

Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Fourth semester B.Tech examinations (S), September 2020

Course Code: ME214**Course Name: THEORY OF MACHINES (MA)**

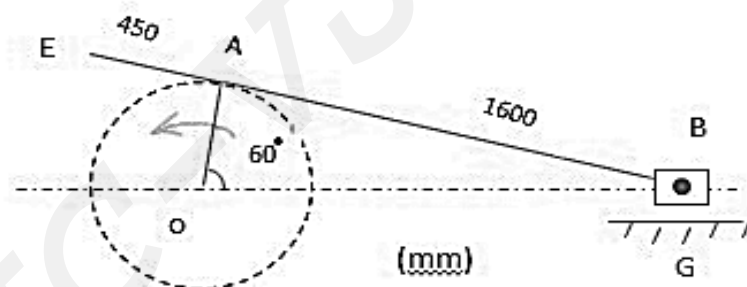
Max. Marks: 100

Duration: 3 Hours

PART A*Answer any three questions, each carries 10 marks*

Marks

- 1 a) A slider crank mechanism is shown in figure. Link OA rotate at 20rad/s in counter clockwise (10)
- (i) Acceleration of the slider at B
- (ii) Acceleration of the point E
- (iii) Angular acceleration of the link AB



- 2 a) What do you mean by inversion? With figure explain different Slider crank Inversions? (10)
- 3 a) What are the different types of brakes? (3)
- b) Explain Law of gearing. (5)
- c) Two spur gears having a velocity ratio of 1/3. The driven gear has 72 teeth of 8mm module and rotates at 300 rpm. Calculate the no of teeth and speed of the driver. What will be the pitch line velocities? (2)
- 4 a) Explain briefly the classification of gears with the help of neat figures. (10)

PART B

Answer any three questions, each carries 10 marks

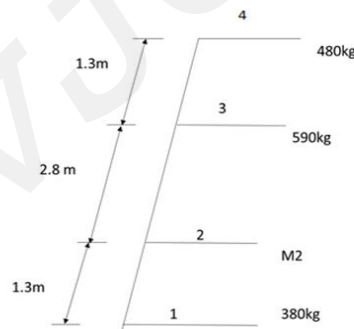
- 5 a) A cam with a minimum radius of 25 mm is to be designed for a knife edge follower with the following data: (10)
- To raise the follower through 50mm during 60° rotation of the cam
Dwell for the next 40° of the cam rotation
Descending of the follower during the next 90° of the cam rotation
Dwell during the rest of the cam rotation
- Draw the profile of the cam if the ascending and descending of the cam is with simple harmonic motion and the line of stroke of the follower is offset 10 mm from the axis of the cam shaft. Find the maximum velocity and acceleration of ascend and descend.
- 6 a) Derive the velocity and acceleration for cycloidal motion. (4)
- b) Draw the profile of a cam operating a knife edge follower having a valve lift of 40mm. The cam raises the follower with SHM for 150° of the rotation followed by a period of dwell for 60°. The follower descends for the next 100° rotation of the cam with uniform velocity, again followed by a dwell period. The cam rotates at a uniform velocity of 120rpm and has a least radius of 20mm. (6)
- 7 a) Explain the gyroscopic effect on an aeroplane. (4)
- b) An aeroplane flying at 240 km/h turns towards the left and completes a quarter circle of 60m radius. The mass of the rotary engine and the propeller of the plane is 450kg with a radius of gyration of 320mm. The engine speed is 2000rpm clockwise when viewed from the rear. Determine the gyroscopic couple on the aircraft and state its effect. In what way is the effect changed when the aeroplane turns towards right. (6)
- 8 a) Explain the terms related to flywheel (4)
- (a) Mean speed of flywheel
(b) Maximum fluctuation of energy
(c) Coefficient of fluctuation of speed
- b) The turning moment diagram for a multi cylinder internal combustion engine is drawn to the scale of 1mm=6 Nm, Crank angle 1mm=1°. The turning moment diagram cycle repeats at every half revolution of the engine. The areas above and below the mean torque line are taken in order are +300, -700, +50, -350, +950, -250mm². Mass of flywheel and the accompanying rotating parts is 25kg at radius

of gyration of 100mm. Determine the coefficient of fluctuation of speed when the engine runs at 2000rpm.

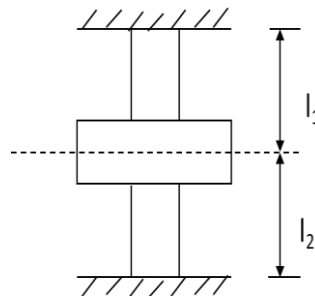
PART C

Answer any four questions, each carries 10 marks

- 9 a) Explain in detail any 4 types of centrifugal governors (10)
- 10 a) What do you mean by dynamic balancing? (4)
- b) A circular disc mounted on a shaft carries three attached masses of 4kg, 3kg and 2.5kg at radial distances of 75mm, 85mm and 50mm and at angular positions of 45° , 135° and 240° respectively. The angular positions are measured counter clockwise from the reference line along the x-axis. Determine the amount of counter mass at a radial distance of 75mm required for static balance. (6)
- 11 a) Explain the working of Porter governor (4)
- b) A four cylinder oil engine is in complete primary balance. The arrangement of the reciprocating masses in different planes are shown in fig. The stroke of each piston is '2r' mm. Determine the reciprocating mass of the cylinder 2 and the relative crank position. (6)



- 12 a) Derive critical speed of shaft? What is its relevance? (5)
- b) Determine the frequency of torsional vibration of the disc shown in figure. If both ends of the shaft are fixed and the diameter of the shaft is 40mm. The disc has a mass of 96kg and a radius of gyration of 0.4m. Take modulus of rigidity of shaft as 85GN/m^2 , $l_1=1\text{m}$ and $l_2=0.8\text{m}$. (5)



- 13 a) Explain Dunkerley's method. (4)
- b) A steel bar 2.5cm wide and 5cm deep is freely supported at two points 1m apart (6)
and carries a mass of 200kg midway between them. Find the frequency of the
natural transverse vibration, neglecting the weight of the bar $E=27 \times 10^5$ bar. Find
the frequency of vibration if an additional mass of 200kg is uniformly distributed
- 14 a) What is Logarithmic decrement? (3)
- b) In a single degree damped vibrating system a suspended mass of 8kg makes 30 (7)
oscillations in 18 sec. The amplitude decreases to 0.25 times of the initial value
after 5 oscillations. Determine
- (a) Stiffness of the spring
 - (b) Logarithmic decrement
 - (c) Damping factor
 - (d) Damping coefficient
