



RN-6861

**B. E. III (Sem. V) (Mech.) Examination**

May / June - 2010

**Theory of Machine - II**

Time : 3 Hours]

[Total Marks : 100

**Instruction :**

(1)

नीचे दशावलि निशानीवाणी विगतो उत्तरवडी पर अवश्य लभवी. Fillup strictly the details of signs on your answer book.	Seat No. :
Name of the Examination :	<input type="text"/>
<input type="text" value="B. E. 3 (Sem. 5) (Mech.)"/>	<input type="text"/>
Name of the Subject :	<input type="text"/>
<input type="text" value="Theory of Machine - 2"/>	<input type="text"/>
Subject Code No. : <input type="text" value="6"/> <input type="text" value="8"/> <input type="text" value="6"/> <input type="text" value="1"/>	Section No. (1, 2,.....) : <input type="text" value="1&amp;2"/>
Student's Signature	

- (2) Attempt all questions.
- (3) Figures to the **right** indicate full marks.
- (4) Assume suitable if required.

**SECTION - I**

- 1 (a) Answer the following questions : 10
  - (1) Prove that the maximum fluctuation of energy  $\Delta E = EX2C_s$ .
  - (2) Draw the turning moment diagram of single cylinder double acting steam engine.
  - (3) How does flywheel differ from governor ?
  - (4) Define principle of virtual workdone.
  - (5) State the static equilibrium conditions of **two** force members with torque.
- (b) The crankshaft of a punching machine runs at 10  
300 rpm speed. In M.S. sheets during punching of 10 mm diameter holes, the torque required by the machine increases uniformly from 1000 Nm to 4000 Nm while the shaft turns through 40°, remains constant for the next 100°, decreases uniformly to 1000 Nm for the next 40° and remains constant for the next 180°. This cycle is repeated during each revolutions The power supplied by a constant torque motor and the fluctuation of speed is to be +3% of the mean speed. Find the power of the motor and M.I. of flywheel fitted to machine.

- 2 Determine the torque to be applied to the link AB of a four link mechanism shown in fig.1 to maintain static equilibrium at the given position AB=200 mm, BC=700 mm, CD=400 mm, AD=700 mm, BE=400 mm.

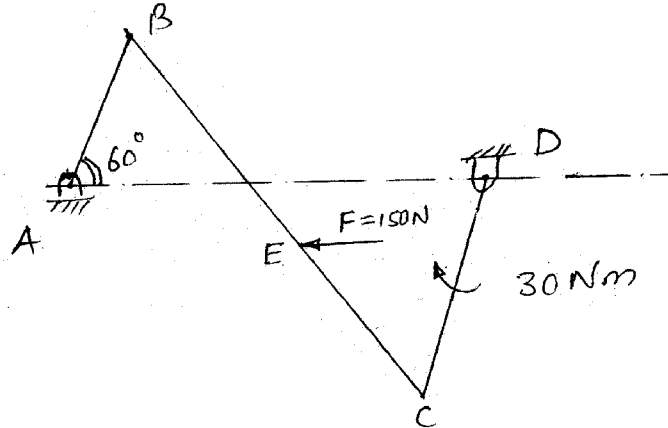


Fig. 1

- 3 Fig.2 shows four link mechanism link AB has angular acceleration of  $26 \text{ r/s}^2$  and angular velocity of  $10.5 \text{ r/s}$  CCW AB=500 mm, BC=660 mm, CD=560 mm, AD=1000 mm,  $I_4=61415 \text{ kg}\cdot\text{mm}^2$ ,  $\alpha_4=79.1 \text{ r/s}^2$  CCW,  $A_{G_4} = 25.7 \text{ m/s}^2 \angle 222^\circ$ ,  $M_4=4.2 \text{ kg/meter}$ ,  $C_{G_4}=280 \text{ mm}$ . Neglecting friction and inertia forces of link 2 and 3, determine the driving torque required to maintain the dynamic equilibrium of mechanism.

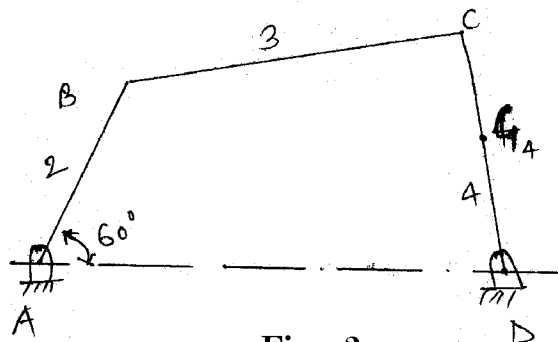


Fig. 2

OR

- 3 The layout of 2-stage gear box is shown in fig-3. The number of teeth gears are  $z_1 = 20$ ,  $z_2 = 50$ ,  $z_3 = 20$ ,  $z_4 = 50$ . The pinion-1 rotates at 1440 rpm in CCW when observed from LH side and transmits 10 kW power to the gear train. The pressure angle is  $20^\circ$  raw the FBD of the gear tooth forces and determine reaction at bearings E and F.

