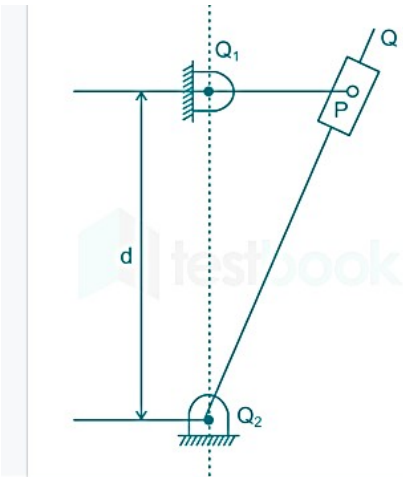
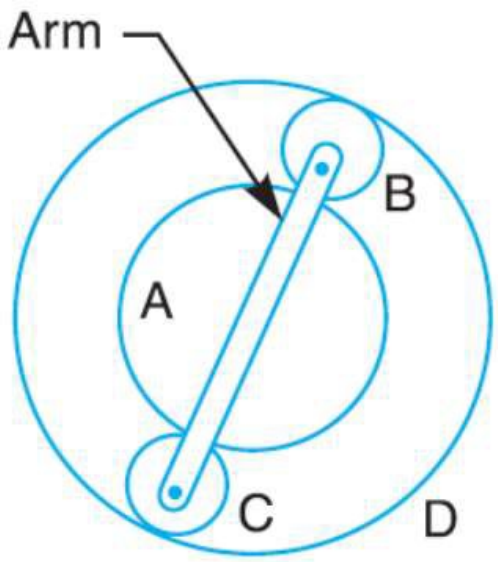
UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, April/May 2018

Course: Kinematics and Dynamics of Machines **Semester: IV**
Program: B. Tech (Automotive Design Engineering)
Time: 03 hrs. **Max. Marks: 100**

Instructions: Assume Suitable Data if necessary attempt all questions; internal choices are given along with the questions.

SECTION A

S. No.		Marks	CO
Q 1	State and explain angular-velocity-ratio theorem as applicable to mechanism.	05	CO1
Q 2	Two masses in different planes are necessary to rectify the dynamic unbalance. Comment.	05	CO4
Q 3	Sketch gear teeth and show the mentioned terms on it: face, flank, tooth thickness, space width, face width and circular pitch.	05	CO3
Q 4	Define base circle, pitch circle, trace point, pitch curve and pressure angle.	05	CO2
	SECTION B		
Q 5	A simple quick return mechanism is shown in the figure 1. The forward to return ratio of the quick return mechanism is 2:1. If the radius of the crank (O_1P) is 125 mm, find out the distance 'd' (in mm) between the crank centre to lever pivot centre point.  Fig. 1: Quick return Mechanism	10	CO1
Q 6	An epicyclic train of gears is arranged as shown in Figure 2. How many revolutions does the arm, to which the pinions B and C are attached, make: 1. when A makes one revolution clockwise and D makes half a revolution	10	CO3

	anticlockwise, and 2. when A makes one revolution clockwise and D is stationary ? The number of teeth on the gears A and D are 40 and 90 respectively.  Figure 2: Epicyclic gear train		
Q 7	A pinion having 30 teeth drives a gear having 80 teeth. The profile of the gears is involute with 20° pressure angle, 12 mm module and 10 mm addendum. Find the length of path of contact, arc of contact and the contact ratio. **OR** Determine the minimum number of teeth required on a pinion, in order to avoid interference which is to gear with, 1. a wheel to give a gear ratio of 3 to 1 ; and 2. an equal wheel. The pressure angle is 20° and a standard addendum of 1 module for the wheel may be assumed.	**10**	**CO3**
Q8	Explain effect of gyroscopic couple acting on the body of the aeroplane for various conditions mentioned below. Case (i): PROPELLER rotates in CLOCKWISE direction when seen from rear end and Aeroplane turns towards LEFT Case (iv):PROPELLER rotates in ANTICLOCKWISE direction when seen from rear end and Aeroplane turns towards RIGHT	**10**	**CO5**

SECTION-C			
Q 9	Draw the cam profile for following conditions: Follower type = Knife edged, in-line; lift = 50mm; base circle radius = 50mm; out stroke with simple harmonic motion (SHM), for 60^0 cam rotation; dwell for 45^0 cam rotation; return stroke with SHM, for 90^0 cam rotation; dwell for the remaining period. Determine max. velocity and acceleration during out stroke and return stroke if the cam rotates at 1000 rpm in clockwise direction. **OR** Draw the cam profile for following conditions: Follower type = knife edged follower, in line; follower rises by 24mm with simple harmonic motion (SHM) in 1/4 rotation, dwells for 1/8 rotation and then raises again by 24mm with uniform acceleration and retardation motion (UARM) in 1/4 rotation and dwells for 1/16 rotation before returning with SHM. Base circle radius = 30mm.	**20**	**CO5**
Q 10	(a)An automobile car is travelling along a track of 100 m mean radius. The moment of inertia of 500 mm diameter wheel is 1.8 kg m^2. The engine axis is parallel to the rear axle and crank shaft rotates in the same sense as the wheel. The moment of inertia of rotating parts of the engine is 1 kg m^2. The gear ratio is 4 and the mass of the vehicle is 1500 kg. If the centre of gravity of the vehicle is 450 mm above the road level and width of the track of the vehicle is 1.4 m, determine the limiting speed of the vehicle for condition that all four wheels maintain contact with the road surface.	**10**	**CO5**
	(b) The four masses A, B, C and D are 100 kg, 150 kg, 120 kg and 130 kg attached to a shaft and revolve in the same plane. The corresponding radii of rotations are 22.5 cm, 17.5 cm, 25 cm and 30 cm and the angles measured from A are 450, 1200 and 2550. Find the position and magnitude of the balancing mass, if the radius of rotation is 60 cm.	**10**	**CO4**