Ex/PG/EE/T/128A/2017

MASTER OF ELECTRICAL ENGINEERING EXAMINATION, 2017

(1st Year, 2nd Semester)

SMALL MACHINES, INCREMENTAL MOTION DEVICES AND ACTUATORS

Time : Three hours | Full Marks : 100

(50 marks for each Part)

Use a separate Answerscript for each Part

PART - I

No. of questions	Answer any three from the following. Two marks for neatness and well orgaised	Marks
Q1	Explain the design procedure to be followed for designing the main dimension of a PMDC Motor. And also design samarium –Cobalt and neodymium-iron-Boron PM materials poles. What measure can reduce the effect of armature reaction?	16
Q2	Develop output equation for designing SRM for a particular duty cycle and effiency and also select the length and diameter (inner) of the machines.	16
Q3	What are basic design factors to be considered for selecting slots, poles, phases and winding for a slotted stator design in BLDC motor? What measure can reduce cogging effect?	16
Q4	What are the basic consideration to be taken for stepper motor application for open loop incremental motion control system?. Discuss the factors affecting stepper motor design depending on application and also give the design guide lines for calculating the main dimensions of a stepper motor.	16
Q5	Explain the design procedure for designing a small D.C PM motor for high speed application rotating from 5000 rpm to 10,000 rpm. Also discuss the materials used for construction of small d.c motor for better commutating performance and continues, short –time duty.	16

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M.E. ELECTRICAL ENGINEERING - FIRST YEAR - SECOND SEMESTER

(1st / 2nd Semester/Repeat/Supplementary/Annual/Bi-Annual)

SUBJECT: - SMALL MACHINES, INCREMENTAL MOTION DEVICES AND ACTUATORS

Time: Three hours

Full Marks 100
(50 marks for each part)

Use a separate Answer-Script for each part

No. of Questions	PART II	Marks
	Answer any three Questions Two marks are for neat and systematic answers	
Q6.	a) Mention some industrial applications of BLDC machines and enumerate its advantage/disadvantages over cage type induction machines for one such application.	4+4
	b) Deduce the expression of induced EMF and torque in a BLDC machine.	8
Q7.	a) Using the model equations of a BLDC machine, develop the control block diagram and show that BLDC motor is inherently stable for speed control applications.	5+5
	b) Explain how current and speed feedback can be taken in a BLDC Drive system.	6
Q8.	a) Draw and explain the schematic diagram of CSI fed BLDC Drive system and indicate the differences of the same from a VSI fed system of equivalent rating.	7+5
	b) Comment on the type of semiconductor switches that can be used in a BLDC drive system.	4
Q9.	a) What is commutation torque ripple? With the help of the machine model equations, show that when the phase resistances are neglected the commutation torque ripple can be zero at a particular speed, but can exist at the other speeds. Draw neat sketches wherever necessary.	2+8
	b) Draw and explain the schematic diagram of a three phase BLDC drive system using three semiconductor switches.	6
Q.10	a) Explain how a Buck converter can be used for speed control of BLDC motor. Draw neat sketch of the scheme and comment on its performance over VSI fed scheme.	6+4
	b) Explain why a PI controller in speed loop is used for a buck converter-fed BLDC drive system.	6