SIDDHARTH INSTITUTE OF ENGINEERING AND TECHNOLOGY (AUTONOMOUS), PUTTUR

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QUESTION BANK (DESCRIPTIVE)

Subject with Code : DC MACHINES AND TRANSFORMERS (23EE0209)
Course & Branch : B. Tech –EEE
Year & Semester : II - B. Tech. & I-Semester **Regulation:** R23

UNIT I

DC GENERATORS

PART-A (2 MARKS)

1.	**What are the major parts of a DC generator?**	**[L1][CO1]**	**[2M]**
2.	**What is meant by armature reaction?**	**[L1][CO1]**	**[2M]**
3.	**Compare lap winding and wave winding used for DC machine armature.**	**[L4][CO1]**	**[2M]**
4.	**Define commutation.**	**[L1][CO1]**	**[2M]**
5.	**State the effects of armature reaction in DC machine.**	**[L2][CO1]**	**[2M]**

PART-B (10 MARKS)

1.		Explain the constructional details of DC generator.	**[L2][CO1]**	**[10M]**
2.		Explain the basic principle of operation of a DC machine	**[L2][CO1]**	**[10M]**
3.	**(a)**	Deduce an expression for E.M.F equation of DC Generator?	**[L2][CO1]**	**[6M]**
	(b)	A 4-pole generator having wound armature winding has 50 slots each slot contains 20 conductors. What will be the volage generated in the machine, when driven at 1500rpm, assuming the flux per pole to be 70 mwb?	**[L2][CO1]**	**[4M]**
4.		Explain the various methods of excitation of DC machines.	**[L2][CO1]**	**[10M]**
5.	(a)	Explain the no-load characteristics for self-excited generator.	**[L1][CO1]**	**[5M]**
	(b)	Explain the no-load characteristics for separately-excited generator	**[L1][CO1]**	**[5M]**
6.	(a)	What is a back emf in dc motor? Write down the significance of Back E.M.F. in a DC motor.	**[L5][CO1]**	**[6M]**
	(b)	A 220V shunt motor takes a total current of 20A. The shunt field and armature resistances are 200Ω and 0.3Ω respectively. Determine (i) Value of back emf (ii) Gross mechanical power in the armature.	**[L4][CO1]**	**[4M]**
7.	(a)	Derive an expression for the torque developed in the armature of a DC motor.	**[L4][CO1]**	**[5M]**
	(b)	List out the applications of DC generator	**[L1][CO1]**	**[5M]**
8.		Explain the effect of armature reaction in a DC generator. Discuss the effect of armature reaction and give the remedial measures.	**[L4][CO1]**	**[10M]**

9.		A 75 kW, 500V, DC shunt motor has 4-poles and wave connected armature winding with 492 conductors. The flux per pole is 0.04Wb and the full load efficiency is 91%. The armature and commutating pole windings have a total resistance of 0.08Ω and the shunt field resistance is 200Ω. Calculate for full load 1) The speed, 2) Useful torque delivered to the load and 3) The torque developed.	**[L4][CO1]**	**[10M]**
10	(a)	Explain the process of commutation of DC generator with neat sketches.	**[L2][CO1]**	**[10M]**

UNIT II

STARTING, SPEED CONTROL AND TESTING OF DC MACHINES

PART-A (2 MARKS)

1.	**What is the necessity of starter for a DC motor?**	**[L1][CO2]**	**[2M]**
2.	**List the various speed control methods of DC shunt motors.**	**[L1][CO2]**	**[2M]**
3.	**What are the precautions to be taken during starting of a DC series motor?**	**[L1][CO2]**	**[2M]**
4.	**What are the losses occurring in DC motor?**	**[L1][CO2]**	**[2M]**
5.	**What is the significance of back emf?**	**[L1][CO2]**	**[2M]**

PART-B (10 MARKS)

