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MANIPAL INSTITUTE OF TECHNOLOGY
(A constituent college of Manipal University, Manipal)

III SEM. B.E. (MECHANICAL ENGG.) DEGREE END SEMESTER (MAKE-UP) EXAMINATION JANUARY 2007

SUBJECT : KINEMATICS OF MACHINERY (MEE -205)
REVISED CREDIT SYSTEM
(11/01/2007)

Time: 3 Hours. MAX.MARKS: 50

Instructions to Candidates:
- Answer **ANY FIVE FULL** questions.
- Missing data, if any, may be suitably assumed and stated.
- Draw neat sketches wherever necessary.

1A) Define the following:
i) Kinematic pair ii) Kinematic chain iii) Inversion iv) Machine
v) Successfully constrained motion. vi) Mobility of mechanism. (06)

1B) If interference between two involute gears is to be avoided then prove that the maximum length of arc of contact will be equal to $(r+R)\tan\Phi$. (04)

2A) With a neat sketch explain the Whitworth quick return motion mechanism and mention the name of the kinematic chain on which it is based. (04)

2B) Figure 1 shows an epicyclic gear train with the following particulars:
A has 40 teeth external
B has 80 teeth internal or annular
C has 20 teeth external) Compound wheel
D has 50 teeth external)
E has 20 teeth external) Compound wheel
F has 40 teeth external)
G has 90 teeth external.
Gear wheel C gears with A&B, D gear with E, F Gears with G. Wheel A is fixed and the arm runs at 100 r.p.m. in counter clockwise direction. Determine the Torque exerted on gear wheel G, if the input torque to the arm is 1000 N-m. (06)

3A) State and prove Kennedy's Theorem. (03)

3B) An open belt running over two pulleys 1.5m and 1.0m diameters connects two parallel shafts 4.80 m apart. The initial tension in the belt when stationary is 3000N, if the smaller pulley is rotating at 600 rpm

and coefficient of friction between the belt and pulley is 0.3, determine the power transmitted taking centrifugal tension into account. the mass of belt is given as 0.6703 Kg/m. length. (07)

4A) In the mechanism shown in fig. 2, the crank OA rotates with a uniform speed of 150 rpm. For the given configuration, find the velocity of piston P and angular velocities of the links ABC and CP. (07)

4B) Define the following:
i) Circular pitch ii) Diametral pitch iii) Module pitch iv) Pressure angle v) Addendum vi) Dedendum. (03)

5A) Synthesize a four bar mechanism using graphical method for three positions as given below:
$\Phi_0 = 30°$, $\Phi_{12} = 50°$, $\Phi_{23} = 90°$, $\Psi_{12} = 30°$, $\Psi_{23} = 60°$, where Φ is the input crank angle and Ψ is the output crank angle. Assume crank radius as 30mm and fixed link $0_2 0_4 = 100$mm. (05)

5B) A single plate clutch transmits 25kW at 900 rpm. The maximum pressure intensity between plates is 85 kN/m^2. The outer diameter of the friction lining is 360mm. Coefficient of friction of contact surfaces is 0.25. Determine the inner diameter of the friction lining and the total axial force exerted by the springs. (03)

5C) Find the power lost in friction assuming uniform pressure when a vertical shaft of 100mm diameter rotating at 150 rpm, rests on a flat end foot step bearing. The coefficient of friction is equal to 0.05 and the shaft carries a vertical load of 15 KN. (02)

6A) Discuss how the fixing torque in case of fixed wheel in epicyclic Train can be calculated. (01)

6B) Define initial Tension in Belts. Derive the expression for optimum speed of flat belt for the transmission of maximum power considering the effect of centrifugal tension. (04)

6C) Calculate (i) length of path of contact (ii) arc of contact and (iii) the contact ratio when a pinion having 23 teeth drives a gear having teeth 57. The profile of the gears is involute with pressure angle 20°, module 8mm and addendum equal to one module. (05)