BTS(C) – VI – 06 - 017 - (H)

B. Tech Degree VI Semester Examination, June 2006

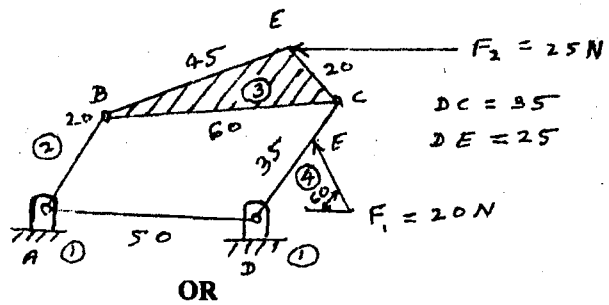
ME 601 DYNAMICS OF MACHINERY

(2002 Admissions)

Time : 3 Hours Maximum Marks : 100

I. (a) What are free body diagrams of a mechanism? Explain with reference to a four link mechanism. (5)

(b) For the mechanism shown in the figure determine the torque on link AB for the static equilibrium of mechanism. (15)



OR

II. (a) What do you mean by dynamically equivalent system? Explain. (5)

(b) In a vertical double acting steam engine the connecting rod is 4.5 times the crank weight of the reciprocating parts is 120Kg and the stroke of the piston is 440mm. The engine runs at 250rpm. If the net load on the piston due to steam pressure is 25KN when the crank has turned through an angle of 120^0 from the top dead center, determine

(i) The thrust on the connecting rod
(ii) The pressure on slide bars
(iii) The tangential force on the crank pin
(iv) The thrust on the bearing
(v) The turning moment on the crank shaft. (15)

III. (a) What are turning moment diagram? Why are they drawn? (5)

(b) The turning moment diagram of a four stroke engine is assumed to be represented by four triangles, the areas of which from the line of zero pressure are

Suction stroke	=	$440mm^2$
Compression stroke	=	$1600mm^2$
Expansion stroke	=	$7200mm^2$
Exhaust stroke	=	$660mm^2$

Each mm^2 of area represents 3 r.m of energy. If the resisting torque is uniform determine the mass of rim of a fly wheel to keep the speed between 218 and 222 rpm when the mean radius of the rim is to be 1.25m (15)

OR

IV. (a) Explain the gyroscopic effect on four wheel vehicles. (5)

(b) Each wheel of a four wheeled, rear engine automobile has a moment of inertia of 2.4 Kgm^2 and an effective diameter of 660mm. The rotating parts of the engine have a moment of inertia of $1.2Kg.m^2$. The gear ratio of engine to the back wheel is 3 to 1. The engine axis is parallel to the rear axle and the crank shaft rotates in the same sense as the road wheels. The mass of the vehicle is 2200Kg and the center of the mass is 550mm above the road level. The track width of the wheel is 1.5m. Determine the limiting speed of the vehicle around a curve with 80m radius so that all the four wheels maintain contact with the road surface. (15)

V. (a) Write a short note on Balancing of multi cylinder engines. (5)

(b) A shaft carries four masses A,B,C and D of magnitude 200Kg, 300Kg, 400Kg and 200Kg respectively and revolving at radii 80mm, 70mm, 60mm and 80mm in planes measured from A at 300mm, 400mm and 7000 mm. The

(Turn Over)

angles between the cranks measured anti clock wise are A to B 450^0 B to C 70^0, and C to D 120^0. The balancing masses are to be placed in planes X and Y. The distance between the planes A and X is 100mm, between X and Y is 400mm and between Y and d is 200mm. If the balancing masses revolve at a radius of 100mm, find their magnitude and angular positions. (15)

OR

VI. (a) What is swaying couple? Derive an expression for finding maximum swaying couple? (5)

(b) The cylinder axes of a V-engine are at right angle to each other. The weight of each piston is 2Kg and of each connecting rod 2.8Kg. The weight of the rotating parts like crank webs and the crank pins is 1.8Kg. The connecting rod is 400mm long and its center of mass is 100mm from the crank pin center. The stroke of the piston is 160mm. Show that the engine can be balanced for the revolving and primary force by a revolving counter mass. Also find the magnitude and the position if its centre of mass from the crank shaft centre is 100mm. What is the value of the resultant secondary force if the speed is 840 rpm? (15)

VII. (a) What is meant by Vibration? How are they caused? (5)

(b) A vibrating system consists of a mass of 50Kg, a spring of stiffness 30KN/m and a damper. The damping provided is only 20% of the critical value. Determine

(i) The damping factor
(ii) The critical damping coefficient
(iii) The natural frequency of damped vibration
(iv) The logarithmic decrement
(v) The ratio of two consecutive amplitudes (15)

OR

VIII. (a) Explain the working of an accelerometer. (5)

(b) A machine supported symmetrically on four springs has a mass of 80Kg. The mass of reciprocating parts is 2.2Kg which move through a vertical stroke of 100mm with simple harmonic motion. Neglecting damping determine the combined stiffness of the springs so that the force transmitted to the foundation is $\frac{1}{20}$ th of the impressed force. The machine crank shaft rotates at 800 rpm. If under actual working conditions, the damping reduces the amplitudes of successive vibrations by 30%, find

(i) The force transmitted to the foundation at 800rpm
(ii) The amplitude of the vibrations at resonance (15)

IX. A steel shaft ABCD 1.5m long has fly wheel at its ends A and D. The mass of the fly wheel A is 600Kg and has a radius of gyration of 0.6m. The mass of the fly wheel D is 800Kg and has a radius of gyration of 0.9m. The connecting shaft has a diameter of 50mm for the portion AB which is 0.4m long; and has a diameter of 60mm for the portion BC which is 0.5m long and has a diameter d mm for the portion CD which is 0.6m long. Determine

(i) The diameter 'd' of the portion CD. So that the mode of the torsional vibration of the system will be at the center of the length BC and
(ii) the natural frequency of the tortional vibrations.

The modulus of rigidity for the shaft material is $80GN/m^2$. (20)

OR

X. A reciprocating I.C engine is coupled to a centrifugal pump through a pair of gears. The shaft from the fly wheel of the engine to the gear wheel has a 48mm diameter and is 800mm long. The shaft from the pinion to the pump has 32mm diameter and is 280mm long. Pump speed is four times the engine speed. Moment of inertia of fly wheel, gear wheel, pinion and pump impeller are $1000Kgm^2$, $14Kgm^2$, $5Kgm^2$, and $18Kgm^2$ respectively. Find the natural frequency of the torsional oscillations of the system. $G = 80GN/m^2$.

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