B Tech (Elect) Sem VIII

17/5/22

Program: B.Tech. (Electrical)   **Duration: 3 hrs.**

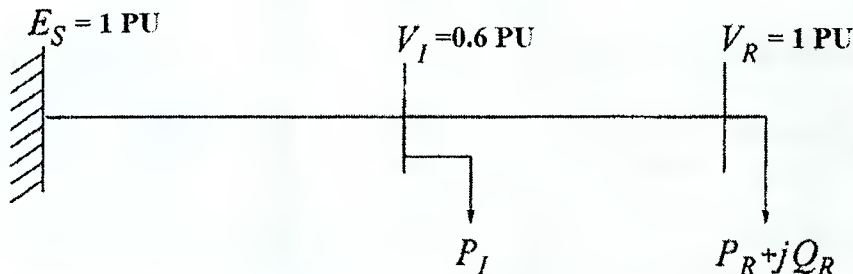**Course Code: PE-BTE801**   **Maximum Points: 100**

Course Name: Power system dynamics and control   **Semester: VII☨**

Notes:

1. Question number 1 compulsory.
2. Attempt any **four** questions out of remaining **six**.
3. Draw neat diagrams.
4. Assume suitable data if necessary.

Q. No.	Questions	Pts.	CO	BL	PI
1.	A 20 MVA, 50 Hz generator delivers 18 MW over a double circuit line to an infinite bus. The generator has kinetic energy of 2.52 MJ/MVA at rated speed. The generator transient reactance is $X'_d = 0.35$ pu. Each transmission circuit has R = 0 and a reactance of 0.2 pu on a 20 MVA base.$|E'|= 1.1$ pu and infinite bus voltage V $=1.0\angle0^0$. Sudden loss of one transmission line takes place. Plot swing curve over the period of 0.2 Sec. using **point by point method** if the fault is sustained.	20	2	L4	2.4.2
2. (a)	What is solution of given system to maintain constant voltage profile? E_S = 1 PU V_I =0.6 PU V_R = 1 PU P_I P_R+jQ_R Schematic diagram	05	2	L2	2.1.2
(b)	Explain in detail operating condition for point A, B and C using given graph. Also draw **normal and abnormal operating region** on graph (b).	10	2	L3	2.4.2

(a) Schematic diagram

(b) Receiving end voltage, current and power as a function of load demand

(c)	With the help of neat diagram explain in detail how to maintain terminal voltage of synchronous generator 1 PU for continuously increasing load demand.	05	1	L2	2.1.2
3. (a)	A generator operating at 50 Hz delivers 1 pu power to an infinite bus through a transmission circuit in which resistance is ignored. A fault takes place reducing the maximum power transferable to 0.5 pu whereas before the fault, this power was 2.0 pu and after the clearance of the fault, it is 1.5 pu. By use of equal are criterion, determine the critical clearing angle. (Consider initial mechanical input power 1.0 pu)	10	2	L3	2.2.3
(b)	Explain in detail small signal stability of dynamic system by using following points a) State space representation b) Concept of state c) Equilibrium points d) Stability of linear and nonlinear system	10	1	L2	.2
4.	Derive expression for small signal stability of a single machine infinite bus system with the help of following points 1. Classical model representation 2. State space representation 3. Block diagram representation 4. Expression of damping ratio (ζ) and natural frequency (ω_n)	20	1	L2	2.1.2

		20	1	L2	2.1.2
5.	With the help of neat diagram explain in detail 1. Classical model representation of synchronous machine 2. Higher order model representation of synchronous machine.				
6.(a)	Write short note on 1. P-V Curve 2. Q-V Curve 3. P-Q Curve	10	1	L2	2.2.3
(b)	With the help of neat diagram explain in detail how to reduce oscillations produced in rotor of synchronous generator during transient conditions. **(Note : Give at least 2 solutions)**	10	2	L3	2.2.3
7.(a)	Which are methods of transient stability enhancement? Explain in detail Steam turbine fast valving.	10	1	L2	2.1.2
(b)	Write short note on 1. V-Q Sensitivity analysis 2. Q-V model analysis	10	1	L2	2.1.2

