CBCS SCHEME

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15ME52

Fifth Semester B.E. Degree Examination, June/July 2019
Dynamics of Machinery

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. State the condition of equilibrium of a body subjected to a system of (i) two forces, (ii) three forces and (iii) member with two forces and a torque. **(06 Marks)**

b. A slider crank mechanism with the following dimensions is acted upon by a force, F = 2 kN at B as shown in Fig.Q1(b). Determine the input torque 'T' on the link OA for the static equilibrium of the mechanism.

OA = 100 mm
AB = 450 mm

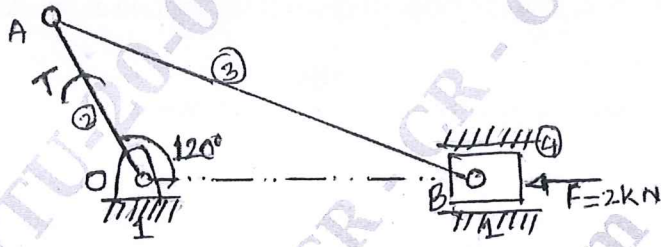

Fig.Q1(b) **(10 Marks)**

OR

2 a. Explain the principle of virtual work. **(06 Marks)**

b. A four link mechanism with the following dimensions is acted upon by a force 80 N at 150° on link DC as shown in Fig.Q2(b). Determine the input torque T on the link AB for the static equilibrium of the mechanism.

AD = 500 mm
AB = 400 mm
BC = 1000 mm
DC = 750 mm
DE = 350 mm

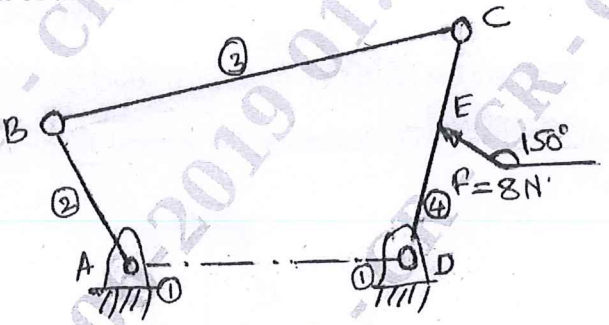

Fig.Q2(b) **(10 Marks)**

Module-2

3 a. Explain static and dynamic balancing of rotating masses. **(04 Marks)**

b. Four masses A, B, C and D carried on a shaft at radii 100 mm, 125 mm, 200 mm and 150 mm respectively. The planes at which these masses are rotating are placed 600 mm apart. The mass B, C and D are 10 kg, 5 kg and 4 kg respectively. Find the mass of A and relative angular positions of the four masses so that the shaft will be in equilibrium. **(12 Marks)**

OR

4 a. Explain partial balancing in reciprocating masses. **(04 Marks)**

b. The successive cranks of a five cylinder inline engine are at 144° apart. The spacing between cylinder centre lines is 400 mm. The lengths of the crank and connecting rod are 100 mm and 450 mm respectively. The reciprocating mass for each cylinder is 20 kg. The engine speed is 630 rpm. Determine the maximum values of primary forces and couples. **(12 Marks)**

Module-3

5 a. Define the following with respect to the working of governors:
i) Sensitiveness
ii) Isochromism
iii) Effort of a governor
iv) Stability of governor **(08 Marks)**

b. Each arm of a porter governor is 200 mm long and is pivoted on the axis of governor. The radii of the balls at the minimum and maximum speeds are 120 mm and 160 mm respectively. The mass of the Sleeve is 24 kg and each ball is 4 kg. Find the range of speed of the governor. Also find the range of speed if the friction at the sleeve is 18 N. **(08 Marks)**

OR

6 a. Derive an expression for gyroscopic couple C = IWWp. **(06 Marks)**

b. An aeroplane flying at 240 km/hr turn towards left and completes a quarter circle of radius 60 m. The mass of the rotary engine and propeller plane is 450 kg with a radius of gyration of 320 mm. the engine speed is 2000 rpm clock wise when viewed from the rear. Determine the gyroscopic couple and state its effect. In what way the effect is changed when the aeroplane turns towards right. **(10 Marks)**

Module-4

7 a. Explain different types of vibrations with sketches. **(06 Marks)**

b. Derive an expression for the natural frequency of spring-mass system using Newton's method and energy method. **(10 Marks)**

OR

8 a. Define vibration. What are the causes of vibrations? Mention remedies for vibrations. **(05 Marks)**

b. Neglecting the mass of the rod, determine the natural frequency of the system shown in Fig.Q8(b).

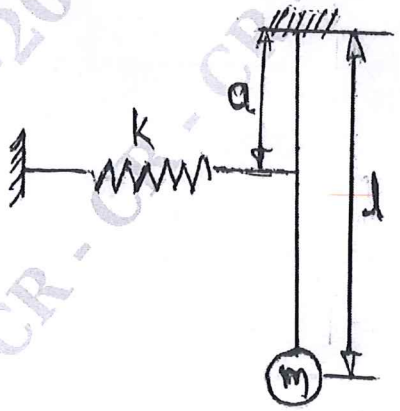

Fig.Q8(b) **(06 Marks)**

c. A mass is suspended from a spring as shown in Fig.Q8(c). Determine the natural frequency of the system.

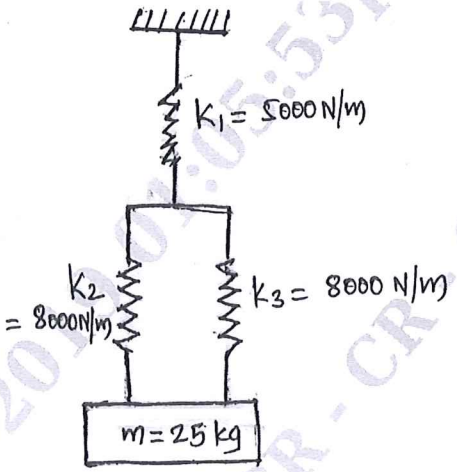

Fig.Q8(c) **(05 Marks)**

Module-5

9 a. List different type of damping. Explain any two type of damping. **(06 Marks)**

b. Determine:
   i) The critical damping coefficient
   ii) The damping factor
   iii) The natural frequency of damping vibrations
   iv) The logarithmic decrement
   v) The ratio of two consecutive amplitudes of a vibrating system which consists of a mass of 25 kg, a spring stiffness 15 kN/m and a damper. The damping provided is 15% of the critical value. **(10 Marks)**

OR

10 a. What is magnification factor? Explain. **(05 Marks)**

b. Explain the terms vibration isolation and transmissibility ratio. **(04 Marks)**

c. The support of a spring-mass system is vibrating with an amplitude of 5 mm and a frequency of 1150 cycle/min. If the mass is 0.9 kg and the spring has a stiffness of 1960 N/m, determine the amplitude of vibration of the mass. What amplitude will result if a damping factor of 0.2 is included in the system? **(07 Marks)**

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