1.		Explain the characteristic of DC shunt and DC series motor.	**[L2][CO2]**	**[10M]**
2.	**(a)**	Explain the characteristic of DC Compound Motor.	**[L2][CO2]**	**[6M]**
	(b)	What are the applications of DC motors.	**[L1][CO2]**	**[4M]**
3.		Explain the various losses of DC motor also derive the condition for maximum efficiency of a DC motor.	**[L2][CO2]**	**[10M]**
4.	**(a)**	A shunt generator supplies 96A at a terminal voltage of 200V. The armature and shunt field resistances are 0.1Ω and 50Ω respectively. The iron and frictional losses are 2000W. Find (i) Emf generated (ii) copper losses (iii) commercial efficiency.	**[L3][CO2]**	**[5M]**
	(b)	A shunt generator has a full-load current of 195A at 250V. The stray losses are 750W and the shunt field resistance is 50Ω. It has a full-load efficiency of 90%. Find the armature resistance. Also find the current corresponding to maximum efficiency.	**[L3][CO2]**	**[5M]**
5.		What is the necessity of starter? Draw the diagram of a 3point starter and explain	**[L4][CO2]**	**[10M]**
6.		Draw a neat diagram of the 4-point starter and explain how they are used to start a DC shunt motor.	**[L4][CO2]**	**[10M]**
7.		What is meant by speed control of a DC motor? Explain the various methods in detail.	**[L2][CO2]**	**[10M]**
8.		Explain in detail about brake test and field test of DC machine. Also mention its merits and de-merits.	**[L2][CO2]**	**[10M]**
9.		With the help of neat circuit diagram, explain Swinburne's test and derive the relations for efficiency (both for generator and motor). Also state the merits and de-merits of this method.	**[L3][CO2]**	**[10M]**
10.		Explain the Hopkinson's test for determining efficiency of two similar DC shunt machines.	**[L2][CO2]**	**[10M]**

UNIT III

SINGLE-PHASE TRANSFORMERS

PART-A (2 MARKS)

1.	Define voltage regulation of a transformer.	**[L1][CO3]**	**[2M]**
2.	Draw the typical equivalent circuit of a single-phase transformer.	**[L2][CO3]**	**[2M]**
3.	State the losses which occur in a transformer.	**[L1][CO3]**	**[2M]**
4.	Why is the rating of transformer expressed in kVA?	**[L4][CO3]**	**[2M]**
5.	Define all day efficiency of a transformer.	**[L1][CO3]**	**[2M]**

PART-B (10 MARKS)

1.		Explain the construction and working principle of 1Ø transformer?	**[L2][CO3]**	**[10M]**
2.		Derive the E.M.F equation of single phase transformer?	**[L4][CO3]**	**[10M]**
3.	**a)**	A 500kVA, 11000V/400V, 50Hz single phase transformer has 100 turns on the secondary winding, calculate: a) The approximate no. of turns in the primary winding. b) The approximate value of primary and secondary currents. The maximum value of flux in the core.	**[L5][CO3]**	**[6M]**
	b)	A single phase 2200/250V, 50Hz transformer has a net core area of 36cm² and a maximum flux density of 6wb/m². calculate the number of turns of primary and secondary windings,	**[L2][CO3]**	**[4M]**
4.	**a)**	Draw and explain the No-load phasor diagram of 1ϕ transformer	**[L4][CO3]**	**[5M]**
	b)	Draw and explain the phasor diagram of transformer when it is operating under load.	**[L4][CO3]**	**[5M]**
5.	**a)**	What are the various losses in a transformer?	**[L4][CO4]**	**[6M]**
	b)	Derive and explain the equivalent circuit of a 1ϕ Transformer?	**[L2][CO4]**	**[4M]**
6.	**a)**	The primary and secondary winding resistances of a 40kVA, 6600V/250V single phase transformer are 10Ω and 0.02Ω respectively. The equivalent leakage reactance referred to the primary winding is 35Ω. Find the full load regulation for load power factor of (i) unity (ii) 0.8 lagging (iii) 0.8 leading.	**[L4][CO4]**	**[5M]**
	b)	A 100KVA, 2000/200V, 50Hz single phase transformer has impedance drop of 5% and resistive drop of 2%. Calculate the % voltage regulation of the transformer at full-load 0.8pf lagging.	**[L4][CO4]**	**[5M]**
7.	**a)**	Derive the condition for maximum efficiency of a Transformer?	**[L4][CO4]**	**[6M]**
	b)	A 25kVA, 400/200V, single phase 50Hz transformer has iron loss of 300W. The copper loss is found to be 100W. Determine (i) Efficiency when delivering full-load current at 0.8 lagging pf. (ii) The % of full load when efficiency will be maximum.	**[L2][CO4]**	**[4M]**
8.	**a)**	What is the effect of variation of frequency and supply voltage on losses.	**[L1][CO4]**	**[4M]**

