Duration: (3 Hours)   **Total Marks: 80**

NB: (1)   Question **No. 1** is **compulsory**
        (2)   **Answer** any **THREE** questions out of the remaining **FIVE** questions.
        (3)   Assume suitable data if **necessary** and **justify** them
        (4)   **Figure** to the **right** indicates **marks**

1 (a)   Explain the block diagram of an electrical drive with an example.   5
   (b)   A motor of smaller rating can be selected for intermittent duty. Why?   5
   (c)   Illustrate with neat diagram the working of single phase fully controlled rectifier   5
         control of DC separately excited motor.
   (d)   What do you mean by load equalization? What are the reasons for using load   5
         equalization in an electrical drive?

2 (a)   Illustrate the four-quadrant operation of a DC motor driving a hoist load by means of   10
.   a suitable diagram. Assume that a four quadrant chopper supplies the motor. Clearly
         show the directions & polarities of the following quantities;   i) Speed ii) load torque
         iii) developed torque iv) converter output voltage v) converter output current and
         vi) back emf of the motor.
   (b)   Explain in detail steady state stability in electric drives. Derive the condition for the   10
         steady state stability?

3 (a)   Draw the block diagram and explain the operation of closed loop speed control scheme   10
.   of a DC motor with inner current control loop. What are the various functions of inner
         current loop?
   (b)   A motor operates on a periodic duty cycle consisting of a loaded period of 20 min and   10
         a no load period of 10 min. The maximum temperature rise is 60°C. Heating and
         cooling time constant are 50 and 70 min respectively. When operating continuously
         on no load, the temperature rise is 10°C. Determine the minimum temperature during
         the duty cycle and the temperature when the motor is loaded continuously.

4 (a)   Explain V/f method of speed control of induction motor with neat speed torque   10
         characteristics. Compare it with stator voltage control.
   (b)   Illustrate with neat diagrams plugging of induction motor and show the transition from   10
         motoring mode to braking mode. Explain the diagram and state the precautions to be
         taken while plugging.

5 (a)   Explain the d-q model of induction motor and draw the equivalent circuit.   10
   (b)   A 3-phase, 400V, 50 Hz, 4 pole, 1370 rpm star connected squirrel cage induction   10
         motor has following parameters referred to stator: $R_s = 2\ \Omega$, $R_r' = 3\Omega$, $X_s = X_r' = 3.5\Omega$.
         The motor is fed from a voltage source inverter with constant V/f ratio. The inverter
         allows frequency variation only from 10 to 50 Hz. Soft starting is used for the motor.
         Calculate the starting torque and current of this drive as a ratio of their values when
         the motor is started at rated voltage and frequency.

6 (a)   Explain with block diagram and phasor diagram direct vector control scheme in   10
.   induction motor drives.
   (b)   With a neat block diagram explain direct torque and flux control of induction motor   10

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3 hours   **80 Marks**

N. B. :

1. Question No. 1 is compulsory
2. Attempt any **THREE from Q2 to Q6** questions
3. Use illustrative diagrams wherever required

Q. No.			Marks

Q1)   Attempt any **FOUR** questions

     a)   List all the possible energy conservation measures in a lighting system?   **05**

     b)   Differentiate between commercial and non-commercial energy, primary and   **05** secondary energy.

     c)   Define specific power consumption (SPC) with an example. A compressor   **05** generates 100 cfm of air. The power drawn by the motor is 10 kW. Find its SPC.

     d)   Name the parameters measured by following energy audit instruments.   **05** 1. Fyrite 2. Ultrasonic flow meter 3. Thermal imager or IR gun 4. Stroboscope 5. Tachometer. List one application each of above instruments.

     e)   Why Sankey diagram is useful in energy balance calculations? Draw Sankey   **05** diagram for domestic gas stove.

Q2) **a)**   In a plant, a boiler is generating saturated steam of 10 TPH at a pressure of   **10** 7 kg/cm2(g) with furnace oil (FO) as a fuel.

         Feed water temperature $= 60°C$

         Evaporation ratio $= 14$.

         Calorific value of FO $= 10000$ kcal/kg

         Specific gravity of FO $= 0.95$.

         Enthalpy of steam at $7 \text{ kg/cm2(g)} = 660$ kcal/kg

         Find out the efficiency of the boiler by direct method and volume of furnace oil tank (in m3) required for 120 hrs of operation.

     b)   Enlist all the possible energy conservation measures possible in furnace system?   **10**

Q3) **a)**   List any TEN ENCON (ENergy CONservation) opportunities possible in HVAC   **10** system.

     b)   Explain the use of Non-Conventional and Renewable Energy Sources in   **10** commercial buildings like hospital, school, hotel and shopping malls.

