

[4]

complete period is 32 sec. The turbine rotor is of mass of 600 kg ; its radius of gyration is 45 cm and it is rotating at 2400 r.p.m. Calculate the maximum value of the gyroscopic couple set up by the rotor. If the rotation of the rotor is clockwise when looking from stern, in which direction will the ship tend to turn while the bow is falling ? What is the maximum angular acceleration to which the ship is subjected to while pitching ? 10

Total No. of Questions : 8] [Total No. of Printed Pages : 4

Roll No.

ME-501(O)

B. E. (Fifth Semester) EXAMINATION, June, 2010

(Old Scheme)

(Mechanical Engg. Branch)

DYNAMICS OF MACHINE

[ME-501(O)]

Time : Three Hours

Maximum Marks : 100

Minimum Pass Marks : 35

Note : Attempt any *five* questions. All questions have equal marks.

1. (a) State and explain D' Alembert's principle. 10
 (b) The connecting rod of a vertical reciprocating engine is 2 m long between centres and weights 250 kg. The mass centre is 800 mm from the big end bearing. When suspended as a pendulum from the gudgeon pin axis, it makes 8 complete oscillations in 22 seconds. Calculate the radius of gyration of the rod about an axis through its mass centre. 10
2. (a) Derive an expression for the angular acceleration of the connecting rod of a reciprocating engine. 10
 (b) A three-cylinder single-acting engine has crank at 120° . The turning moment diagram for each cycle is

triangle for the power stroke with a maximum torque of 60 N.m at 60° after the dead centre of the corresponding crank. There is no torque on the return stroke. The engine runs at 400 r.p.m. Determine the : 10

- (i) Power developed
 - (ii) Coefficient of fluctuation of speed if the mass of the flywheel is 10 kg and radius of gyration is 88 mm
 - (iii) Coefficient of fluctuation of energy
3. (a) Define the following terms as applied to governors : 10
- (i) Sensitiveness
 - (ii) Hunting
 - (iii) Stability
 - (iv) Governor effort
 - (v) Equilibrium speed
- (b) Explain the principle and working of a centrifugal governor. 10
4. (a) Explain the method of finding the counter mass in two planes to balance the dynamic unbalance of rotating masses. 10
- (b) A single cylinder horizontal engine runs 120 r.p.m. The stroke is 54 cm, mass of revolving parts, assumed concentrated at crank pin is 100 kg and the mass of reciprocation parts is 150 kg. Determine the magnitude of balance mass required, assuming that its centre of gravity is 21 cm from the centre of crank-shaft. Calculate the maximum value of the unbalanced horizontal and vertical forces. $C = 2/3$ is

given, where C is fraction of fraction of reciprocating mass to be balanced. 10

5. (a) What do you understand by a primary unbalanced force and a secondary unbalanced force ? How do they differ from each other ? 10
 - (b) Four masses A, B, C, D carried by a rotating shaft at radii 80 mm, 100 mm, 160 mm, and 120 mm respectively are completely balanced. Masses B, C, and D are 8 kg, 4 kg, and 3 kg respectively. Determine the mass A and the relative angular positions of the four masses if the planes are spaced 500 mm apart. 10
6. (a) What do you understand by whirling of shaft ? What is whirling or critical speed ? Explain. 10
- (b) A machine part having a mass of 2.5 kg vibrates in a viscous medium. A harmonic exciting force of 30 N acts on the parts and causes a resonant amplitude of 14 mm with a period of 0.22 second. Find the damping coefficient. If the frequency of the exciting force is changed to 4 Hz, determine the increase in the amplitude of the forced vibrations upon the removal of damper. 10
7. (a) What is Cam ? What type of motion can be transmitted with a cam a follower combination ? What are its elements ? 10
- (b) Explain in what way the gyroscopic couple affects the motion of an aircraft while taking a turn. 10
8. (a) Explain the gyroscopic effect on four-wheeled vehicles. 10
- (b) A ship is pitching through a total angle of 15° , the oscillation may be taken as simple harmonic and