

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES**End Semester Examination, May 2022****Course:** Theory of machines**Program:** B.Tech (mechatronics engineering)**Course Code:** MECH 2013**Semester:** IV**Time :** 03 hrs.**Max. Marks:** 100**Instructions:** Attempt all the questions**SECTION A
(5Qx4M=20Marks)**

S. No.		Marks	CO
Q.1	Explain with a neat sketch the 'sun and planet wheel'.	5	CO1
Q.2	Describe the gyroscopic effect on sea going vessels.	5	CO1
Q.3	Balancing of rotating parts are necessary in vehicle, Justify.	5	CO2
Q.4	Explain the terms 'fluctuation of energy' and 'fluctuation of speed' as applied to flywheels.	5	CO2

**SECTION B
(4Qx10M= 40 Marks)**

Q.5	What is the significance of degrees of freedom of a kinematic chain when it functions as a mechanism? Give examples.	10	CO3
Q.6	In a four bar chain ABCD , link AD is fixed and the crank AB rotates at 10 radians per second clockwise. Lengths of the links are AB = 60 mm ; BC = CD = 70 mm ; DA = 120 mm. When angle DAB = 60° and both B and C lie on the same side of AD, find 1. angular velocities (magnitude and direction) of BC and CD ; and 2. angular acceleration of BC and CD.	10	CO3
Q.7	A pair of gears, having 40 and 20 teeth respectively, are rotating in mesh, the speed of the smaller being 2000 r.p.m. Determine the velocity of sliding between the gear teeth faces at the point of engagement, at the pitch point, and at the point of disengagement if the smaller gear is the driver. Assume that the gear teeth are 20° involute form, addendum length is 5 mm and the module is 5 mm. Also find the angle through which the pinion turns while any pairs of teeth are in contact.	10	CO2
Q.8	Explain the different inversions of double slider crank mechanism.	10	CO3
OR			
Q.9	State the different types of governors. What is the difference between centrifugal and inertia type governors ? Why is the former preferred to the latter ?	10	CO3

SECTION-C**(2Qx20M=40 Marks)**

Q 10	<p>A cam, with a minimum radius of 50 mm, rotating clockwise at a uniform speed, is required to give a knife edge follower the motion as described below :</p> <ol style="list-style-type: none">1. To move outwards through 40 mm during 100° rotation of the cam2. To dwell for next 80°3. To return to its starting position during next 90°, and 4. To dwell for the rest period of a revolution i.e. 90°. <p>Draw the profile of the cam</p> <p>(i) when the line of stroke of the follower passes through the centre of the cam shaft, and</p> <p>(ii) when the line of stroke of the follower is off-set by 15 mm.</p> <p>The displacement of the follower is to take place with uniform acceleration and uniform retardation. Determine the maximum velocity and acceleration of the follower when the cam shaft rotates at 900 r.p.m.</p>	20	CO4
Q.11	<p>Four masses m_1, m_2, m_3 and m_4 are 200 kg, 300 kg, 240 kg and 260 kg respectively. The corresponding radii of rotation are 0.2 m, 0.15 m, 0.25 m and 0.3 m respectively and the angles between successive masses are 45°, 75° and 135°. Find the position and magnitude of the balance mass required, if its radius of rotation is 0.2 m.</p>	20	CO4
OR			
Q.12	<p>The speed ratio of the reverted gear train, as shown in Fig., is to be 12. The module pitch of gears A and B is 3.125 mm and of gears C and D is 2.5 mm.</p> <p>Calculate the suitable numbers of teeth for the gears. No gear is to have less than 24 teeth.</p>	20	CO4