38271   Page **1** of **2**

Q4) a) The specifications of cooling water pump connected to boiler, are as follows: **10**
Discharge- Q = 12.5 lit/sec, head- H = 60m, Power consumption- P = 13.4 kW.
As per the boiler manufacturer, required quality is 12.5 lit/sec at 3.0 kg/cm2.
What type of energy conservation measure can be proposed and estimate the
reduction in power consumption?
Assume operating efficiency of pump as 65% and motor efficiency as 90%.

b) "Steam should always be utilised at the lowest possible pressure" – What are the **10**
important aspects to be considered before fixing up the steam pressure for a
particular application?

Q5) a) Estimate and compare tonne of refrigeration from the data given below for two **10**
AHUs?

Parameter	AHU 1	AHU 2
Evaporator area, m^2	8.75	0.39
Inlet velocity, m/s	1.81	11.50
Inlet air DBT, ^OC	21.5	24.5
RH (%)	75	73.5
Enthalpy (kJ/kg)	53	59.3
Outlet air DBT, ^OC	17.4	19.5
RH (%)	90	83
Enthalpy (kJ/kg)	46.4	53
Density of air, kg/m^3	1.14	1.05

b) Explain how a Variable Frequency Drive saves power in a three phase electric **10**
motor driven pumping system? What will be the reduction in power drawn by a
motor by reducing the speed by half?

Q6) a) Illustrate the main features of Energy Conservation Act-2001. **10**

b) Write short notes on **10**
1. How to convert housing society into Green Building
2. LEED rating

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3 Hours   **80 Marks**

1. Question no. 1 compulsory.
2. Answer any three questions out of remaining five
3. Attempt sub questions in order
4. Figures to the right indicate full marks.

1. Write short notes on **(any 4)**   **[20]**
a) Capacity building
b) Functions of NIDM
c) Sea walls, embankments and bio shields
d) Triage
e) Environmental hazard
f) National Disaster Management Policy
g) Community based disaster preparedness

2. a) Discuss the framework for disaster management in India.   **[8]**

2. b) Explain global warming and climate change.   **[6]**

2. c) Comment on radiation hazards. Also discuss possibilities of chemical spills in Mumbai.
     [6]

3. a) Discuss the various types of technological disasters and highlight the specific efforts to mitigate such disasters in India.   **[8]**

3. b) Explain the role of various international agencies for Disaster Management.   **[6]**

3. c) Explain various means of raising finance for mitigating and managing disasters   **[6]**

4. a) Differentiate between structural and non-structural measures of flood mitigation and discuss the importance of forecasting, warning and monitoring system in India   **[8]**

4. b) Appraise the role of GIS and GPS in disaster management   **[6]**

4. c) Discuss various types of natural disasters in India and highlight their impacts on life.
     [6]

5. a) Explain in detail the design concepts involved in as well as the construction materials used for the safe construction of facilities in case of earthquakes and cyclones. Also discuss the fire resistant facilities that need to be essentially provided in a building/industry.   **[8]**

5. b) Elaborate the guidelines laid down by NDMA for disaster management in India.   **[6]**

5. c) Explain in detail, vulnerability, with reference to floods and cyclones. List down the preparatory measures for minimizing vulnerabilities related to Tsunami.   **[6]**

6. a)   Discuss in brief the Disaster Management Act 2005.   **[6]**

6. b)   Explain Community based disaster preparedness   **[5]**

6. c)   Is rapid depletion of ground water a type of disaster? To which category does this belongs? What are the reasons for this problem?   **[5]**

6. d)   Identify and discuss the various hazards which are associated with volcanic eruptions
                                    [4]

Duration: 3hrs   **[Max Marks: 80]**

N.B. : **(1) Question No 1 is Compulsory.**
         (2) Attempt any three questions out of the remaining five.
         (3) All questions carry equal marks.
         (4) Assume suitable data, if required and state it clearly.

