Exam.Code:0939
Sub. Code: 6703

2122

B.E. (Mechanical Engineering)

Third Semester

MEC-303: Kinematics of Machines

Time allowed: 3 Hours Max. Marks: 50

***NOTE**: Attempt <u>five</u> questions in all, including Question No. I which is compulsory and selecting two questions from each Part.*

x-x-x

1a)Sketch binary, ternary and quaternary joints.
b)Write Freudenstein's equation.
c)What is the effect of centrifugal tension on power transmission in a belt drive.
d)What are dynamometers? Classify them.
e)What is hunting of a governor (10)

Part-A

2a)Sketch and explain all the inversions of four bar chain. (5)
b) In a pin jointed four bar mechanism, AB=300mm, BC = CD = 360 mm and AD = 600 mm. The angle BAD = 60°.The crank AB rotates uniformly at 100 rpm. Locate all the instantaneous centres and find angular velocity of the link BC. (5)

3a)Classify various types of synthesis problems. (3)
b)A 4-bar mechanism is required such that the input and the output angles are co - ordinated as given in the table below:

Input crank angle(Θ)	30°	50°	80°
Output follower angle(φ)	0°	30°	60°

Synthesize the 4-bar mechanism (7)

4a) A steam engine runs at 150 rpm. Its turning moment diagram gave the following area measurements in mm^2 taken in order above and below the mean torque line:
500, -250, 270,-390, 190, -340, 270, -250
The scale for turning moment is 1 mm=500 N-m and for crank angle is 1mm= 5°.If the fluctuation of speed is not to exceed ± 1.5% of the mean speed, determine the cross- section of the rim of flywheel assuming rectangular cross section with width equal to 1.5 times the thickness. The hoop stress is limited to 3.5 M Pa and the density of flywheel material is 7470 kg/m^3. (6)
b) Find the maximum and minimum speeds of a flywheel of mass 5200 kg and radius of gyration 1.8m when the fluctuation of energy is 100800 N m. The mean speed of the engine is 180 rpm. (4)

Part-B

5a)Sketch and explain the working of a Hartnell governor. Also derive the relation for stiffness of spring neglecting the obliquity of arms. (6)
b)Derive the relation for effort and power of Porter governor. (4)

6a)A band and block brake having 14 blocks each of which subtends an angle of 15° at the centre,is applied to a drum of 1 m effective diameter. The drum and flywheel mounted on the same shaft has a mass of 2000 kg and a combined radius of gyration of 500 mm. The two ends of the band are attached to pins on opposite sides of the brake lever at distances of 30 mm and 120 mm from the fulcrum. If a force of 200 N is applied at a distance of 750 mm from the fulcrum, find: i)Maximum braking torque ii)Angular retardation of the drum and iii)Time taken by the system to come to rest from speed of 360 rpm .Take $\mu = 0.25$ (5)

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b)The mean diameter of a bolt having V-threads is 25 mm. The pitch of the thread is 5 mm and the angle of threads is 55°.The bolt is tightened by screwing a nut whose mean radius of bearing surface is 25 mm. The coefficient of friction for nut and bolt is 0.1 and for nut and bearing surface is 0.15. Find the force required at the end of a 0.5 m lever when the load on the bolt is 15 kN. (5)

7a)Prove that $T_1/T_2 = e^{\mu\theta}$ for flat belt drive where T_1=Tight side tension, T_2=Slack side tension, μ=coefficient of friction between belt and pulley and θ=angle of contact. (5)

b)An open belt running over two pulleys 24 cm and 60 cm diameters connects two parallel shafts 3 m apart and transmit 3.75 kW from the smaller pulley that rotates at 300 rpm, coefficient of friction between the belt and pulleys is 0.3 and the safe working tension is 100 N/cm width. Determine: i) Minimum width of belt ii)Initial belt tension iii)length of the belt required (5)

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