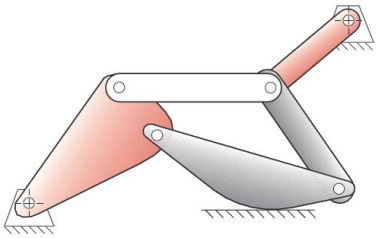
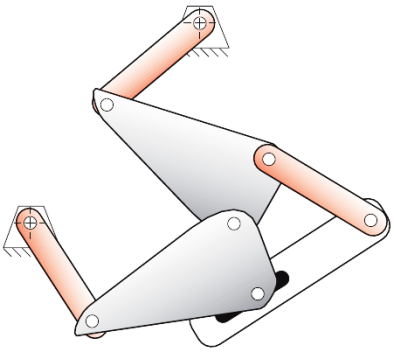
Reg. No.										

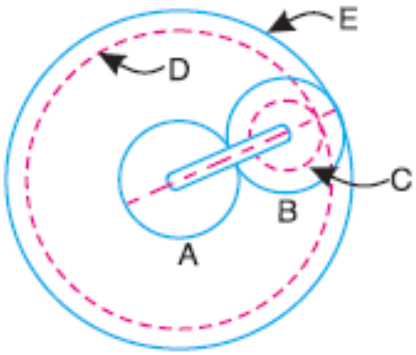
MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

DEPARTMENT OF MECHATRONICS
I SEMESTER M.TECH. INDUSTRIAL AUTOMATION & ROBOTICS
END SEMESTER EXAMINATIONS, NOVEMBER/DECEMBER 2023
SUBJECT: MACHINES AND MECHANISM [MTE 5410]
(Date:30/11/2023)

Time: 3 Hours **MAX. MARKS: 50**

Instructions for the Candidates:
- Answer **ALL** questions.
- Data did not provide any, may be suitably assumed.

Q. No		M	CO	PO	LO	BL
1A	Summarize why there is a need to balance the rotating masses. enumerate the various ill effects of unbalanced rotating masses in machinery.	**3**	**3**	**5**	**1**	**2**
1B	Illustarte why are parallel-crank four-bar linkage and deltoid linkage considered special cases of four-link mechanism. Support your answer with Grashof's law.	**3**	**1**	**4**	**1**	**3**
1C	Calculate the mobility of the linkages shown in Fig.1C(i) and Fig.1C(ii) and identify the items as a mechanism, Structure, or preloaded structure  Fig.1C(i)  Fig.1C(ii)	**4**	**1**	**4**	**2**	**3**
2A	Elaborate on an electronic camming technology utilized for synthesizing intricate motion and their control.	**3**	**2**	**4**	**1**	**2**
2B	Illustrate a straight-line mechanism extensively used to prevent relative sideways motion between the axle and body of the car.	**3**	**1**	**5**	**3**	**4**
2C	Articulate the need to utilise Coriolis acceleration in the kinematics of mechanism and obtain an expression for the Coriolis component of acceleration.	**4**	**2**	**4**	**2**	**3**
3A	A shaft carries four masses A, B, C and D placed in parallel planes perpendicular to the shaft axis and in this order along the shaft. The masses	**5**	**3**	**5**	**3**	**4**

	B and C are 40kg and 28kg and both are at 160mm radius. While the masses in planes A and D are at 200mm radius. Angle between B and C is 100°, B and A is 190°, both angleare s measured in the same sense. Planes A and B are 250mm apart, B and C are 500mm apart. If the shaft is to be in complete balance, determine (i) masses in planes A and D, (ii) distance between planes C and D and (iii) angular position of mass D					
3B	Fig.3B shows an epicyclic gear train. Pinion A has 15 teeth and is rigidly fixed to the motor shaft. The wheel B has 20 teeth and gears with A and also with the annular fixed wheel E. Pinion C has 15 teeth and is integral with B (B, C being a compound gear wheel). Gear C meshes with annular wheel D, which is keyed to the machine shaft. The arm rotates about the same shaft on which A is fixed and carries the compound wheel B, C. If the motor runs at 1000 r.p.m., find the speed of the machine shaft. Estimate the torque exerted on the machine shaft, if the motor develops a torque of 100 N-m.  Fig.3B Epicyclic Gear	**5**	**4**	**5**	**2**	**4**
4A	PQRS is a four-bar chain with link PS fixed. The lengths of the links are PQ = 62.5 mm ; QR = 175 mm ; RS = 112.5 mm ; and PS = 200 mm. The crank PQ rotates at 10 rad/s clockwise. Draw the velocity and acceleration diagram when angle QPS = 60° and Q and R lie on the same side of PS. Find the angular velocity and angular acceleration of links QR and RS.	**6**	**2**	**4**	**3**	**5**
4B	Using the Analytical Approach obtain an expression for static balancing of rotating masses.	**4**	**3**	**5**	**3**	**4**
5A	How many DOF do the following Joints have? a. Your Knee b. Your Ankle c. Your Shoulder d. Your Hip	**2**	**1**	**4**	**1**	**2**
5B	Elaborate the phenomena of Creep in belt drives and enumerate the limitations of belt drives.	**3**	**4**	**5**	**1**	**2**
5C	Describe the differential gear mechanism and using the tabular method analyze the differential gear mechanism used in automobiles for its speed.	**5**	**4**	**4**	**3**	**5**