Exam No: _____

GANPAT UNIVERSITY

B. TECH SEM- IV (MC)

CBCS REGULAR EXAMINATION– APRIL-JUNE 2016

2MC402 Dynamics of Machines

TIME: 3 HRS **TOTAL MARKS: 60**

Instructions: (1) This Question paper has two sections. Attempt each section in separate answer book.
(2) Figures on right indicate marks.
(3) Be precise and to the point in answering the descriptive questions.

SECTION: I

Q.1 Attempt the following questions.

(A) Explain the method of balancing of several masses rotating in same plane. **(04)**

(B) Find out the natural frequency of the spring mass system as shown in **Fig.-1.** **(06)**
$k_1 = 2800\ N/m$; $k_3 = 1900\ N/m$; $k_2 = 1400\ N/m$; $k_4 = k_5 = 2800\ N/m$; $m = 0.5\ Kg$.

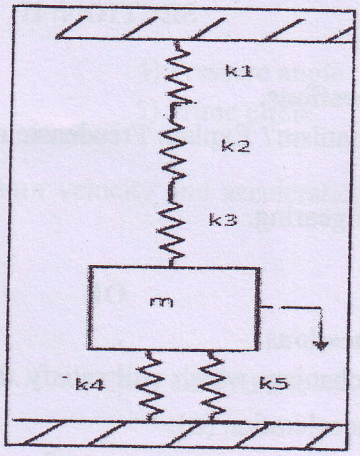

Fig.-1.

OR

Q. 1 Attempt the following questions.

(A) Describe function of Hartnell governor and deduce a relation to find the stiffness of spring. **(04)**

(B) Four masses A, B, C, D are completely balanced. Masses C and D make angle of 90° and 210° respectively with B in the same sense. The planes containing B and C are 250 mm apart. Masses A, B, C and D can be assumed to be concentrated at radius of 360, 480, 240 and 300 mm respectively. The masses B, C and D are 15 Kg., 25Kg. and 20 Kg. respectively. Determine : **(06)**

1) The mass A and its angular position 2) The position of plane A and D.

Q.2 Attempt the following questions.

(A) Derive the expression for equivalent stiffness of spring combinations for following two cases: **(04)**

1) Springs in parallel 2) Springs in series

(B) Explain the balancing of reciprocating masses in Multi cylinder Inline Engine. **(06)**

OR

Q.2 **Attempt the following questions.**

(A) Determine the natural frequency of vibratory system using D'Alembert's Principle. (04)

(B) The arms of a Porter governor are each 250 mm long and pivoted on the governor axis. The mass of each ball is 5 kg and the mass of the central sleeve is 30 kg. The radius of rotation of the balls is 150 mm when the sleeve begins to rise and reaches a value of 200 mm for maximum speed. Determine the speed range of the governor. If the friction at the sleeve is equivalent of 20 N of load at the sleeve, determine how the speed range is modified. (06)

(10)

Q.3 **Attempt Any TWO.**

(A) What is meant by effort and power of governor? Find Expression for the same in a Porter governor.

(B) Explain the partial balancing of reciprocating engine.

(C) Define following terms:

1. Frequency
2. Stiffness
3. Amplitude
4. Degree of Freedom
5. Damping co-efficient

SECTION: II

Q.4 **Attempt the following questions.**

(A) What is synthesis of mechanism? Explain Freudenstein's method of three point synthesis of mechanisms. (05)

(B) State and derive the law of gearing. (05)

OR

Q.4 **Attempt the following questions.**

(A) Synthesise a four bar mechanism which will satisfy the following specifications of angular velocity (ω) and angular acceleration (α): (05)

$\omega_1 = 12$ rad/sec $\quad \alpha_1 = 6$ rad/sec^2

$\omega_2 = 3$ rad/sec $\quad \alpha_2 = 14$ rad/sec^2

$\omega_3 = 6$ rad/sec $\quad \alpha_3 = 1$ rad/sec^2

(B) Make a comparison of cycloidal and involute tooth forms. (05)

Q.5 **Attempt the following questions.**

(A) Explain gyroscopic effect in airplane. (04)

(B) Total mass of motor cycle, rider and passenger is 330 kg and the center of gravity is 550 mm above the ground surface. The mass of each wheel of motorcycle is 10 kg and a radius of gyration of 250 mm. The effective rolling radius of each wheel is 300 mm. The rotating parts of the motor cycle engine have a mass of 14 kg and a radius of gyration of 80 mm. The engine parts rotate in opposite sense as compared to the wheels and the gear ratio from engine to back wheel is 4:1. The motor cycle is travelling around curve. Determine the angle of banking necessary for the motor cycle to ride normal to the track one a bend of 62 m radius at a speed of 110 kmph, allowing for gyroscopic effect. (06)

OR

Q.5 Attempt the following questions.

(A) Derive the equation for gyroscopic couple of a disc. (04)

(B) A rear engine automobile is travelling along a curve of 100 m mean radius. Each of the four wheels has a moment of inertia of 2 kgm^2 and an effective diameter of 600 mm. The rotating parts of the engine have a moment of inertia of 1 kgm^2. The engine axis is parallel to the rear axle and the crankshaft rotates in the same sense as the road wheels. The gear ratio of engine to back wheel is 3:1. The vehicle weight 205 kg and has its center of gravity 500 mm above the road level. The width of the track of the vehicle is 1.5 m. Determine the limiting speed of the vehicle around the curve for all four wheels to maintain contact with the road surface. (06)

Q.6 Attempt Any TWO. (10)

(A) A cam operating a knife-edge follower having a lift of 30 mm. The cam raises the follower with SHM for 150° of the rotation followed by a period of dwell for 60°. The follower descends for the next 100° rotation of the cam with uniform velocity, again followed by a dwell period. The cam rotates at a uniform velocity of 120 rpm and has a least radius of 20 mm. What will be the maximum velocity and acceleration of the follower during the lift and the return?

(B) Define the following terms

1) Base circle
2) Pitch point
3) Pitch Curve
4) Pressure angle
5) Prime circle

(C) Derive the equation of maximum velocity and acceleration for simple harmonic motion of follower.

----------END OF PAPER----------