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B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

June 2025 Semester End Main Examinations

Programme: B.E. **Semester: III**

Branch: Electrical and Electronics Engineering **Duration: 3 hrs.**

Course Code: 23EE3PCTDC **Max Marks: 100**

Course: Transformers and DC Machines

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

		UNIT - I	*CO*	*PO*	Marks
1	a)	What is the need of transformers? Explain principle of operation of transformer with a diagram	*CO1*	*PO1, 2,3*	**05**
	b)	Explain Sumpner's test with a circuit diagram to predetermine efficiency.	*CO1*	*PO1, 2,3*	**07**
	c)	A 50kVA 4400/220V transformer has R_1= 3.45Ω, R_2=0.009Ω, X_1= 5.2Ω & X_2= 0.015Ω. Calculate for the transformer (i) equivalent resistance as referred to secondary (ii) equivalent reactance as referred to secondary (iii)full load copper loss (iv)efficiency at full load, UPF when iron losses is 450W regulation at 0.8 pf lag	*CO1*	*PO1, 2,3*	**08**
		OR			
2	a)	Explain why the flux in a transformer is constant. Draw the phasor diagram under no-load and explain the components of no-load current.	*CO1*	*PO1, 2,3*	**05**
	b)	Develop the equivalent circuit of a single-phase transformer starting from the fundamentals.	*CO1*	*PO1, 2,3*	**07**
	c)	A 10kVA, 200/400 V single-phase transformer gave the following test results: OC test: (HV open): 200 V, 1.3 A, 120 W SC test: (LV shorted): 22 V, 30 A, 300 W Determine (i) the parameters of the equivalent circuit, (ii) Voltage regulation at full-load 0.8 power factor lead when the current is 25A	*CO1*	*PO1, 2,3*	**08**

			UNIT - II			
	3	a)	Explain delta/delta and open delta connection with circuit diagram	*CO1*	*PO1, 2,3*	**06**
		b)	What is an autotransformer? Derive the expression for saving of copper in an autotransformer.	*CO2*	*PO3, 4*	**07**
		c)	Two 2200/110V transformers are connected in parallel to share a load of 100kW at 0.8pf lagging. Transformers are rated as follows: Transformer A: 100kVA; 0.9%resistance & 10% reactance Transformer B: 50kVA; 1%resistance & 5% reactance. Find the load carried by each transformer and its power factor.	*CO1*	*PO1, 2,3*	**07**
			OR			
	4	a)	What are the conditions to be satisfied in care of parallel operation of transformers? Derive the expression for load sharing in case of similar transformers.	*CO1*	*PO1, 2,3*	**06**
		b)	Explain the concept of tap changing of transformers.	*CO2*	*PO3, 4*	**07**
		c)	An autotransformer supplies a load of 3kW at 115 volts at UPF. If the applied voltage is 230V, calculate (i) The power transferred to the load a) Inductively b) Conductively (ii) kVA rating (iii) Calculate the currents in the different parts of the winding. (iv) % Saving of copper	*CO2*	*PO3, 4*	**07**
			UNIT - III			
	5	a)	With a diagram explain the constructional features of a DC generator.	*CO3*	*PO1, 2,3*	**07**
		b)	Derive the EMF equation of a DC generator starting from the fundamentals	*CO3*	*PO1, 2,3*	**06**
		c)	A 4-pole DC generator is wound with 560 conductors and is driven at 1200 rpm. The useful flux per pole is 0.04 wb. The current in each conductor is 50 A. Calculate the total current, total voltage generated and the power developed when the armature conductors are connected in i) Lap ii) Wave	*CO3*	*PO1, 2,3*	**07**
			OR			
	6	a)	Explain internal and external characteristics of a DC shunt generator.	*CO3*	*PO1, 2,3*	**06**
		b)	What are the various losses in a DC generator? Derive the condition for maximum efficiency in a DC generator.	*CO3*	*PO1, 2,3*	**07**
		c)	A 110V DC shunt generator delivers a load current of 50A. The armature resistance is 0.2 ohm and the field circuit resistance is 55 ohms. The generator is rotating at a speed of 1800 rpm and has 6-	*CO3*	*PO1, 2,3*	**07**

			poles. The armature has 360 lap wound conductors. Find i) No load voltage in the armature ii) Flux per pole (iii) induced voltage when speed is 1500rpm			
			UNIT - IV			
	7	a)	What is the significance of back EMF? Explain the power stages of a DC motor.	*CO3*	*1,2,3*	**06**
		b)	Explain the different methods of speed control of a DC shunt motor with relevant diagrams.	*CO3*	*1,2,3*	**07**
		c)	A 250 V, 15 kW DC shunt motor has maximum efficiency of 90 % at a speed of 800 rpm when delivering 85% of its rated output. The resistance of shunt field is 125 Ω. Determine the armature resistance and efficiency when the motor draws 50A from the mains.	*CO3*	*1,2,3*	**07**
			OR			
	8	a)	Explain the factors affecting the speed control of a DC motor.	*CO3*	*1,2,3*	**06**
		b)	Explain three-point starter for a DC shunt motor with a neat diagram	*CO3*	*1,2,3*	**07**
		c)	A DC series motor is running with a speed of 800 rpm while taking a current of 20 A from the supply. If the load is changed such that the current drawn by the motor is increased to 50 A, calculated the speed of the motor on new load. The armature and series field winding resistances are 0.2 Ω and 0.3 Ω respectively. Assume $\phi \alpha$ I, V=250 V.	*CO3*	*1,2,3*	**07**
			UNIT - V			
	9	a)	Explain Hopkinson's test with a circuit diagram.	*CO5*	*4,7,9, 10*	**07**
		b)	Explain field's test with a circuit diagram.	*CO5*	*4,7,9, 10*	**06**
		c)	A 500V DC shunt motor when running on no load takes 5A, armature resistance = 0.5Ω and shunt field resistance is 250Ω. Find the efficiency of the motor when running full load and taking current of 50A.	*CO5*	*4,7,9, 10*	**07**
			OR			
	10	a)	Explain retardation test with a circuit diagram.	*CO5*	*4,7,9, 10*	**07**
		b)	What are the merits and demerits of indirect testing?	*CO5*	*4,7,9, 10*	**06**
		c)	The Hopkinson test on two shunt machines gave the following results for full load: Line voltage: 250 V, Line current: 59.2A, Motor armature current: 380A, Field currents: 5A and 4.2A. Calculate the efficiency of each machine. The armature resistance of each machine: 0.02 Ω.	*CO5*	*4,7,9, 10*	**07**

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