	b)	A transformer with normal voltage impressed as a flux density of 1.2T and a core loss consisting of 1200W eddy current losses and 3500W hysteresis losses. What do these values become under the following conditions. (i) Increasing the applied voltage by 5% at rated frequency. (ii) Reducing the frequency by 5% with normal voltage impressed. (iii) Increasing both impressed voltage and frequency by 5%	**[L2][CO4]**	**[6M]**
9.	**a)**	Why is the rating of transformer given in KVA? List out the applications of transformer.	**[L2][CO4]**	**[4M]**
	b)	A 15kVA, 2000V/200V transformer has an iron loss of 250W and full load copper loss 350W. During the day it is loaded as follows. No. of hours | Load | Power factor 9 | ¼ load | 0.6 7 | Full load | 0.8 6 | ¾ load | 1 2 | No – load | - Calculate the All-day efficiency.	**[L4][CO4]**	**[6M]**
10.		Find all-day efficiency of a transformer having maximum efficiency of 98% at 15kVA at UPF and loaded as follows. 12hrs – 2kW at 0.5pf lag 6 hrs. – 12kW at 0.8pf lag 6hrs – at no-load	**[L4][CO4]**	**[10M]**

UNIT IV

TESTING OF TRANSFORMERS

PART-A (2 MARKS)

1.	**Why short circuit test on a transformer performed on HV side?**	**[L4][CO5]**	**[2M]**
2.	**What is Sumpner's test?**	**[L1][CO5]**	**[2M]**
3.	**What are the conditions for parallel operation of single-phase transformer?**	**[L1][CO5]**	**[2M]**
4.	**What is an auto transformer?**	**[L1][CO6]**	**[2M]**
5.	**Specify the applications of autotransformer.**	**[L2][CO6]**	**[2M]**

PART-B (10 MARKS)

1.		With a circuit diagram how to obtain equivalent circuit by conducting O.C. & S.C. test in a single-phase transformer.	**[L4][CO4]**	**[10M]**
2.		Obtain the approximate equivalent circuit of a given 200V/2000V, single phase 25kVA transformer having the following test results. **O.C. test**: 200V, 6A, 350W on L.V. side **S.C. test:** 70V, 15A, 600W on H.V. side	**[L5][CO4]**	**[10M]**
3.		A 100kVA, 2000/400V, 50Hz single phase transformer gave the following test results. OC test: 2000V, 1.8A, 1.75W – on HV side SC test: 13V, 300A, 1kW – on LV side Obtain the equivalent circuit as referred on HV side.	**[L6][CO4]**	**[10M]**
4.		Explain Sumpner's test in detail and write its advantages and disadvantages.	**[L2][CO4]**	**[10M]**
5.	(a)	Explain in detail about separation of hysteresis and eddy current losses in a transformer.	**[L4] [CO4]**	**[5M]**

	(b)	The total core loss of a specimen of silicon steel is found to be 1500W at 50Hz. Keeping the flux density constant, the loss becomes 3000W. When the frequency is raised to 75Hz, calculate separately the hysteresis and eddy current losses at each of those frequencies.	**[L4] [CO4]**	**[5M]**
6.	(a)	Deduce an expression for the load shared by the two transformers with equal voltage ratios.	**[L4][CO4]**	**[5M]**
	(b)	Two single phase transformers with equal turns have impedance of (0.5+j3) ohm and (0.6+j10) ohm with respect to the secondary. If they operate in parallel determine how they will share the total load of 100KW at PF 0.8 lagging.	**[L3][CO4]**	**[5M]**
7.		Deduce an expression for the load shared by the two transformers with unequal voltage ratios.	**[L4][CO4]**	**[10M]**
8.	**a)**	What is an autotransformer? What is the difference between auto-transformer and two winding transformer.	**[L2][CO4]**	**[7M]**
	b)	What are the applications of auto transformer?	**[L2][CO4]**	**[3M]**
9	**a)**	Draw and explain briefly about equivalent circuit of an auto transformer?	**[L4][CO4]**	**[5M]**
	b)	An auto transformer supplies a load of 5kW at 125V and at unity power factor. If the primary voltage is 250V. Determine (a) Transformation ratio (b) Secondary current (c) Primary current (d) No. of turns across secondary if total number of turns is 250 (e) Power transformed (f) Power conducted directly from the supply mains to load.	**[L3][CO4]**	**[5M]**
10.		Derive an expression for saving in conductor material in an autotransformer over two winding transformers of equal rating. State its merits and de-merits.	**[L4][CO4]**	**[10M]**

