Exam No.....

GANPAT UNIVERSITY

B.TECH SEM. 3rd MECHATRONICS ENGINEERING

REGULAR EXAMINATION NOV-2011

MC 304 KINEMATICS

Time: 3 Hours **Total Marks – 70**

Instruction:-

1. **All questions are compulsory**
2. **Figure to the right indicates full marks of the respective section**
3. **Support answers with appropriate diagram**

SECTION - I

Que.-1

[A] What is Inversion of Mechanism? Explain Elliptical Trammel with neat sketch **[3]**

[B] Explain the Quick Return Mechanism with neat sketch **[3]**

[C] Determine following things of mechanism shown in figure 1.1 **[6]**

(1) No. of binary links (2) No. of Ternary Links (3) No. of Quaternary links (4) Degree of Freedom

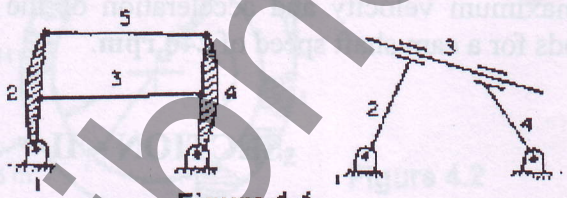

Figure 1.1

OR

Que.-1

[A] Prove that Harts Mechanism is Straight Line Mechanism **[3]**

[B] What is Steering Mechanism? Write the correct steering condition. **[3]**

[C] Write the difference between Davis and Ackermann Steering Mechanism with neat sketch **[6]**

Que.-2

[A] In a slider crank mechanism shown in figure 2.1, **block P** reciprocating along the fixed line **OB** and the crank has a uniform speed of **230 rpm**. Determine the velocity and acceleration of block P. Draw Acceleration and Velocity Polygon. Take **OC = 150 mm** **[11]**

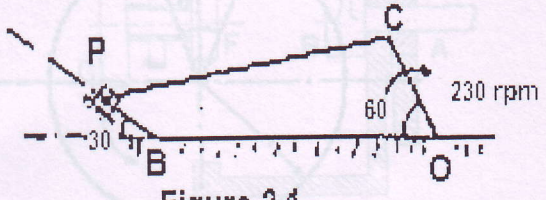

Figure 2.1

P.T.O.

OR

Que.-2

[A] A Quick Return Mechanism is shown in figure 2.2. Link 2 rotates at **20 rad/sec**. Draw the Velocity and Acceleration diagram. Given **BC = 25 mm, DC = 35 mm** [11]

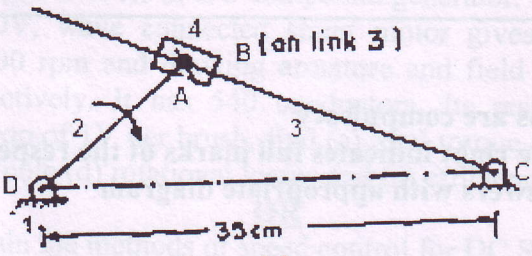

Figure 2.2

Que.-3

[A] Classify the Cam and Follower [3]

[B] Design a cam for operating the exhaust valve of an oil engine. It is required to give **S.H.M.** during opening and closing of the valve each of which corresponds to **90°** of cam rotation. The valve must remains in the fully open position for **60°** of cam rotation. The lift of valve is **36** mm and least radius of cam is **50** mm. The follower is provided with a roller of **20** mm diameter and its line of stroke passes through the axis of the cam. Find maximum velocity and acceleration of the follower during opening and closing periods for a cam shaft speed of **240 rpm**. [9]

SECTION – II

Que.-4

[A] Explain the Band Brake with neat sketch. [3]

[B] Classify the Brakes. [3]

[C] The diameter of the brake drum of a single block brake shown in figure 4.1 is **1 m**. it sustains **240 N-m** of torque at **400 rpm**. The coefficient of friction is **0.32**. Determine the required force to be applied when the rotation of the drum is Clockwise and also Counter Clockwise and the angle of contact is **100°**. Given that **a = 800** mm, **b =150** mm and **c = 25** mm. Also find the new values of **c** for self locking of the brake. [6]

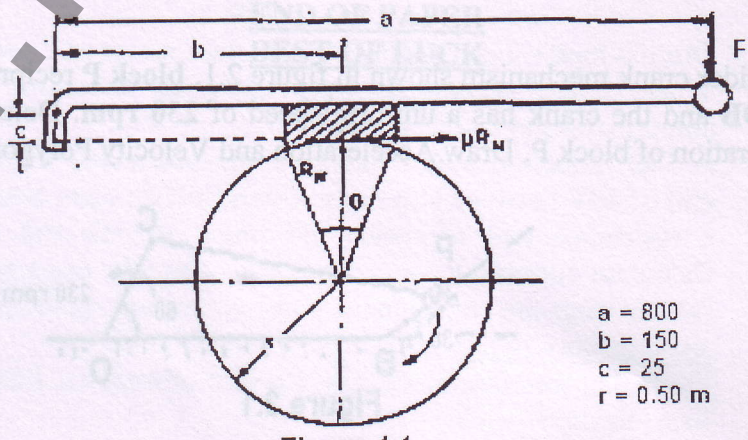

Figure 4.1

OR

Que.-4

[A] Classify the Dynamometer and explain one of them with neat sketch. [4]

