B.Tech. – VIEP – MECHANICAL ENGINEERING (BTMEVI)

Term-End Examination

00974

June, 2017

BIMEE-007 : ADVANCED DYNAMICS OF MACHINES

Time : 3 hours   *Maximum Marks : 70*

Note : *Attempt any **five** questions. All questions carry equal marks. Assume missing data, if any. Use of scientific calculator is permitted.*

1. (a) A body has mass 10 kg and radius of gyration about the mass centre is 25 cm. At a given instance it is acted upon by a force of 25 N having line of action 25 cm from the mass centre of the body. What effect will the given force have on the motion of the body ?   10

    (b) Describe d'Alembert's principle with suitable illustrations.   4

2. (a) What are the stresses acting on rotating members ? What is Dynamic Analysis ? Discuss.   6

(b)   A train moving at 36 km/hour is hit by a stone thrown at right angles to it with a velocity of 18 km/hour. Find the velocity and the direction with which the stone appears to hit a person travelling in the train.   *8*

3.   (a)   Find the inertia force for the following data of an I.C. engine :   *10*

Bore = 175 mm, stroke = 20 mm

crank angle = 60° from T.D.C and mass of reciprocating parts = 180 kg, length of connecting rod = 40 mm.

(b)   What is the fluctuation of crank-shaft speed ? Describe.   *4*

4.   (a)   The flywheel of a steam engine has a radius of gyration of 1 m and mass 2500 kg. The starting torque of the steam engine is 1500 Nm. Determine (i) the angular acceleration of the flywheel, and (ii) the kinetic energy of the flywheel after 10 seconds from the start.   *10*

(b)   What is a flywheel ? How can energy be stored in a flywheel ? Explain.   *4*

5. (a) Why is balancing of the rotating parts of the engine necessary ? Elaborate. *4*

(b) The weights of four masses W_1, W_2, W_3 and W_4 are 200 kg, 300 kg, 240 kg and 260 kg respectively. The corresponding radii of rotation are 20 cm, 15 cm and 30 cm respectively and the angles between successive masses are 45°, 75° and 135°. Find the position and magnitude of the balance weight required, if its radius of rotation is 20 cm. *10*

6. (a) What is the effect of gyroscope couple on an aeroplane ? Explain. *4*

(b) A uniform disc of 150 mm diameter has a mass of 5 kg. It is mounted centrally in bearings which maintain its axle in a horizontal plane. The disc spins about its axle with a constant speed of 1000 rpm while the axle precesses uniformly about the vertical at 60 rpm. If the distance between the bearings is 100 mm, find the resultant reaction at each bearing due to the mass and the gyroscopic effects. *10*

7. (a) A shaft 15 m long, supported in flexible bearing at the ends, carries two wheels each of 50 kg mass. One wheel is situated at the centre of the shaft and the other at a distance of 375 mm from the centre. The shaft is hollow, of external diameter 75 mm, internal diameter 40 mm, the density of the shaft material is 7700 kg/m^3 and its modulus of elasticity 200 GN/m^2. Find the lowest critical speed of the shaft, taking into account the height of the shaft itself. *10*

   (b) Explain the term "Critical speed of the shaft". *4*

8. Write short notes on any *two* of the following : *7+7*

   (a) Two-plane Balancing

   (b) Gyroscopic Stabilization

   (c) Flywheel Analysis

   (d) Balancing of Internal Combustion Engine

———