

(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) | State the factors affecting the choice of Electric drives. | 5 |
| | (b) | Explain the term intermittent periodic duty. | 5 |
| | (c) | What do you understand by constant torque drive and constant power drive? | 5 |
| | (d) | Variable frequency control of induction motor is more efficient than stator voltage control, why? | 5 |
| 2 | (a) | Explain the Speed-Torque conventions and Multi-quadrant Operation of Electric drives with an example. | 10 |
| | (b) | Derive and explain Thermal Model of Motor for Heating and Cooling. | 10 |
| 3 | (a) | Explain the operation of closed loop speed control scheme with inner current control loop. What are the function of inner current loop? | 10 |
| | (b) | Illustrate with neat diagram the working of Three phase fully controlled rectifier control of DC separately excited motor | 10 |
| 4 | (a) | A 2.8 kW, 400 V, 50 Hz, 4 pole, 1370 rpm delta connected squirrel cage induction motor has following parameters referred to the stator: $R_s = 2\Omega$, $R_r' = 5\Omega$, $X_s = X_r' = 5\Omega$, $X_m = 80\Omega$. Motor speed is controlled by stator voltage control. When driving a fan load it runs at rated speed at rated voltage. Calculate motor terminal voltage, current and torque at 1200 rpm. | 10 |
| | (b) | Explain variable frequency control of induction motor and explain the following points | 10 |
| | | i. For speeds below base speed (V/f) ratio is maintained constant, why? | |
| | | ii. For speed above base speed, terminal voltage is maintained constant, why? | |
| 5 | (a) | Explain star-delta and autotransformer starters of induction motor. Why high current inrush occurs during open circuit transition in star-delta and autotransformer starters of induction motors? | 10 |
| | (b) | Explain d-q model of Induction Motor. | 10 |
| 6 | (a) | Explain with diagrams, the principle of vector control in AC drives. | 10 |
| | (b) | Explain control methodology of Direct Torque Control of induction motor. | 10 |

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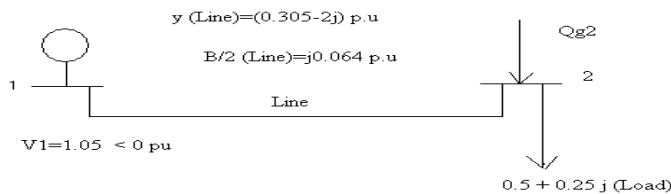
NOTE

1. Question number 1 is compulsory
2. Attempt any three from the remaining
3. Figures to right indicates full marks
4. Assume suitable data if necessary and mention the same

1. Attempt any four of the following :- **20**
 - a) Explain why frequency control loop and voltage control loop are not interacting **05**
 - b) For following Y_{BUS} fill in the blanks, all $y_{i0} = 0$ **05**

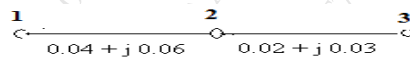
$$j \begin{bmatrix} -13 & 10 & 5 & - \\ - & -18 & 10 & - \\ - & - & -13 & - \\ - & - & - & - \end{bmatrix}$$
 - c) Define power system stability and classify it on the basis of nature of disturbance **05**
 - d) State assumptions made in transient stability studies **05**
 - e) In turbine speed governor system ΔP_c is unit step, $\Delta f = 0$, $R = 2.5$, $K_{sg} = 1$, $T_{sg} = 0.4$, Determine ΔY_E at $t = 0.2$ s **05**

2. **20**
 - a) A simple two-bus power system is shown in fig **10**



$|V_2| = 1.0$ p.u (Bus 2 is PV bus). Obtain δ_2 and Q_{g2} at the end of first iteration of N-R method.

- b) For the network shown in figure obtain the complex bus bar voltage at bus 2 at the end of the first iteration. Use the Gauss seidal method. Line impedances are given in pu Given Bus 1 is slack bus with $V_1 = 1 < 0$ **10**
 $P_2 + j Q_2 = -5.6 + j 1.46$ Assume $V_3^0 = 1.02 < 0$ $V_2^0 = 1 < 0$

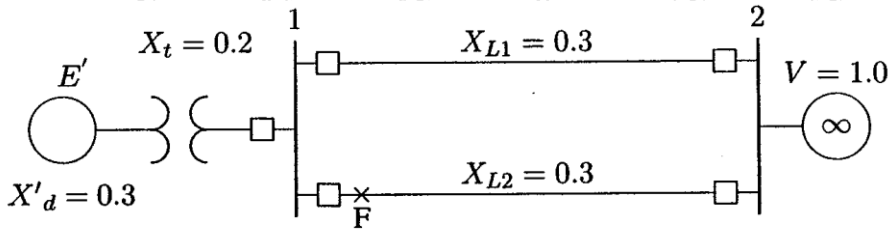


3. **20**
 - a) Determine the economic operation point for three thermal units delivering a total load of 600 MW with considering generator limit **10**
 Unit1 $P_{max} = 600$ MW; $P_{min} = 150$ MW
 $F_1(P_1) = 550 + 7.7P_1 + 0.00165P_1^2$
 Unit2 $P_{max} = 500$ MW; $P_{min} = 125$ MW
 $F_2(P_2) = 300 + 7.88P_2 + 0.002P_2^2$
 Unit3 $P_{max} = 600$ MW; $P_{min} = 75$ MW
 $F_3(P_3) = 80 + 7.99P_3 + 0.005P_3^2$
 - b) Derive formula for B_{mn} coefficients in transmission loss formula **10**

