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CBCS SCHEME

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17EE42

Fourth Semester B.E. Degree Examination, June/July 2019

Power Generation and Economics

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Discuss the utility of hydrograph, flow duration curve and mass curve for the power plants. (06 Marks)
- b. Explain with neat sketch the working of hydroelectric power plant station and explain the function of each component in it. (10 Marks)
- c. Describe different turbines and their use in hydroelectric plants. (04 Marks)

OR

- 2 a. What are the main considerations for selection of site for a hydroelectric power station? (06 Marks)
- b. Explain the governing mechanism of water turbine, with neat sketch. (06 Marks)
- c. How the Hydro plants are classified? Explain in detail. (08 Marks)

Module-2

- 3 a. A thermal station has an overall efficiency of 21% and 0.75 kg of coal is burnt per kWh of generated energy. Determine the calorific value of coal. (04 Marks)
- b. Draw the schematic diagram of modern steam power station and explain its operation with its important components. (10 Marks)
- c. Write short notes on : (06 Marks)
 - (i) Electrostatic precipitator
 - (ii) Underfeed stokers.

OR

- 4 a. Discuss in brief the methods of improving thermal efficiency of gas turbine power plants. (09 Marks)
- b. Discuss the advantages and disadvantages of a diesel power plant. (04 Marks)
- c. Draw a layout of Diesel power plant. Showing the various systems, including cooling, lubrication, starting, intake and exhaust systems. (07 Marks)

Module-3

- 5 a. Explain with a neat diagram various parts of a nuclear reactor, explain clearly the each part. (06 Marks)
- b. Mention the factors to be considered for the selection of site for nuclear power plant. (06 Marks)
- c. Describe construction and working of a pressurized water reactor. (08 Marks)

OR

- 6 a. With examples, explain the difference between a fissible material and a fertile material. (04 Marks)
- b. Describe the different types of fuels used in a Nuclear power plant and discuss the problem of nuclear waste disposal. (08 Marks)
- c. Explain the function of moderator, coolant, control rod and shielding in nuclear power plant. (08 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-4

- 7 a. Explain the function of transformer, high voltage circuit breaker and high voltage insulator in substation. (06 Marks)
b. Define substation and mention different types of substation. (06 Marks)
c. Explain resonant grounding and resistance grounding with a neat diagram. (08 Marks)

OR

- 8 a. Explain single bus-bar with bus sectionalizer. (06 Marks)
b. Explain Gas Insulated substation and mention its advantages. (08 Marks)
c. Explain Earthing Transformer with neat diagram. (06 Marks)

Module-5

- 9 a. Define Tariff. Explain (i) Block Rate Tariff (ii) Two Port Tariff (iii) KVA Maximum demand Tariff. (06 Marks)
b. Explain methods of determination of depreciation. (09 Marks)
c. Write a short notes on Classification of costs. (05 Marks)

OR

- 10 a. State the causes and effects of a poor power factor. Also explain methods of power factor improvement. (10 Marks)
b. Calculate the annual energy cost of an industrial consumer who takes a load of 20 kW for 1 hour per day, 150 kW for 7 hours per day and 50 kW for 8 hours/day. The tariff in force is Rs. 20 per kilowatt of maximum demand (Maximum demand = 220 kW) and 10 paise per KWH. Assume 6 working days in a week. (06 Marks)
c. Explain concept of load sharing and choice of size and number of generating plants. (04 Marks)

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Scheme & Solution

Signature of Scrutinizer

Subject Title : Power Generation and Economics

Subject Code : 17EE42

Question Number	Solution	Marks Allocated
Q. 1. a)	Explanation of Hydrograph with Graph - (02) Explanation of flow duration Curve with Graphical representation (02) Explanation of Mass curve with Graphical representation (02)	06
b)	Diagram of Hydro electric power plant - (02) Explanation of i) Dam (01) ii) Reservoir (01) iii) Penstock (01) iv) Surge Tank (01) v) Power House (Turbine & Generator) - (01) vi) Tail Race (01) vii) Spill ways (01) viii) Draft tube (01)	10
c)	Explanation of Pelton turbine (01) Kaplan turbine (01) Francis turbine (01) Propeller turbine (01)	04
Q. 2. a)	Explanation of Six points ; Each point carry one mark → i) Availability of water (01) ii) Availability of Storage of water (01) iii) Head of water (01) iv) Distance of power plant from load centres (01) v) Accessibility of site (01) vi) Nearer to load centre (01)	06
b)	Diagram → (3) Explanation → (3)	06
c)	Classification of Hydro plant. i) Available Head → (03) ii) Quantity of water available → (03) iii) Nature of loads (02)	08

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Registrar (Evaluation)