[B] In the band and block brake shown in figure 4.2, the band is lined with **12 blocks** each of which subtends an angle of **15°** at the centre of the rotating drum. The thickness of block is **75 mm** and diameter of the drum is **850 mm**. If, When the brake is in action, the greatest and least tension in the brake trap are T_1 and T_2 shows that [8]

$$\frac{T_1}{T_2} = \left[\frac{1+\mu \tan 7.5^\circ}{1-\mu \tan 7.5^\circ}\right]^{12}$$

Find the least force required at c for the blocks to absorb **225 kW** at **240 rpm**. Take **μ = 0.40**

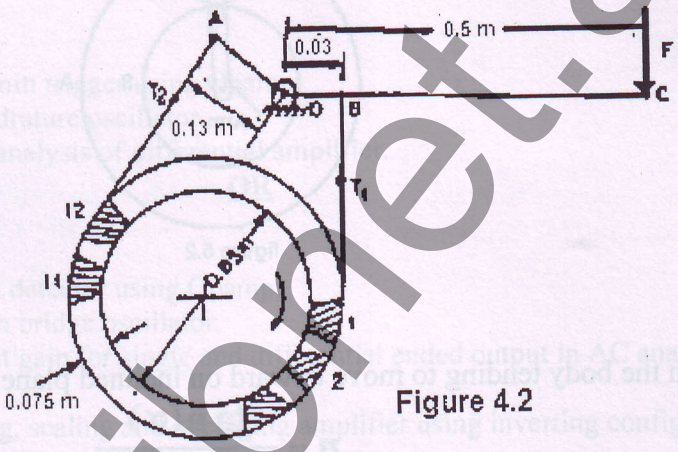

Figure 4.2

Que.-5

[A] Explain the Epicyclic Gear Trains. [4]

[B] An Epicyclic reduction gear is shown in figure, has a shaft **A** fixed to arm **B**. The arm **B** has a pin fixed to its outer end and two gears **C** and **E** which are rigidly fixed revolve on this pin. Gear **C** meshes with annular wheel **D** and gear **E** with pinion **F**. **G** is driver pulley and **D** is kept stationary. The No. of teethes are as follows: **D = 80, C = 10, E = 24, F = 18.** The pulley **G** runs at **200 rpm**. Find the speed of shaft **A.** [7]

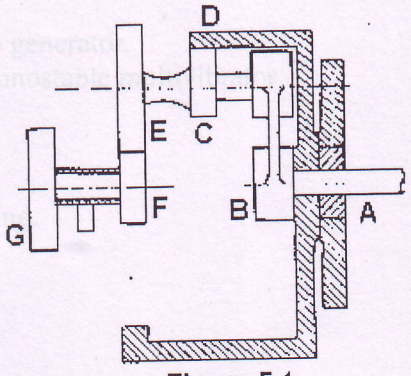

Figure 5.1

P.T.O.

OR

Que.-5

[A] Explain the Differential Gears **[4]**

[B] In a simple Epicyclic Gear train the Sun wheel **'S'** has t_1 teeth and the annulus **'A'** has t_2 teeth (internal). A planet wheel **'P'** meshes with **'S'** and **'A'** and turns on the end of an arm whose axis is coincident with that of **'S'** and **'A'**. If **x** and **y** are the speeds of **'S'** and **'A'** respectively, show that the speed of arm is $\frac{t_1x + t_2y}{t_1 + t_2}$ and hence find the ratio $\frac{t_2}{t_1}$ when **'A'** is fixed and arm makes **0.4** revolution for one revolution of **'S'**. **[7]**

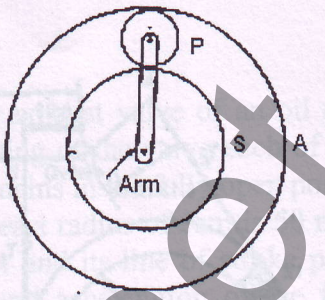

figure 5.2

Que.-6

[A] When the body tending to move upward on inclined plane, shows that efficiency is **[4]**

$$\eta = \frac{\tan(\alpha)}{\tan(\alpha + \emptyset)}$$

[B] Define: (1) Angle of Repose (2) Limit Angle of Friction **[2]**

[C] The thrust shaft of a ship has **6** collars of **600 mm** external diameter and **300 mm** internal diameter. The total thrust from propeller is **10 kN**. If the coefficient of friction is **0.12** and the speed of the engine is **90 rev/min**, find the power absorbed in friction of the thrust block, assuming (1) Uniform Pressure (2) Uniform Wear **[6]**

END OF PAPER