

# CBCS SCHEME

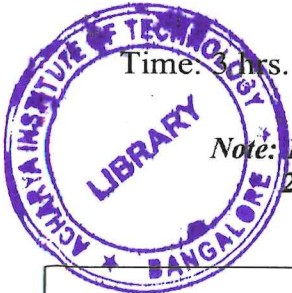
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BEE304

**Third Semester B.E./B.Tech. Degree Examination, June/July 2026**

## 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. | Derive EMF equation of single phase transformer.                                                                                                                                                                                                                                                                                                                                                                                       | 6 | L2 | CO1 |
|            | b. | Explain how to transfer equivalent circuit parameters from primary to secondary winding in a single phase transformer.                                                                                                                                                                                                                                                                                                                 | 6 | L2 | CO1 |
|            | c. | With the help of phasor diagram explain the operation of practical transformer connected to upf, lagging pf and leading pf loads.                                                                                                                                                                                                                                                                                                      | 8 | L2 | CO1 |
| OR         |    |                                                                                                                                                                                                                                                                                                                                                                                                                                        |   |    |     |
| Q.2        | a. | With a neat circuit diagram explain the tests to be conducted to predetermine efficiency and regulation of a 1 $\phi$ transformer.                                                                                                                                                                                                                                                                                                     | 8 | L2 | CO1 |
|            | b. | 5 kVA, 500/250 V, 50 Hz single phase transformer gave the following readings:<br>OC test 500 V 1A 50 W (HV side open)<br>SC test 25 V 10 A 60 W (LV side open)<br>Determine :<br>i) Efficiency on full load 0.8 pf lagging<br>ii) Voltage regulation on full load 0.8 pf leading<br>iii) Efficiency at 60% of full load, 0.8 pf lagging<br>iv) Draw equivalent circuit parameters referred to primary and insert all the values in it. | 8 | L3 | CO1 |
|            | c. | Discuss the various losses occurring in a 1 $\phi$ transformer.                                                                                                                                                                                                                                                                                                                                                                        | 4 | L2 | CO1 |

## Module – 2

|     |    |                                                                                              |   |    |     |
|-----|----|----------------------------------------------------------------------------------------------|---|----|-----|
| Q.3 | a. | With a neat sketch, explain the constructional features of 3 $\phi$ transformers.            | 6 | L2 | CO2 |
|     | b. | Discuss the 3 $\phi$ transformer connections. Explain any 2 type of connection with diagram. | 8 | L2 | CO2 |
|     | c. | Enumerate the advantages of 3 $\phi$ transformer over single phase transformers.             | 6 | L2 | CO2 |

## OR

|     |    |                                                                                                                                                                                                                                                                                                                                         |   |    |     |
|-----|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|----|-----|
| Q.4 | a. | Why parallel operation of 2 or more transformers needed? Mention the necessary conditions to be satisfied for parallel operation.                                                                                                                                                                                                       | 6 | L2 | CO2 |
|     | b. | Derive expression for load sharing between 2 transformers having un equal voltage ratio's connected in parallel.                                                                                                                                                                                                                        | 6 | L3 | CO2 |
|     | c. | A 20 kVA, 2300/230V, 2 winding transformer is to be used as an autotransformer, with constant source voltage of 2300 V at full load upf, calculate the power output, power transformed and power conducted, if the $\eta$ of the 2 winding transformer at 0.6 pf is 96%, find the auto transformer efficiency at the same power factor. | 8 | L4 | CO2 |

## Module – 3

|     |    |                                                                                                               |   |    |     |
|-----|----|---------------------------------------------------------------------------------------------------------------|---|----|-----|
| Q.5 | a. | What is armature reaction? What are their effects, briefly explain.                                           | 6 | L2 | CO3 |
|     | b. | What are the causes for harmonics in synchronous generators? Explain the methods of elimination of harmonics. | 8 | L3 | CO3 |
|     | c. | With a neat sketch explain the equivalent circuit of synchronous generators.                                  | 6 | L2 | CO3 |

## OR

|     |    |                                                                                                                                    |    |    |     |
|-----|----|------------------------------------------------------------------------------------------------------------------------------------|----|----|-----|
| Q.6 | a. | With the help of neat sketches, explain how the voltage regulation can be determined using EMF method from OC and SC test results. | 10 | L2 | CO3 |
|-----|----|------------------------------------------------------------------------------------------------------------------------------------|----|----|-----|

