Model Question Paper-1/2 with effect from 2022-23 (CBCS Scheme)

USN

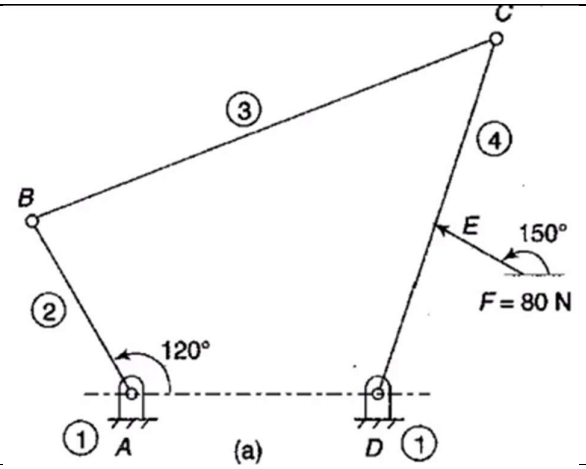
Fourth Semester B.E. Degree Examination

Subject Title: 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	BTL	Marks
Q.01	a	Define the following: i) Kinematic pair, ii) Kinematic Chain iii) Mechanism iv) Structure v) Machine vi) Inversion	L1	6
	b	Explain with neat sketch quick return mechanism.	L2	8
	c	Describe with neat sketches inversions of single slider crank chain.	L1	6
		OR		
Q.02	a	Define linear and angular acceleration.	L1	4
	b	A four bar mechanism has a fixed link AD = 1m driving crank AB = 0.3m, follower link CD = 0.6 m & the connecting link 1.2 m. The crank rotates at 300 rpm, clockwise, with an angular acceleration of 200 rad/sec^2 anticlockwise direction. When the angle made by the crank with the fixed link is 135 degree, in the anit-clockwise direction, determine • Angular velocity of link BC • Angular acceleration of CD	L4	16
		Module-2		
Q. 03	a	What is Interference? Explain the method of avoiding it	L1	10
	b	Two gear wheels mesh externally are to give a velocity ratio of 3. Involute teeth are of 6mm module and of 20 degree pressure angle. Addedndum is one module and the pinion rotates at 400 rpm. Calculate the number of teeth on each gear, to aviod interference, length of arc of contact, maximum velocity of sliding, arc of contact and contact ratio	L4	10
		OR		
	a	Draw the profile of a cam operatinig a roller reciprocating follower and with the following data : Minimum radius of cam = 25mm Lift = 30mm Roller diameter = 15mm The cam lifts the follower for 120° with SHM, followed by a dwell period of 30°. Then the follower lowers down' during 150° of cam rotation with uniform acceleration and retardation followed by a dwell. period. If the cam rotates at a uniform speed of 150 rpm. Calculate the maximum velogity and acceleration of follower during the descent period.	L4	20
		Module-3		
Q. 05	a	Explain with an example the static force analysis of machinery.	L2	(6
	b	Determine the various forces on the links shown in figure	L4	(14

				
		OR		
Q. 06	a	Explain D'Alemberts principle.	L1	4
	b	Explain briéfly four body mechanism with free body diagram List and-éxplain the important force & acting on the reciprocating parts of an engine.	L2	16
		Module-4		
Q. 07	a	Derive the equation for size of flywheel or hoop stress developed in a flywheel.	L3	8
	b	The turning moment diagram for a petrol engine is drawn to the following scales: Turning moment, 1 mm = 5 N-m; crank angle, 1 mm = 1°. The turning moment diagram repeats itself at every half revolution of the engine and the areas above and below the mean turning moment line taken in order are 295, 685, 40, 340, 960, 270 mm2. The rotating parts are equivalent to a mass of 36 kg at a radius of gyration of 150 mm. Determine the coefficient of fluctuation of speed when the engine runs at 1800 rpm.	L4	(12
		OR		
Q. 08	a	With neat figure explain Porter govenor	L2	8
	b	Write the classification of governors and compare between functions of flywheel and governors	L1	12
		Module-5		
Q. 09	a	A flat foot step bearing 300mm in diameter supports a load of 10kN. If the coefficient of friction is 0.1 and speed of the shaft is 60 rpm, find power lost in friction, assuming : 1) Uniform pressure. ii) Uniform wear.	L4	(6
	b	In a thrust bearing, the external and the internal diameter of the contact surface are 300mm and 200mm respectively. The total axial load is 100 kN and the intensity of pressure is 250 kN /m" The. speed of the shaft is 500 rpm and the coefficient of friction = 0.05. Calculate i) Number of collars required ii) Power lost to fiiction, assuming uniform pressure theory.	L4	(14
		OR		
Q. 10	a	Derive an expression for length of closed belt drive.	L4	(8
	b	Belt of 100mm width 4nd 10mm thick is transmitting power at 1000 m/min. The net driving tension is 1.8 times the tension on the slack side. If the safe permissible stress is 4 MPa, calculate the magimum power that can be transmitted at this speed. Assume the density of leather as 1200 kg/m^3. Also calculate the absolute max. power that can be transmitted by this belt and the speed at which this can be transmitted and the percentage increase in the power.	L4	(12

