete oscillation. Assuming that damping force varies as the velocity, determine the: 10
i) Damping coefficient.
ii) Ratio of frequencies of damped and undamped vibrations.
iii) Periodic time of damped vibration.

b) Explain machine conditioning monitoring & fault diagnosis of rotating masses. 10

Q.6 **a)** Explain transmissibility and vibration isolation. Enlist vibration isolating material. Draw plot between tranmissibility Vs. Frequency ratios for various damping factors. 08

b) Four masses m_1=200 kg, m_2=300 kg, m_3=240 kg and m_4=260 kg are attached to a shaft and are revolving at radii r_1=270 mm, r_2=210 mm, r_3=300 mm and r_4=360 mm respectivey in the plane measured from plane of m_1 to l_1=270 mm, l_2=420 mm and l_3=720 mm respectively. The angle measured counterclockwise are m_1 to m_2 45°, m_2 to m_3 75°, m_3 to m_4 135°, and the distance between planes L & M, the planes in.which balance masses are placed is 500 mm. The distance between planes for m_1 and plane L is 120 mm and plane M and Plane for m_4=100 mm. The radius of quotation of balance mas b is 720 mm. Determine the magnitude and angular position of the balancing masses. Solve the problem graphically. 12
