Code No: 134AU **R16**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech II Year II Semester Examinations, December - 2018
DYNAMICS OF MACHINERY
(Mechanical Engineering)

Time: 3 Hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.
Illustrate your answer with NEAT sketches wherever necessary

PART- A

(25 Marks)

1.a) Write the gyroscopic effect on Aeroplanes in the following cases **:** [2]

Case	***Direction (Sense) of Spin***	***Sense of precession***
(i)	*Clockwise* when viewed from rear	Left turn
(ii)	*Clockwise* when viewed from rear	Right turn

b) Define *Static Equilibrium* of a body. What are the conditions to be satisfied for a body to be in static equilibrium? [3]
c) Define the terms**:** 'coefficient of fluctuation energy' and 'coefficient of fluctuation of speed'. [2]
d) Explain precisely the uses of turning moment diagram of reciprocating engines. [3]
e) What is '*Force of Friction*'? Explain with a suitable sketch. [2]
f) What are the different types of friction clutches? Explain briefly. [3]
g) What do you understsnd by reference plane? Why is it used? [2]
h) Explain the terms**:** Sensitiveness, Isochronism, and Hunting in connection with governors. [3]
i) When does the *Whirling of Shafts* occur? Explain. [2]
j) Distinguish between longitudinal, transverse and torsional free vibrations. [3]

PART-B

(50 Marks)

2.a) A thin circular disc is fitted to a shaft as shown in Figure.1. Weight of the disc is 500N and diameter is 1.2m. Shaft rotates at 300 rpm in anticlockwise direction when seen from the right side. Find the effect of the gyroscopic couple on the shaft, and the bearing reactions at A and B taking the effect of the weight of the disc.

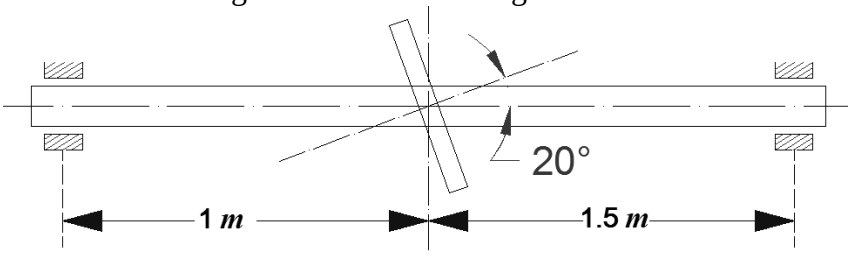

Figure.1

b) Discuss briefly the following**:** D'Alembert's Principle, Dynamically equivalent system. [5+5]

OR

3.a) A four-bar mechanism shown in Figure 2 is acted upon by a force P of 100 N at 120^0 on the link CD. Dimensions of the various links are**:** AB = 40 mm, BC = 60 mm, CD = 50 mm, AD = 30 mm, and DE = 20 mm. Determine the input torque on AB for static equilibrium. (*Figure is not to scale*)

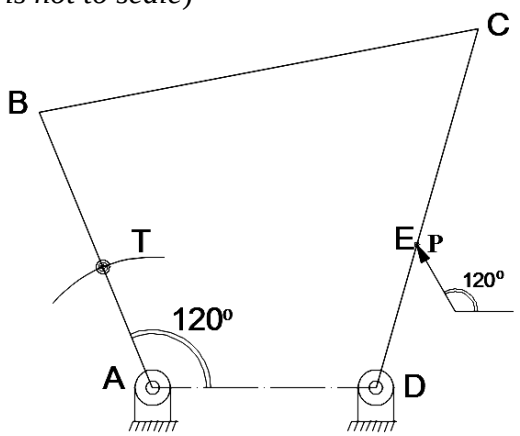

Figure.2

b) Explain the terms spin and precession. How do they differ from each other? Explain. [5+5]

4.a) Draw and explain the Turning moment-Crank angle (T- θ) diagram for a multi-cylinder engine. And, from this diagram, deduce the concepts of *Maximum fluctuation of energy*, *Coefficient of Fluctuation of Energy*.

b) Find the maximum and minimum speeds of a flywheel of mass 3250 kg and radius of gyration 1.8 m, when the fluctuation of energy is 112 kN-m. The mean speed of the engine is 240rpm. [5+5]

OR

5. In a turning moment diagram, the areas above and below the mean torque line taken in order are 4400, 1150, 1300, and 4550mm^2 respectively. The scales of the turning moment diagram are**:** Turning moment : 1mm = 100 N – m; Crank angle: 1mm = 1^0. Find the mass of the flywheel required to keep the speed between 297 and 303rom, if the radius of the gyration is 0.525m. [10]

6.a) In a cone clutch with semi-cone angle of 15^0, the maximum and minimum radii of the contact surfaces are 120 mm and 80mm respectively. The speed is 800 rpm, and the maximum allowable normal pressure is 150 kPa. Determine the axial load and the power transmitted, taking the coefficient of friction as 0.3.

b) Derive from first principles, the expression for the frictional moment (or torque due to friction) of a conical collar bearing. [5+5]

OR

7.a) What is uniform pressure theory? Deduce an expression for the friction torque considering this theory for a flat collar.

b) Discuss the effect of applying brakes to a four-wheeled vehicle when (i) the brakes are applied to the rear wheels only, and (ii) the brakes are applied to the front wheels only. [5+5]

8.a) In how many ways the arms of a Watt governor may be connected to the spindle? Explain.

b) A two-cylinder engine with cranks at 180^0 and the cylinders on the same side of the crankshaft center-line is having identical reciprocating masses, crank lengths and connecting rod lengths for each cylinder. If the crank of the first cylinder makes an angle of 30^0 with I.D.C., then to what extent the engine is balanced for**:** (i) Primary forces, and (ii) Secondary couples? [5+5]

OR

9.a) Derive the expressions for variation in tractive force, swaying couple, and hammer blow for an uncoupled two cylinder locomotive engine.

b) A Porter governor has all its four arms 300 mm long and pivoted on the axis of rotation. Each ball weighs 7 kg, and the load on the sleeve is 54 kg. Determine the equilibrium speeds corresponding to two extreme radii of rotation of 200 mm and 250 mm of the governor balls. [5+5]

10.a) In the case of free torsional vibrations of two – rotor system, prove that the *node* divides the length of the shaft in the inverse ratio of the moments of inertia of the corresponding rotors.

b) In a spring-mass vibrating system, the natural frequency of vibration is 3.56 Hz. When the amount of suspended mass is increased by 5 kg, the natural frequency is lowered to 2.9 Hz. Determine the original unknown mass and the spring constant. [5+5]

OR

11.a) A 1.2 m long shaft has a diameter of 45 mm for half the length, and 60 mm diameter for the remaining length. One end of the shaft is fixed, and the other end carries a rotor of mass 200 kg with a radius of gyration of 45 mm. Find the frequency of free torsional vibrations of the shaft. Neglect the inertia of the shaft, and take G = 84 GN/m^2.

b) In the free longitudinal vibrations of a spring-mass system, how does the Inertia of the mass of spring affect the natural frequency of vibrations? Explain. [5+5]

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