End Semester re-examination July 2022

B. Tech (Electrical) Sem VIII 8/7/22

Program: B.Tech. (Electrical)
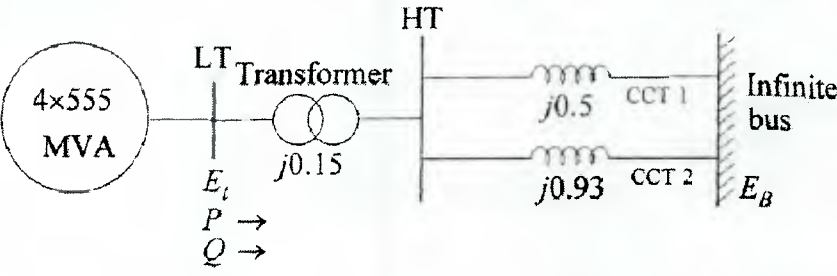
Duration: 3 hrs.

Course Code: PE-BTE801

Maximum Points: 100

Course Name: Power system dynamics and control

Semester: VIII

Notes:

1. Question number 1 compulsory.
2. Attempt any **four** questions out of remaining **six**.
3. Draw neat diagrams.
4. Assume suitable data if necessary.

Q. No.	Questions	Pts.	CO	BL	PI
1.	Fig.1 shows the system representation applicable to thermal generating station consisting of four 555 MVA, 24 KV, 60 Hz units Fig. 1 The network reactance shown in figure are in per unit on 2220 MVA, 24 KV base. Resistances are assumed to be negligible. Type of fault occur: **Loss of circuit 1 (CCT 1)** The post fault system condition in per unit on the 2220 MVA, 24 KV base is as follows: P = 0.9 Q = 0.3 (overexcited) $E_t = 1.0\angle36^0$ $E_B = 0.995\angle0^0$ The generators are modeled as a single equivalent generator represented by the classical model with the following parameters expressed in per unit on 2220 MVA, 24 KV base: $X_d' = 0.3$ $H = 3.5\ MW.s/MVA$ Write the linearized state equation of the system. Determine the eigen values, Damped frequency of oscillation in Hz, damping ratio and undamped natural frequency for each of the following values of damping coefficient (in pu torque/	20	2	L4	2.4.2

	pu speed) : (i) $K_D = 0$ (ii) $K_D = -10.0$ (iii) $K_D = 10.0$				
2. (a)	A generator operating at 50 Hz delivers 1 pu power to an infinite bus through a transmission circuit in which resistance is ignored. A fault takes place reducing the maximum power transferable to 0.5 pu whereas before the fault, this power was 2.0 pu and after the clearance of the fault, it is 1.5 pu. By use of equal are criterion, determine the critical clearing angle. (Consider initial mechanical input power 1.0 pu)	10	2	L3	2.2

(b)	Explain in detail small signal stability of dynamic system by using following points
	
	   a) State space representation
	   b) Concept of state
	   c) Equilibrium points
	   d) Stability of linear and nonlinear system
		10	1	L2	2.1

3.	Derive expression for small signal stability of a single machine infinite bus system with the help of following points
	
	   1. Classical model representation
	   2. State space representation
	   3. Block diagram representation
	   4. Expression of damping ratio (ζ) and natural frequency (ω_n)
		20	1	L2	2.

4.	With the help of neat diagram explain in detail
	   1. Classical model representation of synchronous machine
	   2. Higher order model representation of synchronous machine.
		20	1	L2	2.

5.	A 20 MVA, 50 Hz generator delivers 18 MW over a double circuit line to an infinite bus. The generator has kinetic energy of 2.52 MJ/MVA at rated speed. The generator transient reactance is $X'_d = 0.35$ pu. Each transmission circuit has R = 0 and a reactance of 0.2 pu on a 20 MVA base.$|E'| = 1.1$ pu and infinite bus voltage V $=1.0\angle 0^0$. A three-phase short circuit occurs at the midpoint of one of the transmission lines. Plot swing curves with fault cleared by simultaneous opening of breakers at both ends of the line at2.5 cycles using **Runge-Kutta (Order-2)** method.	20	2	L4	2.4

6.(a)	Write short note on
	   1. P-V Curve
	   2. Q-V Curve
	   3. P-Q Curve
		10	1	L2	2.2

(b)	Explain in detail operating condition for point A, B and C using given graph. Also draw **normal and abnormal operating region** on graph (b).	10	2	L3	2.2.3

