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**BACHELOR OF TECHNOLOGY IN
MECHANICAL ENGINEERING
(COMPUTER INTEGRATED
MANUFACTURING)**

Term-End Examination

December, 2010

**BME-020 : KINEMATICS & DYNAMICS OF
MECHANISMS**

Time : 3 hours

Maximum Marks : 70

Note : Answer any five of the following questions. Use of non programmable scientific calculator is allowed.

1. (a) Explain different power transmission devices. In which type of drive centre distance between the shaft axes is lowest ? Give reasons for your answer. **6+8**

- (b) An annulus A in the gear train shown in Figure 1. rotates at 300 rpm about the axis of fixed gear S which has 80 teeth. Three arm spider is driven at 180 rpm. Determine number of teeth required on planetary gear P.

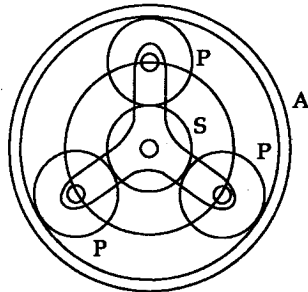


Figure - 1

2. (a) Define a kinematic link. Explain different types of links. 5+9
- (b) Plot all the instantaneous centres for a 4 - bar kinematic chain.
3. (a) Explain Klein's construction and determine acceleration of piston by using this method in a slider crank chain for crank angles 0° , $\frac{\pi}{2}$ and π . 6+8
- (b) In a four bar chain $O_2 ABO_4$, point C is 28 mm from A on the coupler AB. The crank $O_2 A$ rotates in clockwise sense with angular velocity equal to 100 rad/s. Determine velocity of C and angular velocity

of AB for the following directions ;

$O_2A = 75\text{mm}$, $AB=80\text{mm}$, $O_4B=37\text{mm}$

Fixed link $O_2O_4=125\text{mm}$ and $\angle O_4O_2A=53^\circ$.

4. (a) Classify followers. 4+10
(b) Draw profile of a cam operating a knife edge follower for the following data :
Max. lift of the follower = 4.5cm
Angle for rise of follower with SHM = 150°
Angle for dwell period after rise = 60°
Angle for return of the follower with uniform acceleration and retardation = 100°
Least radius of the cam = 3cm.
Cam rotates at 200 rpm in clockwise sense.
Determine max. velocity and acceleration during rise.
5. Determine the length of each of the four links in a 4 - bar chain if the length of the smallest link is 15cm to generate $Y=\log_{10}x$ in the interval of $1 \leq x \leq 10$ for three accuracy points. The angles for input and output links are given by $45^\circ \leq \theta \leq 105^\circ$ and $135^\circ \leq \phi \leq 225^\circ$ respectively. 14
6. (a) Explain equivalent dynamical system. 5+9
Determine expression for the correction couple.
(b) Design a slider crank mechanism by using relative pole. Explain the method.
7. (a) Explain the principle of designing vibration measuring instruments. 5+9

- (b) The flywheel of a generator set weighs 150kg and its radius of gyration is 25cm. The diameter of flywheel shaft is 4.5cm and length is 22cm. The mass of armature is 90kg and radius of gyration is 20cm. The armature shaft is 4cm in diameter and 18cm long. Determine natural frequency of torsional vibration and plot mode shape. Assume $G=8.24 \times 10^6 \text{ N/cm}^2$
8. (a) The cranks in a V-twin engine has the cylinder axes at 90° . Each cylinder has reciprocating weight equal to 100N. The crank radius is 75mm and length of each connecting rod is 350mm. Determine unbalance in the engine and suggest how can it be balanced if crank rotates at 500rpm ? 6+8
- (b) A punching machine punches 6 holes / min. The diameter of each hole is 4cm and the thickness of plate is 3 cm. The stroke of punch is 10 cm. The work done is 600 J per centimetre square of sheared area. The maximum speed of flywheel at its radius of gyration is 28 m/s. Determine mass of the flywheel required so that its speed at radius of gyration does not fall below 26m/s Determine power of the motor required.
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