Seat No.: _____ *Enrolment No._____*

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – I • EXAMINATION – WINTER • 2014

Subject code: 2714701 **Date: 07-01-2015**

Subject Name: Concepts in Mechatronics Engineering

Time: 02:30 pm - 05:00 pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1	**(a)**	Give the types of kinematic pairs based on nature of relative motion with neat sketches and examples.	**07**
	(b)	Explain construction ,operating mechanism and working principle of D.C. motor.	**07**
Q.2	**(a)**	Explain construction and operating mechanism (with characteristics) of power MOSFET.	**07**
	(b)	Explain how a kinematic chain can be considered for different number of restraints.Give examples and sketch.	**07**
		OR	
	(b)	Refer Fig.1.Find degree of freedom.Comment on the result.	**07**
Q.3	**(a)**	Differentiate between open and cross belt drive.A shaft runs at 80 rpm and drives another shaft at 150 rpm through belt drive.The diameter of driving pulley is 600 mm.Determine the diameter of the driven pulley in the following cases.(i)neglecting belt thickness(ii)taking belt thickness as 5 mm(iii)consider for case (ii) the total slip of 4% (iv)assuming for case (ii) a slip of 2% on each pulley	**07**
	(b)	Explain construction and principle of relays with neat sketch.	**07**
		OR	
Q.3	**(a)**	Define various pitches for gear with neat sketch and related equations. Two spur gears have a velocity ratio of 1/3.The driven gear has 72 teeth of 8 mm module and rotates at 300rpm.Calculate the number of teeth and the speed of the driver.What will be the pitch line velocities?	**07**
	(b)	Explain construction and operating mechanism (with characteristics) of power diode.	**07**
Q.4	**(a)**	State the various considerations for material selection for designing any machine element.What are the basic loads and stresses for the mechanical design?Explain giving equations and sketch.	**07**
	(b)	A hollow circular column carries a projecting bracket which supports a load of 25 KN as shown in the Fig.2.The inner diameter of the column is 0.8 times of the outer diameter.The column is made of steel FeE 200(S_{yt}=200 N/mm^2)and the factor of safety is 4.The column is to be designed on the basis of maximum tensile stress and compression is not the criterion of failure.Determine the dimensions of the cross section of the column.	**07**
		OR	
Q.4	**(a)**	State the various factors to be considered for taking factor of safety while designing a machine element.	**07**
	(b)	Explain(i)torsion and (ii)bending type of load for a machine component with example and related equations.	**07**

Q.5	**(a)**	Give detailed classification of electrical motors.Draw schematic diagram of any one.	**07**
	(b)	Explain split phase motor,capacitance ,split phase motor and shaded pole motors.	**07**

OR

Q.5	**(a)**	Draw circuit diagram of series,shunt and compound motor and also explain the principle.	**07**
	(b)	Draw the symbols and explain double pole,single throw(DPST) and double pole double throw (DPDT) switches.	**07**

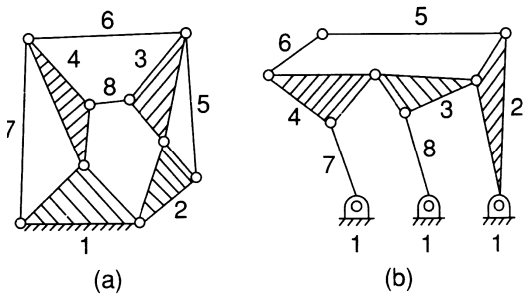

Fig 1, Q.2(b) OR

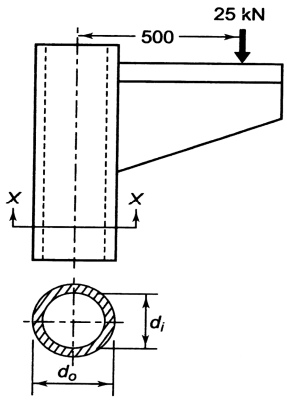

Fig 2,Q.4(b)

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