(a) Schematic diagram

$\phi = 18.2°$
$\theta = 84.3°$
$I_{SC} = E_S/Z_{LN}$

Z_{LN}/Z_{LD}

(b) Receiving end voltage, current and power as a function of load demand

7.(a)	Which are methods of transient stability enhancement? Explain in detail Steam turbine fast valving.	10	1	L2	2.1.2
(b)	Write short note on 1. V-Q Sensitivity analysis 2. Q-V model analysis	10	1	L2	2.1.2

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END SEMESTER EXAMINATION

EVEN SEM MAY 2022

Program: ELECTRICAL ENGINEERING.   **Duration: 03Hr**

Course Code: PE-BTE803   **Maximum Points: 100**

Course Name: HVDC TRANSMISSION SYSTEMS   **Semester: VIII**

NB: Five questions to be answered as per instructions given within the questions (Qs-1 to Qs-5)

Draw neat circuit & phasor diagrams wherever necessary to support your answer.

Assume suitable data if necessary.

Qs. No.	Questions	Points
Qs-1.	**a.** Compare AC & DC transmission system based on the based on the factors. a) Economics of transmission b) Technical Performance c) Reliability.	10
	b. Name & state performance and operational differences of different forms of configuration of HVDC inter connection.	10
Qs-2.	**Answer (a &b) OR (c&d)**	
	a. What is the effect of firing angle delay and commutation overlap on output voltage of a three phase six pulse converter? Support your answer analytically with required circuit diagram and waveform.	10
	b. A 230 kV ac system is connected to a 3-phase 12-pulse converter, operating as rectifier, through a transformer having nominal voltage ratio 220kV/110kV and an effective turn ratio 0.48. When the converter is operated with an ignition delay angle of 20°, the reduction in average direct voltage due to commutation overlap is 22.61 kV. Determine (i) the commutation angle (ii) dc output voltage (iii) effective commutation reactance, if the dc current delivered by the rectifier is 1750A	10
	c. What is Voltage-Dependent Current-Order Limit & how is it implemented in HVDC power flow control? Support your answer with neat circuit diagram and characteristics.	10
	d. Show the block diagram representation of HVDC system control hierarchy and mention the function of each block.	10
Qs-3.	**Answer (a &b) OR (c&d)**	
	a. Show the block diagram representation of EPC based Constant-Current control system. Also, name & define each block with its function.	10

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END SEMESTER EXAMINATION

EVEN SEM MAY 2022

	b.	Show neat schematic representation of converter station of a classic HVDC system with the component names & then state the basic functions of the following components in the system: i) Converters ii) smoothing reactors iii) Harmonic filters	**10**
	c.	What do you understand by Selective Harmonic Elimination (SHE)? Support your answer with required diagrams.	**10**
	d.	Compare two-level & three-level VSCs with support of waveform and circuit diagram and switching sequence.	**10**
Qs-4.	**Answer (a &b) OR (c&d):**		
	a.	Draw the equivalent circuit of a classic two terminal HVDC link with LCC. Name all parameters used in the circuit.	**05**
	b.	With reference to the equivalent circuit, draw the V-I characteristics & explain the complete power flow control including power reversal of the two terminal HVDC link.	**15**
	c.	What is SVPWM technique & how is implemented in VSC based HVDC systems?	**10**
	d.	How is the following transformations obtained (i) a-b-c to α-β transformation (ii) α-β to d-q synchronous rotating frame	**10**
Qs-5.	**Answer any two:**		
	a.	Basic parameters that concern Stability in power system & Role of STATCOM in stability Enhancement using an HVDC link .	**10**
	b.	Compare Multi terminal link and point-to-point link. Support your answer with neat diagrams.	**10**
	c.	Draw the basic diagram of phase locked loop showing voltages and hence mention how is the required output derived	**10**
	d.	DC line faults in VSC based system & LCC based system.	**10**

RE EXAMINATION

EVEN SEM JULY-2022

B.Tech (El-ed) Sem VIII 11/7/22

Program: ELECTRICAL ENGINEERING.　　　**Duration: 03Hr**

Course Code: PE-BTE803　　　　　　　**Maximum Points: 100**

Course Name: HVDC TRANSMISSION SYSTEMS　　**Semester: VIII**

NB: Answer Five questions as per instructions given within the questions (Qs-1 to Qs-5)
Draw neat circuit & phasor diagrams wherever necessary to support your answer.
Assume suitable data if necessary.