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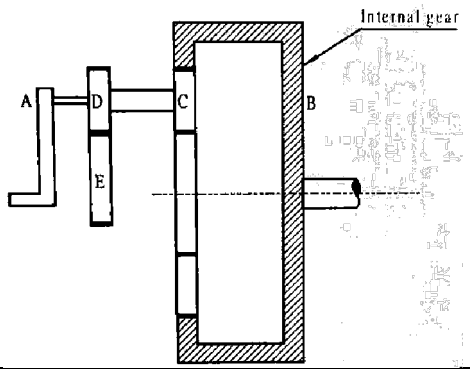
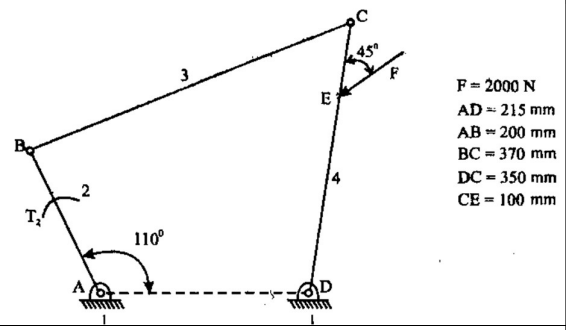
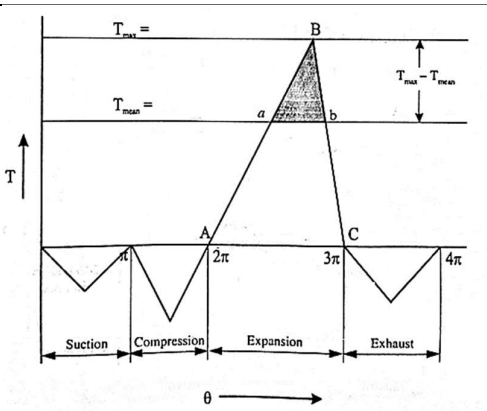
Note: 01. Answer any **FIVE** full questions, choosing at least **ONE** question from each **MODULE**.

		Module -1	BTL	Marks
Q.01	a	Conclude Inversions of double slider crank chain mechanism applied to elliptical trammel	L4	6
	b	What is quick return motion? Explain with neat sketch crank and slotted lever mechanism.	L1	8
	c	Illustrate Kinematic Pair and Mechanism	L3	6
OR				
Q.02	a	Define linear and angular acceleration.	L1	4
	b	A four bar mechanism ABCD is made up of four links, pin jointed at ends. AD is a fixed link which is 180m long. The links AB, BC, and CD are 90mm, 120mm and 120mm long respectively. At certain instant, the link AB makes an angle of 60^0 with the link AD. If the link AB rotates at a uniform speed OF 100RPM clockwise determine: i) angular velocity of the links BC and CD ii) Angular acceleration of the links CD and CB.	L4	16
		Module-2		
Q. 03	a	In figure the fixed annular wheel B have 92 teeth. Wheel C and D have 25 and 15 teeth respectively. Wheel E = 52 teeth. If the arm A rotates at 130 rpm, solve this for speed of E. 	L3	10

	b	Analyze the Tabular column method for calculating gear speeds by taking simple epicyclic gear train as an example	L4	10
		OR		
Q.04	a	Give the classification of cam types.	L2	3
	b	What is the advantage of using offset follower over in-line follower ?	L1	3
	c	From the following data, draw the profile of a cam in which the follower moves with simple harmonic motion during ascent while it moves with uniformly accelerated motion during descent : Least radius of cam = 50 mm ; Angle of ascent = 48° ; Angle of dwell between ascent and descent = 42° ; Angle of descent = 60° ; Lift of follower = 40 mm ; Diameter of roller = 30 mm ; Distance between the line of action of follower and the axis of cam = 20 mm	L3	14
		Module-3		
Q. 05	a	Analyze the Equilibrium of Engine mechanism	L4	10
	b	In a four bar mechanism shown, calculate required value of T2 and various forces on links for the equilibrium of the system. 	L3	10
		OR		
Q. 06	a	Explain D'Alemberts principle and state why it is used.	L4	8
	b	The radius of crank of a horizontal engine is 300 mm. The mass of the reciprocating parts is 200 kg. The difference between driving and back pressure is 0.4 N/mm2 when the crank has travelled 600 from I.D.C. The length of connecting rod is 1.2 m and the cylinder bore is 0.5 m. The engine runes at 240 rpm. Neglecting the effect of piston rod, find (a) Pressure on the slide bar, (b) thrust in the connecting rod, (c) tangential force, and (d)Turning moment on the crankshaft.	L1	12
		Module-4		
Q. 07	a	Conclude TMD of 4 stroke IC engine with suitable diagram	L4	10

	b	The TMD for a four stroke gas engine may be assumed for simplicity to be represented by 4 triangles the area of which from the line of zero pressure as follows. Expansion = 35.5 cm2, suction = 3.5 cm2, Exhaust = 5 cm2, compression = 14 cm2. Each sq-cm represents 295 Nm of work. Assuming the resisting moment to be uniform, find the mass of the rim of the flywheel required to keep the mean speed 200rpm within ±2% of the mean speed. Radius of the rim may be taken as 75cm. 	L1	10
		OR		
Q. 08	a	Compare flywheel and Governor	L4	10
	b	Derive the equation for speed and height of the Porter governor by resolution of forces	L3	10
		Module-5		
Q. 09	a	Derive the equation of total frictional torque flat collar bearing by considering uniform pressure	L3	10
	b	A flat foot step bearing 300mm in diameter supports a load of 10kN. If the coefficient of friction is 0.1 and speed of the shaft is 60 rpm, find the power lost in friction, assuming a) uniform pressure b) uniform wear	L1	10
		OR		
Q. 10	a	Derive an expression for length of open belt drive.	L3	10
	b	A rope drive is to transmit 250kW from a pulley of 1000mm diameter running at a speed of 250rpm. The semi groove angle is 22.5ºand the angle of lap is 180º. The ropes used are 50mm diameter and their mass is 1.3kg per meter length. Each rope has a safe maximum pull of 2000N. The coefficient of friction between rope and pulley is 0.3. Find the number of ropes required.	L1	10