Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

(A Government Aided Autonomous Institute)

Munshi Nagar, Andheri (West), Mumbai – 400058.

End Semester Examination

June-2023

14/6/23

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**

(Sheet)

Instructions: Final Year B.Tech (Sem-VIII). (~~Held~~)

- Question no.1 is compulsory and solve any four from remaining 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.

Qu. No	Description of question	Max. Marks	CO
Q.1	Solve Any Four		
a.	Discuss the analogy of DC drive used to develop the vector control of three phase induction motor.	05	02
b.	What are the limitations of three phase dynamic model of three phase induction motor?	05	02
c.	Compare the scalar control and vector control of three phase induction motor.	05	02
d.	Compare the Voltage Source Inverter (VSI) and Current Source Inverter (CSI).	05	01
e.	Compare sine triangle PWM technique with SVM technique for the control of three phase inverter.	05	01
Q.2 a	What are the limitations of per phase equivalent circuit model of three phase induction motor? Suggest the applications where this model is used and provide reasons for the same.	08	01

b.	Develop the stator and rotor voltage equations in rotor reference frame. (Model of three phase induction motor in rotor reference frame).	12	03
Q.3 a	Draw the block diagram and explain the Stator Flux Oriented control of three phase induction motor	10	02
b.	Develop the torque equation of three phase induction motor in arbitrary rotating reference frame.	10	02
4 a.	What is indirect rotor flux oriented control (FOC) of three phase induction motor? Draw the block diagram and discuss the closed-loop implementation under constant flux operation of induction motor.	12	03
b.	Discuss the flux weakening operation of induction motor in Rotor Flux Oriented control . Note: No need to draw the block diagram.	08	03
5 a.	Draw the block diagram and explain the implementation of DTC of three phase induction motor.	12	03
b.	In Sine-Triangle PWM technique, what is the criterion to select the number of pulses/cycle? Discuss the effect of switching frequency on the operation of inverter.	08	01
6a.	In space vector modulation technique, explain the synthesis of space vector. Derive the expression for T_1, T_2 and T_Z. What is the effect on application of voltage vectors as the magnitude of space vector increases?	10	01
b.	Draw the block diagram and explain the vector control of permanent magnet synchronous motor.	10	02
7a.	Draw the schematic diagram of synchronous machine and write the equation of stator, rotor and shaft in synchronous reference frame.	06	03
b.	What is the working principle of switched reluctance motor (SRM)? Discuss the requirements of SRM converter.	08	02
c.	The armature of separately excited DC motor is controlled using single phase fully controlled rectifier while the field is connected using uncontrolled rectifier. Discuss the possible quadrant operation of the drive with suitable waveforms.	06	03

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END SEM

9/6/23

Program: Electrical/Civil/Mechanical Engineering **Date: 09/06/2023**
Duration: 3 hrs. **Course code: OE_BTE805**
Maximum Marks: 100 **Semester: VIII**

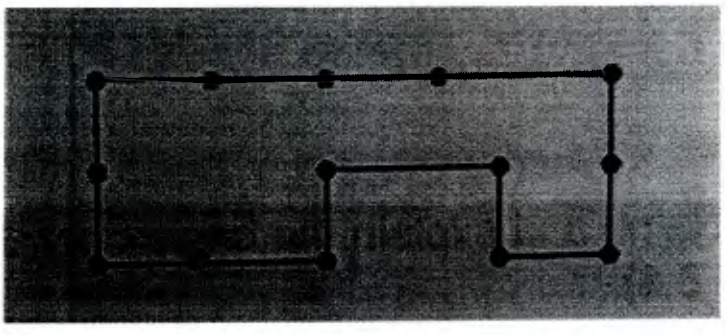
Course Name: Image Processing

Instructions: Q1. is compulsory. Solve any 4 questions from the remaining six.
Assume data if required

Final year (Sem VIII) (E, M, E)