4. 20

a) Find the steady state power limit of a system consisting of a generator equivalent reactance 0.5 p.u connected to an infinite bus through a series reactance of 1.0 p.u. The terminal voltage of the generator is held at 1.2 p.u and the voltage of the infinite bus is 1 p.u. 10

b) A 50 Hz synchronous generator having inertia constant $H=5$ MJ/MVA and a direct axis transient reactance $x_d' = 0.3$ p.u is connected to an infinite bus through a purely reactive circuit as shown in the figure below. Reactances are marked on the diagram on a common system base. The generator is delivering real power $P_e=0.8$ pu and $Q=0.074$ pu to the infinite bus at voltage $v=1$ pu. A temporary three phase fault occurs at the sending end of the line at point F. When the fault is cleared, both the lines are intact. Determine the critical clearing angle and the critical clearing time 10



5. 20

a) Draw turbine speed governor system and explain briefly 4 major parts in it 10

b) Explain dynamic response of change in frequency for step change in load of an isolated power system. How dynamic response changes with integral control action 10

6. Write short notes on 20

a) power pool and its advantages and disadvantages 10

b) System state classification of power system security 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) What is the difference between IoT and M2M? (5)
- (b) List and explain at least 3 sources of IoT. (5)
- (c) Write a short notes on AWS and Xively cloud for IoT. (5)
- (d) Describe integration of mobile with the server. (5)
2. (a) Draw and Explain different IoT Levels in detail. (10)
- (b) Explain how RFID and bluetooth helps in device communications? (10)
3. (a) Explain LPWAN with respect to LORA and NBIoT. (10)
- (b) Explain the significance of privacy and security measures in IoT based systems. Explain few privacy and security measures. (10)
4. (a) Describe physical devices and end points in IoT based systems. (10)
- (b) Discuss SOAP and REST protocols used for web connectivity. (10)
- 5 (a) Explain data handling in IoT based systems with respect to data acquiring and storage. (10)
- (b) Draw and explain in detail the functional block diagram of IoT. (10)
6. (a) How can IoT be used in agriculture with respect to monitoring weather conditions, soil quality, crop growth progress and water consumption? Explain with respect to the software, hardware, sensors, protocols, architecture and platforms used to design this system. (10)
- (b) Explain in brief various operating systems used in IoT (10)

Time: 3 Hours

Marks: 80

Instructions:

- Question No: 1 is compulsory.
- Answer any three from the remaining five questions.
- Figures to the right indicate full marks.
- Answers to questions should be grouped and written together.

- Q1** a) Illustrate with neat diagram the mono polar and bipolar links of HVDC system. What are the main features of these links? **20**
- b) Illustrate the causes of over voltages in HVDC system and over voltage protection method used in HVDC system?
- c) Show that the expression for the power factor of an HVDC converter with grid control and overlap angle less than 60° is $\frac{1}{2}(\cos \alpha + \cos(\alpha + \mu))$
- d) Illustrate with block diagram the operation of HVDC Transmission for Offshore Wind Farms?
- Q2** a) Illustrate the relative merits of AC and DC mode of transmission based on economics of transmission and power flow through a conductor **10**
- b) Derive the equivalent circuit of three phase rectifier with grid control and overlap angle less than 60° . **10**
- Q3** a) Illustrate the control characteristics of HVDC and explain how power reversal is possible in HVDC. **10**
- b) Illustrate with neat diagram the equidistant pulse generation schemes used in HVDC system control method and mention its advantages and disadvantages? **10**
- Q4** a) What are the causes and effects of harmonics in HVDC system? How harmonics is classified? **10**
- b) Explain the transfer of current to bypass valve in rectifier operation. **10**
- Q5** a) Describe with neat diagrams single commutation failure of converters. **10**
- b) Calculate the secondary line voltage, active power, power factor and reactive power of the transformer for a three phase bridge rectifier to provide a DC voltage of 120 kV. Assume $\alpha = 30^\circ$, $\mu = 15^\circ$. What is the effective reactance X_L , if the rectifier gives 800 A of DC output current **10**
- Q6** a) What are the features of ground return used in HVDC systems? **10**
- b) With neat diagram explain components of HVDC system. **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) Write short note on breadth first search **05**
- (b) Biological neurons have a cell body, axons, dendrites and synapses. Draw a diagram and label these terms on it and explain each in brief. **05**
- (c) State the reason for increase in the popularity of data mining in the field of machine learning. **05**
- (d) Calculate accuracy, precision, recall and F1-score for following confusion matrix **05**

