(DME 313)

B.Tech. DEGREE EXAMINATION, MAY - 2015

(Examination at the end of Third Year)

MECHANICAL ENGINEERING

Paper - III : Machine Dynamics

Time : 3 Hours **Maximum Marks : 75**

Answer question No.1 compulsory ***(15)***

Answer ONE question from each unit ***(4 × 15 = 60)***

1) Explain the following :

a) ISOCHRONISM.

b) Gyroscopic Torque.

c) PRONY Brake Dynamometer.

d) Dynamic Balancing.

e) Stability of a Governor.

UNIT – I

2) In a vertical double – acting steam engine, the connecting rod is 4.5 times the crank. The weight of the reciprocating parts is 120 kg and the stroke of the piston is 440 mm. The engine runs at 250 rpm. If the net load on the piston due to steam pressure is 25kN when the crank has turned through an angle of 120º from the top dead centre, determine the

i) thrust in the connecting rod.

ii) pressure on slide bars.

iii) tangential force on the crank pin.

iv) thrust on the bearings.

v) turning moment on the crankshaft.

OR

3) The length of a connecting rod of a gas engine is 500 mm and its centre of gravity lies at 165 mm from the crank pin centre. The rod has a mass of 80 kg and a radius of gyration of 182 mm about an axis through the centre of mass. The stroke of piston is 225 mm and the crank speed is 300 rpm.

Determine the inertia force on the crank shaft when the crank has turned a) 30º and b) 135º from the inner dead centre.

UNIT - II

4) Discuss in brief the following :

a) Balancing of Locomotives.

b) Hammer blow.

c) Swaying couple.

d) Slider – Crank mechanism.

e) Dynamic Balancing.

OR

5) Derive an expression for secondary force while balancing V-engines. Explain with a neat sketch.

UNIT - III

6) a) Derive an expression for power using Belt Transmission Dynamometer with neat sketch.

b) Following data refers to a rope brake dynamometer.

Brake drum radius	=	120 cm
Radius of rope (r_1)	=	10 cm
Dead laod (w)	=	2500 N
Spring balance (s)	=	400 N
Speed N	=	300 RPM

Determine brake power, indicated power and frictional power if mechanical efficiency is 80%.

OR

7) a) Explain with neat sketches, the Gyroscopic effect on Naval ships.

b) A motor cycle and its rider together have a mass of 200 kg and their centre of gravity is 0.6 m above the ground level when the motor cycle is upright. Each road wheel is 0.6m diameter and has a moment of inertia 1kgm^2. The rotating parts of the engine have a moment of inertia 0.17kgm^2. The engine rotates at 5.5 times the speed of the road wheels and in the same sense. Determine the angle of heel necessary when the motor cycle is rounding a curve of 30m radius at a speed of 55KPMH.

UNIT - IV

8) Each arm of a porter governor is 200mm long and is pivoted on the axis of the governor. The radii of rotation of the balls at the minimum and the maximum speeds are 120mm and 160mm respectively. The mass of the sleeve is 24kg and each ball is 4kg. Find the range of speed of the governor. Also determine the range of speed if the friction at the sleeve is 18N.

OR

9) In a spring loaded governor of Hartnell type the lengths of the horizontal and the vertical arms of the bell-crank lever are 40mm and 80mm respectively. The mass of each ball is 1.2kg. The extreme radii of rotation of the balls are 70mm and 105 mm. The distance of the fulcrum of each bell-crank lever is 75mm from the axis of rotation of the governor. The minimum equilibrium speed is 420 rpm and the maximum equilibrium speed is 4% higher than this. Neglecting obliquity of the arms,

Determine

a) The spring stiffness.

b) Initial compression and

c) Equilibrium speed corresponding to radius of rotation of 95mm.

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