|                        |                                                                                                                                                                                                                                                                                                                                            |                        |      |      |      |      |      |      |                     |   |   |   |     |   |   |                    |    |    |    |    |    |    |  |  |  |
|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|------|------|------|------|------|------|---------------------|---|---|---|-----|---|---|--------------------|----|----|----|----|----|----|--|--|--|
| b.                     | The OC and SC test results for a 3 $\phi$ Y-connected 1000 kVA, 1905 V, 50 Hz alternator are                                                                                                                                                                                                                                               | 10                     | L4   | CO3  |      |      |      |      |                     |   |   |   |     |   |   |                    |    |    |    |    |    |    |  |  |  |
|                        | <table><tr><td>V<sub>oc</sub> (line)</td><td>760</td><td>1500</td><td>1700</td><td>1905</td><td>2300</td><td>2600</td></tr><tr><td>I<sub>sc</sub> (A)</td><td>-</td><td>-</td><td>-</td><td>335</td><td>-</td><td>-</td></tr><tr><td>I<sub>f</sub> (A)</td><td>10</td><td>20</td><td>25</td><td>30</td><td>40</td><td>50</td></tr></table> | V <sub>oc</sub> (line) | 760  | 1500 | 1700 | 1905 | 2300 | 2600 | I <sub>sc</sub> (A) | - | - | - | 335 | - | - | I <sub>f</sub> (A) | 10 | 20 | 25 | 30 | 40 | 50 |  |  |  |
| V <sub>oc</sub> (line) | 760                                                                                                                                                                                                                                                                                                                                        | 1500                   | 1700 | 1905 | 2300 | 2600 |      |      |                     |   |   |   |     |   |   |                    |    |    |    |    |    |    |  |  |  |
| I <sub>sc</sub> (A)    | -                                                                                                                                                                                                                                                                                                                                          | -                      | -    | 335  | -    | -    |      |      |                     |   |   |   |     |   |   |                    |    |    |    |    |    |    |  |  |  |
| I <sub>f</sub> (A)     | 10                                                                                                                                                                                                                                                                                                                                         | 20                     | 25   | 30   | 40   | 50   |      |      |                     |   |   |   |     |   |   |                    |    |    |    |    |    |    |  |  |  |
|                        | R <sub>a</sub> = 0.2 $\Omega$ /ph. Find its full load regulation at 0.85 lagging by MMF method.                                                                                                                                                                                                                                            |                        |      |      |      |      |      |      |                     |   |   |   |     |   |   |                    |    |    |    |    |    |    |  |  |  |

**Module – 4**

|            |           |                                                                                       |          |           |            |
|------------|-----------|---------------------------------------------------------------------------------------|----------|-----------|------------|
| <b>Q.7</b> | <b>a.</b> | With a neat sketch explain two reaction theory.                                       | <b>8</b> | <b>L2</b> | <b>CO4</b> |
|            | <b>b.</b> | What are the conditions to be satisfied when 2 alternators are connected in parallel? | <b>6</b> | <b>L2</b> | <b>CO4</b> |
|            | <b>c.</b> | Explain reluctance power and effects of saliency.                                     | <b>6</b> | <b>L2</b> | <b>CO4</b> |

**OR**

|            |           |                                                                                                                                                        |           |           |            |
|------------|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-----------|------------|
| <b>Q.8</b> | <b>a.</b> | With a neat phasor diagram, derive expression for the power output of a salient pole alternator. Draw the variation of power v/s load angle $\delta$ . | <b>10</b> | <b>L2</b> | <b>CO4</b> |
|            | <b>b.</b> | Explain capability curve of alternator.                                                                                                                | <b>6</b>  | <b>L2</b> | <b>CO4</b> |
|            | <b>c.</b> | What is hunting in synchronous generator? Explain.                                                                                                     | <b>4</b>  | <b>L2</b> | <b>CO4</b> |

**Module – 5**

|            |           |                                                                   |          |           |            |
|------------|-----------|-------------------------------------------------------------------|----------|-----------|------------|
| <b>Q.9</b> | <b>a.</b> | With a neat block diagram, explain wind energy conversion system. | <b>8</b> | <b>L2</b> | <b>CO5</b> |
|            | <b>b.</b> | With a neat sketch, explain horizontal axis WECS.                 | <b>6</b> | <b>L3</b> | <b>CO5</b> |
|            | <b>c.</b> | Enumerate advantages and disadvantages of WECS.                   | <b>6</b> | <b>L2</b> | <b>CO5</b> |

**OR**

|             |           |                                                                   |          |           |            |
|-------------|-----------|-------------------------------------------------------------------|----------|-----------|------------|
| <b>Q.10</b> | <b>a.</b> | Explain the basic components of solar cell, with a neat sketch.   | <b>6</b> | <b>L2</b> | <b>CO5</b> |
|             | <b>b.</b> | With a neat sketch, explain grid tied solar pv generation system. | <b>8</b> | <b>L3</b> | <b>CO5</b> |
|             | <b>c.</b> | List the advantages and disadvantages of solar pv generation.     | <b>6</b> | <b>L2</b> | <b>CO5</b> |