INDIAN MARITIME UNIVERSITY
(Central University, Government of India)

May/June 2016 End Semester Examinations
B.Tech. (Marine Engineering)

Fourth Semester – Mechanics of Machines - II -
(UG11T2403/UGT1403)

Date : 13.06.2016 **Max. Marks: 100**
Time: 3 Hrs **Pass Marks : 50**

Part-A **(3 x 10 = 30 Marks)**
Compulsory Question

1) a) What do you understand by the term "In-line Engines"?
   b) Define "Simple Harmonic motion" (SHM).
   c) Write the expression for equivalent stiffness of springs in series.
   d) Draw sketch and show number of nodes for two rotors and three rotors system of torsional vibration.
   e) Write the expression for the length of an torsionally equivalent shaft.
   f) What are types of forcing function encountered in forced vibrations?
   g) Define whirling of shaft.
   h) Explain the term "critical damping co-efficient". How it is related to "damping factor"
   i) Explain critical speed of rotor.
   j) Explain viscous and coulomb damping.

Part-B **(14 x 5 =70 Marks)**
Answer any Five Questions

2) The reciprocating mass per cylinder in a 60° V-twin engine is 1.5 kg. The stroke and connecting rod lengths are 100 mm and 250 mm respectively. If the engine runs at 2500 RPM, Determine the maximum and minimum values of the primary forces. Also find out the resultant secondary force. (14)

3) A gun barrel having a mass of 560 kg, is designed with the following data. Initial recoil velocity- 36m/s, Recoil distance on firing- 1.5 m. Calculate (a) Spring constant (b) Critical damping co-efficient (c) Time required for the barre to return to a position 0.12 m from its initial position. (14)

4) Derive the differential equation of motion for a rotating unbalance system (14)

5) Three rotors are fitted in a uniform diameter shaft. Rotor A and C are fitted at two ends, B is intermediate rotor. L1 is distance between A and B, L2 is distance between B and C. Derive torsional vibration of 3- rotor system. If mass moment of inertia of A, B and C are 20 kgm2, 40 Kgm2 and 30 Kgm2 respectively, uniform shaft diameter is 80 mm and L1 = 700 mm and L2 = 1200 mm, find frequencies of free torsional vibration at single node and two node vibration.
   Take G = 80 GN/m2. (7+7)

6) (a) Two springs in parallel, having stiffness 500 N/m and 550 N/m are fixed at one end, a mass of 10 kg is hanging from other end. Derive differential equation of motion of free vibration considering initial displacement as X_0 and find the equation of displacement, velocity and acceleration and also draw their curve with time.

(b) A body of mass 20 Kg is hanging from a spring having stiffness 900 N/m and mass of 4 Kg. Derive differential equation of motion of vibration and find natural frequency of vibration. (7+7)

7) (a) Find the natural frequency of vibration of several concentrated load by maximum energy method.

(b) A simply supported beam of span of 2.5m.The mass of the beam is 200kg/m and area movement of inertia is $14X10^{-6}$ m^4. Two equal load of 1 tonne each are applied at points 0.8m from each end. Find the natural frequency of transverse vibration of the system. Assume $E=200GN/m^2$. (7+7)

8) (a) Derive differential equation of forced, damped linear vibration. Draw the steady state and transient state displacement curve.

(b) A machine part of mass 3 Kg vibrates in a viscous medium. Determine the damping coefficient when the maximum harmonic exciting force of 30 N. results in resonant amplitude of 15 mm with time period of 0.25 sec. What is the amplitude, if the system is excited by same harmonic force of new frequency of 3 HZ. (7+7)

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