New   Exam No: _____

GANPAT UNIVERSITY
B. TECH SEM- IV (ME) ENGINEERING
CBCS Regular Examination– April/June - 2017
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 full marks.
                  (3) Assume suitable data if necessary.

SECTION: I

Q.1   Attempt Followings.
 (A) Describe the classifications of synthesis problem.   **(04)**
 (B) A pinion having 20 involute teeth of module pitch 6 mm rotates at 200 r.p.m. and transmits 1.5   **(06)**
          kW to a gear wheel having 50 teeth. The addendum on both the wheels is 1/4 of the circular
          pitch. The angle of obliquity is 20°. Find :
          (i) The length of the path of approach ;
          (ii) The length of the arc of approach;
          (iii) The normal force between the teeth at an instant where there is only pair of teeth in contact.

OR

Q. 1   Attempt Followings.
 (A) Derive an expression for the minimum number of teeth required on the pinion in order to avoid   **(04)**
          interference in involute gear teeth when it meshes with wheel.
 (B) A four bar mechanism is required such that the input and output angles are coordinated as   **(06)**
          given in table. Synthesize the four bar mechanism.

Input crank angle	30°	50°	80°
Output follower angle	0°	30°	60°

Q.2   Attempt Followings.
 (A) What is static force analysis? Explain method for equilibrium of two & three force members.   **(04)**
 (B) The crank and connecting rod of a reciprocating engine are 200 mm and 700 mm   **(06)**
          respectively. The crank is rotating in clockwise direction at 120 rad/s. Find with the help of
          Klein's construction:
          (i)   Velocity and acceleration of the piston,
          (ii) Velocity and acceleration of the midpoint of the connecting rod, and
          (iii) Angular velocity and angular acceleration of the connecting rod, at the instant when
                the crank is at 30° to I.D.C. (inner dead centre).

OR

Q.2   Attempt Followings.
 (A) What is dynamic force analysis? Explain D' Alembert principle for equilibrium.   **(04)**
 (B) A four link mechanism with the following dimensions is acted upon by a force 80 N at 150° on   **(06)**
          link DC. AD = 50 mm, AB = 40 mm BC = 100 mm, DC = 75 mm, DE = 35 mm Determine the
          input torque T on the link AB for the static equilibrium of mechanism for the given in **Fig. 1.**

Fig. 1.

Q.3   Attempt Followings.
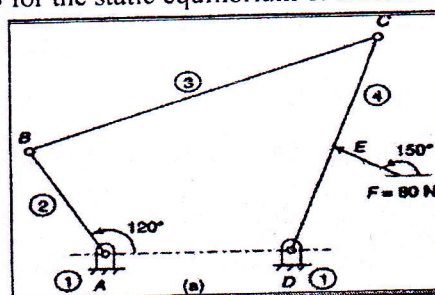 (A) Explain dynamic analysis of slider crank mechanism.   (05)
 (B) Define following terms: (05)
      (i) Module, (ii) Backlash, (iii) Circular pitch, (iv) Addendum, (v) Angle of Obliquity.

SECTION: II

Q.4   Attempt Followings.
 (A) Derive an expression for the height of the Proell Governor.   (05)
 (B) The arms of the porter governor are 350 mm long. The upper arms are pivoted on the axis of (05)
     rotation. The lower arms are attached to a sleeve at a distance of 40 mm from the axis of
     rotation. The mass of the load on the sleeve is 75 Kg and the mass of each ball is 8 Kg.
     Determine the equilibrium speed when the radius of rotation of the ball is 250 mm.

OR

Q.4   Attempt Followings.
 (A) Define the following terms :-   (05)
      (i) Stable governor, (ii) Hunting of Governor, (iii) Sensitivity of governor, (iv) Unstable
      governor, and (v) Isochronous of governor.
 (B) In a Proell governor which has equal arms each 240 mm and pivoted on the axis of rotation, (05)
     determine the minimum speed. The mass of each ball is 5 Kg and central mass on the sleeve
     is 25 Kg. The extension arms of the lower links are each 50 mm long and parallel to the axis
     when the minimum radius of the ball is 100 m.

Q.5   Attempt Followings.
 (A) Explain following with suitable sketch: -   (05)
      (i) Gyroscopic axes and plane (ii) Precession axes and plane (iii) Spin axes and plane.
 (B) The turbine rotor of a ship is of mass 3500 Kg. It has a radius of gyration of 0.45 m and a (05)
     speed of 3000 rpm, clockwise when looking from stern end. Determine the gyroscopic
     couple and its effect upon the ship: (i) When the ship is steering to the left on a curve of 100
     m radius at a speed of 36 Km/Hour, (ii) When the ship is pitching in a simple harmonic
     motion, the bow falling with its max. velocity. The period of pitching is 40 Sec and the total
     angular displacement between the two extreme positions of pitching is 12 degree.

OR

Q.5   Attempt Followings.
 (A) Discuss the effect of gyroscopic couple on sea vessel.   (05)
 (B) An aero plane makes a complete half circle of 50 m radius, towards left, when flying at 200 (05)
     Km/Hour. The rotary engine and the propeller of the plane have a mass of 400 Kg and a
     radius of gyration of 0.3 m. The engine rotates at 2400 rpm clockwise when viewed from the
     rear end. Find the gyroscopic couple of the aircraft and state its effect on it.

Q.6   Attempt Any TWO.   (10)
 (A) What is a Hook's joint? With a sketch, describe the working of Hook's joint.
 (B) Calculate the vertical distance or vertical height of a watt governor when it rotates at 90 rpm.
     Also find the change in vertical height when its speed increased 110 rpm.
 (C) The angle between the axes of two shafts connected by Hook's joint is 18°. Determine the
     angle turned through by the driving shaft when the velocity ratio is maximum and unity.

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