

GANPAT UNIVERSITY
B. TECH SEM- IV (MECHATRONICS ENGG.)
CBCS REGULAR EXAMINATION – APRIL/JUNE - 2017
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.

- (A) Explain the method balancing of several masses rotating in different planes. (03)
 (B) A, B, C and D are four masses carried by a rotating shaft at radii 110, 140, 210 and 160 mm respectively. The planes in which the masses revolve are spaced 700 mm apart and the masses of B, C and D are 12 Kg, 7 Kg and 5 Kg respectively. Find the required mass A and the relative angular positions of the four masses so that the shaft is in complete balance. (07)

OR

Q.1 Attempt the following.

- (A) Explain partial balancing of reciprocating engine. (03)
 (B) A six cylinder four stroke in line reciprocating engine has a firing order 1-4-5-2-3-6. The firing takes place with equal angular interval. The mass of reciprocating parts per cylinder is 3 Kg. The length of crank and connecting rod are 50 mm & 200 mm respectively. The cylinders are spaced at 300 mm pitch. If the engine run at 1000 rpm. Determine:- (i) the unbalanced primary & Secondary forces, if any and (ii) the maximum value of unbalanced primary and secondary couples with reference to central plane of engine and position of crank no. 1 at which these maximum value occur. (07)

Q.2 Attempt the following.

- (A) Define vibration. Explain phenomena of vibration & enlist cause of vibration with advantage & disadvantages. (05)
 (B) Find the natural frequency of a system as shown in Figure - 1. Take $K = 1000 \text{ N/m}$, $M = 10 \text{ Kg}$, $m = 2 \text{ Kg}$, $r_1 = 30 \text{ mm}$ and $r_2 = 50 \text{ mm}$. (05)

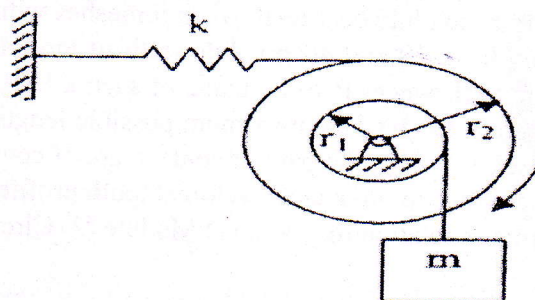


Figure - 1

OR

Q.2 Attempt the following.

- (A) Enlist and explain the stages of kinematic synthesis. (05)
 (B) Synthesize a four bar linkage using Freudenstein's equation to generate the function $y = x^{1.5}$ (05)
 for the interval $1 \leq x \leq 4$. The input crank is to start from $\theta_2 = 30^\circ$ and is to have a range of 90° . Take three accuracy points. Take output crank angle from 0 to 90° .

Q.3 Attempt any TWO.

- (A) Derive the equation for the natural frequency of vibratory system using the Rayleigh's Method. (10)
 (B) Explain internal balancing and external balancing with neat sketch.
 (C) Explain the sketches the types of motion that follower can move.

SECTION: II

Q.4 Attempt the following.

- (A) Explain basic terms used for gyroscopic with proper diagram. (05)
(B) A turbine rotor of a ship rotates at 2500 rpm in CCW direction when seen from the aft (stern) (05)
and has total mass moment of inertia of 125 Kg.m^2 . The ship pitches with SHM through an angle of 14° and the cycle time is of 30 sec. In which direction will the bow tends to turn, while ship falling from the mean position when looking from aft?

OR

Q.4 Attempt the following.

- (A) What do you understand by gyroscopic couple? Derive a formula for its magnitude (05)
(B) An aeroplane flying at 250 Km/hr turns towards left and completes a quarter circle of 70 m (05)
radius. The mass of the rotary engine and the propeller of the plane amounts to 460 Kg with a radius of gyration of 330 mm. The engine speed is 2100 rpm clockwise when viewed from the rear. Determine the gyroscopic couple on the aeroplane and state its effect.

Q.5 Attempt the following.

- (A) State the different types of governors. What is the difference between centrifugal and inertia (05)
type governors? Why is the former preferred to the latter?
(B) A Porter governor has equal arms each 250 mm long and pivoted on the axis of rotation. Each (05)
ball has a mass of 5 kg and the mass of the central load on the sleeve is 25 kg. The radius of rotation of the ball is 150 mm when the governor begins to lift and 200 mm when the governor is at maximum speed. Find the range of speed, sleeve lift, governor effort and power of the governor when the friction at the sleeve is neglected.

OR

Q.5 Attempt the following.

- (A) Define and explain the following terms relating to governors : (05)
1. Stability 2. Sensitiveness 3. Isochronism and 4. Hunting
(B) Discuss the controlling force and stability of a governor and show that the stability of a (05)
governor depends on the slope of the curve connecting the controlling force (FC) and radius of rotation (r) and the value (FC /r).

Q.6 Attempt Any TWO.

- (A) Derive an expression for the minimum number of teeth required on the pinion in order to (10)
avoid interference in involute gear teeth when it meshes with wheel
(B) Two mating gears have 20 and 40 involute teeth of module 10 mm and 20° Pressure angle.
The addendum on each wheel is to be made of such a length that the line of contact on each side of the pitch point has half the maximum possible length. Determine the addendum height for each gear wheel, length of the path of contact, arc of contact and contact ratio.
(C) 1. Comparison between Involute and Cycloidal tooth profile
2. Explain the terms in relation to gears: (1) Module (2) Circular Pitch (3) Pressure Angle

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