Reg.No. _____

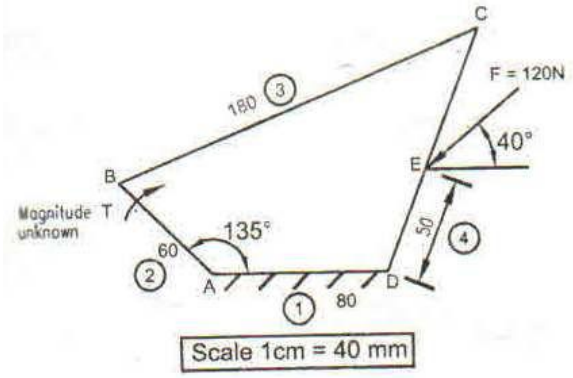
Karunya UNIVERSITY

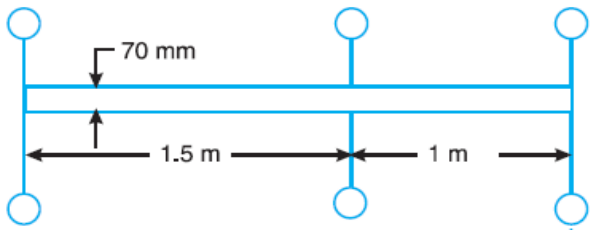
(Karunya Institute of Technology & Sciences)
(Declared as Deemed-to-be University under Sec.3 of the UGC Act, 1956)

End Semester Examination – Nov/Dec – 2016

Code : 14ME2027 **Semester : 2016-17 ODD**
Sub. Name : DYNAMICS OF MACHINERY **Duration : 3 hrs**
Max. marks : 100

ANSWER ALL QUESTIONS (5 x 20 = 100 Marks)

Q. No.	Sub Div.	Questions	Course Outcome	Marks
1.	a.	For the linkage shown in Fig (a), find all the constraint forces and the torque T required is F=120 N. The dimensions of the linkages are as follows: AB = 60 mm; BC = 180 mm; CD = 120 mm; AD = 80 mm and DE = 50 mm.  Fig (a)	CO 1	20
		(OR)		
2.	a.	The turning moment diagram for a multicylinder engine has been drawn to a scale of 1 mm = 600 N-m vertically and 1 mm = 3º horizontally. The intercepted areas above and below the mean torque line taken in order are +52, -124, +92, -140, +85, -72 and +107 mm^2, when the engine is running at a speed of 600 rpm. The total fluctuation of speed is not to exceed ± 1.5% of the mean speed, find the mass of the flywheel of radius 0.5 m.	CO 1	20
3.	a.	A shaft carries four masses A, B, C and D of magnitude 200 kg, 300 kg, 400 kg and 200 kg respectively and revolving at radii of 80 mm; 70 mm; 60 mm and 80 mm in planes measured from A at 300 mm; 400 mm and 700 mm. The angles between the cranks measured anticlockwise are A to B is 45º; B to C is 70º and C to D is 120º. The balancing masses are placed in planes X and Y. The distance between the planes A and X is 100 mm; between X and Y is 400 mm and between Y and D is 200 mm. If the balancing masses revolve at a radius of 100 mm, find their magnitudes and angular positions.	CO 2	20
		(OR)		
4.	a.	Three cranks of a three cylinder locomotive are all on the same axle and are set at 120º. The pitch of the cylinder is 1 m and the stroke of each piston is 0.6 m. The reciprocating masses are 300 kg for the inside cylinder and 260 kg for each outside cylinder, and the planes of rotation of the balance masses are 0.8 m from the inside crank. If 40% of the reciprocating parts are to be balanced, find the magnitude and position of the balancing masses required at a radius of 0.6 m.	CO 2	20
5.	a.	A shaft 50 mm diameter and 3 m long is simply supported at the ends and carries three loads of 1000 N, 1500 N and 750 N at 1 m, 2 m and 2.5 m from the left support. The Young's Modulus for the shaft material is 200 GN/m^2. Find the	CO 3	10

		frequency of transverse vibration.		
	b.	A coil of spring stiffness 4 N/mm supports vertically a mass of 20 kg at the free end. The motion is resisted by the dashpot. The amplitude at the beginning of the fourth cycle is 0.8 times the amplitude of the previous vibration. Determine the damping factor per unit velocity. Also find the ratio of frequency of damped and undamped vibrations.	CO 3	10
		(OR)		
6.	a.	Calculate the whirling speed of a shaft 20 mm diameter and 0.6 m long carrying a mass of 1 kg at its mid-point. The density of he shaft material is 40 Mg/m^3 and Young's modulus is 200 GN/m^2. Assume the shaft to be freely supported.	CO 3	10
	b.	The measurements on a mechanical vibrating system show that it has a mass of 8 kg and that the springs can be combined to give an equivalent spring stiffness of 5.4 N/mm. If the vibrating system has a dashpot attached, which exerts a force of 40 N/m/s; find (i) critical damping coefficient; (ii) damping factor; (iii) logarithmic decrement and (iv) ratio of two consecutive amplitudes.	CO 3	10
7.	a.	A steel shaft 1.5 m long is 95 mm in diameter for the first 0.6 m of its length, 60 mm in diameter for the next 0.5 m of length and 50 mm in diameter for the remaining 0.4 m of its length. The shaft carries two flywheels at its two ends; the first having a mass of 900 kg and 0.85 m radius of gyration located at the 95 mm diameter end and the second having a mass of 700 kg and 0.55 m radius of gyration located at the other end. Find the location of the node and the natural frequency of free torsional vibration of the system. The modulus of rigidity of the shaft material is 80 GN/m^2.	CO 3	20
		(OR)		
8.	a.	A single cylinder engine drives a centrifugal pump. The rotating mass of the engine, flywheel and the pump with the shaft is equivalent to a three rotor system as shown in the Fig (b). The mass moment of inertia of the rotors A, B and C are 0.15; 0.3 and 0.09 $kg-m^2$. Find the natural frequency of the torsional vinbrations. The modulus of rigidity of the shaft material is 84 kN/mm^2.  Fig (b)	CO 3	20
		Compulsory:		
9.	a.	The arms of a porter governor are each 250 mm long and pivoted on the governor axis. The mass of each ball is 5 kg and the mass of the central sleeve is 30 kg. The radius of rotation of the ball is 150 mm when the sleeve begins to rise and reaches 200 mm for the maximum speed. Find the speed range of the governor.	CO 4	20

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