CBCS SCHEME

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BEE304

Third Semester B.E./B.Tech. Degree Examination, June/July 2024
Transformers and Generators

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	Explain the construction and working principle of single phase transformer with neat sketch.	7	L2	CO1
	b.	Define efficiency. Also, derive an expression for condition for maximum efficiency.	6	L2	CO1
	c.	A 50 KVA single phase transformer has primary winding resistance of 3Ω and reactance of 5Ω. The secondary winding resistance of 0.02 Ω and reactance of 0.03 Ω, it is 2500/250 V, 50 Hz. Find (i) Equivalent resistance, reactance and impedance as referred to primary side. (ii) Equivalent resistance, reactance and impedance as referred to secondary side. (iii) Full load currents on primary side and secondary side. (iv) Total copper losses.	7	L4	CO1
		OR			
Q.2	a.	With a neat circuit, explain the necessity and procedure of Sumpner's test on transformers.	6	L2	CO1
	b.	With a neat phasor diagram, explain the operation of transformer on load for lagging power factor.	7	L2	CO1
	c.	A 200 KVA, 2000/440 V, 50 Hz single phase transformer gave the following test data : OC Test : 2 KV, 1.8 A, 1.75 KW, [HV side] SC Test : 13 V, 300 A, 1 KW [LV side] (i) Find the parameters of equivalent circuit as referred to HV side. (ii) Efficiency at full load at 0.8 p.f. lagging. (iii) Regulation at 0.8 p.f. lagging.	7	L4	CO1
		Module – 2			
Q.3	a.	Describe the constructional features of three-phase transformer, with a neat sketch.	6	L2	CO2
	b.	With a neat circuit diagram, explain the necessity of parallel operation of single phase transformer.	6	L2	CO2
	c.	What is Auto transformer? Show the copper economy in auto transformer with necessary expression.	8	L2	CO2
		OR			
Q.4	a.	Draw a delta/delta connected 3-phase transformer and explain its operation. Also mention its advantages.	7	L3	CO2
	b.	What is the necessity of tap changing? Explain the process of on load tap changing in transformer.	8	L2	CO2
	c.	Determine the core area, the number of turns and the position of the tapping point for a 500 KVA, 50 Hz, single phase, 6600/5000 V auto-transformer. Consider Emf/turn as 8 V and maximum flux density 1.3 Wb/m^2.	5	L4	CO2

<table>
<tr><td colspan="6">Module – 3</td></tr>
<tr><td>Q.5</td><td>a.</td><td>With neat sketch, explain the construction and working of synchronous generator.</td><td>8</td><td>L2</td><td>CO3</td></tr>
<tr><td></td><td>b.</td><td>Derive an expression for EMF equation of synchronous generator.</td><td>6</td><td>L3</td><td>CO3</td></tr>
<tr><td></td><td>c.</td><td>A 24 pole alternator has a star connected armature winding with 144 slots and 10 conductors per slot. It is driven by a speed of 250 rpm. The winding has full pitched coils with a distribution factor of 0.966. The flux per pole is 67 milli-webers. Determine : (i) Frequency of the induced emf
(ii) Emf per phase (iii) Line voltage.</td><td>6</td><td>L4</td><td>CO3</td></tr>
<tr><td colspan="6">OR</td></tr>
<tr><td>Q.6</td><td>a.</td><td>Define short circuit ratio. Also draw and explain open circuit and short circuit characteristics in synchronous generator.</td><td>7</td><td>L2</td><td>CO3</td></tr>
<tr><td></td><td>b.</td><td>What do you mean by harmonics? Mention its methods of reduction and elimination.</td><td>6</td><td>L2</td><td>CO3</td></tr>
<tr><td></td><td>c.</td><td>A 3.5 MVA, star connected alternator ratio at 4160 V at 50 Hz has open circuit characteristic given by the following voltage :
<table>
<tr><td>Field current (A)</td><td>50</td><td>100</td><td>150</td><td>200</td><td>250</td><td>300</td><td>350</td><td>400</td><td>450</td></tr>
<tr><td>EMF (volts)</td><td>1620</td><td>3150</td><td>4160</td><td>4750</td><td>5130</td><td>5370</td><td>5550</td><td>5650</td><td>5750</td></tr>
</table>
A field current of 200 A is found necessary to circulate full load current on short circuit of the alternator. Neglect resistance, find regulation at 0.8 pf lagging using synchronous impedance method.</td><td>7</td><td>L4</td><td>CO3</td></tr>
<tr><td colspan="6">Module – 4</td></tr>
<tr><td>Q.7</td><td>a.</td><td>Discuss about two reaction theory and voltage regulation.</td><td>6</td><td>L2</td><td>CO4</td></tr>
<tr><td></td><td>b.</td><td>Describe the parallel operation of generators and load sharing.</td><td>8</td><td>L2</td><td>CO4</td></tr>
<tr><td></td><td>c.</td><td>Write a note on hunting and damper windings.</td><td>6</td><td>L2</td><td>CO4</td></tr>
<tr><td colspan="6">OR</td></tr>
<tr><td>Q.8</td><td>a.</td><td>Draw power angle diagram if synchronous generator, explain.</td><td>7</td><td>L3</td><td>CO4</td></tr>
<tr><td></td><td>b.</td><td>Define synchronization. Explain any one method of synchronization in synchronous generator.</td><td>8</td><td>L2</td><td>CO4</td></tr>
<tr><td></td><td>c.</td><td>Write a note on voltage regulation by EMF method in synchronous generator.</td><td>5</td><td>L2</td><td>CO4</td></tr>
<tr><td colspan="6">Module – 5</td></tr>
<tr><td>Q.9</td><td>a.</td><td>Explain the basic components of wind energy conversion system with a suitable sketch.</td><td>10</td><td>L2</td><td>CO5</td></tr>
<tr><td></td><td>b.</td><td>Describe the principle of solar cell.</td><td>5</td><td>L2</td><td>CO5</td></tr>
<tr><td></td><td>c.</td><td>List the advantages and disadvantages of wind energy conversion system.</td><td>5</td><td>L2</td><td>CO5</td></tr>
<tr><td colspan="6">OR</td></tr>
<tr><td>Q.10</td><td>a.</td><td>Explain the basic solar photo voltaic system for power generation with a neat sketch.</td><td>10</td><td>L2</td><td>CO5</td></tr>
<tr><td></td><td>b.</td><td>List the advantages and disadvantages of solar photo voltaic system.</td><td>5</td><td>L2</td><td>CO5</td></tr>
<tr><td></td><td>c.</td><td>Write short notes on horizontal and vertical axis in WECS.</td><td>5</td><td>L2</td><td>CO5</td></tr>
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