BT-MRE-V(S)-12.16-1494 Reg. No.

B

B. Tech. Degree V Semester Supplementary Examination in Marine Engineering December 2016

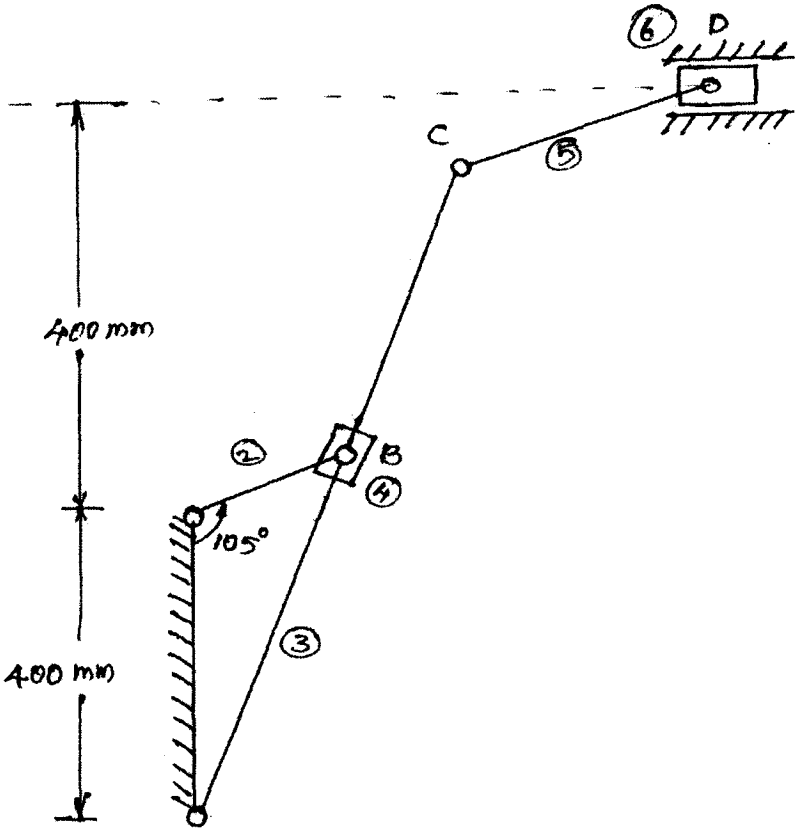
MRE 501 DYNAMICS OF MACHINERY

(Prior to 2013 Scheme)

Time: 3 Hours Maximum Marks: 100

(5 × 20 = 100)

I. For the static equilibrium of the quick-return mechanism shown in fig., determine the input torque T_2 to be applied on link AB for a force 300 N on the slider D. The dimensions of the various links are: (20)
0A = 400 mm AB = 200 mm OC = 800 mm CD = 300 mm.



OR

II. (a) Derive an expression for the velocity of the piston of a slider crank mechanism. (6)

(b) The crank and connecting rod of a vertical single cylinder gas engine running at 2000 rpm are 80 mm and 300 mm respectively. The diameter of the piston is 100 mm and the mass of the reciprocating parts is 1.2 kg. At a point during the power stroke when the piston has moved 20 mm from the top dead centre position, the pressure on the piston is 800 kN/m^2. Determine (i) the net force on the piston (ii) the thrust in the connecting rod (iii) the thrust on the sides of the cylinder walls (iv) the engine speed at which the above values are zero. (14)

(P.T.O.)

III. (a) Derive an expression for the coefficient of fluctuation of speed. (6)

(b) The areas above and below the mean torque line for an I.C. engine are –25, +200, –100, +150 and –75 mm^2 taken in order. The scale for the turning moment diagram is 1 m vertical scale = 10 Nm and 1 mm horizontal scale = 1.5°. The mass of the rotating parts are 45 kg with a radius of gyration 150 mm. If the engine speed is 1500 rpm, find the coefficient of fluctuation of speed. (14)

OR

IV. The rotor of the turbine of a ship has mass of 2500 kg and rotates at a speed of 3200 rpm counter clockwise when viewed from stern. The rotor has a radius of gyration of 0.4 m. Determine the gyroscopic couple and its effect when (i) the ship turns to the left in a curve of 80 m radius at a speed of 15 knots (1 knot = 1860 m/h). (ii) The ship pitches 5 degrees above and 5 degrees below the normal position and the bow is descending with its maximum velocity. The pitching motion is simple harmonic with 40 sec time period. (iii) The ship rolls and at the instant its angular velocity is 0.4 rad/s clockwise when viewed from stern. Also find the maximum angular acceleration during pitching. (20)

