

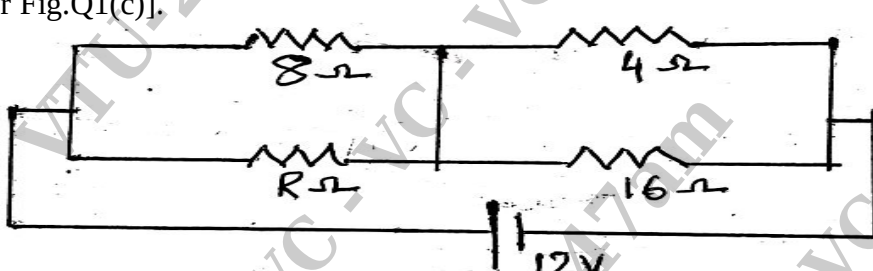
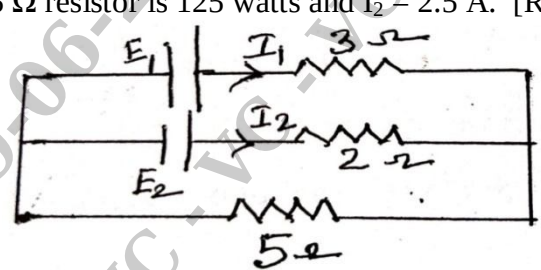
## First/Second Semester B.E./B.Tech. Degree Examination, June/July 2026

### Basics of Electrical Engineering

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.  
 3. VTU Formula Hand Book is permitted.

| Module – 1                                                                                                                        |    |                                                                                                                                                                            |  | M  | L  | C   |
|-----------------------------------------------------------------------------------------------------------------------------------|----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|----|----|-----|
| Q.1                                                                                                                               | a. | Define Absolute permittivity and relative permittivity. Mention the limitations of Ohm's law                                                                               |  | 06 | L1 | CO1 |
|                                                                                                                                   | b. | State and explain Kirchoff's laws as applied to DC circuit. Are these laws applicable to AC circuits?                                                                      |  | 06 | L1 | CO1 |
|                                                                                                                                   | c. | In the network shown find the value of R and the current flowing through it. [Refer Fig.Q1(c)].                                                                            |  | 08 | L2 | CO1 |
|  <p style="text-align: center;">Fig.Q1(c)</p>  |    |                                                                                                                                                                            |  |    |    |     |
| OR                                                                                                                                |    |                                                                                                                                                                            |  |    |    |     |
| Q.2                                                                                                                               | a. | State Coulomb's law and mention the factors affecting the capacitance of a parallel plate capacitor.                                                                       |  | 06 | L2 | CO1 |
|                                                                                                                                   | b. | Derive an expression for the energy stored in an electrostatic field.                                                                                                      |  | 06 | L1 | CO1 |
|                                                                                                                                   | c. | In the network shown find the values of $E_1$ and $E_2$ such that the power dissipated in the $5\Omega$ resistor is 125 watts and $I_2 = 2.5\text{ A}$ . [Refer Fig.Q2(c)] |  | 08 | L2 | CO1 |
|  <p style="text-align: center;">Fig.Q2(c)</p> |    |                                                                                                                                                                            |  |    |    |     |
| Module – 2                                                                                                                        |    |                                                                                                                                                                            |  |    |    |     |
| Q.3                                                                                                                               | a. | State Fleming's right hand rule and Fleming's left hand rule. Mention their applications.                                                                                  |  | 06 | L2 | CO2 |
|                                                                                                                                   | b. | Define self-inductance and mutual inductance. Mention their units. Also deduce the relationship between selfinductance, mutual inductance and coefficient of coupling.     |  | 06 | L1 | CO2 |

