**B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2025**
Sixth Semester
**Electrical and Electronics Engineering**
**20EEEL603 - ELECTRIC ENERGY UTILIZATION AND CONSERVATION**
Regulations - 2020

Duration: 3 Hours                                                   Max. Marks: 100

**PART - A (MCQ) (10 × 1 = 10 Marks)**
Answer ALL Questions

| | | Marks | K–Level | CO |
|---|---|---|---|---|
| 1. | In flood lighting, when beam spread angle ≥ 40 degree it falls in the category of _____ <br> (a) Narrow Beam    (b) Medium Beam    (c) Wide beam    (d) Close beam | 1 | K1 | CO1 |
| 2. | The cosine law states that illumination is proportional to the cosine of the angle between the normal to the surface and the <br> (a) Source of light    (b) Incident light    (c) Reflected light    (d) Absorbed light | 1 | K1 | CO1 |
| 3. | Split AC systems consist of which two main components? <br> (a) Compressor and Evaporator    (b) Indoor unit and Outdoor unit <br> (c) Condenser and Expansion valve    (d) Cooling coil and Thermostat | 1 | K1 | CO2 |
| 4. | What type of electric motors typically provide the highest efficiency in applications requiring variable speed? <br> (a) Induction motors    (b) Permanent magnet motors <br> (c) Synchronous motors    (d) Universal motors | 1 | K1 | CO2 |
| 5. | In direct resistance heating, the current flows <br> (a) Through the element only    (b) Around the charge <br> (c) Through the charge directly    (d) Not used at all | 1 | K1 | CO3 |
| 6. | Anodizing is typically performed on which metal? <br> (a) Copper    (b) Aluminum    (c) Steel    (d) Zinc | 1 | K1 | CO3 |
| 7. | In electric traction, braking is often achieved using <br> (a) Magnetic braking    (b) Hydraulic braking <br> (c) Regenerative braking    (d) Pneumatic braking | 1 | K1 | CO4 |
| 8. | What is the main reason for using high voltage AC in railway electrification? <br> (a) Simplicity of the system    (b) Low transmission losses <br> (c) High current capacity    (d) Better motor efficiency | 1 | K1 | CO4 |
| 9. | Energy conservation planning aims to <br> (a) Reduce output to save energy    (b) Identify opportunities for energy saving <br> (c) Increase production output    (d) Ignore energy usage patterns | 1 | K1 | CO5 |
| 10. | In commercial buildings, energy conservation can be achieved by <br> (a) Increasing lighting levels beyond necessity <br> (b) Keeping all systems running 24/7 <br> (c) Using automated lighting and HVAC systems <br> (d) Avoiding insulation in walls and roofs | 1 | K1 | CO5 |

**PART - B (12 × 2 = 24 Marks)**
Answer ALL Questions

| | | Marks | K–Level | CO |
|---|---|---|---|---|
| 11. | State the importance of glare control in lighting design. | 2 | K1 | CO1 |
| 12. | A lighting scheme uses 4 lamps, each of 1000 lumens, with a utilization factor of 0.6 and maintenance factor of 0.8. Calculate the illumination provided over an area of 10 m². | 2 | K2 | CO1 |
| 13. | Name two important factors considered in street lighting design. | 2 | K1 | CO1 |
| 14. | What are the factors that affect the efficiency of a domestic refrigerator? | 2 | K1 | CO2 |
| 15. | Classify the factors contribute to the reduced efficiency of a motor over time. | 2 | K2 | CO2 |
| 16. | Infer how can the concept of direct savings be applied in evaluating the efficiency of motors? | 2 | K2 | CO2 |
| 17. | Compare resistance welding and arc welding based on heat generation. | 2 | K2 | CO3 |
| 18. | Inspect the output voltage of a bridge rectifier and a center-tap rectifier for the same input. | 2 | K2 | CO3 |

*K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create*        **14315**

| | | |
|---|---|---|
| 19. Why are series wound motors preferred in traction applications? | 2 | K1 CO4 |
| 20. Examine the advantages of regenerative braking over conventional braking methods in electric trains. | 2 | K2 CO4 |
| 21. Differentiate between energy conservation and energy efficiency. | 2 | K2 CO5 |
| 22. Describe the role of smart meters in household energy conservation. | 2 | K2 CO5 |

**PART - C (6 × 11 = 66 Marks)**
Answer ALL Questions

| | | |
|---|---|---|
| 23. a) (i) Identify the difference between the Inverse Square Law and the Cosine Law in terms of their application to surface illumination. | 6 | K3 CO1 |
| (ii) A lamp of 100 candela is placed 2 meters above a working plane. Calculate the illumination directly beneath the lamp and at a point 1.5 meters horizontally away from the vertical axis. | 5 | K3 CO1 |

**OR**

| | | |
|---|---|---|
| b) (i) Choose the different types of lamps used in lighting systems and compare their advantages and disadvantages in terms of efficiency, cost, and lifespan. | 6 | K3 CO1 |
| (ii) Plan the basic requirements for factory lighting. How do the types of work and safety regulations influence the design of lighting in factories? | 5 | K3 CO1 |

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| 24. a) Explain in detail the various types of air conditioning systems and discuss their working principles. | 11 | K2 CO2 |

**OR**

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|---|---|---|
| b) Demonstrate the construction and working of a domestic water cooler. Compare it with a refrigerator in terms of operational principle, components, and cooling mechanisms. | 11 | K2 CO2 |

| | | |
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| 25. a) Illustrate the process of electroplating using the principles of Faraday's Laws. Draw and explain the setup and label all components involved. | 11 | K2 CO3 |

**OR**

| | | |
|---|---|---|
| b) Describe the advantages of resistance welding over other types of welding. Apply your understanding to explain the process in the automotive industry. | 11 | K2 CO3 |

| | | |
|---|---|---|
| 26. a) Choose the factors to be considered in the choice of an electric motor for traction applications. Compare the performance characteristics of DC motors and AC motors for traction systems. | 11 | K3 CO4 |

**OR**

| | | |
|---|---|---|
| b) Make use of the concept of power and energy output from the driving axles in a railway system. How is the power delivered from the traction motors to the wheels, and how is it related to the train's speed and acceleration? | 11 | K3 CO4 |

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| 27. a) Summarize various methods to improve energy efficiency in electrical generation. Explain how Combined Heat and Power (CHP) systems contribute to energy conservation. | 11 | K2 CO5 |

**OR**

| | | |
|---|---|---|
| b) Outline the major causes of energy losses in generation, transmission, and distribution systems. Explain the methods to minimize these losses suitable examples. | 11 | K2 CO5 |

| | | |
|---|---|---|
| 28. a) (i) Identify the importance of torque-speed characteristics in the choice of an electric motor for railway traction. | 6 | K3 CO4 |
| (ii) Explain five measures to reduce electricity consumption in a typical household. | 5 | K2 CO5 |

**OR**

| | | |
|---|---|---|
| b) (i) Identify the advantages and limitations of dynamic braking systems in electric traction. | 6 | K3 CO4 |
| (ii) Plan the steps to perform an energy audit in an electrical distribution system. | 5 | K2 CO5 |

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