Qs. No.	Questions	Points
Qs-1.	**a.** Draw the typical layout of HVDC transmission system and explain functions of each part & components? **b.** Mention the advantages of HVDC technical economical reliability aspects?	10 10
Qs-2.	**a.** Considering the effect of firing angle delay and commutation overlap, obtain the expressions for average dc voltage, AC current and reactive power absorbed by the 3-phase 6-pulse converter? Support your answer with relevant diagrams. & hence, obtain the equivalent circuit of an HVDC link using LCC. OR (b&c) **b.** What is Voltage-Dependent Current-Order Limit & how is it implemented in HVDC power flow control? Support your answer with neat circuit diagram and characteristics. **c.** Show the block diagram representation of HVDC system control hierarchy and mention the function of each block.	20 10 10
Qs-3.	**Answer any two** **a.** What is meant by individual phase control and what are the draw backs of this control and explain how these drawbacks can be eliminated? **b.** Explain the constant extinction angle control and constant current control? **c.** Explain the Principles of Link Control in a VSC HVDC system? **d.** Name & state performance and operational differences of different	 10 10 10 10

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RE EXAMINATION
EVEN SEM JULY-2022

	forms of configuration of HVDC inter connection.		
Qs-4.	**Answer any two questions:**		
	a. Draw the V-I characteristics & explain the complete power flow control including power reversal of the two terminal HVDC link.	10	
	b. What is SVPWM technique & how is implemented in VSC based HVDC systems?	10	
	c. How is stability Enhancement attained using an HVDC link.	10	
	d. Draw the basic diagram of phase locked loop showing voltages and hence mention how is the required output derived	10	
Qs-5.	**Answer any two questions:**		
	a. Voltage-Dependent Current-Order Limit & how is it implemented in HVDC power flow control	10	
	b. Multi terminal link and point-to-point link	10	
	c. Effect of commutation failure, misfire and current extinction in LCC links	10	
	d. Modular Multi Level Converters.	10	

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End Sem Examination
May-2022

Max. Marks: 100   Duration: **03 Hours**

Class: **B.TECH.**   Semester: **VIII**   Program: **B.TECH (Electrical)**

Name of the Course: **Advanced Electric Drives**   Course Code: **PE-BTE 805**

Instructions:
- Solve Any five questions
- Answers to all sub questions should be grouped together
- Figures to the right indicates full mark
- **Assume suitable data if required and justify the same.**

Ques. No	Description of question	Max. Marks	CO
Q.1 a)	The overexcited synchronous motor is controlled by using the inverter. The switches used in the inverter are SCR. Justify.	05	01
b.	Compare the Voltage Source Inverter (VSI) and Current Source Inverter (CSI).	05	01
c.	Compare the Scalar Control and Vector Control of three phase induction motor.	05	02
d.	What are the important characteristics of PWM (Pulse Width Modulation) technique to control power electronics converter.	05	03
Q.2 a)	Compare the peak value of phase voltage for: (a) Square wave inverter (b) Sine-Triangle PWM technique (c) Sine-Triangle PWM plus third harmonic injection technique (d) space vector PWM (SVPM) technique.	08	01
b.	In space vector modulation technique, derive the relation for the time of application (T_1, T_2 and Tz) of switching vectors in the given sampling time (Ts).	06	01
c.	What are the limitations of three phase dynamic model of three phase induction motor?	06	03

Q.	Question	Marks	CO
Q.4a)	Develop the model of three phase induction motor in arbitrary reference frame.	12	03
b.	Discuss the analogy of DC drive used to develop the vector control of three phase induction motor.	08	03
Q.5a)	Draw the block diagram and discuss the flux weakening operation of three phase induction motor in Direct Rotor Flux Oriented control.	06+06	02
b	What is stator flux oriented control of three phase induction motor? What are the advantages of Rotor Flux Oriented control of three phase induction motor over Stator Flux Oriented control?	04+04	02
Q.6a)	Draw the block diagram and explain the Direct Torque Control of three phase Induction Motor.	06+06	02
b	Compare the conventional synchronous motor with permanent magnet synchronous motor (PMSM). What are the types of rotor of PMSM?	04+04	02
Q.7a)	What is the difference between Brushless DC motor and Brushed DC motor? Draw the block diagram and discuss the closed loop control of BLDC motor.	04+08	02
b	Discuss the hysteresis current controlled PWM technique used in electrical drives. What are the draw backs of this technique?	08	03

