BME503

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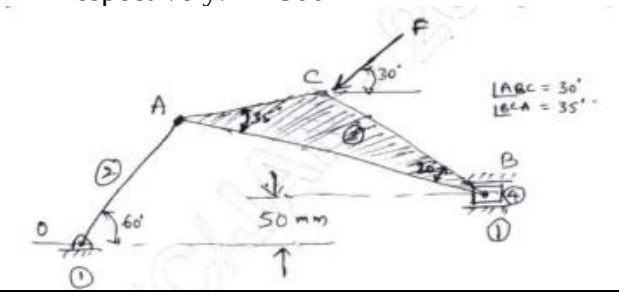
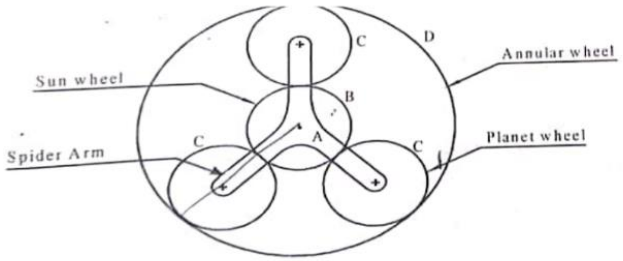
Model Question Paper 2022-23 (CBCS Scheme)
Fifth Semester B.E. Degree Examination (Mechanical Engineering)
THEORY OF MACHINES

TIME: 03 Hours **Max. Marks: 100**

Note: 01. Answer any FIVE full questions, choosing at least ONE question from each MODULE

		Module -1	Bloom's Taxonomy Level	Marks	CO
Q.01	**a**	Define the following: (1) Mechanism (ii) Machine (iii) Link (iv) Inversion (v) Degree of freedom	**L2**	**10**	**CO1**
	b	Explain any three inversions of four-bar kinematic chain, with neat sketch.	**L3**	**10**	**CO1**
		OR			
Q.02	**a**	Explain with a neat diagram, the crank and slotted lever mechanism	**L2**	**6**	**CO1**
	b	Distinguish between machine and structure	**L2**	**4**	**CO1**
	c	In a Slider crank mechanism, the crank OB is 30 mm long and the connecting rod BC=120 mm long. The crank rotates at a uniform speed of 300 rpm clockwise about crank position ∠BOC=60 degree, draw the configuration and find (i) Velocity of position C and angular velocity of connecting rod BC (ii) Acceleration of Piston C and angular acceleration of connecting rod BC.	**L3**	**10**	**CO1**
		Module-2			
Q.03	**a**	The turning moment diagram for a multi cylinder engine has been drawn to a scale of 1 mm = 600 N-m vertically and 1 mm = 3° horizontally. The intercepted areas between the output torque curve and the mean resistance line taken in order from one end are as follows +52, -124 , +92, -140, +85 -72 and +107 mm^2, when the engine is running at a speed of 600 rpm. If the total fluctuation of speed is not to exceed ±1.5 of the mean, find the necessary mass of the flywheel of radius 0.5 m.	**L3**	**10**	**CO2**
	b	Obtain an expression for the Mass and Hoop stress developed in the rim of fly wheel	**L3**	**10**	**CO2**
		OR			
Q.04	**a**	For the mechanism shown in fig find the required input torque for static equilibrium. The length of OA and AB are 250 mm and 650 mm respectively. F= 500 N 	**L3**	**10**	**CO2**
	b	When the crank is 45 degree from the inner dead centre on the down stroke, the effective steam pressure on the piston of a vertical steam engine is 2.5 bars. The diameter of the cylinder = 0.75 m, Stroke of the piston = 0.50 m and length of the connecting rod = 1 m. Determine the torque on the crank shaft, if the engine runs at 350 rpm and the mass of the reciprocating parts is 200 kg.	**L3**	**10**	**CO2**

Module-3					
Q. 05	**a**	Derive the expression for length of path of contact and arc of path of contact for involute gears.	**L2**	**10**	**CO3**
	b	Two gear wheel mesh externally and are to give a velocity ratio of 3. The teeth are of involute formal module 6mm and standard addendum one module. Pressure angle = 18°. Pinion rotates at 90 rpm. Find (i) Number of teeth on each wheel so that interference is just avoided (ii) Length of path of contact (iii) Length of arc of contact (iv) Maximum velocity of sliding between teeth. (v) Number of pair of teeth in contact	**L3**	**10**	**CO3**
OR					
Q. 06	**a**	Explain in details any 3 types of gear train with a neat sketch	**L2**	**10**	**CO3**
	b	An epicyclic gear train of sun and planet type is shown in Fig. The pitch diameter of internally ted ring D is approximately 228 mm and the module is 4 mm. When the ring is stationary, the spider A which carries three planet wheels C of equal size is to make one revolution for every five revolutions of the spindle carrying the sun wheel B. Determine suitable number of teeth for the entire wheel and the exact pitch orde diameter of ring D. If a torque of 30 Nm is supplied to the sun-wheel B, what will be the torque required to keep the ring stationary? 	**L3**	**10**	**CO3**
Module-4					
Q. 07	**a**	Derive an expression for equilibrium speed of porter governor.	**L2**	**10**	**CO4/ CO5**
	b	The arms of a Porter governor are 300mm long. The upper arms are pivoted on the axis of rotation and the lower arms are attached to the sleeve at a distance of 35 mm from the axis of rotation. The mass of the sleeve is 54kg and the mass of each ball is 7 kg. Determine the equilibrium speed when the radius of rotation of the ball is 225mm. What will be the range of speed for this position, if the frictional resistance to the motion of the sleeve is equivalent to a force of 30N at the sleeve?	**L3**	**10**	**CO4/ CO5**
OR					
Q. 08	**a**	The radius of rotation of the balls of a Hartnell governor is 80 mm at the minimum speed of 300 r.p.m. Neglecting gravity effect, determine the speed after the sleeve has lifted by 60 mm. also determine the initial compression of the spring, the governor effort and the power. The particulars of the governor are given below: Length of ball arm = 150 mm, length of sleeve arm = 100 mm, mass of each ball = 4 kg and stiffness of the spring = 25 N/mm.	**L2**	**10**	**CO4/ CO5**
	b	Define balancing and Explain in detail static and dynamic balancing with an example.	**L3**	**10**	**CO4/ CO5**

Module-5					
Q. 09	**a**	Define the terms used in vibration system i. Natural frequency ii. Resonance iii. Amplitude of vibration iv. SHM v. Damping	**L2**	**10**	**CO6**
	b	Derive an expression of natural frequency for simple pendulum	**L3**	**10**	**CO6**
OR					
Q. 10	**a**	Define logarithmic decrement. Obtain an expression for logarithmic decrement.	**L2**	**10**	**CO6**
	b	Explain in detail with a neat sketch different types of damping system.	**L3**	**10**	**CO6**