|              |    |                                                                                                                                                                                                                                                                                                                    |    |    |     |
|--------------|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|----|-----|
| 1BBEE105/205 |    |                                                                                                                                                                                                                                                                                                                    |    |    |     |
| Q.3          | c. | A wire of length 50 cms moves at right angles to its length at 50 m/s in a uniform field of density 1 wb/m <sup>2</sup> determine the emf induced in the conductor when the direction of motion is (i) perpendicular to the field (ii) inclined at 30° to the direction of the field. (iii) parallel to the field. | 08 | L3 | CO2 |
| OR           |    |                                                                                                                                                                                                                                                                                                                    |    |    |     |
| Q.4          | a. | Define Statically induced emf and Dynamically induced emf. Also state Lenz's law.                                                                                                                                                                                                                                  | 06 | L1 | CO2 |
|              | b. | Derive an expression for the energy stored in a magnetic field.                                                                                                                                                                                                                                                    | 08 | L1 | CO2 |
|              | c. | An air cored coil has 1000 turns with an inductance of 0.12H. two hundred turns are removed from the coil and a steel core is placed around the coil. Determine the new value of the inductance. Assume $\mu_r$ of steel as 75.                                                                                    | 06 | L1 | CO3 |
| Module – 3   |    |                                                                                                                                                                                                                                                                                                                    |    |    |     |
| Q.5          | a. | Define RMS value, Average value, Form factor and Peak factor of a sinusoidal wave.                                                                                                                                                                                                                                 | 04 | L2 | CO3 |
|              | b. | Show that the power in a series R- L circuit is $V I \cos \phi$ and draw the waveforms of voltage, current and power.                                                                                                                                                                                              | 08 | L3 | CO3 |
|              | c. | An emf whose instantaneous value is $100 \sin(314t - \pi/4)$ is applied to a circuit and the current flowing through it is $20 \sin(314t - 1.5708)$ , find the values of the circuit elements.                                                                                                                     | 08 | L3 | CO3 |
| OR           |    |                                                                                                                                                                                                                                                                                                                    |    |    |     |
| Q.6          | a. | Derive an expression for the power in a pure capacitor energized from AC voltage. Draw the waveforms of voltage, current and power.                                                                                                                                                                                | 08 | L2 | CO3 |
|              | b. | A current of 10 A flows in a circuit with a 30° lag when the applied voltage is 100V. Find (i) Resistance, reactance and Impedance (ii) Conductance, Susceptance and Admittance.                                                                                                                                   | 06 | L2 | CO3 |
|              | c. | A circuit consists of 20 $\Omega$ resistance in series with an inductance of 0.05H. A supply of 230V, 50 Hz is given to the circuit. Calculate<br>(i) current (ii) phase angle (iii) power factor (iv) real power<br>(v) reactive power                                                                            | 06 | L3 | CO3 |
| Module – 4   |    |                                                                                                                                                                                                                                                                                                                    |    |    |     |
| Q.7          | a. | What are the advantages of 3 $\phi$ system over 1 $\phi$ system?                                                                                                                                                                                                                                                   | 06 | L2 | CO3 |
|              | b. | Deduce the relationship between phase and line values of voltages currents in 3 $\phi$ star connected system.                                                                                                                                                                                                      | 08 | L3 | CO3 |
|              | c. | Each of the two watt meters connected to measure the input power to a 3 $\phi$ circuit reads 20KW. What does each instrument read when the load power factor is 0.866 lag with the total power remaining unchanged.                                                                                                | 06 | L3 | CO3 |
| 2 of 3       |    |                                                                                                                                                                                                                                                                                                                    |    |    |     |

OR

|            |           |                                                                                                                                                                                                          |           |           |            |
|------------|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-----------|------------|
| <b>Q.8</b> | <b>a.</b> | Briefly explain the generation of 3 phase voltages.                                                                                                                                                      | <b>05</b> | <b>L2</b> | <b>CO4</b> |
|            | <b>b.</b> | With the help of a neat circuit and vector diagrams show that only two watt meters are sufficient to measure the $3\phi$ input power in a balanced star connected system.                                | <b>08</b> | <b>L2</b> | <b>CO4</b> |
|            | <b>c.</b> | A 500V, 3 phase motor has an output of 37.3kw and operates at a power factor of 0.85 with an efficiency of 90%. Calculate the reading on each of the 2 watt meters connected to measure the input power. | <b>07</b> | <b>L2</b> | <b>CO4</b> |

**Module – 5**

|            |           |                                                                                                                                                              |           |           |            |
|------------|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-----------|------------|
| <b>Q.9</b> | <b>a.</b> | What is an electric shock? What are the precautions to be taken to prevent electric shock?                                                                   | <b>06</b> | <b>L2</b> | <b>CO5</b> |
|            | <b>b.</b> | Write short notes on Fuse and MCB.                                                                                                                           | <b>06</b> | <b>L3</b> | <b>CO5</b> |
|            | <b>c.</b> | A consumer has a maximum demand of 300KW at 35% load factor. If the tariff is Rs 125/KW of maximum demand plus 15 paise/KWh, calculate the overall cost/KWh. | <b>08</b> | <b>L2</b> | <b>CO5</b> |

OR

|             |           |                                                                                                                                                                                                                                                                                                                                                                                                      |           |           |            |
|-------------|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-----------|------------|
| <b>Q.10</b> | <b>a.</b> | With a neat wiring diagram and truth table explain 2 way and 3 way control of lamps.                                                                                                                                                                                                                                                                                                                 | <b>06</b> | <b>L2</b> | <b>CO5</b> |
|             | <b>b.</b> | What is Earthing? With a neat diagram explain pipe – earthing.                                                                                                                                                                                                                                                                                                                                       | <b>08</b> | <b>L2</b> | <b>CO5</b> |
|             | <b>c.</b> | In a residential building, the following loads are connected.<br>(i) Six lamps of 40 W each, switched on for 5 hours.<br>(ii) Two fans of 60 W each, switched on for 12 hours.<br>(iii) One 1000 W heater switched on for 2 hours. and<br>(iv) One refrigerator of 250W working for 10 hours a day.<br>If the cost of energy is Rs 6.50/unit what is the total cost of energy in the month of April. | <b>06</b> | <b>L2</b> | <b>CO5</b> |

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