

MANIPAL

(A constituent unit of MAHE, Manipal)

IV SEMESTER B.TECH. (MECHANICAL ENGG.)

END SEMESTER MAKE-UP EXAMINATIONS, JUNE 2018

SUBJECT: DYNAMICS OF MACHINERY [MME 2203]

REVISED CREDIT SYSTEM

Time: 3 Hours

MAX. MARKS: 50

Instructions to Candidates:

- ✤ Answer ALL the questions.
- Missing data may be suitably assumed.
- **1A.** For the mechanism shown in figure 1A, determine the torque that must be applied to cam shaft to overcome a horizontal force P acting at the midpoint of link 5. $O_5D=50$ mm, $O_5E=25$ mm, AB=15 mm, $O_3B=15$ mm. Angle CAD is 50° and ADC is 45° respectively. All dimensions are in mm. (Draw the configuration, free body and analysis diagrams)



Figure 1A

1B. For the mechanism shown in figure 1B, determine the toque that must be applied on crank 2 for maintaining static equilibrium. $O_2A = 40$ cm, AB = 90 cm, AC = 24 cm. All dimensions are in cm. (Draw the configuration, free body and analysis diagrams)



Figure 1B

- 2A. A structural member is under the action of three forces. State the necessary conditions for that member to be in static equilibrium.
- **2B.** Derive an expression (Analytical method) to determine the crank effort for a **04** single cylinder I.C. engine.
- 2C. A single cylinder, single acting 4 stroke cycle gas engine has a piston diameter of 33 cm & a stroke of 60 cm. Mean speed = 200 rpm. Mean pressures in the cylinder above atmosphere are as follows: Suction stroke = 0.7 N/cm² below atmosphere, Compressions stroke = 20 N/cm², Expansion stroke = 70 N/cm², Exhaust stroke = 1.4 N/cm². Assuming constant resistance and minimum and maximum speed to occur at the beginning and end of expansion stroke, determine the moment of inertia of flywheel if total fluctuation of speed is not to exceed 1% of mean speed. Find also the drop in speed which will then occur during a cycle in which there is no admission.
- **3A.** Explain the significance of different types of flywheels with neat sketch. **02**
- 3B. A five cylinder inline engine running at 500 rpm has successive cranks at 144° apart as shown in figure 3B. The distance between the cylinder centrelines is 300 mm. Piston stroke = 240 mm. Length of connecting rod = 480 mm. Examine the engine for balance of primary and secondary forces and couples, taking central plane as a reference. Reciprocating mass of each cylinder is 150 N. Solve using graphical method.



Figure 3B

- **3C.** A shaft is attached with 5 masses A, B, C, D and E revolving in the same planes at equal radii. The magnitude of the masses are A = 20 Kg, B = 10 Kg, C = 16 Kg, D = d Kg, E = e Kg. The angular positions of B, C, D and E measured in the same direction from A are 60° , 135° , 210° and 270° . Determine the magnitude of the masses D and E.
- **4A.** Explain the concept of balancing of reciprocating masses with neat sketch. **04**
- **4B.** Derive an expression to determine the height of a proell governor.
- 4C. In a Porter governor, each of the four arms is 400 mm long. The upper arms are pivoted on the axis of the sleeve whereas the lower arms are attached to the sleeve at a distance of 45 mm from the axis of rotation. Each ball has a mass of 8 kg and the load on the sleeve is 60 kg. Determine the equilibrium speeds and the range of speed for the two extreme radii of 250 mm and 300 mm of rotation.
- **5A.** State and explain the significance of the following with respect to centrifugal **02** governor: (i). Controlling force (ii). Effort
- 5B. A boat is operated by a steam turbine which rotates at 3100 rpm in the clockwise direction when looking from the bow end. What will be the magnitude and effect of gyroscopic couple acting on the boat when the boat travels towards port side along a circular path making one complete revolution in 15 seconds? The moment of inertia of rotating parts of the turbine is 515 Kg-m². How the gyroscopic effect would change, if boat was to travel towards starboard side.
- **5C.** Explain the concept of stabilization of an automobile with neat sketch. **04**

03