BT-MRE-V(S.S)-12.20-1346 Reg. No. | | | | | | | | |

B

B.Tech. Degree V Semester Special Supplementary Examination in Marine Engineering December 2020

MRE 501 DYNAMICS OF MACHINERY

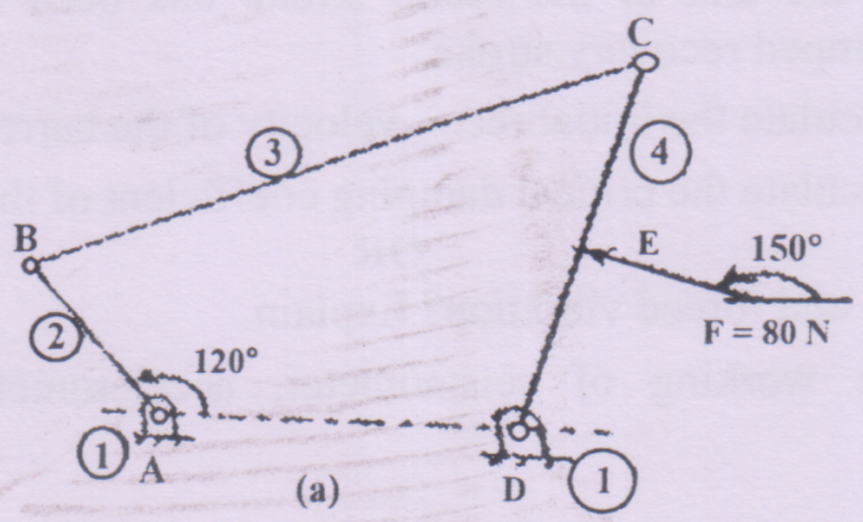
(*Prior to 2013 scheme*)

Time: 3 Hours Maximum Marks: 100

(5 × 20 = 100)

I. (a) Define and explain the superposition theorem as applicable to a system of forces acting on a mechanism? (5)

(b) A four-link mechanism with the following dimensions is acted upon by a force 80 N at angle 150° on the link DC. AD = 500 mm, AB = 400 mm, BC = 1000 mm, DC = 750 mm, DE = 350 mm. Determine the input torque T on the link AB for the static equilibrium of the mechanism for the given configuration. (15)



OR

II. (a) State and explain D'Alembert's principle. (5)

(b) A horizontal gas engine running at 210 rpm has a bore of 220 mm and a stroke of 440 mm. The connecting rod is 924 mm long and the reciprocating parts weigh 20 kg. When the crank has turned through an angle of 30 ° from the inner dead center, the gas pressure on the cover and the crank sides are 500 kN and 60 kN respectively. Diameter of the piston rod is 40 mm. Determine (i) turning moment on the crank shaft (ii) thrust on the bearings (iii) acceleration of the flywheel which has a mass of 8 kg and radius of gyration of 600 mm while the power of the engine is 22 kW. (15)

III. A single cylinder 4 stroke gas engine develops 18.4 KW at 300 rpm with work done by the gases during the expansion being 3 times the work done on the gases during compression. The work done during the suction and exhaust strokes is negligible. The total fluctuation of speed is 2% of the mean. The TMD may be assumed to the triangular in shape. Find the mass moment of inertia of the flywheel. (20)

OR

IV. A four-wheeled trolley car of mass 2500 Kg runs on rails, which are 1.5 m apart and travels around a curve of 30 m radius at 24 km/hr. The rails are at the same level. Each wheel of the trolley is 0.75 m in diameter and each of the two axles is driven by a motor running in a direction opposite to that of the wheels at a speed of five times the speed of rotation of the wheels. The moment of inertia of each axle with gear and wheels is 18 kg-m^2. Each motor with shaft and gear pinion has a moment of inertia of 12 kg-m^2. The centre of gravity of the car is 0.9 m above the rail level. Determine the vertical force exerted by each wheel on the rails taking into consideration the centrifugal and gyroscopic effects. State the centrifugal and gyroscopic effects on the trolley. (20)

(P.T.O.)

V. Four masses A, B, C and D revolves at equal radii and equally spaced along a shaft. The mass B is 7 kg and the radii of C and D make angles of 90° and 240° respectively with the radius of B. Find the Magnitude of masses A, C and D and angular position of A, so that the system may be completely balanced. (20)

OR

VI. Derive the following expression, for an uncoupled two cylinder locomotive engines (i) variation in tractive force (ii) swaying couple (iii) hammer blow. (20)

VII. (a) Write a short note on viscous damping. (5)

(b) A cannon barrel of mass 545 kg is observed to recoil by 1.22 m every time on firing. The recoil spring has stiffness 292 kN/m. To ensure that the barrel returns to its original position as quickly as possible, a dashpot engaged at the end of the recoil stroke has been designed to cause critically damped recovery stroke. (15)

(i) Calculate the initial recoil velocity of the barrel.

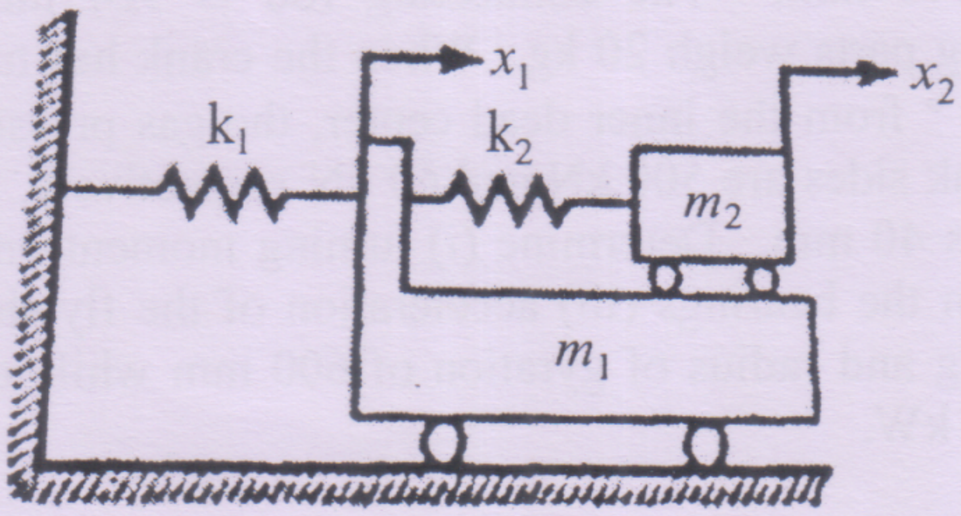
(ii) Calculate the critical damping coefficient of the dashpot.

OR

VIII. (a) What is free and forced vibration? Explain. (5)

(b) Explain the working of seismometer, accelerometer and vibration exciters? (15)

IX. Determine the natural frequencies of the vibrating system shown in the following figure. Take $m_1 = 196$ kg, $m_2 = 49$ kg, $k_1 = 98$ kN/m and $k_2 = 19.6$ kN/m. (20)



OR

X. (a) Describe Dunkerly Method to find the fundamental natural frequency of a shaft carrying various point loads, vibrating in transverse direction. (5)

(b) A shaft 50 mm diameter and 3 metres long is simply supported at the ends and carries three loads of 1000 N, 1500 N and 750 N at 1 m, 2 m and 2.5 m from the left support. The Young's modulus for shaft material is 200 GN/m^2. Find the approximate fundamental frequency of free transverse vibrations. (15)

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