	ADAMAS UNIVERSITY **END-SEMESTER EXAMINATION : JANUARY 2021** (Academic Session: 2020 – 21)		
Name of the Program:	B.Tech	**Semester:**	V
Paper Title :	Kinematics and Dynamics of Machines	**Paper Code:**	EME43103
Maximum Marks :	40	**Time duration:**	3 hours
Total No. of questions:	08	**Total No. of Pages:**	02
Answer all the Groups			

Group A

(Answer all the questions)

$5 \times 1 = 5$

1. a) The number of kinematic pairs in a four bar mechanism is _____.

b) An aeroplane generally has two counter-rotating turbines to nullify the gyroscopic effects due to forced precession. Justify.

c) For an open belt drive, length of belt is **L**. When the centre distance between the pulleys is doubled, the required length of belt will be _____.

d) A multi-cylinder engine will require a smaller flywheel compared to a single cylinder engine of same power rating. Explain.

e) A gear set has a pinion with 20 teeth and a gear with 40 teeth. The pinion runs at 30 rev/s and transmits a power of 20 kW. The teeth are on the 20° full–depth system and have a module of 5 mm. The centre distance for the above gear set is _____ mm.

Group B

*(Answer any **three** questions)*

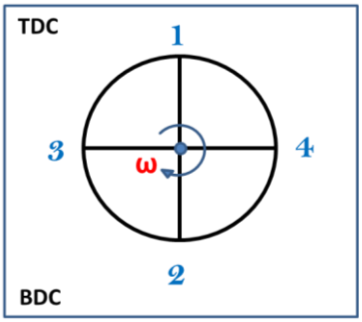
$3 \times 5 = 15$

2. A V-belt weighing 1.6 kg/m run has an area of cross-section of 750 mm^2. The angle of lap is 165^0 on the smaller pulley which has groove angle of 40^0, $\mu = 0.12$. The maximum safe stress in the belt is 9.5 N/mm^2. What is the power that can be transmitted by the belt at a speed of 20 m/s.

3. An aeroplane flying at 240 km/hr turns towards left and completes a quarter circle of 60 m radius. The mass of the rotating parts of the engine along with the propeller of the plane amounts to 450 kg with a radius of gyration of 320 mm. The engine speed is 2000 rpm clockwise when viewed from the rear. Determine the magnitude of the gyroscopic couple on the aircraft and state its effect on the aeroplane with proper vector diagram.

4. In a rack and pinion steering system, it is desired to avoid interference. Formulate the minimum number of teeth required to avoid interference. Use standard notations.

5. The primary crank diagram of a four-cylinder in-line engine is shown below. Illustrate the crank layout, and, indicate the number of working strokes per cycle and the firing order.



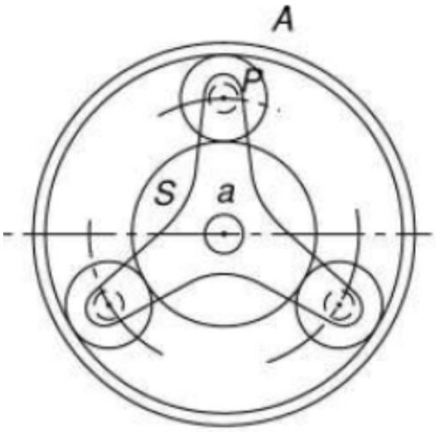
6. Find the angle of inclination with respect to the vertical of a two wheeler negotiating a turn. Combined mass of the vehicle with its rider 250 kg; moment of inertia of the engine flywheel 0.3 kg-m^2; moment of inertia of each road wheel 1 kg-m^2; speed of engine flywheel is 5 times that of the road wheels and in the same direction; height of centre of gravity of rider with vehicle 0.6 m; two wheeler speed 90 km/h; wheel radius 300 mm; radius of turn 50 m.

Group C

*(Answer any **two** questions)*

$2 \times 10 = 20$

7. The pitch circle diameter of the internally toothed ring **A** is to be approximately 216 mm and the module 4 mm. When the ring **A** is stationary, the spider **a**, which carries three planet wheels **P** of equal size, is to make one revolution in the same sense as the sun wheel **S** for every five revolutions of the driving spindle carrying the sun wheel **S**. Determine suitable number of teeth for all the wheels and the exact diameter of pitch circle of the ring **A**.



8. 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 600, 1350 and 2700 from mass **A**. Find the magnitude and position of the balancing mass at a radius of 100 mm.

9. The pulleys of two parallel shafts that 8 m apart are 600 mm and 800 mm in diameters and are connected by a crossed belt. It is needed to change the direction of rotation of the driven shaft by adopting the open-belt drive. Calculate the change in length of the belt.

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