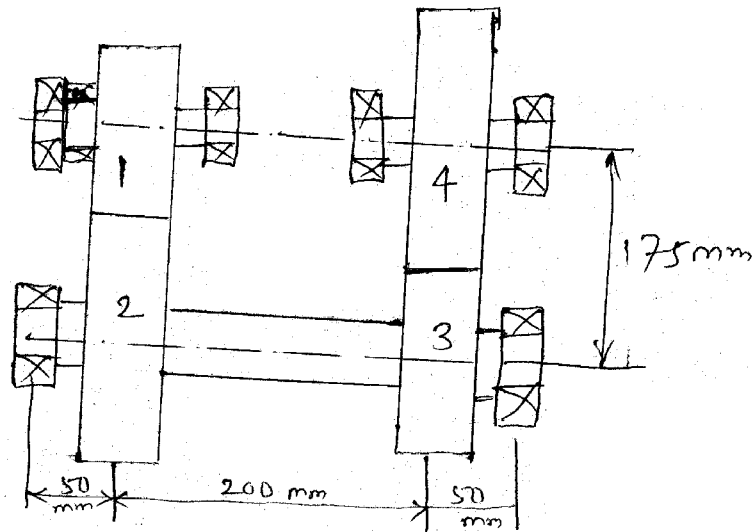


Fig. 3

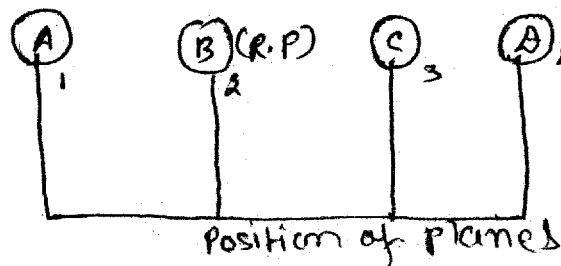
## SECTION - II

- 4 (a) Attempt the following questions : (any five) 10
- (i) Explain : Spinning and precession.
  - (ii) Explain : Particle balancing of primary force.
  - (iii) Define : Sensitiveness and hunting of governor.
  - (iv) Explain term : hammer blow.
  - (v) What are the in line engines ? How are they balanced.
  - (vi) Classify the centrifugal governor.
- (b) A single cylinder reciprocating engine has the 10  
 following data :
- |                             |                       |
|-----------------------------|-----------------------|
| Speed of engine             | 120 rpm               |
| Stroke                      | 320 mm                |
| Mass of reciprocating parts | 45 kg                 |
| Mass of revolving parts     | 35 kg at crank radius |
- If 60% of the reciprocating parts and all the revolving parts are to be balanced then find :
- (i) The balance mass required at a radius of 300 mm.
  - (ii) The unbalanced force when the crank has rotated  $60^\circ$  from TDC.
  - (iii) Maximum primary unbalanced forces.
- 5 Attempt any two :
- (a) (i) The mass moment of inertia of a blade of an 5  
 airscrew is  $100 \text{ kg-m}^2$  about the axis of rotation. The speed of air screw is 1600 rpm, when the speed of flight is 250 kmph. If the airplane makes a right turn on a path,  $r=150$  radius. Find the gyroscopic reaction on the air plane, if there are three blades.

- (ii) Prove that governor effort for porter governor is  $p=c(m+M)g$  when  $p$ =governing effect  
 $c$ =factor, which gives increase in speed  
 $M$ =mass of sleeve  
 $m$ =mass of ball. 5

- (ii) Explain the direct and reverse cranks methods of balancing radial and v-engines. 5

- (b) A four cylinder vertical engine has cranks 300 mm long. The planes of rotation of the first, third and fourth cranks are 750 mm, 1050 mm and 1650 mm respectively from that of the second crank and their reciprocating masses are 150 kg, 400 kg and 250 kg respectively. Find the mass of the reciprocating parts for the second cylinder and relative angular positions of the cranks in order that the engine may be in completely primary balance. Consider the angular position of crank A in horizontal direction. 15



- (c) (i) Classify the centrifugal governor and explain its working principle with neat sketch. 7
- (ii) A porter governor has equal arms 200 mm long pivoted on the axis of rotation. The mass of each ball is 3 kg and the mass to sleeve is 15 kg. The ball path is 120 mm when the governor begins to lift and 160 mm at the maximum speed. Determine the range of speed. If the friction at the sleeve is equivalent to force of 10N, find the coefficient of insensitiveness.