C 47638 (Pages 3) Name.....

Reg. No.....

SIXTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION, JUNE 2008

ME 04 606—DYNAMICS OF MACHINERY

(2004 Admissions)

Time : Three Hours Maximum : 100 Marks

Answer **all** *questions.*

I. (a) State the Principle of Virtual work.

(b) Explain two force and three force members with simple sketches.

(c) Explain Swaying couple and Hammer Blow.

(d) Why balancing of rotating parts of the engine is necessary.

(e) Explain any one method of vibration analysis.

(f) Write short notes on Vibration Isolation.

(g) Define Eigenvalue and Eigenvectors.

(h) State the differences between linear and non-linear vibrations.

(8 × 5 = 40 marks)

II. (a) A gear train is composed to three helical gears with shaft centers in line. The driver is a right hand helical gear having a pitch radius of 50 mm, a transverse pressure angle of 20°, and a helix angle of 30°. An idler gear in the train has the teeth cut left hand and has a pitch radius of 81 mm. The idler transmits no power to its shaft. The driven gear in the train has the teeth cut right hand and has a pitch radius of 62.5 mm. If the transmitted force is 275 kg, find the shaft forces acting on each gear. Gravitational forces can be neglected.

Or

(b) The figure shows a slider-crank mechanism with an external force F_B applied to the piston. for the given velocity, find all the reaction forces in the joints and the crank torque.

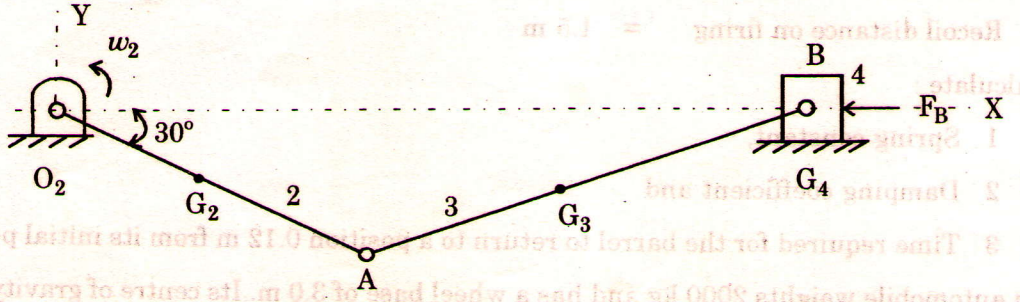


Fig. 1.

$R_{AO2} = 3$ in, $R_{BA} = 12$ in, $R_{G202} = 1.25$ in, $R_{G3A} = 3.5$ in, $w_2 = 0.95$ lb, $w_3 = 3.5$ lb, $w_4 = 2.5$ lb, $I_{G2} = 0.00369$ in.lb.s^2, $I_{G3} = 0.110$ in.lb.s^2, $\omega_2 = 160\ \hat{k}$ rad/s, $\alpha_2 = 0$, $\alpha_3 = -3090\ \hat{k}$ rad/s^2, $A_{G2} = 2640\ \angle 150°$ ft/s^2, $A_{G3} = 6130\ \angle 158.3°$ ft/s^2, $A_{G4} = 6280\ \angle 180°$ ft/s^2, $F_B = 800\ \angle 180°$ lb.

Turn over

III. (a) A shaft carries 4 rotating masses A, B, C and D in this order along its axis. The mass A may be assumed to be concentrated at a radius of 18 cm, B at 24 cm, C at 12 cm, and D at 15 cm. The weights of B, C and D are 30 kg, 50 kg and 40 kg respectively. The plants containing B and C are 30 cm apart. The angular spacing of the planes containing C and D are 90° and 210° respectively relative to B measured in the same sense.

If the shaft and masses are to be in complete dynamic balance,

Find :

1 The weight and angular position of mass A,

2 The position of the planes A and D.

Or

(b) Cranks and connecting rods of a four-cylinder-in line engine running at 1800 rpm are 6 cm and 24 cm each respectively and the cylinders are spaced 15 cm apart. If the cylinders are numbered 1 to 4 in sequence from one end, the cranks appear at intervals of 90° in an end view in the order 1 – 4 – 2 – 3. Reciprocating mass corresponding to each cylinder weights 1.5 kg.

Determine :

1 Unbalanced primary and secondary forces if any and

2 Unbalanced primary and secondary couples with reference to central plane of the engine.

IV. (a) Derive the differential equations of damped free vibration for Over damped, Critically damped and Under damped system.

Or

(b) A gun barrel having mass 560 kg is designed with the following data :

Initial recoil velocity = 36 m/s

Recoil distance on firing = 1.5 m

Calculate :

1 Spring constant,

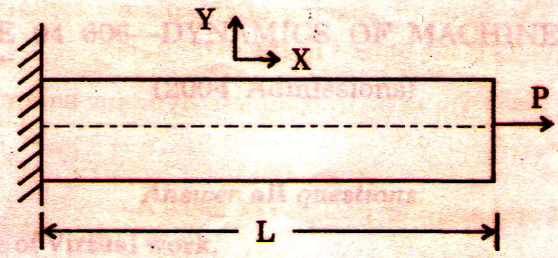
2 Damping coefficient and

3 Time required for the barrel to return to a position 0.12 m from its initial position.

V. (a) An automobile weights 2000 kg and has a wheel base of 3.0 m. Its centre of gravity is located 1.4 m behind the front wheel axis and has a radius of gyration about its C.G. as 1.1 m. The front springs have a combined stiffness of 6000 kg/cm and the rear springs 6500 kg/cm. Find the principal mode of vibration of the automobile and locate the nodal points for each mode.

Or

(b) A bar fixed at one end is pulled at the other end with a force P. The force is suddenly released. Investigate the vibration of the bar.



(4 × 15 = 60 marks)