Enrolment No:	UPES UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2021

Course: Theory of machine **Semester : IV**
Program: B. Tech ASE **Time : 03 hrs.**
Course Code: MECH 2013 **Max. Marks : 100**

SECTION A

1. **Each Question will carry 5 Marks**

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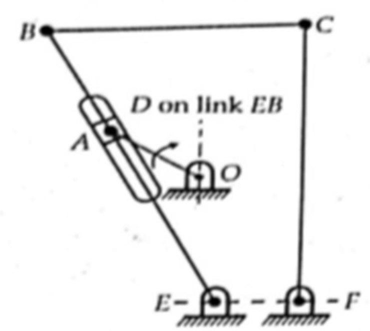
Q 1	1. The balancing of rotating and reciprocating parts of an engine is necessary when it runs at (*a*) slow speed (*b*) medium speed (*c*) high speed **[2.5]** 2. For static balancing of a shaft, (a) the net dynamic force acting on the shaft is equal to zero (b) the net couple due to the dynamic forces acting on the shaft is equal to zero (c) both (a) and (b) (d) none of the above **[2.5]**	**C02**
Q 2	1. In order to have a complete balance of the several revolving masses in different planes (a) the resultant force must be zero (b) the resultant couple must be zero (c) both the resultant force and couple must be zero (d) none of the above **[2.5]** 2. The size of a cam depends upon (a) base circle (b) pitch circle (c) prime circle (d) pitch curve **[2.5]**	**C02**
Q 3	1. The type of gears used to connect two non-parallel non-intersecting shafts are (a) spur gears (b) helical gears (c) spiral gears (d) none of these **[2.5]** 2. An imaginary circle which by pure rolling action, gives the same motion as the actual gear, is called (a) addendum circle (b) dedendum circle (c) pitch circle (d) clearance circle **[2.5]**	**C01**
Q 4	1. The direction of linear velocity of any point on a link with respect to another point on the same link is (a) parallel to the link joining the points (b) perpendicular to the link joining the points (c) at 45° to the link joining the points (d) none of these **[2.5]** 2.According to Aronhold Kennedy’s theorem, if three bodies move relatively to each other, their instantaneous centres will lie on a (a) straight line (b) parabolic curve (c) ellipse (d) none of these **[2.5]**	**C01**

Q5	1. In a mechanism, the fixed instantaneous centers are those centers which (a) remain in the same place for all configurations of the mechanism (b) vary with the configuration of the mechanism (c) moves as the mechanism moves, but joints are of permanent nature (d) none of the above **[2.5]** 2. When a particle moves with a uniform velocity along a circular path, then the particle has (a) tangential acceleration only (b) centripetal acceleration only (c) both tangential and centripetal acceleration **[2.5]**	**C01**
Q6	1. When a particle moves along a straight path, then the particle has (a) tangential acceleration only (b) centripetal acceleration only c) both tangential and centripetal acceleration **[2.5]** 2. The partial balancing means (a) balancing partially the revolving masses (b) balancing partially the reciprocating masses (c) best balancing of engines (d) all of the above **[2.5]**	**C02**

SECTION B

1. **Each Question will carry 10 Marks**
2. **Instruction: Assume necessary data if needed**

Q 1	Determine the velocity of the slider A and angular velocity of link BC if the crank OA rotates uniformly at 20 rad/sec clockwise, For the given mechanism with the following dimension BC= 18 cm, FC = 25 cm, OA = 7.5 cm, EB = 27 cm, EF = 6 cm angle Between EFC = 90 degree.  	**C02**
Q2	Explain Grubler's criterion for determining degree of freedom for mechanisms. Using Grubler's criterion for plane mechanism, prove that the minimum number of binary links in a constrained mechanism with simple hinges is four.	**C02**
Q3	A pinion having 20 involute teeth of module pitch 6 mm rotates at 200 r.p.m. and transmits 1.5 kW to a gear wheel having 50 teeth. The addendum on both the wheels is 1/4 of the circular pitch. The angle of obliquity is 20°. Find (a) the length of the path of approach ; (b) the length of the arc of approach	**C03**
Q4	Analyze piston motion in single slider crank mechanism statically and dynamically.	**C03**

Q5	Four masses A, B, C and D are attached to a shaft and revolve in the same plane. The masses are 12 kg, 10 kg, 18 kg and 15 kg respectively and their radii of rotations are 40 mm, 50 mm, 60 mm and 30 mm. The angular position of the masses B, C and D are 60°, 135° and 270° from the mass A. Find the magnitude and position of the balancing mass at a radius of 100 mm.	**CO4**
SECTION C 1. **Each Question will carry 20 Marks** 2. **Instruction: Assume necessary data if needed**		
Q 1	A cam operating a knife-edged follower has the following data : (a) Follower moves outwards through 40 mm during 60° of cam rotation. (b) Follower dwells for the next 45°. (c) Follower returns to its original position during next 90°. (d) Follower dwells for the rest of the rotation. The displacement of the follower is to take place with simple harmonic motion during both the outward and return strokes. The least radius of the cam is 50 mm. Draw the profile of the cam when 1. the axis of the follower passes through the cam axis, and 2. the axis of the follower is offset 20 mm towards right from the cam axis. If the cam rotates at 300 r.p.m., determine maximum velocity and acceleration of the follower during the outward stroke and the return stroke. **OR** A disc cam rotating in a clockwise direction is used to move a reciprocating roller with simple harmonic motion in a radial path, as given below : (i) Outstroke with maximum displacement of 25 mm during 120° of cam rotation, (ii) Dwell for 60° of cam rotation, (iii) Return stroke with maximum displacement of 25 mm during 90° of cam rotation, and (iv) Dwell during remaining 90° of cam rotation. The line of reciprocation of follower passes through the camshaft axis. The maximum radius of cam is 20 mm. If the cam rotates at a uniform speed of 300 r.p.m. find the maximum velocity and acceleration during outstroke and return stroke. The roller diameter is 8 mm. Draw the profile of the cam when the line of reciprocation of the follower is offset by 20 mm towards right from the cam shaft axis	**CO4**