GANPAT UNIVERSITY
B. TECH SEM- IV (MECHANICAL) REGULAR EXAMINATION APRIL-JUNE 2016
2ME402: 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
(A) Draw the polar velocity diagram describing the salient features of driving shaft speed. **(05)**
(B) Two shafts are connected by a Hooke's joint. The driving shaft revolves uniformly at 500 **(05)** r.p.m. If the total permissible variation in speed of a driven shaft is not to exceed 6% of the mean speed, find the greatest permissible angle between the centre lines of the shafts. Also determine the maximum and minimum speed of the driven shaft

OR

Q.1
(A) Explain Hooke's joint with proper sketch. Also derive the equation for equal speeds of the **(05)** driving and driven shafts.
(B) Two shafts are connected by a universal joint. The driving shaft rotates at a uniform speed of **(05)** 1200 r.p.m. Determine the greatest permissible angle between the shaft axes so that the total fluctuation of speed does not exceed 100 r.p.m. Also calculate the maximum and minimum speeds of the driven shaft.

Q.2
(A) Define following: **(05)**
(i) Module (ii) Circular pitch (iii) Addendum (iv) Clearance (v) Pitch circle
(B) Two mating gears have 20 and 40 involute teeth of module 10 mm and 20° pressure angle. **(05)** 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.

OR

Q.2
(A) State and prove the law of gearing. Show that involute profile satisfies the conditions for **(05)** correct gearing.
(B) Two mating gears have 20 and 40 involute teeth of module 10 mm and 20° pressure angle. **(05)** 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.

Q.3 **(10)**
(A) Write advantages of involute gear tooth profile over cycloidal gear tooth profile.
(B) Explain Function generation, path generation and motion generation.
(C) Explain Oldham coupling with sketch.

SECTION: II

Q.4
(A) Discuss the effect of gyroscopic couple on aeroplane while taking a right turn & the rotor **(03)** rotates in clockwise direction when seen from tail end.
(B) A turbine rotor of a sea vessel having mass of 750 kg and rotates at a speed of 1500 rpm in **(07)** CW direction viewed from the rear end. Its radius of gyration is 0.3 m. Determine the gyroscopic couple and its effect on the sea vessel for the following conditions:
(i) When the ship taking left turn in a curvature of 200 mm radius with the speed of 30 km/hr.
(ii) When the ship pitches with an angular velocity of 1 rad/s and the bow is rising.
(iii) When the ship rolls and at a certain instant, it has an angular velocity of 0.04 rad/s.

OR

Q.4

(A) Explain various axes & plains to understand the concept of the gyroscope with suitable sketch. **(03)**

(B) A propeller of a sea vessel having mass of 1500 kg and has a radius of gyration of 1250 mm. The speed of propeller is 100 rpm in CW direction when seen from the rear. The sea vessel takes left turn at a speed of 25 km/hr in a radius of 0.16 m curvature. Determine the magnitude and effect of gyroscopic couple on the sea vessel. **(07)**

Q.5

(A) Draw free body diagram for four bar chain mechanism. **(03)**

(B) Determine the couple T_2 as applied in following fig.-1. **(07)**
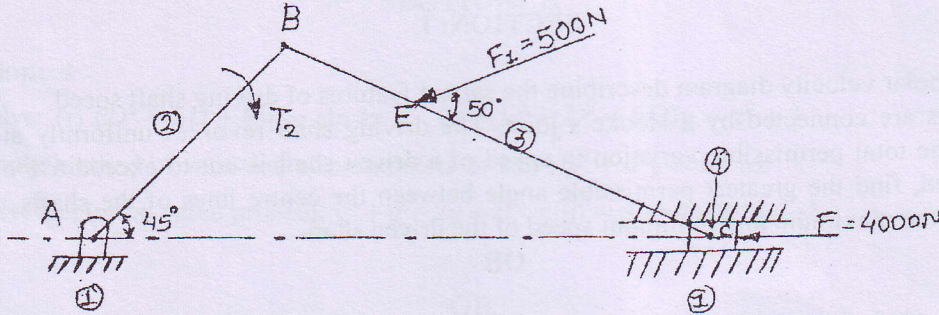AB = 30 m, BC = 45.5 m and BE = 17.5 m.

Fig.-1

OR

Q.5

(A) Define following terms: (i) Static, (ii) Dynamic, (iii) Couple, (iv) Static force analysis, (v) Free body diagram, (vi) Dynamic force analysis. **(03)**

(B) The dimensions of a four link mechanism shown in fig.-2 are: - AB = 400 mm, BC = 700 mm, CD = 500 mm, AD = 900 mm and an angle DAB = 60°. Ad is the fixed link, E is a point on link BC such that BE = 400 mm and CQ = 300 mm. (BEC clockwise)
A force of 150 N with an angle 45° acts on DC at a distance of 250 mm from D. Another force of magnitude of 100 N with an angle 125° acts at point E. Find the required input torque on link AB for static equilibrium of the mechanism. **(07)**
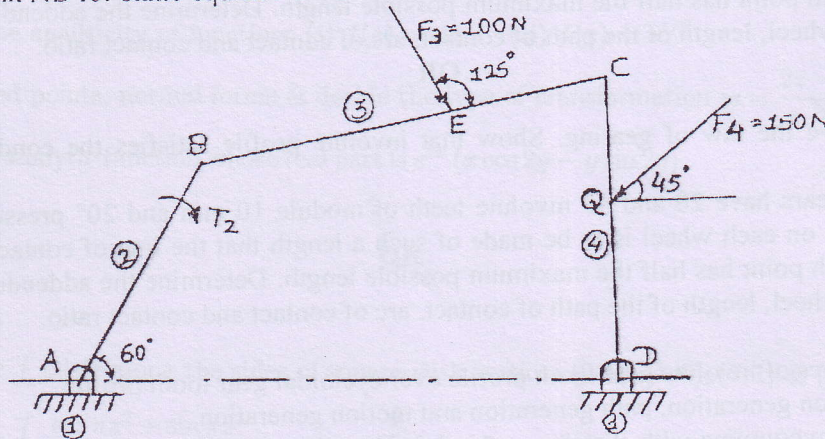

Fig.-2

Q.6

(A) Explain the meaning of sensitivity, hunting & Stability of a governor. **(03)**

OR

(A) Define and explain effort and power of a governor. **(03)**

(B) Each arm of a porter governor is 250 mm long. The upper and lower arm are pivoted at the axis of the governor. The mass of each ball is 5 kg and the mass of central load is 30 kg. The radius of rotation of balls is 150 mm when the sleeve begins to rise and reaches to 200 mm for maximum speed. Find speed range. **(07)**

---END OF PAPER---