Time: 3 Hours **Total Marks: 80**

Instructions:

i. **Question No.1 is compulsory.**
ii. **Attempt any 3 out of the remaining questions.**
iii. **Use your judgement for unspecified data, if any but justify the assumption.**
iv. **Numbers to the right indicate marks.**

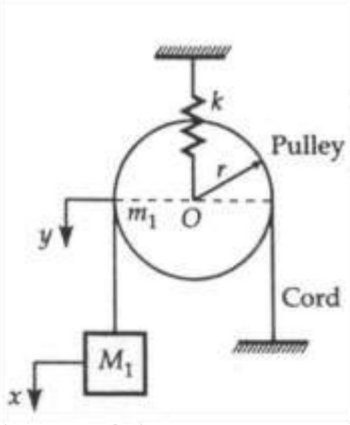
Q1 Attempt any FOUR of the following:

A	Explain any four characteristics of Governors.	**05**
B	State the importance of vibration in engineering applications.	**05**
C	The connecting rod of a gasoline engine is 300 mm long between its centres. It has a mass of 17 kg and mass moment of inertia of 7000 kg-mm^2. Its centre of gravity is at 200 mm from its small end centre. Determine the dynamical equivalent two-mass system of the connecting rod if one of the masses is located at the small end centre.	**05**
D	Discuss the partial balancing in reciprocating Engine.	**05**
E	List various Vibration Isolators and explain any four with suitable examples.	**05**

Q2 A In a Hartnell governor, the lengths of ball and sleeve arms of bell crank lever are 120 mm and 100 mm respectively. The distance of the fulcrum of the bell crank lever from the governor axis is 140 mm. Each governor ball has a mass of 4 kg. The governor runs at a mean speed of 300 rpm with the ball arms vertical and sleeve arms horizontal. For an increase of speed of 4%, the sleeve moves 10 mm upwards. Neglecting friction, Find: **10**

(i) The minimum equilibrium speed if the total sleeve movement is limited to 20 mm. (ii) The spring stiffness. (iii) The sensitiveness of the governor.

Q2 B Determine the natural frequency of the system as shown in fig below. **10**



Q3 A The mass of the turbine rotor of a ship is 20 tonnes and has a radius of gyration of 0.60 m. Its speed is 2000 r.p.m. The ship pitches 6° above and 6° below the horizontal position. A complete oscillation takes 30 seconds and the motion is simple harmonic. Determine the following: **10**

1. Maximum gyroscopic couple, 2. Maximum angular acceleration of the

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ship during pitching, and 3. The direction in which the bow will tend to turn when rising, if the rotation of the rotor is clockwise when looking from the left.

Q 3B A vibrating system is defined by following parameters: m=3kg, k=100N/m, C =3N-S/m. Determine the damping factor, natural frequency of damped vibration, logarithmic decrement, ration of two consecutive amplitude and number of cycles after which the original amplitude is reduced to 20%. **10**

Q4 A A vertical double acting steam engine has a cylinder 300 mm diameter and 450 mm stroke and runs at 200 r.p.m. The reciprocating parts has a mass of 225 kg and the piston rod is 50 mm diameter. The connecting rod is 1.2 m long. When the crank has turned through 125°from the top dead centre, the steam pressure above the piston is 30 kN/m^2 and below the piston is 1.5 kN/m^2. Calculate the effective turning moment on the crank shaft. **10**

Q4 B An aircraft radio weighing 118N is to be isolated from an engine vibrations ranging in frequency from 1600 to 2000 rpm, Calculate static deflection an isolator have so that it can have 85% isolation. **10**

Q5 A Explain vibration-based condition monitoring and fault diagnosis in rotating machine. **10**

Q5 B A gun barrel of mass 600 kg has to recoil spring of stiffness 294000N/m. If the barrel recoils 1.3 m on firing determine initial recoil velocity of the barrel, critical damping coefficient of the dash pot which is engaged at the end of the stroke and the equation for the motion. **10**

Q6 A A four-cylinder vertical engine has cranks 150 mm long. The planes of rotation of the first, second and fourth cranks are 400 mm, 200 mm and 200 mm respectively from the third crank and their reciprocating masses are 50 kg, 60 kg and 50 kg respectively. Find the mass of the reciprocating parts for the third cylinder and the relative angular positions of the cranks in order that the engine may be in complete primary balance. **10**

Q6 B 1) Explain static and dynamic balancing **05**
2) Explain the concept of correction couple **05**

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