BTS(C) – VI– (S) - 09 – 045 – G

B. Tech Degree VI Semester (Supplementary) Examination, October 2009

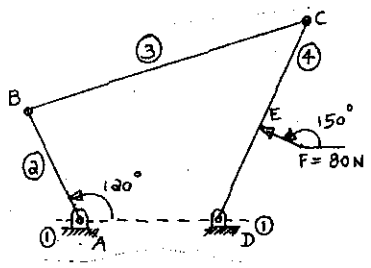
ME 601 DYNAMICS OF MACHINERY

(1999 Scheme)

Time : 3 Hours Maximum Marks : 100

I. a. Explain with sketches, the first and second inversions of a slider –crank chain. (6)

b. A four-link mechanism with the following dimensions is acted upon by a force $80 \angle 150^0$ N on the link DC as shown in the figure.



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. (14)

OR

II. a. State and explain D' Alembert's principle. (6)

b. The crank and connecting rod of a vertical petrol engine, running at 1800 r.p.m. are 60mm and 270 mm respectively. The diameter of the piston is 100 mm and mass of the reciprocating parts is 1.2 Kg. During the expansion stroke when the crank has turned 20^0 from the top dead centre, the gas pressure is 650 kN/m^2. Determine the

(i) net force on the piston
(ii) net load on the gudgeon pin
(iii) thrust on the cylinder walls
(iv) speed at which the gudgeon pin load is reversed in direction. (14)

III. a. Explain the effect of 'Gyroscopic Couple on Aeroplane.' (6)

b. Each road wheel of a motor cycle has a mass moment of inertia 1.5 Kg-m^2. The rotating parts of the engine of the motor cycle have a mass moment of inertia of 0.25 Kg-m^2. The speed of the engine is 5 times the speed of the wheels and is in the same sense. The mass of the motor cycle with its rider is 250 Kg and its centre of gravity is 0.6m above the ground level. Find the angle of heel if the cycle is travelling at 50 Km per hour and is taking a turn of 30m radius. Wheel diameter is 0.6m. (14)

OR

IV. a. What is meant by static and dynamic unbalance in machinery? How can the balancing be done? (6)

b. A shaft is supported in bearings that are 1.6m apart projects 400mm beyond bearings at each end. It carries three pulleys one at each end and one at the center of its length. The masses of the end pulleys are 40 kg and 22 kg and their centres of mass are at 12mm and 18mm respectively from the shaft axes. The mass of the center pulley is 38 kg and its center of mass is 15 mm from the shaft axis. The pulleys are arranged in a manner that they give static balance. Determine the

(i) relative angular positions of the pulleys.
(ii) Dynamic forces developed on the bearings when the shaft rotates at 210 rpm. (14)

(Turn over)

V. a. Find out the natural frequency of a vibrating system by equilibrium method. (6)

b. A vibrating system consists of a mass of 20 kg a spring of stiffness 20kN/m and a damper. The damping provided is only 30% of the critical value. Determine the natural frequency of the damped vibration and the ratio of two consecutive amplitudes. (14)

OR

VI. a. What do you mean by whirling of shafts? What is whirling or critical speed? Explain. (6)

b. The following data relate to a shaft held in long bearings.

Length of shaft	-	1.2 m
Diameter of shaft	-	14 mm
Mass of a rotor at mid point	-	16 kg.
Eccentricity of center of mass of rotor from center of rotor	-	0.4 mm
Modulus of elasticity of shaft material	-	200 GN/m^2
Permissible stress in shaft material	-	70 x $10^6 N/m^2$

Determine the critical speed of the shaft and the range of speed over which it is unsafe to run the shaft. Assume the shaft to be mass less. (14)

VII. a. Give an account of an accelerometer. (6)

b. An accelerometer is used to measure the motion of a structure which vibrates at 15 Cpm. The static deflection of the seismic mass of the accelerometer is 1.30 cm. Determine the amplitude of the structure if the reading of the instrument is 0.6 cm. (14)

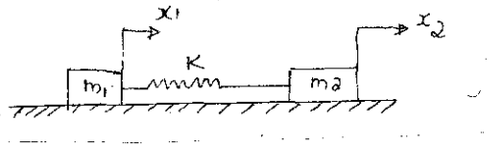
OR

VIII. a. Discuss free torsional vibrations of geared system. (6)

b. A centrifugal pump rotating at 400 rpm is driven by an electric motor at 1200 rpm through a single stage reduction gearing. The moments of inertia of the pump impeller and the motor are 1500 kg m^2 and 450 kg m^2 respectively. The lengths of the pump shaft and the motor shaft are 500 mm and 200 mm and their diameters are 100 mm and 50 mm respectively. Neglecting the inertia of the gears, find the frequency of torsional oscillations of the system. Take G=85 GN/m^2. (14)

IX. a. Explain Dunkerley's method to find the natural frequency of a system of shaft carrying several loads. (6)

b. Figure shows a vibrating system having two degrees of freedom. Determine the two natural frequencies of vibrations and the ratio of amplitudes of the motion of m_1 and m_2 for the two modes of vibration. Take m_1 = 10 kg, m_2 = 15 kg, K = 320N/m. Neglect surface friction. (14)



OR

X. a. Explain vibration absorber. (6)

b. A shaft supported freely at the ends has a mass of 120 kg placed 250mm from one end. The shaft diameter is 40 mm. Determine the frequency of the natural transverse vibrations, if the length of the shaft is 700 mm. Take E=200GN/m^2. (14)

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