END SEMESTER EXAMINATION MAY 2022

Program: B.Tech *(Electrical)*

Course Code: PE-BTE802

Course Name: Smart Grid

Duration: 3 Hours

Maximum Points: 100

Semester: VIII

Notes:
1. **Attempt any five questions out of seven.**
2. **Draw neat diagrams wherever necessary.**

Q.No.		Questions	Points	CO	BL
1 (a)		Explain the concept of smart grid and hence discuss the evolution of electric grid. Describe the present development of smart grid in India.	02+03 +05	01	L1
1 (b)		What is CDM? Hence explain CDM opportunities in smart grid. Discuss various international policies in smart grid. (Any three)	01+03 +06	01	L1
2 (a)		What is the significance of real time prizing in smart grid? Hence discuss the advantages of real time prizing.	02+03	02	L1
		Explain the role of Plug in Hybrid Electric Vehicle (PHEV) in making greener future with its advantages and disadvantages.	+05		L2
2 (b)		What is Smart Meter and hence explain the different functions of Smart Meters.	02+03	02	L1
		Explain the different tasks to be performed by home area network (HAN) in smart grid environment.	+05		
3 (a)		Explain the significance of smart storage. Hence describe superconducting magnetic energy storage (SMES) and pumped hydro compressed air energy storage with diagram.	01+05 +04	02	L1
3 (b)		Explain the working of Phasor Measurement Unit with block diagram in detail. State the advantages of PMU over the conventional methods.	05+02 +03	02	L2
4 (a)		What are the different challenges related to protection of microgrid? Hence explain various approaches about the control strategies used in microgrid.	04+06	03	L2

4 (b)	Explain the working principle with diagram, advantages, disadvantages and application of Variable speed wind generators and Microturbines.	05+05	03	L2
5 (a)	Explain the different power quality issues of grid connected renewable energy sources integrated in Smart Grid.	05	03	L2
5 (b)	What is power quality conditioner? Explain any **TWO** power quality conditioners used in Smart Grid.	01+07 +07	03	L1
6 (a)	What is the importance of information and communication technology system (ICT) in smart grid environment? Hence, explain Home area network (HAN), neighbourhood area network (NAN), wide area network (WAN).	02+03 +03+03	04	L1
6 (b)	Explain Bluetooth, Zigbee and Wi-Fi communication protocols/networks used in smart grid with the comparison between them.	03+03 +03	04	L1
7 (a)	What are the different services provided by cloud computing to smart grid? Hence, explain the different cloud computing opportunities and challenges to work efficiently in smart grid environment.	02+04 +04	04	L1
7 (b)	Draw and explain the architecture of broadband over power line (BPL) communication system used for smart grid communication. List and explain different IP based protocols used for security of smart grid.	01+04 +05	04	L1

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End Semester Examination
May-2022

Max. Marks: **100**   Duration: **03 Hours**
Class: **B.TECH.**   Semester: **VIII**   Program: **B.TECH (Electrical)**
Name of the Course: **Power Quality and FACTS**   Course Code: **PE-BTE 804**

Instructions:
- **Solve any five questions.**
- Answers to all sub questions should be grouped together
- Figures to the right indicates full mark
- **Assume suitable data if required and justify the same.**

Ques. No	Description of question	Max. Marks	CO
Q.1 a)	Define power quality. Discuss the effects of harmonics on the operation of power system equipments.	05	03
b.	What is selective harmonic elimination technique?	05	04
c.	Compare TCR and GCSC.	05	04
d.	What are the advantages of using the rotating reference frame in electrical system?	05	02
Q.2 a)	In space vector modulation control of inverter, calculate the time of application (T_1, T_2 and T_z) of switching vectors in the given sampling time (T_s). Draw the switching diagram (diagram showing the change of switching vector in the sampling time T_s) and explain the requirement of changing the switching positions.	06+04	04
b.	Draw the control block diagram and discuss the controlled current SLCVC (in which the compensator current Ic is sensed). What are the demerits of this scheme?	08+02	02
Q.3 a)	What are the important features of Multilevel Inverter? Derive the magnitude and angle of medium voltage space vector for three level inverter and show their position on voltage hexagon.	03+07	02
b.	Derive the expression of active power and reactive power in terms of two phase stationary components.	10	03

