Fifth Semester B.E. Degree Examination, June/July 2015 Dynamics of Machines

Time: 3 hrs. Max. Marks: 100

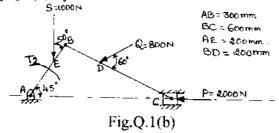
Note: Answer any FIVE full questions, selecting atleast TWO questions from each part.

PART - A

- 1 a. State the conditions for a link to be in equilibrium:
 - When two forces act
- ii) When three forces at
- iii) When four forces act
- iv) When two forces and a torque acts.

(08 Marks)

b. Determine the couple T₂ (shaft torque) on the input link AB for static equilibrium of the mechanism shown in Fig.Q.1(b) by virtual work method. (12 Marks)



- 2 a. Explain the following terms with respect to I.C. engine:
 - i) Piston effort
 - ii) Force acting along the connecting rod
 - iii) Crank pin effort
 - iv) Crank effort.

(08 Marks)

- b. A vertical double acting steam engine has a cylinder 300mm diameter and 450mm stroke and runs at 200rpm. The reciprocating parts has a mass of 225kg and the piston rod is 50mm diameter. The connecting rod is 1.2m long. When the crank has turned through 125° from the top dead centre, the steam pressure above the piston is 30kN/m² and below the Piston is 1.5 kN/m². Calculate the effective turning moment on the crank shaft. (12 Marks)
- 3 a. Draw the turning moment diagram of a single cylinder double acting steam engine.

(05 Marks)

b. The turning moment diagram for a four stroke gas engine may be assumed for simplicity to be represented by four triangles, the areas of which from the line of zero pressure are as follows: section stroke = $0.45 \times 10^{-3} \,\mathrm{m}^2$, compression stroke = $1.7 \times 10^{-3} \,\mathrm{m}^2$, expansion stroke = $6.8 \times 10^{-3} \,\mathrm{m}^2$, exhaust stroke = $0.65 \times 10^{-3} \,\mathrm{m}^2$. Each m^2 of area represents 3MN-m of energy.

Assuming the resisting torque to be uniform, find the mass of the rim of a flywheel required to keep the speed between 202 and 198 rpm. The mean radius of the rim is 1.2m. (15 Marks)

4 a. What do you mean cams with specified contours? Explain.

(03 Marks)

b. In a four stroke petrol engine, the crank angle is 4° after TDC, when the suction valve opens and 50° after BDC when the suction valve closes. The lift is 10mm, the nose radius is 2.5mm and the least radius of the cam 20mm. The shaft rotates at 600rpm. The cam is of the circular type with a circular nose and flanks while the follower is flat faced. Determine the maximum velocity, maximum acceleration and retardation of the valve. What is the minimum force exerted by the springs to overcome the inertia of moving parts weighing 250gm.

(17 Marks)

PART - B

- a. Explain briefly static balance and dynamic balance as applied to revolving masses in 5 different planes.
 - b. Four masses of magnitude 5, 6 M and 8kg revolve in planes A, B, C and D respectively. The planes B, C, D are placed at a distance 0.3m, 1.2m and 2.0m respectively from A. The masses are at same radii of 0.3m. Find the magnitude of M and relative angular position of (16 Marks) all masses for complete balance.
- a. What are In-line engines? State how they are balanced.

(06 Marks)

- b. The Pistons of a 4 cylinder vertical engine reach their uppermost position at 90° interval in order of their axial position. Pitch of cylinder = 0.35m, crank radius = 0.12m, length of connecting rod = 0.42m. The engine runs at 600 rpm. If the reciprocating parts of each engine has a mass of 2.5kg, find the unbalanced primary and secondary forces and couples. Take central plane of engine as reference plane.
- Explain the following terms with respect to governor: 7
 - Sensitiveness
 - Govern or effort ii)
 - Governor power iii)
 - iv) Hunting
 - Stability v)
 - Isochronous. vi)

(06 Marks)

- The radius of rotation of the balls of a hartnell governor is 8cm at the minimum speed of 300rpm. Neglecting gravity effect determine the speed after the sleeve is lifted by 6cm, also determine the initial compression of the spring, governor effort and power. The particulars of the governor are, length of ball arm = 15cm, length of sleeve arm = 10cm, mass of each (14 Marks) ball = 4kg and stiffness = 25000 N/m.
- Describe the effect of the gyroscopic couple on an aero plane for the following cases, with 8 vector diagram:

Case no.	Viewing from	Direction of rotation of propeller	Turn of the aero plane towards
	Nose	Clock wise	Left
	Nose	Counter clock wise	Left
	Nose	Clock wise	Right
	Nose	Counter clockwise	Right

b. Each road wheel of a motor cycle has a moment of inertia of 2kgm2. The rotating parts of the engine of the motor cycle has a moment of inertia of 0.2 kgm2. The speed of the engine is 5 times the speed of the wheel and is in the same sense. The mass of the motor cycle with rider is 200kg and its CG is 500mm above ground level. The diameter of the wheel is 50mm. The motor cycle is travelling at 15m/sec. on a curve of 30m radius. Determine: i) Gyro couple, centrifugal couple, overturning and balancing couple in terms of angle of heel and (08 Marks) ii) Angle of heel.