

(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) What are the main factors which decide the choice of electrical drive for a given application? 5
 (b) State and explain with neat sketches the three main classes of motor duty cycle 5
 (c) With speed torque characteristics, explain the stator voltage control of induction motor. 5
 (d) Compare vector control and direct torque control of an induction motor 5
- 2 (a) Choose an application and explain with neat diagrams the multi quadrant operation of an electrical drive. Mention the speed torque conventions in all the four quadrants. 10
 (b) A drive has the following equations for motor torque (T) and load torque (T_l). 10
 $T = -1-2\omega_m$; $T_l = -3\sqrt{\omega_m}$ where ω_m is the motor speed in rad/s. Obtain the equilibrium points and determine their steady state stability.
- 3 (a) Derive the thermal model of motor for heating and cooling and draw the heating and cooling curves. 10
 (b) Half hour rating of a motor is 200 kW. Heating time constant is 80 min. The maximum efficiency occurs at 75% of full load. Determine the continuous duty rating of the motor. 10
- 4 (a) With a neat block diagram explain closed loop speed control with an inner current control loop in an electric drive. 10
 (b) Draw the circuit diagram of a four quadrant chopper drive for a DC separately excited motor and explain in detail its operation with necessary diagrams in forward motoring mode and regenerative braking mode. 10
- 5 (a) With the speed torque characteristics explain V/f control of induction motor. In the speed torque characteristics, include the region below base speed as well as above base speed. 10
 (b) A 3-phase, 440 volt, 50 hertz, 6 pole star connected induction motor has following parameters referred to stator: $R_s = 0.5 \Omega$, $R_r' = 0.6 \Omega$, $X_s = X_r' = 1 \Omega$. Stator to rotor turns ratio is 2. If the motor is used for the regenerative braking, determine
 (i) Maximum overhauling torque it can hold and the range of speed in which it can operate safely.
 (ii) The speed at which it will hold a load with a load torque of 160 N-m 10
- 6 (a) Draw the block diagram and explain in brief the direct torque control of three phase induction motor. What is voltage vector switching table? 10
 (b) What do you mean by vector control or field oriented control of induction motor? Explain with necessary phasor diagram the working principle of vector control 10

Duration: 3hrs

[Max Marks: 80]

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 (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 the following** **20**
- a** Draw input-output curve, heat rate curve and incremental fuel cost curve and explain their importance in economic load dispatch.
- b** Derive characteristic equation and state the condition for steady state stability in power system.
- c** Write the static load flow equations and explain the classification of buses in power system.
- d** For an isolated single area, consider the data given below.
 Load decreases by 1% for a decrease in frequency by 1%. Find the gain and time constant of the power system represented by a first order transfer function.
 Total Area Capacity=1000 MW, Normal Operating Load = 500 MW, H = 5 sec, R= 2.5 Hz / pu MW, Operating Frequency =50 Hz.
- e** Draw the diagram to indicate interconnection between different operating states of power system and explain each operating state.
- Q 2. A** Derive the equation for optimum generation scheduling considering transmission losses (Exact coordinate equation) **10**
- Q 2. B** A synchronous generator is generating 20% of the maximum power it is capable of generating. If the mechanical input to the generator is increases by 250% of the previous value, calculate the maximum value of torque angle during the swing of rotor round the new equilibrium point. **10**
- Q3. A** Compare GS, NR and Fast decoupled load flow methods for solution of Static Load Flow Equations of a power system. **10**
- Q3. B** A constant load of 300 MW is supplied by two 200 MW generators, 1 and 2, for which the respective incremental fuel costs are **10**
 $IC_1 = 0.1P_1 + 20$ Rs/MWh
 $IC_2 = 0.12P_2 + 15$ Rs/MWh
 with powers in MW and costs C in Rs/hr. Determine (a) the most economical division of load between the generators, and (b) the saving in Rs/day thereby obtained compared to equal load sharing between machines.
- Q4. A** Derive Swing equation for a synchronous machine that describes rotor dynamics. **10**
- Q 4. B** Find the steady state power limit of a system consisting of a generator equivalent reactance 0.50 pu connected to an infinite bus through a series reactance of 1.0 pu. The terminal voltage of the generator is held at 1.20 pu and the voltage of the infinite bus is 1.0 pu. **10**

Q 5 A Draw complete block diagram and explain dynamic response of Load frequency controller for an isolated power system with and without PI controller. **10**

