NAME OF THE EXAMINATION: B.E. POWER ENGINEERING THIRD YEAR SECOND SEMESTER - 2022

SUBJECT: SMART GRID SYSTEMS(HONS.)

TIME: 3 HOURS   FULL MARKS: 100

Answer *Q1* and **_any six_** questions from the rest

1.   *Choose the correct option for any TEN questions*:   (10@1 = 10)
   (i)   A smart grid is _____ whereas conventional grids are _____   [CO1]
         a) sequential, unidirectional
         b) adaptive, predictive
         c) stable, unstable
         d) networked, radial
   (ii) NSGM stands for   [CO1]
         a) National Smart Grid Management
         b) National Smart Grid Monitoring
         c) National Smart Grid Mission
         d) National Smart Grid Movement
   (iii) A smart grid envisages to empowering customers by the following   [CO3]
         ways:
         A. Reducing ATC losses
         B. Consumer education and awareness
         C. Self-healing feature
         D. Residential consumer energy management
         E. Information and communication technology
         F. Load forecasting
         Out of the above, the correct choices are:
         a) A, B, E
         b) B, D, E
         c) C, D, F
         d) A, C, F
   (iv) Which one of the following is a feature of Smart Grid?   [CO2]
         a) Distributed Generation
         b) Prosumers (Producers + Consumers)
         c) Bidirectional Communication
         d) All of the above
   (v)   Smart grid enables   [CO2]
         a) Distributed energy management
         b) Centralized energy management
         c) Both distributed as well as centralized energy management
         d) None of these
   (vi) A localized grouping of electricity generations, energy storages, and   [CO1]
         loads is termed as?
         a) Virtual Power Plant
         b) Macro Grid
         c) Micro Grid
         d) Traditional Grid
   (vii) What is the full form of DR in the context of Smart Grids?   [CO3]
         a) Delivery Rate
         b) Divide & Rule
         c) Demand Response
         d) Distributed Resources
   (viii) How many national power grids are there in India?   [CO1]
         a) 4
         b) 5
         c) 3
         d) 6

(ix)   Use of Electric Vehicles (EV) as a component of smart grid enables [CO4]
         CO_2 reduction by:
         A. Reducing gasoline usage
         B. Serving as distributed storage
         C. Reducing gasoline based emission
         D. Alter EV charging period towards off-peak hours
         E. Reducing distribution losses
         F. Enabling smart communication
       Out of the above, the best combination for correct choices are:
         a) A, B, C, E
         b) A, B, D, F
         c) A, B, C, D
         d) A, D, E, F

(x)   A sustainable energy solution feature of smart grid implies that the [CO3]
       operation must be
         a) Economic
         b) Environmentally benign
         c) Socially acceptable
         d) All of the above

(xi)   What are the challenges in RE integration? [CO4]
         a) Variability & intermittency
         b) Highly predictable
         c) High unpredictability
         d) Both (a) and (c)

(xii) To operate and manage RE generation into the grid, separate centers [CO4]
         developed is
         a) Regional Load Despatch Centre
         b) State Load Despatch Centre
         c) Renewable Energy Management Centre
         d) All of the above

Answer any Six (6) Questions

2   (a) Define "Smart Grid" as per NSGM, Govt. of India.   (3)   [CO1]
    (b) Compare between conventional power grid and smart grid with respect   (7)   [CO1]
         to the following characteristics: Architecture, Consumer Participation,
         Generation options, Storage options, Communication, Fault response,
         Asset optimization
    (c) Explain any five (5) significant challenges faced while deploying   (5)   [CO1]
         smart grid infrastructure by upgrading the existing power grid.

3   (a) What are the various domains of smart grid?   (3)   [CO1]
    (b) Pictorially describe how these domains are interrelated with each   (5)   [CO1]
         other.
    (c) What are the different service providers and their roles on smart grid?   (7)   [CO1]

4   (a) What do you understand by "optimization of smart grid"?   (2)   [CO2]
    (b) What are the benefits of grid optimization?   (5)   [CO2]
    (c) List the components of smart grid optimization.   (3)   [CO2]
    (d) List the processes by which optimization can be achieved in a smart   (5)   [CO2]
         grid.

5   (a) List the various cyber-physical threats envisaged in a smart grid   (4)   [CO3]
         infrastructure that can compromise the safety, security, and reliability
         of the power network.
    (b) Mark the threats that you have listed in part (a) in a graph as shown   (6)   [CO3]
         below that points out their likelihood against consequences:
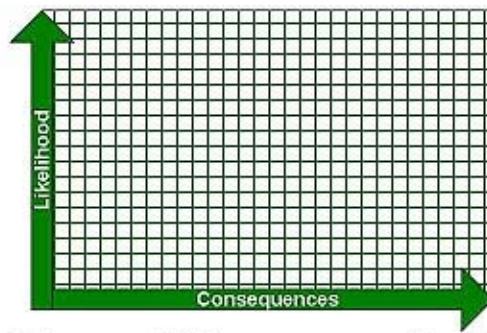
| | (c) | Point out probable consequences of such threats in a smart grid system. | (5) | [CO3] |

6 (a) Define DRM (Demand Response Management) in smart grid. (4) [CO2]
  (b) Explain with proper diagrams, how consumers' load profiling can enable efficient load demand management in a smart power network. (5) [CO2]
  (c) Differentiate between Incentive-based direct load control (DLC) and Dynamic pricing-based energy consumption scheduling (ECS) as modes of DRM (6) [CO2]

7 (a) Highlight how the features of smart grid enable effective integration of renewable energy sources in the power network. (5) [CO4]
  (b) In a tabular form, list the *technical* challenges involved and the possible solutions for integrating renewable energy sources to smart grid. (5) [CO4]
  (c) List the different forecasting techniques and the corresponding tools used as applied to smart grid operation. (5) [CO4]

8 (a) List the various categories of energy storage systems with examples as used in smart grid. (5) [CO4]
  (b) Draw and explain the architecture of a typical smart energy meter (5) [CO4]
  (c) What are the benefits of pre-paid metering from the perspectives of utilities? How a customer can benefit from pre-paid metering? (5) [CO3]

9 Write short notes on *any three*: (3@5=15)
  (a) Involvement and participation of customers in the entire energy management process in a smart grid environment [CO2]
  (b) Techniques employed for performing grid optimization calculations [CO2]
  (c) "Self-healing" feature of a smart-grid [CO1]
  (d) Need for "Asset Management" in smart grid infrastructure [CO2]
  (e) Components of a SCADA system and their functions in a typical smart grid. [CO4]
  (f) Benefits of Electric Vehicles (EV) over gasoline-based vehicles [CO4]

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