1   Attempt any FOUR   [20]
   a   Define micro grid and state it's needs.
   b   Define smart grid and elaborate it's need in current situation.
   c   Give comparison between conventional grid and smart grid
   d   Evaluate advantages and disadvantages of wind power system in micro-grid.
   e   Justify the need of anti-Islanding scheme

2 a   Draw schematic diagram of D.C. microgrid and elaborate it along with its   [10]
       advantages, disadvantages, and limitations.
   b   Elaborate the significance of Energy storage devices in micro grid.   [10]

3 a   Compare non-conventional sources from the point of micro-grid suitability.   [10]
   b   Give importance of islanding in case of grid connected micro grid. Also give the [10]
       proper sequence of operation for successful islanding.

4 a   Draw a block diagram on centralized control and elaborate its working, advantages [10]
       and limitations
   b   What is black start. Elaborate role of micro grid in it.   [10]

5 a   Elaborate opportunities & barriers of Smart Grid   [10]
   b   Enlist various communication methods used for smart grid and elaborate any one [10]
       in detail.

6 a   Draw and elaborate a functional block diagram of smart meter.   [10]
   b   Describe the resilience and self-healing characteristics of smart grid   [10]

38266

(Duration: 3Hours)   [Total Marks: 80]

N.B.: **(1) Question No. 1 is Compulsory.**
(2) Attempt any three questions out of the remaining five.
(3) Each question carries 20 marks and sub-question carry equal marks.
(4) Assume suitable data if required.

1.		Attempt any **FOUR** of the following.	
	(a)	What is difference between IoT and M2M?	(05)
	(b)	Compare Request-Response, Push-Pull, Publish-Subscribe and Exclusive Pair communication model in IoT.	(05)
	(c)	Write short note on Medium Access Control (MAC). List down various MAC protocols used in IOT.	(05)
	(d)	Explain the concept of Piconet in wireless communication.	(05)
	(e)	Compare Arduino and Raspberry Pi platform for IoT development.	(05)
2.	(a)	Define IoT. List & Explain Characteristics of IoT.	(10)
	(b)	Explain the significance of privacy and security measures in IoT based systems. Explain few privacy and security measures.	(10)
3.	(a)	What are the real-world design constraints while designing IoT system.	(10)
	(b)	What is IoT Operating System? Explain in brief various operating systems used in IoT.	(10)
4.	(a)	Explain the Zigbee and Z-Wave protocols. Provide examples of real-world applications where each protocol is commonly employed.	(10)
	(b)	List various cloud based IoT platforms and explain any 3 in detail.	(10)
5	(a)	Explain Bluetooth BLE. How Bluetooth BLE is different than classical Bluetooth?	(10)
	(b)	Explain the flow of development of mobile App for IoT system.	(10)
6	(a)	Describe fog computing, illustrate it with a clear diagram. Also identify few industries/applications where fog computing is applied.	(10)
	(b)	Draw and explain system design diagram of a home automation system using IoT to control devices like light, TV, house climate and home appliances. Explain with respect to the software, hardware, sensors, protocols, and platforms used to design this system.	(10)

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Paper / Subject Code: 42274 / HVDC Transmission Systems (DLOC - III)

Time: 3 Hours   **Marks: 80**

Note :

- **Question No.1 is compulsory.**
- Solve **ANY THREE** questions from the **remaining** five questions.
- Figure to the right indicates full marks.
- Assume suitable data wherever required, but justify the same.

Marks

Q. 1		Solve **ANY FOUR** questions from following. (Each question carries 5 marks)	**20**
	a)	Illustrate with block diagram the equidistant pulse generation scheme used in HVDC system	
	b)	Show that for a converter with overlap angle less than 60° the inversion starts before 90°	
	c)	What are the reasons for maintaining high power factor in an HVDC system	
	d)	What are the causes of arc back? Explain its impact on HVDC converter operation.	
	e)	With complete control characteristics, show how power reversal is attained in HVDC system	
Q. 2	**a)**	Illustrate with neat diagram the different links in HVDC system.	**10**
	c)	Show that replacing 6-pulse converter with 12-pulse converter eliminate 5th and 7th order current harmonics from AC side. Explain harmonic mitigation techniques.	**10**
Q3	**a)**	Demonstrate the IPC scheme used in HVDC system and derive the mathematical expression to find the instant of firing. Also show how the equation is modified to find the instant of firing in CEA control.	**10**
	b)	From ideal control characteristics, show the various step involved in developing the control characteristics of an actual HVDC system. What is current margin and what is its impact.	**10**
Q4	**a)**	What are the different protection methods used in HVDC system	**10**
	b)	Illustrate with neat waveform the effect of single commutation failure.	**10**
Q5	**a)**	Develop the equivalent circuit of a three phase fully controlled rectifier with grid control and overlap angle less than 60 degree.	**10**
	b)	Show with neat waveform how the current transfer occurs from faulty rectifier to the bypass valve. Explain the sequence followed to transfer current from bypass valve to rectifier.	**10**
Q6	**a)**	Illustrate the causes and effect of harmonics in HVDC system	**10**
	b)	Draw and explain the various component of HVDC Converter station	**10**

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**Duration: 3hrs**   **[Max Marks: 80]**

N.B.: **(1) Question No 1 is Compulsory.**
       (2) Attempt any three questions out of the remaining five.
       (3) All questions carry equal marks.
       (4) Assume suitable data, if required and state it clearly.

