

B.E., DEGREE EXAMINATIONS: MAY/JUNE 2013

Fourth Semester

AERONAUTICAL ENGINEERING

AER105 : Mechanics of Machines

Time: Three Hours

Maximum Marks: 100

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. The lead screw of a lathe with nut forms a
 - a) Sliding Pair
 - b) Rolling Pair
 - c) Screw Pair
 - d) Turning Pair
2. The relation between the number of pairs(p) forming a kinematic chain and the number of links (l) is
 - a) $l = 2p - 2$
 - b) $l = 2p - 3$
 - c) $l = 2p - 4$
 - d) $l = 2p - 5$
3. The angle of inclination of the plane, at which the body begins to move down the plane is called
 - a) Angle of Friction
 - b) Angle of repose
 - c) Angle of projection
 - d) Angle of plane inclination
4. Due to slip of the belt, the velocity ratio of the belt drive
 - a) Increase
 - b) Decrease
 - c) Constant
 - d) Does not change
5. The module is the reciprocal of
 - a) Diametral pitch
 - b) Circular pitch
 - c) Pitch diameter
 - d) Addendum circle diameter
6. The cam follower generally used in automobile engine is
 - a) Knife edge
 - b) Flat faced
 - c) Spherical
 - d) Roller
7. When a body is subjected to transverse vibration, the stress induced in a body will be
 - a) Shear stress
 - b) Tensile stress
 - c) Compressive Stress
 - d) Tangential Stress
8. The ratio of the maximum displacement of the forced vibration to the deflection due to the static force is known as
 - a) Damping factor
 - b) Damping coefficient
 - c) Logarithmic decrement
 - d) Magnification factor

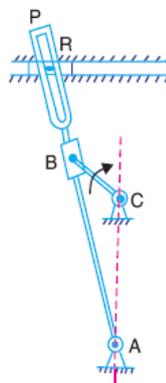
9. The balancing of rotating and reciprocating parts of an engine is necessary when it runs at
- | | |
|---------------|-------------------|
| a) Slow speed | b) Medium speed |
| c) High speed | d) Constant speed |
10. The swaying couple is due to the
- | | |
|-------------------------------|-------------------------------|
| a) Primary unbalanced force | b) Secondary unbalanced force |
| c) Two cylinder of locomotive | d) Two cylinder of locomotive |

PART B (10 x 2 = 20 Marks)

11. Define degrees of freedom.
12. Differentiate between a machine and a structure.
13. What are the effects of limiting angle of friction?
14. What are the disadvantages of V belt drive over flat belt?
15. What is meant by arc recess and arc of contact?
16. List the four different motion of the follower.
17. What is meant by critical damping?
18. What is the effect of inertia on the shaft in longitudinal and transverse vibration?
19. What is the need for balancing of rotation masses, particularly in high speed engines?
20. What is meant by primary and secondary balancing?

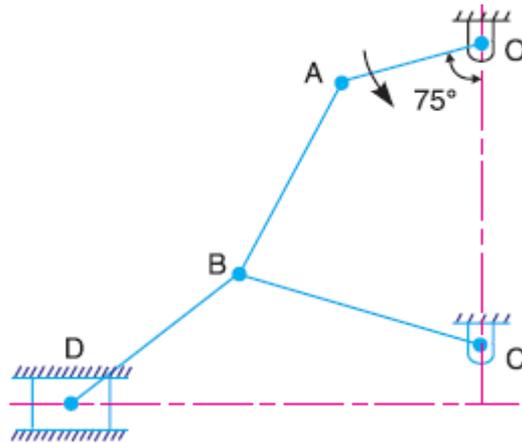
PART C (5 x 14 = 70 Marks)

21. a) The layout of a quick return mechanism of the oscillating line type for a special purpose machine as shown. The driving crank BC is 30mm long and time ratio of the working stroke to the return stroke is to be 1.7. If the length of the working stroke of R is 120mm, determine the dimension of Ac and AP.



(OR)

- b) From the figure the angular velocity of the crank OA is 600rpm. Determine the linear velocity of the slider D and the angular velocity of the link BD, when the crank is inclined at an angle of 75° to the vertical. The dimensions of various links are $OA = 28 \text{ mm}$, $AB = 44\text{mm}$, $BC = 49\text{mm}$ and $BD = 46\text{mm}$. The centre distance between the centres of rotation O and C is 65mm. The path of travel of the slider is 11mm below the fixed point C. The slider moves along a horizontal path and OC is vertical.



22. a) A square threaded bolt of root diameter 22.5 mm and pitch 5mm is tightened by screwing a nut whose mean diameter of bearing surface is 50mm. If coefficient of friction for nut and bolt is 0.1 and for nut and bearing surface 0.16, find the force required at the end of a spanner 500mm long when the load on the bolt is 10KN.

(OR)

- b) A shaft rotating at 200rpm drives another shaft at 300rpm and transmits 6kw through a belt. The belt is 100mm wide and 10mm thick. The distance between the shafts is 4m. The smaller pulley is 0.5m in diameter. Calculate the stress in the belt, if it is 1. a open belt drive 2. a cross belt drive. Take $\mu = 0.3$.

23. a) In a reverted epicyclic gear train, the arm A carries two gears B and C and a compound gear D – E. The gear B meshes with gear E and the gear C meshes with gear D. The number of teeth on gears B, C and D are 75, 30 and 90 respectively. Find the speed and directions of gear C when gear B is fixed and the arm A makes 100rpm clockwise.

(OR)

- b) A cam is to be designed for a knife edge follower with the following data:

1. Cam lift = 40mm during 90° of cam rotation with simple harmonic motion
2. Dwell for the next 30° .
3. During the next 60° of cam rotation, the follower returns to its original position with simple harmonic motion.
4. Dwell during the remaining 180° .

Draw the profile of the cam when a. the line of stroke of the follower passes through the axis of the cam shaft and b. the line of stroke is offset 20mm from the axis of the cam shaft. The radius of the base circle of the cam is 40mm. Determine the maximum velocity and acceleration of the follower during its ascent and descent, if the cam rotates at 240rpm.

24. a) A shaft of length 0.75m supported freely at the ends, is carrying a body of mass 90kg at 0.25m from one end. Find the natural frequency of transverse vibration. Assume $E = 200 \text{ GN/m}^2$ and shaft diameter = 50mm.

(OR)

- b) A Shaft of 100mm diameter and 1 meter long has one of its end fixed and the other end carries a disc of mass 500kg at a radius of gyration of 450mm. The modulus of rigidity for the shaft material is 80 GN/m^2 . Determine the frequency of torsional vibrations.

25. a) A shaft carries four masses in parallel planes A, B and C in this order along its length. The masses at B and C are 18kg and 12.5 kg respectively and each has an eccentricity of 60mm. The masses at A and D have an eccentricity of 80mm. The angle between the masses at B and C is 100° and that between the masses at B and A is 190° both being measured in the same directions. The axial distance between the planes A and B is 100mm and that between B and C is 200mm. If the shaft is in complete dynamic balance, determine 1. The magnitude of the masses at A and D, 2. The distance between planes A and D and 3. The angular position of the mass at D.

(OR)

- b) A single cylinder reciprocating engine has speed 240rpm stroke 300mm, mass of reciprocating parts 50kg, mass of revolving parts at 150mm radius 37kg. If two third of the reciprocating parts and all the revolving parts are to be balanced find 1. The balance mass required at a radius of 400mm and 2. The residual unbalanced force when the crank has rotated 60° from the dead centre.
