Sample Question Paper - I

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COURSE	: MECHANICAL ENGG. GROUP	
COURSE CODE	: ME/PT/PG/AE/MH	**9050**
SEMESTER	: FOURTH	
SUBJECT	: THEORY OF MACHINES AND MECHANISMS	
MAX MARKS	: 80	**TIME: 3 HOUR**

Instructions:

1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Use of non-programmable calculator is permissible.
4. Illustrate your answer with neat sketches wherever necessary.
5. Preferably, write the answers in sequential order.

Q.1 A) Attempt Any Four Of the following: **08 Marks**

   a) Define kinematic link and kinematic pair.
   b) List four inversions of single slider crank chain.
   c) Define rolling pair with one example.
   d) Study the coupler rod of locomotive given in figure and identify the type of kinematic pairs.
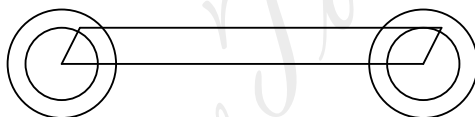
   e) List four types of followers.
   f) Define the pressure angle as related to cam.

Q.1 B) Attempt any Two of the following:-   **08 Marks**

   a) Draw a sketch and describe the working principle of Geneva mechanism.
   b) Draw labeled sketch of Oldhams Coupling.
   c) Distinguish between machine and structure on the basis of
      i) Motion   ii) Type of entity transferred iii) Mechanism iv) Application

Q.2 Attempt Any three of the following: **12 Marks**

   a) Draw a neat sketch of Whitworth's Quick return mechanism and explain its working.
   b) State and Explain relative velocity and acceleration of a point on link.

c) Two parallel shafts are to transmit 6 kW of power and are separated by 1m distance. Power is to be transmitted without slip. Suggest a suitable drive for given situation. Justify your answer.

d) A flat belt is required to transmit 35 kW from a pulley of 1.5 m effective diameter running at speed of 300 rpm. The angle of contact is spread over 11/24 of the circumference. Coefficient of friction for the surface is 0.3. Determine the maximum tension in the belt.

Q.3: Attempt any three of following: **12 Marks**

a) Distinguish between flat belt and V belt on the basis of power transmitted, space, grip and application.

b) Explain the effects of following action taken on belt tension adjusting mechanism.
   i) Over tightening of belt on pulley ii) Under tightening of belt on pulley.

c) Define the following terms related to spur gears.
   i) Module ii) Circular pitch iii) Diameteral Pitch iv) Pitch circle diameter.

d) Draw a neat sketch and explain the working of simple gear train.

Q4: Attempt any two of the following: **16 Marks**

a) In a slider crank mechanism the length of connecting rod is 80 cm, ratio of length of connecting rod to length of crank is 4. Determine i) Velocity of slider ii) Velocity of connecting rod , if crank makes an angle of 120^0 with IDC.

b) Draw the cam profile for following specifications: -
   i) Least circle radius = 50 mm.
   ii) Stroke length 40 mm.
   iii) Out stroke = 60^0 with SHM.
   iv) Dwell = 30^0
   v) Return stroke = 60^0 with uniform velocity.
   vi) The axis of roller follower of 20 mm diameter is collinear with the axis of cam and the cam rotates in clockwise direction.

c) A shaft has a number of collar integral with it. The outer and inner diameter of collars is 400 mm and 250 mm respectively. If the intensity of pressure is 0.35 MN/m^2 and its coefficient of friction is 0.05, estimate power absorbed in overcoming friction when the shaft runs at 105 rpm and carries an axial load of 150 kN. Also find out the number of collars required.

Q5: Attempt any three of the following: **12 Marks**

a) A single plate friction clutch with both sides of plate being effective is used to transmit power at an engine speed of 2000 rpm. It has outer and inner radii 10 cm and 8 cm respectively. Find i) Maximum axial thrust ii) Torque transmitted. Assume $\mu = 0.25$.

b) Distinguish between flywheel and governor on the basis of i) Load ii) Speed iii) Turning moment diagram iv) Application.

c) Draw neat labeled sketch of Hartnell Governor.

d) Draw T-θ diagram of four-stroke single cylinder engine. Also indicate mean torque line.

Q.6: Attempt any three of the following:-　　　　　　　　　　　　**12 Marks**

a) State the conditions for self-energizing brakes and self-locking brakes.
b) Explain with neat sketch of rope brake dynamometer.
c) A band brake acts on the $3/4^{th}$ circumference of drum of 450-mm diameter that is keyed to the shaft. The band brake provides a braking torque of 225 N-m. One end of the band is attached to the fulcrum pin of the lever and the other end to a pin 100 mm from the fulcrum. If the operating force is applied at 500 mm from the fulcrum and $\mu = 0.25$, find the operating force when the drum rotates in:-　i) Anticlockwise direction　ii) Clockwise Direction.
d) Give four causes of vibration in machine and their harmful effects.

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