Q1. Answer **any four** from the following: **20**
  a) What is significance of equal area criteria in power system?
  b) Why numerical methods are used for solution of load flow equations?
  c) Draw state diagram and explain each operating state of power system.
  d) Draw schematic diagram of a synchronous generator and explain why
       frequency control loop and voltage control loop are not cross-coupling?
  e) State and explain the factors which can improve transient stability.

Q 2.
 A A cylindrical rotor generator delivers 0.5 pu power in the steady-state to an   **10**
   infinite bus through a transmission line of reactance 0.5 pu. The generator
   no-load voltage is 1.5 pu and the infinite bus voltage is 1 pu. The inertia
   constant of the generator is 5 MW-s/ MVA and the generator reactance is 1
   pu. Find the critical clearing angle in degrees for a three-phase dead short
   circuit fault at the generator terminal.

 B Derive the equation for optimum generation scheduling considering   **10**
   transmission losses (Exact coordinate equation).

Q3.
 A Figure below shows the single-line diagram of three-bus power system with   **10**
   generation at bus 1 and bus 3. The voltage at bus 1 is $V_1 = 1.025 \angle 0^o$ per
   unit. The voltage magnitude at bus 3 is fixed at 1.05 per unit with a real
   power generation of 250 MW. The scheduled load on bus 2 is marked on
   the diagram. Line impedances are marked in per unit on a 100 MVA base.
   Line resistances and line charging susceptances are neglected. Obtain the
   bus voltages at the end of first iteration by Gauss-Seidel method.
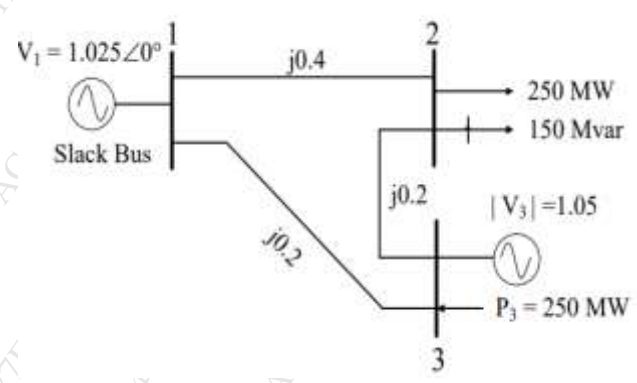
 B Draw turbine speed governor system and explain the operation of major   **10**
   components of the system.

42863   **Page 1 of 2**

Q4.

A A 50 Hz, 4-pole turbo generator rated 100 MVA, 11 kV has an inertia   **10**
constant of 8 MJ/MVA. Find
   a. The stored kinetic energy in the rotor at synchronous speed.
   b. The rotor acceleration, if the mechanical input is suddenly raised to 90
      MW for an electrical load of 60 MW.
   c. The speed at the end of 10 cycles. Neglect mechanical and electrical
      losses.

B Explain Decoupled load flow method for load flow solutions.   **10**

Q 5 A power station consists of two generators and supplies a total load of 310
A MW. The incremental fuel cost in Rs/MWh are: **10**
$IC_1 = 0.125P_{G1} + 18.9$ Rs/MWh
$IC_2 = 0.131P_{G2} + 12$ Rs/MWh
Determine the most economical division of load between generators. Find
saving in Rs/day obtained compared to equal load sharing between
generators.

B What is power pool? Explain the different types of energy transactions and   **10**
interchanges in power system.

Q 6.

A Two generating units rated 300 MW and 400 MW have governor speed   **10**
regulation of 6% and 4% respectively from no load to full load. Both the
generating units are operating in parallel to share a load of 600 MW.
Assuming that the generators are operating at 50 Hz at no load and free
governor action, find the load shared by each unit and frequency of
operation.

B Derive Swing equation for a synchronous machine that describes rotor   **10**
dynamics.

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