Q 5.B For the following system generators are connected to all the four buses and loads are connected at buses 2 and 3. All buses other than slack bus are PQ buses. Assuming flat voltage start, determine the bus voltages at the end of first Gauss Seidel iteration. **10**

Line Bus to bus	Y(pu)
1-2	2-j6
1-3	1-j3
2-3	0.6667-j2
2-4	1-j3
3-4	2-j6

Bus	P(pu)	Q(pu)	V(pu)	Remarks
1	-	-	1.04<0°	Slack
2	0.5	-0.2	-	PQ
3	-0.1	0.5	-	PQ
4	0.3	-0.1	-	PQ

Q 6. A What is power pool? Explain the different types of energy transactions and interchanges in power system. **10**

Q 6. B Two generators rated 250 MW and 350 MW are operating in parallel. The droop characteristics of their governors are 4% and 5%, respectively from no load to full load. Assuming that the generators are operating at 50 Hz at no load, how would a load of 600 MW be shared between them? What will be the system frequency at this load? Assume free governor operation. **10**

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) Compare HVAC and HVDC Transmission w.r.to Technical parameters of system.	
	b) Illustrate the need and operation of VDCOL, voltage dependent current order limit in HVDC control	
	c) Illustrate with neat diagram the features of HVDC link which has both positive and negative polarity conductors	
	d) Operation of the bridge converter with overlap angle between 60° and 120° is abnormal. Justify	
	e) Explain the additional control characteristics in HVDC inverter side used under abnormal operation.	
Q. 2	a) Illustrate with neat diagram the Component of HVDC Converter Station.	10
	c) Derive the expression for direct current of a three phase rectifier with grid control and overlap angle less than 60 degree	10
Q.3	a) Demonstrate the IPC scheme used in HVDC and mention its advantages and disadvantages	10
	b) Illustrate the control characteristics of HVDC system	10
Q.4	a) What are the different protection methods used in HVDC system. Exemplify with neat diagrams.	10
	b) Illustrate with neat waveform the effect of single commutation failure and double commutation failure	10
Q.5	a) Illustrate with neat diagram and waveforms the operation of a twelve pulse converter	10
	b) What is the need of seventh valve in HVDC system and explain with circuit diagram and waveform the operation of seventh valve in rectifier operation	10
Q.6	a) Illustrate in detail the effect of harmonics and the various means of reducing it.?	10
	b) Develop the equivalent circuit of the inverter side of an HVDC system	10

(3 Hours)

[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. (a) How to integrate mobile with the server? (5)
- (b) List and explain characteristics of IoT (5)
- (c) What is fog computing? (5)
- (d) What is the advantage of low power mesh networking in communication protocols? (5)
2. (a) Draw and explain in detail functional block diagram of IoT. (10)
- (b) What are the real world design constraints while designing IoT system? (10)
3. (a) Discuss MQTT and REST protocols used for web connectivity. (10)
- (b) Discuss various physical devices and end point in IoT based system. (10)
4. (a) List various cloud based IoT platforms and explain any 3 in detail. (10)
- (b) Explain Zigbee and Bluetooth for device communications in IoT. (10)
5. (a) What is purpose of position and localization in IoT? Discuss in brief. (10)
- (b) Explain in brief various operating systems used in IoT (10)
6. (a) How IoT can be employed for home automation to control devices like light, TV, house climate, and home appliances? Explain with respect to the software, hardware, sensors, protocols, architecture and platforms used to design this system. (10)
- (b) Why privacy and network security is important in IoT based system and applications? Explain various privacy and network security measures in IoT based systems. (10)

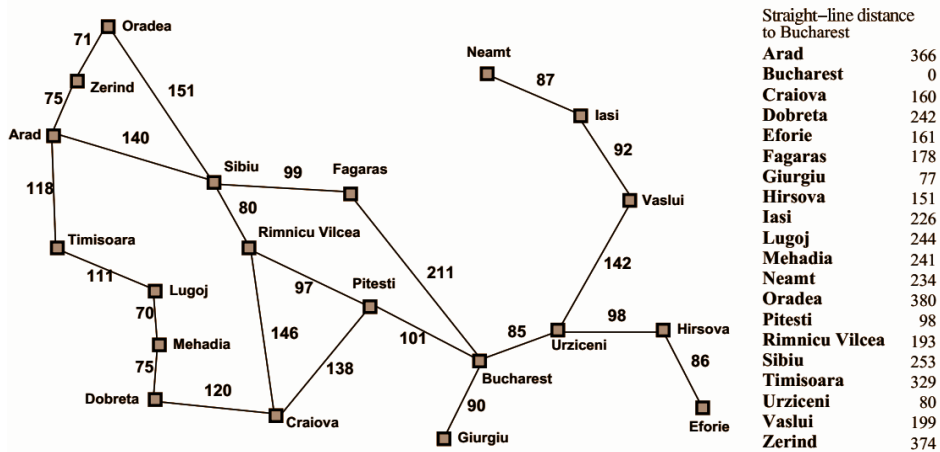
(3 Hours)