UNIT V

THREE PHASE TRANSFORMERS

PART-A (2 MARKS)

1.	What are the various types of three phase transformer connections?	**[L1][CO5]**	**[2M]**
2.	What are the conditions for parallel operation of 3-phase transformers?	**[L1][CO5]**	**[2M]**
3.	Mention the transients in switching of on-load and off-load tap changers.	**[L2][CO5]**	**[2M]**
4.	Write the advantages and dis-advantages of star-star connection.	**[L1][CO5]**	**[2M]**
5.	Mention the applications of Scott connection.	**[L1][CO5]**	**[2M]**

PART-B (10 MARKS)

1.	**a)**	Explain the delta-star connection of transformer in detail	**[L2][CO5]**	**[5M]**
	b)	A 3 phase, 100kVA, 6600/1100V transformer is delta connected on the primary and star connected on the secondary. The primary resistance per phase is 1.8Ω and secondary resistance per phase is 0.025Ω. Determine the efficiency when the secondary is supplying full load at 0.8 pf and the iron loss is 15kW.	**[L3][CO5]**	**[5M]**
2.	**a)**	Explain star-star connection of transformer with diagram	**[L4][C05]**	**[5M]**
	b)	List the advantages and dis-advantages of star-star connection of transformer	**[L4][C05]**	**[5M]**

3.	**a)**	Explain delta-delta connection of transformer with sketch	**[L2][CO5]**	**[5M]**
	b)	List the advantages and dis-advantages of delta-delta connection of transformer	**[L4][C05]**	**[5M]**
4.		A 3-phase step down transformer is connected to 6600 volts mains and it takes 10A. Calculate the secondary line voltage, line current, and output for the following connections a) Star – Star b) Delta – Delta The turns ratio per phase is 12. Draw the connection diagram.	**[L4][C05]**	**[10M]**
5.	**a)**	Explain star-delta connection of transformer with sketch	**[L2][C05]**	**[5M]**
	b)	A 3Phase step down transformer takes 15A when connected to 4400V mains, the turns ratio per phase is 10. Neglecting losses find the secondary line voltage, line current and output power. If the windings are connected in star-delta.	**[L1][C05]**	**[5M]**
6.		Explain in detail about open – delta connection and write the advantages, disadvantages and uses of open delta connection	**[L2][C05]**	**[10M]**
7.	a)	Write the voltage and current relationships for different types of connections	**[L2][C05]**	**[5M]**
	b)	A Δ-Δ bank consisting of three 40kVA, 2300/230V transformers supplies a load of 80kVA. If one transformer is removed, find for the resulting V-V connection i) KVA load carried by each transformer ii) percent of rated load carried by each transformer. iii) ratio of the V-V bank to Δ-Δ bank transformer ratings. iv) percent increase in load on each transformer when bank is converted into V-V bank.	**[L1][C05]**	**[5M]**
8.		Discuss in detail about off-load tap changing and on-load tap changing.	**[L5][C05]**	**[10M]**
9.		Explain Scott connection in detail.	**[L2][C05]**	**[10M]**
10.		A 50Hz Scott-connected transformer supplied an unbalanced 2-phase load at 200V per phase. For the leading phase (phase "A") the load has a resistance of 10ohms and an inductance of 42.3mH. For the other phase the load consists of a resistor of 13.3ohms and a capacitor of 318 micro-farads in series. Neglecting magnetizing current and the internal impedance of the transformer, calculate the line currents on the 3-phase side. The main transformer primary/secondary turns ratio is 12/1.	**[L4][C05]**	**[10M]**

Prepared By: V. Supriya