V. (a) Explain hammer-blow and swaying couple. (6)

(b) A shaft carries four rotating masses A, B, C and D which are completely balanced. The masses B, C and D are 50 kg, 80 kg and 75 kg respectively. The masses C and D make angles 90° and 195° respectively with mass B in the same sense. The masses A, B, C and D are concentrated at radius 75 mm, 100 mm, 50 mm and 90 mm respectively. The plane of rotation of masses B and C are 250 mm apart. Determine (i) the mass A and its angular position (ii) the position of plane of A and D. (14)

OR

VI. (a) Derive an expression for maximum variation in tractive force. (4)

(b) Each crank and connecting rod of a 4 cylinder in line engine are 200 mm and 800 mm respectively. The outer cranks are set at 120° to each other and each has a reciprocating mass of 200 kg. The spacing between adjacent sides of cranks are 400mm, 600 mm and 500 mm. If the engine is in complete primary balance, determine the reciprocating masses of the inner cranks and their relative positions. (16)

VII. (a) Determine the effect of the mass of the spring on the natural frequency of a spring mass system. (8)

(b) A vibrating system consists of a mass of 50 kg, a spring of stiffness 30 kN/m and a damper. The damping provided is only 20% if the critical value. Determine (i) the damping factor (ii) the critical damping coefficient (iii) natural frequency of the damped vibrations (iv) the logarithmic decrement (v) the ratio of two consecutive amplitudes. (12

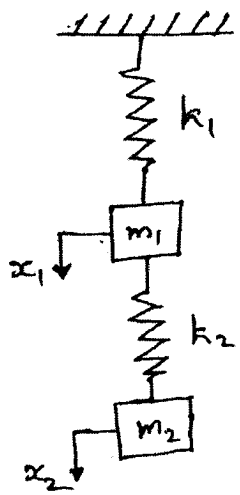
OR

VIII. (a) Derive an expression for the critical speed of shaft. (8)

(b) A shaft 40 mm diameter and 2.5 m long has a mass of 15 kg per meter length. It is simply supported at the ends and carries three masses 90 kg, 140 kg and 60 kg at 0.8 m, 1.5 m and 2 m respectively from the left support. Taking E= 200 GN/m^2, find the frequency of the transverse vibrations. (12)

(Contd.....3)

IX. (a) The fig. shows a vibrating system having two degrees of freedom. Determine the natural frequencies of vibrations and the ratio of amplitudes of the motion of m_1 and m_2 for the two modes of vibration. Given: (14)



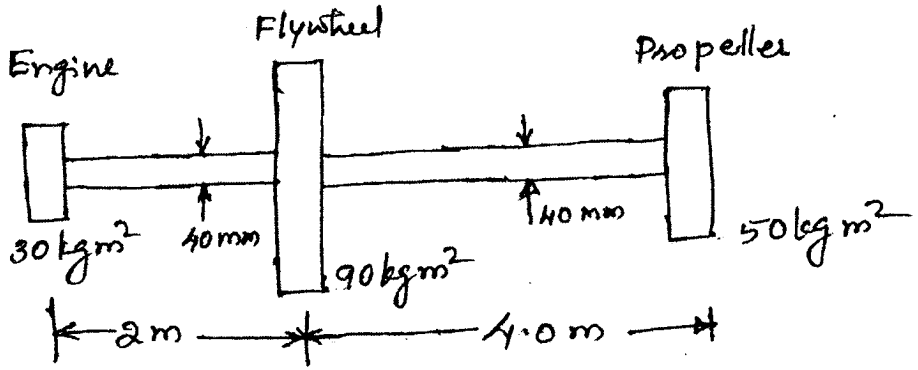
$m_1 = 1.5\,kg \quad m_2 = 0.80\,kg$

$k_1 = k_2 = 40\,N/m$

(b) Explain what is torsionally equivalent shaft. (6)

OR

X. A torsional system shown in the fig. Find the frequencies of vibration and the positions of nodes. Also find the amplitudes of vibration. (20)



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