[Total Marks: 80]

- Note: 1. Question number 1 is **compulsory**.
 2. Solve any **three** questions out of the remaining **five** questions
 3. Assume suitable data if necessary.
 4. Figure to the right indicates full marks.

Q.1 Solve any **Four** of the following.

- (a) Consider the graph shown in figure below. Assume that the initial state is Arad and the goal state is Bucharest. Create a search tree to find a path from the initial state to the goal state using Greedy Best First Search. Generate the solution cost using the straight line distance mentioned. **05**



- (b) List different types of neural networks and explain any one in detail. **05**
 (c) Compare supervised and unsupervised machine learning. **05**
 (d) Calculate root mean square error for following electricity consumption dataset **05**

Area	Actual Demand (kW)	Forecasted Demand (kW)
A	56	58
B	45	42
C	68	65
D	49	47
E	26	29
F	40	46
G	52	50
H	38	33
I	30	31
J	48	47

- (e) Demonstrate that data cleansing is an important aspect for unsupervised learning. **05**
- Q.2** (a) Describe McCulloch-Pitts neuron model and discuss its performance for the implementation of NOT, OR, and AND operations. **10**
- (b) Develop the perceptron training rule and state the limitations of it. **10**
- Q.3** (a) Define SVM? Explain the following terms: hyperplane, separating hyperplane, margin, and support vectors with suitable examples. **10**
- (b) Consider the following dataset in Table, from a motor maintenance department based on the high voltage/impulse test performed on the machine. The data set contains three attributes and one class, use Naïves Bayes classifier to evaluate the class (Broken/ Healthy) of status for a {Red, AC motor, Domestic}. **10**

Machine No	Core Color	Type	Origin	Status
1.	Red	DC motor	Domestic	Broken
2.	Red	DC motor	Domestic	Healthy
3.	Red	DC motor	Domestic	Broken
4.	Yellow	DC motor	Domestic	Healthy
5.	Yellow	DC motor	Imported	Broken
6.	Yellow	AC motor	Imported	Healthy
7.	Yellow	AC motor	Imported	Broken
8.	Yellow	AC motor	Domestic	Healthy
9.	Red	AC motor	Imported	Healthy
10.	Red	DC motor	Imported	Broken

- Q.4** (a) Describe different types of clustering methods. **10**
- (b) Examine the role of deep learning in contrast to machine learning with the help of an example. **10**

Q.5 (a) With the help of a suitable constrained power system model, discuss the challenges in static security assessment. **10**

(b) Analyze in detail the impact of cyberattack on power system operation and comment on how machine learning methods can address this issue? **10**

Q.6 Write short notes on any **Four**

(a) Informed and uninformed strategies **05**

(b) Diversity of data: Structured and unstructured **05**

(c) Overfitting, bias, and variance **05**

(d) Confusion matrix **05**

(e) Wind speed forecasting using machine learning **05**

Duration: 3hrs

MGSG

[Max Marks:80]

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

- 1 Attempt any FOUR [20]**
- a** Define micro grid and state it's advantages.
 - b** Compare centralized and de-centralized control of micro grid.
 - c** Draw and elaborate a suitable diagram of AMI in smart grid
 - d** Define smart grid and elaborate it's need in current situation.
 - e** Compare characteristics of Solar PV and Wind energy source as a renewable energy sources
- 2 a** Compare non-conventional sources with respect to their suitability and characteristics in micro grid. **[10]**
- b** 'Energy storage devices play a very important role in micro grid.' Justify the statement. **[10]**
- 3 a** Draw schematic diagram of D.C. microgrid and elaborate it along with its advantages, disadvantages, and limitations. **[10]**
- b** Give importance of islanding in case of grid connected micro grid. Also give the proper sequence of operation for successful islanding. **[10]**
- 4 a** Draw a block diagram on hierarchical control and elaborate its working **[10]**
- b** What is black start? Does micro grid is helpful for it? Justify your answer. **[10]**
- 5 a** State inverter control modes and elaborate any one in detail. **[10]**
- b** Draw and elaborate a functional block diagram of smart meter **[10]**
- 6 a** Enlist various communication methods used for smart grid and elaborate any one in detail. **[10]**
- b** Describe the 'self-healing' characteristic of smart grid **[10]**

(3 Hours)

Total Marks: 80

Note:

1. **Question No. 1 is compulsory.**
2. Attempt any **THREE** out of the remaining **FIVE** questions.
3. Assume suitable data if necessary.