Q.4 a)	Explain the operation of FC-TCR. Draw the complete characteristics of reactive power supplied by FC-TCR.	08	02
b.	Draw the circuit diagram and discuss the operation of hybrid filter. What are the limitations of hybrid filter?	05+02	03
c.	A single phase active filter is connected to the supply of 230 V, 50 Hz and it is expected that the active filter should supply only harmonic current. Discuss the required control of active filter. What should be the fundamental frequency output voltage of inverter?	05	03
Q.5a)	What is phase locked loop (PLL)? Discuss the implementation of PLL.	10	04
b.	What is instantaneous reactive power? Draw the block diagram and explain the compensation of reactive power based on this theory. What are the limitations of instantaneous reactive power compensation?	02+06+ 02	03
Q.6a)	Draw the block diagram of UPFC (showing both series and shunt compensators). Discuss the control capabilities of UPFC?	04+06	01
b.	What is Static Synchronous Series Compensator (SSSC)? Discuss the voltage compensation mode and impedance compensation mode of SSSC. What is the requirement to inject the active power in grid by SSSC.	02+06+ 02	02
Q.7 a)	What is the purpose of GCSC (GTO controlled series capacitor)? Draw the waveform of voltage across capacitor as the function of delay angle alpha and explain the voltage compensation and impedance compensation mode.	02+04+ 04	01
b.	What is the criterion of current injection using mid-point compensation? Derive the relation for active power and reactive power flow when mid-point compensation is provided. The power flow over transmission line is 1 p.u. when Vs=Vr=1 p.u., the equivalent line reactance is 0.8 p.u.. Calculate the new power angle delta when mid-point compensation is used and same power is flowing over transmission line.	02+06+ 02	02

17|5|22

End Semester Examination

May 2022

Max. Marks: 100

Duration: 3 Hrs

Class: Final Year B.Tech   Semester: VIII   Program: Electrical

Name of the Course: **Industrial Automation**   Course Code : PE-**BTE806**

Note: 1) In the absence of any data, make suitable assumptions and justify the same.

2) Solve Any five questions.

Q. No	Question	Max. Marks	CO
Q1a	What is Integral windup effect? How to eliminate this effect?	08	
Q1b	What are the components and features of SCADA?	08	
Q1C	State the difference between SCADA and DCS.	04	
Q2a	What are the different program and data files available with a PLC? Explain in detail there use.	10	
Q2b	There is an industrial motor which is switched ON using NO type green push button and switched off using NC type red push button. When the motor is running, a cooling fan is kept ON which remains ON for 15 minutes after motor goes OFF. When motor completes 8 Hrs of running time, a maintenance pilot lamp should be lit indicating that motor needs maintenance. Motor should not be allowed to run after 8 hrs of its working unless maintenance person gives a command through NO type push button. Write a PLC ladder logic to control above process.	10	
Q3a)	List any two communication protocols used in automated industry and explain in detail.	05	
Q3b)	Explain the architecture of DCS.	05	
Q3c)	Explain different types of automation systems.	05	
Q3d)	What is a CNC machine and what are its advantages?	05	
Q4a)	A unity negative feedback system has an open loop transfer function $G(s) = \frac{1}{(s+3)(s+2)}$ .What should be proportional controller gain Kp to have the closed loop damping ratio of 0.25. What is the steady state error with Kp added in	08	

	the system and reference input applied is 5u(t)? Suggest a way to eliminate steady state error completely and justify the same.		
Q4b)	How is tuning carried out in quarter amplitude method and relay experiment? What are the advantages and disadvantages of these methods?	12	
Q5a)	Explain in detail any of the three instructions i) RTO iii) CTD ii) SQO iv) SUB	12	
Q5b)	Explain the role of electric drives in automation industry. List any four advantages of using drives.	08	
Q6 a)	What are the various design stages in an industrial automation projects?	05	
Q6b)	List out any two static characteristics of a measuring instrument used in industry. Explain in detail about the listed characteristics.	05	
Q6c)	Explain MES and ERP in detail.	05	
Q6 d)	What is Process Flow Diagram and Process & Instrumentation Diagram? What is difference between them.	05	
Q7 a)	In P&I diagram below identify the symbols.	05	

Example

PRV-100

V-100

PIC

PT

Q7b)	What are the benefits of quality assurance in an Industry?	05	
Q7c)	Draw symbol of the following equipment / instrument- 1) Drain tap (with strainer) 2) motor 4) motor valve 3) Three-way valve 5) Centrifugal Pump	05	
Q7d)	Show how Proportional controller helps in disturbance rejection performance of a first order plant.	05	