Question Number	Solution	Marks Allocated
Q. 3. a)	<p>Heat Produced Per 0.75 Kg of Coal = $\frac{\text{output in heat units}}{\text{overall efficiency}} = \frac{18860}{0.21} = 4095 \text{ Kilo Calries} \rightarrow (02)$</p> <p>Grific Value = $\frac{\text{Heat Produced}}{\text{useful Coal}} = \frac{4095}{0.75} = 5460 \text{ Kilo Calries/Kg} \rightarrow (02)$</p>	04
b)	<p>Diagram of Thermal power plant $\rightarrow 04$</p> <p>Explanation of Each block $\rightarrow 06$</p>	10
c)	<p>Explanation of Electrostatic Precipitator with Diagram $\rightarrow (02)$</p> <p>Explanation of underfeed Stokers with Diagram $\rightarrow (01)$</p>	06
Q. 4. a)	<p>Explanation of i) Regeneration with Diagram $\rightarrow (03)$</p> <p>ii) Intercooling with Diagram $\rightarrow (03)$</p> <p>iii) Reheater with Diagram $\rightarrow (03)$</p>	09
b)	<p>List at least Two Advantages $\rightarrow (02)$</p> <p>Two Disadvantages $\rightarrow (02)$</p>	04
c)	<p>Layout of Diesel Engine power station $\rightarrow (02)$</p> <p>Explanation of various Systems $\rightarrow (05)$</p>	07
Q. 5. a)	<p>Diagram of Nuclear Reactor $\rightarrow (02)$</p> <p>Explanation of Each part of Nuclear Reactor $\rightarrow (04)$</p>	06
b)	<p>Explanation of (i) Availability of water $\rightarrow (01)$</p> <p>(ii) Distance from populated area $\rightarrow (01)$</p> <p>(iii) Nearness to Load Centre $\rightarrow (01)$</p> <p>(iv) waste disposal $\rightarrow (01)$</p> <p>(v) Accessibility of Rail and Road $\rightarrow (01)$</p> <p>(vi) Availability of Source $\rightarrow (01)$</p>	06

Question Number	Solution	Marks Allocated
Q. 5. c)	Diagram of Pressurized water reactor → (03) Explanation of Pressurized water reactor → (05)	<u>08</u>
Q. 6. a)	Explanation of Fissile material → (01) Example U-235 (01) Explanation of Fertile material → (01) Example U-233; Pu-239 → (01)	<u>04</u>
6. b)	Explanation of types of Fuels used in Nuclear power plant like U-235, U-233, Pu-239, Th-232 → (04) Explanation of Disposal of waste & its problems → (04)	<u>08</u>
6. c)	Explanation of Moderator → (02), Coolants → (02) Control Rod → (02) Shielding → (02)	<u>08</u>
Q. 7. a)	Explanation of Transformer → (02); High Voltage Circuit breaker → (02) & High Voltage insulator → (02)	<u>06</u>
b)	Definition of Substation → (02) Explain types of Substation (any two ^{four} types) → (04)	<u>06</u>
c)	Explanation of Resonant Grounding → (02) Diagram → (02) Explanation of Resistance Grounding → (02) vector diagram → (01) Diagram → (01)	<u>08</u>
Q. 8. a)	Diagram → (02) Explanation → (04)	<u>06</u>
b)	Diagram → (02); Explanation → (04); Merits → 02	<u>08</u>
c)	Diagram → (02) Explanation → (04)	<u>06</u>

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Question Number	Solution	Marks Allocated
9 a)	Explanation each Tariff classes 02 marks $\rightarrow 0.2 \times 3 \rightarrow$	<u>06</u>
b)	Explanation of i) Straight line method \rightarrow (03) ii) Discounting value method \rightarrow (03) iii) Sinking fund method \rightarrow (03)	<u>09</u>
c)	Explanation of i) Fixed cost \rightarrow (02) ii) Semi fixed cost \rightarrow (02) iii) Running cost & operating cost \rightarrow (01)	<u>05</u>
10 a)	Explanation of effects of Poor Power factor \rightarrow (04) Explanation of methods of power factor improvement i) By use of static capacitor \rightarrow (01) ii) By use of Synchronous motor \rightarrow (01) iii) By use of phase advancers \rightarrow (01) iv) By use of Synchronous Induction motor \rightarrow (01) v) By use of High power factor motor \rightarrow (01) vi) By use of Synchronous Condensers \rightarrow (01)	<u>10</u>
10 b)	Solving for Annual Energy Consumption $(20\text{kw} \times 1\text{hr} + 150\text{kw} \times 7\text{hrs} + 50\text{kw} \times 8\text{hrs}) \times 312 \text{ days} = 458640 \text{ kWh}$ (312 days because of only 6 working days) \rightarrow (02) Maximum demand: $20\text{kw} + 150\text{kw} + 50\text{kw} = 220\text{kw} \rightarrow$ (01) Annual Energy Cost = $\text{Rs. } 20 \times 220\text{kw} + \text{Rs. } 0.1 \times 458640$ $= \text{Rs. } 4400 + 45864$ $\text{Rs. } 50,264 \rightarrow$ (03)	<u>06</u>
10 c)	Explanation of Load Sharing \rightarrow 02 Explanation on choice of size \rightarrow 01 Explanation on choice of number of Generating units \rightarrow 01	<u>04</u>

Scheme of this subject 17EE42 appears to be OK.
Member BBE

[Signature] 27/06/19

Dr. S. B. Shivakumar
Chairman, B.O.E (E&E)

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