Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

IV SEMESTER B.TECH (MECHANICAL ENGG.) END SEMESTER EXAMINATIONS, APRIL 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 on crank OA to maintain static equilibrium. OA=75 mm, AC=100mm, CD=110mm, BC=60mm, OQ=215 mm. BQ =60 mm and is horizontal. All dimensions are in mm. (Draw the configuration, free body and analysis diagrams) **05**

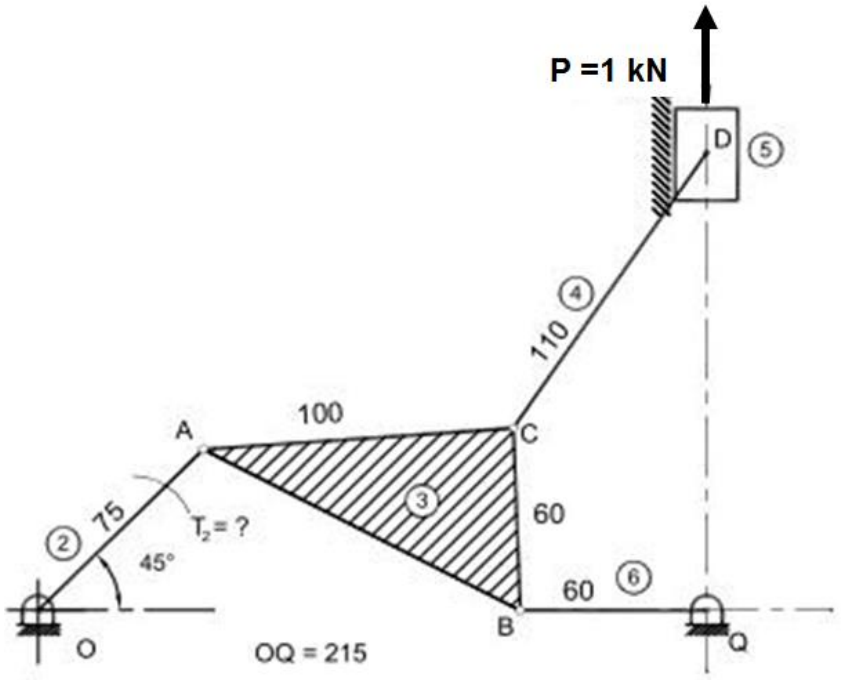

Figure 1A

1B. For the mechanism shown in figure 1B, find the toque that must be applied on crank 2 for static equilibrium. OA =250 mm, AB = 650 mm, Link OA is inclined at 60^0 to horizontal. Vertical distance between point O and B is 50 mm. Angle CAB =35^0 and Angle CBA = 30^0. All dimensions are in mm. (Draw the configuration, free body and analysis diagrams) **05**

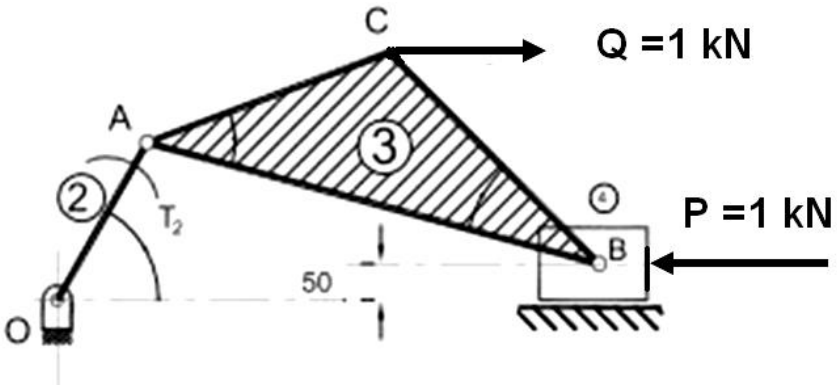

Figure 1B

2A. A structural member is under the action of two forces and a torque. State the necessary condition for that member to be in static equilibrium. **02**

2B. With neat sketches describe the effect of various forces acting on the turning moment diagram of a single cylinder I.C. Engine. **04**

2C. Find the weight of flywheel needed by a machine to punch 22 mm holes in 18 mm steel plates. The machine is to make 30 revolutions per minute and is to be capable of punching a hole every revolution. The hole is to be formed during 30° of rotation of crankshaft of the punch. The crank shaft is to be connected to the fly wheel shaft by a gear train of 12:1 ratio so that the maximum rpm of flywheel will be 12 times that of the machine. Assume mechanical efficiency to be 85%. Minimum speed of flywheel is to be 90% of the maximum. Mean diameter of flywheel rim is 1 m. Ultimate shear strength of the plate is 35,000 N/cm^2. **04**

3A. Derive an expression to correlate the mean kinetic energy, coefficient of fluctuation of energy and coefficient of fluctuation of speed. **02**

3B. The following data refers to a four cylinder symmetrical engine which is in complete primary balance. Mass of reciprocating parts attached to intermediate cranks = 500 kg. Angle between intermediate cranks = 90° as shown in figure 3B. Distance between centerlines of intermediate cranks = 50 cm. Distance between centerlines of extreme cranks = 200 cm. Length of each crank = 25 cm. Connecting rod length = 100 cm. Estimate the reciprocating mass attached at extreme cranks and their relative angular position. If the engine runs at 300 rpm, determine and draw the position of secondary cranks. Solve using graphical method. **06**

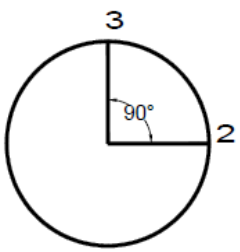

Figure 3B

3C.	Three cylinders of an air compressor have their axes at 120° to one another and their connecting rods are coupled to a single crank. The stroke is 10 cm and length of connecting rod is 15 cm. Mass of reciprocating parts per cylinder is 1.5 kg. Using direct and reverse crank method determine the secondary forces of the engine running at 3000 rpm.	**02**
4A.	Derive an expression to determine the primary disturbing forces in case of V-engines.	**04**
4B.	Derive an expression to determine the spring stiffness for a hartnell governor.	**03**
4C.	A porter governor has equal arms each 200 mm long and pivoted to the axis of rotation. Each fly ball has a mass of 3 kg and mass of the sleeve is 15 kg. When the radius of rotation of the fly balls is 120 mm, the sleeve begins to rise and reaches maximum speed at radius of rotation of 160 mm. Determine the (i). Range of speed (ii). Lift of the sleeve (iii). Effort of the governor (iv). Power of the governor.	**03**
5A.	State and explain the significance of the following with respect to centrifugal governor: (i). Hunting (ii). Isochronism	**02**
5B.	The propeller shaft of an aeroplane rotates at 3000 rpm. The direction of rotation is clockwise when looking from the front end of the aircraft. The rotary engine of the aircraft has a mass of 300 kg. Determine gyroscopic couple acting on the aeroplane when the plane travels at a speed of 360 km/h and takes a turn to the right along a circular path of 100 m radius. Also explain the effect of gyroscopic couple on the aircraft. Take radius of gyration of the rotating parts = 0.314 m.	**04**
5C.	Explain the concept of gyrostabilizers of ships with neat sketch.	**04**