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UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, December 2017

Program: B.Tech - ASE	**Semester – III**
Subject (Course): Theory of Machines	**Max. Marks : 100**
Course Code : GNEG 251	**Duration : 3 Hrs**
No. of page/s : 02	

The paper contains three sections A, B and C. You have to attempt every section. Marks for each question is given on the right hand side of the question in brackets.

SECTION A

1. Explain different kinds of friction. Define the terms coefficient of friction and limiting angle of friction. (5)
2. Explain the terms sensitiveness, hunting and stability relating to governors. (5)
3. Explain the terms elevator, rudder and aileron as applicable to aeroplanes. Discuss the use of turnbuckles. (5)
4. Differentiate between Whitworth quick return mechanism and crank & slotted-lever mechanism. (5)

SECTION B

5. A multiple disc clutch has 6 active friction surfaces. The power transmitted is 20 kW at 400 rpm. Inner and outer radii of the friction surfaces are 90 and 120 mm respectively. Assuming uniform wear with coefficient of friction 0.3, evaluate the maximum, minimum and average pressure between the discs. (10)
   Compare the average intensity of pressure when uniform pressure theory is used.

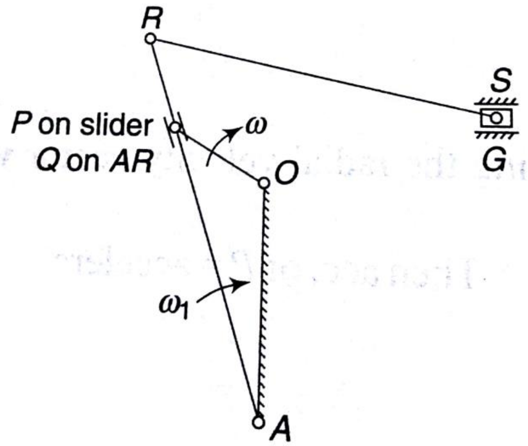
   OR

   Derive an expression for the efficiency of an inclined plane when a body moves up the plane. (10)
6. Each arm of a Porter governor is 250 mm long and is pivoted on the axis of rotation. The mass of each ball is 5 kg and the sleeve is 25 kg. The sleeve begins to rise when the radius of rotation of balls is 150 mm and reaches the top when it is 200 mm. Determine the range of speed, lift of sleeve, governor effort and power. Compute the changes when friction at sleeve is equivalent to 10 N. (10)
7. The moment of inertia of an aeroplane air screw is 20 kg-m^2 and the speed of rotation is 100 rpm clockwise when viewed from the rear end. The speed of the flight is 200 km/hr. Compute the gyroscopic couple on the air screw of the aeroplane when it makes a left handed turn on a path of 150 m radius. Explain the gyroscopic effect with a suitable diagram. Discuss the change in the gyroscopic effect if the plane takes a right turn. (10)
8. In a slider-crank mechanism, the lengths of the crank and the connecting rod are 200 (10)

mm and 800 mm respectively. Locate all the I-centres of the mechanism for the position of the crank when it has turned 30º from the inner dead centre. Also, find the velocity of the slider and the angular velocity of the connecting rod if the crank rotates at 40 rad/s.

SECTION C

9. In a crank and slotted-lever quick return mechanism as shown in figure below, the distance between the fixed centres O and A is 250 mm. Other lengths are: OP = 100 mm, AR = 400 mm, RS = 150 mm and <AOP = 120º. Uniform speed of the crank is 60 rpm clockwise. Line of stroke of the ram is perpendicular to OA and is 450 mm above A. Calculate the velocity and the acceleration of the ram S. (20)



10. Differentiate between static and dynamic balancing of rotating masses. (5+15)

Four masses A, B, C and D are completely balanced. Masses C and D make angles of 90º and 210º respectively with that of mass B in the counterclockwise direction. The rotating masses have the following properties-

m_b = 15 kg r_a = 360 mm
m_c = 25 kg r_b = 480 mm
m_d = 20 kg r_c = 240 mm
r_d = 300 mm

Planes B and C are 250 mm apart. Determine the mass A and its angular position with that of mass B. Also find the positions of all the planes relative to plane of mass A.

OR

A rotor has the following properties: (20)

Mass	Magnitude	Radius	Angle	Axial Distance from 1st mass
1	9 kg	100 mm	0º	
2	7 kg	120 mm	60º	160 mm
3	8 kg	140 mm	135º	320 mm
4	6 kg	120 mm	270º	560 mm

If the shaft is balanced by two counter-masses located at 100 mm radii and revolving in planes midway of planes 1 and 2, and midway of 3 and 4, determine the magnitude of the masses and their respective angular positions. Justify your answer by graphical method.