		Predicted Class	
		No	Yes
True Class	No	55 (TN)	5 (FP)
	Yes	10 (FN)	30 (TP)

- (e) Illustrate the impact of outliers in a data set. **05**

Q.2 (a) Draw the block diagram of error back propagation algorithm and explain with a flow chart the concept of back propagation. **10**

- (b) List different types of activation function and describe any three in brief. **10**

Q.3 (a) Explain with suitable examples the advantages of Bayesian approach over classical approaches to probability. **10**

- (b) Consider the following 2-D dataset in Table. Construct a SVM classifier model. Given (2,1), (2, -1), and (4, 0) as support vectors, estimate the parameters of the model and classify (4, 2). **10**

(X1, X2)	(1, -1)	(2, -1)	(5, -1)	(4, 0)	(6, 0)	(1, 1)	(2, 1)	(5, 1)
Class	C1	C1	C2	C2	C2	C1	C1	C2

- Q.4** (a) Describe the steps to reduce dimensionality using the principal component analysis method by clearly stating mathematical formulas used. **10**
- (b) Explain reinforcement learning in detail along with the various elements involved in forming the concept. **10**
- Q.5** (a) Explain voltage control expert system (VCES) along with its advantages over algorithmic approach. **10**
- (b) Discuss the challenges faced in demand side management and explain how machine learning enhances the demand side management process. **10**
- Q.6** Write short notes on any **Four**
- (a) Informed and uninformed strategies **05**
- (b) Structured and unstructured data **05**
- (c) Tradeoff between Bias and Variance **05**
- (d) Linear regression **05**
- (e) Load pattern classification using machine learning **05**
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(3Hrs)

Marks: 80

N.B.

1. **Question No.1 is Compulsory.**
2. Answer any three out of remaining five questions
3. Assume any suitable data wherever required but justified the same
4. Illustrate answer with sketches wherever required

- Q 1 Answer **any four** from the following questions. (20)
- a. Illustrate the regulatory standards/ framework for Distributed
 - b. Illustrate the black-start and grid synchronization operation of
 - c. Compare characteristics of Solar PV and Wind energy source as a renewable energy sources.
 - d. Illustrate the role of bidirectional convertor in micro-grid?
 - e. Explain the concept of smart substation.
- Q 2 a) Discuss the issues in islanded mode of operation of micro-grid (10)
- b) What do you mean by Intelligent Electronic Devices (IED). Illustrate its role in monitoring and protection of smart grid. (10)
- Q 3 a) Illustrate operating principle of Fuel cell. State the types of fuel cell. (10)
- Explain the operation of any one in detail.
- b) State the different control architecture of Microgrids. Illustrate any one in detail. (10)
- Q 4 a) Discuss the anti-islanding schemes of operation of Microgrid. (10)
- b) Illustrate Adaptive protection in micro grid? (05)
- c) Compare AC micro-grid & DC micro-grid (05)
- Q 5 a) Illustrate the role of Energy storage system towards Microgrid operation and stability. (10)
- b) Explain the concept of real time pricing as a smart grid technology. (05)
- c) State the opportunities and barriers of smart grid. (05)
- Q 6 a) Illustrate different types of Data communication /protocols used in smart grid operation? (10)
- b) Explain the typical micro-grid structure configuration in grid connected mode. (10)

3 Hours

80 Marks

Instructions

1. Question number 1 is compulsory
2. Attempt any **THREE Questions** out of remaining **FIVE Questions**.
3. Use illustrative diagrams wherever required.

- Q1)** Attempt any Four.
- a) Discuss the present energy scenario in the world. **05**
 - b) Give examples of energy conservation and energy efficiency. **05**
 - c) Differentiate between high-grade energy and low-grade energy. **05**
 - d) Enlist any five energy audit instruments. **05**
 - e) Define Net Present Value (NPV). Write the formula to find NPV. **05**
 - f) What do you mean by the term LEED rating of building? **05**
- Q2)**
- a) What do you mean by energy management? Explain the types of energy audit. **10**
 - b) Define energy audit. What are the duties and responsibilities of energy auditor? **10**
- Q3)**
- a) Explain Energy Conservation Act- 2001 and its Features. **10**
 - b) Explain the Elements of monitoring & targeting. **10**
- Q4)**
- a) Define power factor. What are the benefits of power factor improvement? **10**
 - b) List any TEN Energy conservation measures in lighting system. **10**
- Q5)**
- a) Explain any FIVE energy conservation measures in pumping system. **10**
 - b) Discuss general fuel economy measures in Boilers and furnaces. **10**
- Q6)**
- a) Enlist five energy saving measures in a commercial building. **05**
 - b) List the steps to evaluate performance of HVAC system. **05**
 - c) List the steps to evaluate performance of lighting system. **05**
 - d) Explain ECBC code of buildings. **05**
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