- 1 Answer the following (any 4) (20)
- a) Define the terms: Hazard, Vulnerability, Risk 5
 - b) Discuss the Direct and indirect effects of disasters 5
 - c) What is Disaster Scenario of India? 5
 - d) Explain types of Manmade disasters. 5
 - e) What is Climate Change? What are the effects of Global Warming? 5
- 2
- a) What are different types of flood? Enlist structural mitigation measures for flood. 10
 - b) Explain the types of landslide and factors affecting them. Give a case study for the same. 10
- 3
- a) What are different government agencies responsible for various types of disasters? 10
 - b) Explain roles and responsibilities of NDMA in detail. 10
- 4
- a) Discuss the role of GIS and Remote Sensing in disaster management. 10
 - b) Describe the institutional mechanism setup in India. 10
- 5
- a) What is role of NGOs in disaster management? Enlist major NGOs working on disaster management. 10
 - b) Explain Bio shield and Sea wall in detail with schematic diagram. 10
- 6
- a) What is Community Base Disaster Management (CBDM)? Discuss how it is useful in Indian scenario. 10
 - b) What are Do's and don'ts in Earthquake, Tsunami and Cyclone? 10

3 hours

80 Marks

N. B. :

1. Question number 1 is **compulsory**.
2. Attempt any **THREE** from question number 2 to 6
3. Use illustrative diagrams wherever required

Q. No.	Marks
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- | | | |
|------------|--|-----------|
| Q1) | Attempt any FOUR questions | |
| a) | What is main objective of Electricity Act, 2003? | 05 |
| b) | Define specific power consumption (SPC) with an example. A compressor generates 100 cfm of air. The power drawn by the motor is 18 kW. Find its SPC. | 05 |
| c) | Why Sankey diagram is useful in energy balance calculations? Draw Sanky diagram for domestic gas stove. | 05 |
| d) | What are the impacts of steam leakages on the performance of boiler? | 05 |
| e) | Enlist any THREE types of lamps and write their significant features. | 05 |
| Q2) | a) Briefly describe the economic reforms in coal, oil and natural gas and electricity sectors in India. | 10 |
| b) | Define energy management. Distinguish between 'preliminary energy audit' and 'detailed energy audit'? | 10 |
| Q3) | a) Annual savings after replacement of HVAC plant for year 2019 is Rs. 5,00,000, for year 2020 is Rs. 5,50,000, and for year 2021 is Rs. 6,50,000. Total project cost is Rs 13.5 lakh. Considering cost of capital as 12%, what is the net present value of the proposal? | 10 |
| b) | What are the base line data that an audit team should collect while conducting detailed energy audit of thermal power plant? | 10 |

Q. No.	Marks
Q4) a) During April-2022, the university has recorded a maximum demand of 600 kVA and average PF (power factor) is observed to be 0.82 lag, The minimum average PF to be maintained is 0.92 lag as per the independent utility supplier and every one % dip in PF attracts a penalty of Rs 10,000/in each month. a) Calculate the improvement in PF for May-2022 by installing 100kVAR capacitors. b) Calculate penalty to be paid if any during May-2022.	10
b) List all the possible energy conservation measures possible in HVAC system.	10
Q5) a) In a plant, a boiler is generating saturated steam of 10 TPH at a pressure of 7 kg/cm ² (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 kg/cm ² (g) = 660 kcal/kg Find out the efficiency of the boiler by direct method and volume of furnace oil tank (in m ³) required for 120 hrs of operation.	10
b) Explain how a Variable Frequency Drive saves power in a three phase electric motor driven pumping system? What will be the reduction in power drawn by a motor by reducing the speed by half?	10
Q6) a) What do mean by ECBC? Discuss the schemes of government regarding implementation of ECBC in shopping mall.	10
b) Write short notes on 1. How to convert housing society into Green Building 2. LEED rating	10
