

BITS, PILANI K K BIRLA GOA-CAMPUS
SEMESTER-I, 2022-2023
COURSE: EEE F427 ELECTRIC POWER UTILIZATION AND ILLUMINATION
COMPREHENSIVE EXAMINATION DATE: 23-DEC-2022; TIME: 2.00 P.M. TO 5 P.M.

REG, CB/OB, TOTAL WT 35%, MM: 100

Instructions:

1. Question Paper is presented in two parts- PART-A {CB, 1 Hr, 4 Main Questions, 10 Marks each} and PART-B {OB, 2 Hr., 6 Questions, 10 Marks each}. PART-B can be answered ONLY after submitting Answer Book for PART-A.
 2. In each Part, the questions are categorized thematically as indicated by “#...” line. Write answers to sub-questions so as to be relevant to the given theme “#...”.
 3. While attempting PART-B, access to printed material ONLY is permitted, including the prescribed Text Book(s) and Reference book(s), SSR and hand-written class-notes.
 4. Write complete answers to questions in the order these are presented category-wise. Identify your answer with correct question number (main & sub-question number). Avoid writing statement of the Question. In the case when you decide not to answer a question (main or sub-question) write “NA” (for Not Attempted) against the Question (main or sub-question).
 5. Only complete and conclusive answers, relevant to the given theme, will be considered for award of marks as indicated. Irrelevant and/or Invalid answers may be awarded equivalent negative marks.
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PART-A {CLOSED BOOK, 1 Hr., 4 Main Questions, 10 Marks each}

#1 Principles of Electric Power Utilization

- a) Explain why option of electric system equivalent to an existing mechanical system, should be preferred for certain applications in an industry.
- b) Explain options for optimizing electric power utilization in any generic application of electric system in an industry.
- c) Explain good practices for safe utilization of electric power.
- d) Explain options for electric energy conservation and electric energy substation in an Industry.
- e) Explain direct and indirect benefits of optimizing electric power utilization.

#2 Generation, Distribution and Utilization of Electric Power

- a) Explain options for bridging demand-supply gap in electricity generation and supply.
- b) State the current installed power generation capacity in India and percentage contribution of non-renewable as well as renewable energy sources in power generation.
- c) Explain objectives of electric power system and roles of different stakeholders.
- d) Explain options available for reducing transmission and distribution losses in the power system.
- e) Explain how electricity tariff applicable to large consumer of electricity helps in regulating power distribution losses.

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#3 Optimizing Electric Power Utilization in Industry

- a) Explain important considerations in selecting electric motors for electric drive applications.
- a) Explain strategies for reducing electricity bill for a representative large industrial electricity consumer.
- b) Explain importance of preparation of an object for electroplating.
- c) Explain importance of maintaining effective temperature in the human comfort range inside an air-conditioned building, during summer and during winter.
- d) Explain importance of load equalization using flywheel in electric drive system.

#4 Technologies for Optimizing Electric Power Utilization

- a) Explain advantages of obtaining ISO 50001 certification for the energy management system (EMS) in an industry, relevant to total quality improvement in the industry.
- b) Explain, with neatly labeled diagram, effect of power factor improvement for justifying cost implications of the power factor improvement.
- c) Explain, with suitable diagram, principle of induction heating.
- d) Explain, with suitable illustration diagram, different types of lighting systems.
- e) Explain optimization of electric power consumption by using different types of electric drive system.

=====END OF PART-A=====

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PART-B {OPEN BOOK, 2 Hrs., 6 Main Questions, 10 Marks each}

#1 Energy Management Perspectives of Electric Power Utilization

- a) Explain main features of the Electricity Act of India (2003), relevant to strategic energy management in electric power sector.
- b) State objectives of supply side energy management and demand-side energy management.
- c) State types of energy intensive industries for which demand-side energy management is highly recommended for continuous improvement of overall energy efficiency.
- d) Explain, with a suitable block diagram, essential functions to be implemented for effective energy management system for an energy intensive industry.
- e) Explain energy audit approaches for periodic monitoring and review of energy performance of a large energy intensive industry for recommending measures for efficiency improvement.

#2 Opportunities for achieving objectives of energy management in electric power utilization

- a) Explain, giving suitable examples, scope for improving efficiency and effectiveness of air-conditioning system.
- b) Explain practical measures for improving energy performance of electrolytic processes.
- c) Explain, giving suitable examples, scope for automation in electric drive applications for electric traction systems.
- d) Explain scope for improving service life as well as energy performance of induction motor used in electric drive applications.
- e) Explain scope for improving service life as well as energy performance of dc motors used in electric drive applications.

#3 Functions of Energy Management System for electric power utilization

- a) Explain step-by-step approach for identifying opportunities for improving lighting efficiency and efficacy in factory lighting.
- b) Explain step by step approach for identifying opportunities for improving energy efficiency in electric arc welding
- c) Explain step by step approach for identifying opportunities for improving energy efficiency in direct core type induction furnace
- d) Explain step by step approach to improving energy performance of a centralized power generation station.
- e) Explain step by step approach to improve power factor to most economical power factor when the active power demand is constant at user end.

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#4 Opportunities for Energy Efficiency improvement

- a) Explain criteria for selection of electric motors for extensive industrial application
- b) Explain effective method for improving power factor of motor of rating higher than 150 kW.
- c) Explain criteria for selection of energy efficient method of electric heating.
- d) Explain consideration for selecting most energy efficient welding technology.
- e) Explain considerations for providing energy efficient lighting solutions.

#5 Challenges in optimizing electric power utilization in industries.

- a) Explain, giving suitable examples, measures for improving overall efficiency of electric heating used in an industry.
- b) Explain, giving suitable examples, measures for improving quality of electric welding in an industry.
- c) Explain, giving suitable examples, measures for improving overall efficacy of indoor lighting systems, in an industry.
- d) Explain, giving suitable examples, measures for minimizing operations and maintenance requirements in an electric drive system.
- e) Explain, giving suitable example, measures for reducing electricity consumption in electro-deposition plant in an industry.

#6 Advantages of energy management system.

- a) State major advantages of Supply Side Energy Management System for Power Generation Plant.
- b) State major advantages of Demand Side Energy Management System for an industrial consumer.
- c) Describe options for Supply Side Energy Management on Campus.
- d) Describe measures implemented for strategic electrical energy saving on Campus.
- e) Describe, giving example of an energy application on campus, appropriate energy performance indexes for measuring energy performance of the energy application.

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