Q. No.	Questions	Max Points	CO No.	Module No.	BL
1a	Quality of an image depends on number of pixels and gray levels of the picture. Justify or contradict.	05	1	1	4
b	Explain Median filter. For the following image perform median filtering 12 17 16 19 150 17 16 15 19	05	2	3	2
c	With an example explain how Hough transform is used in image processing.	05	2	3	2
d	With an example explain 4-, 8- and m- adjacency in images.	05	1	1	2
2 a	For the following image find negative of an image, bit plane slicing and contrast modifications. 11 3 4 8 12 15 7 10 5 8 4 3 1 6 11 8	06	1	2	3
b	How edge detection is performed in digital images using (i)Laplacian Operator (ii) Sobel Operator (iii) Prewitt	06	1	3	3

2

	Operator Compare their outcomes				
c	Describe Histogram Equalization. Obtain Histogram Equalization on the following 8 bit image segment of size 5x5. Write inference on image segment before and after equalization. 200 200 200 130 220 140 130 130 130 170 170 170 170 170 130 170 190 190 190 220 210 130 170 190 210	08	1	3	3
3 a	Develop an image processing application of vehicle number plate recognition at toll booth.	06	1	1	3
b	How can the chain code be used to record a shape contour? Obtain the shape number for figure shown below. Use 4-directional chain code. 	06	2	4	3
c	For the following image operate on central 3 x 3 pixels by low pass and high pass filter mask and obtain 3 x 3 images as outputs. Using these outputs verify that original image = low pass output + high pass output. In case of discrepancy explain the reasons. 6 5 10 10 3 12 10 11 10 9 8 13 4 8 6 8 3 7 4 7 8 3 12 8 5	08	1	3	3

4 a	If I(x,y) =1 for a digital image of size NxN. Find its Fourier Transform using FFT algorithm	06	2	6	3
b	Evaluate DCT of the following 4x4 image. 4 8 4 6 8 12 16 16 8 16 20 12 4 6 8 4	07	2	6	3
c	Compute Hadamard transform of the image 1 2 1 2 2 1 3 1 1 3 5 3 2 1 3 1	07	2	6	3
5 a	With a an example explain the following morphological operations (i) Boundary Extraction (ii) Hit or Miss Transformation (iii)Thinning and Thickening	12	4	5	3
b	Explain thinning algorithm. Select appropriate structuring element to thin the following image. Show the image after each iteration 	08	4	5	3
6 a	For the following 6x6 image, generate codebook of size two. The two code vectors are represented by 0 and 1 respectively. How is the image represented in compressed form? What is the compression ration Recover the image and comment whether it is lossy or lossless compression.	10	3	07	3

200	236	236	236	240	240
245	72	85	85	25	82
230	36	85	845	25	74
238	39	78	78	27	37
240	100	100	100	123	160
160	160	160	160	160	160

b	How is the JPEG image formed?	05	3	07	3
c	Form Huffman code for the following image	05	3	07	3

200	200	200	200
255	200	200	00
200	255	255	255
255	150	150	100

7 a	Explain following region based algorithm 1. Region Growing 2. Region splitting 3. Region merging What will be the segmented regions if split and merge algorithm is implemented on the following image	10	2	4	3
b	Compare Local, Global and Optimal thresholding. An image composed of small non overlapping blobs of mean gray level 125 and variance =400 on a background of mean 16 and variance 400. All blobs occupy 25% of the image area. Find threshold val	10	2	4	3

0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	1	1	1	1
0	0	0	0	1	1	1	1
0	0	0	0	1	1	1	1
0	0	0	1	1	1	1	1
0	0	1	1	1	1	0	0
0	0	1	1	1	0	0	0

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End Semester Examination June 2023

12/6/23

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

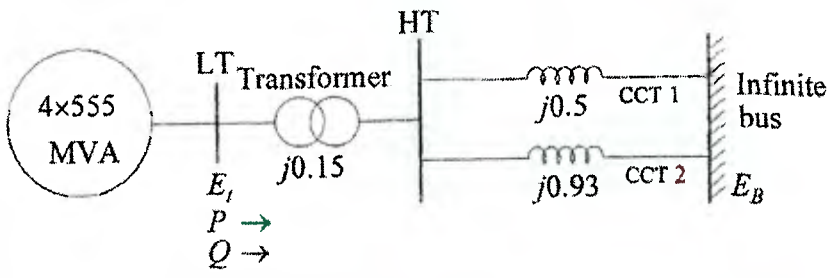
Course Code: PE-BTE801 **Maximum Points: 100**

Course Name: Power system dynamics and control **Semester: VIII**

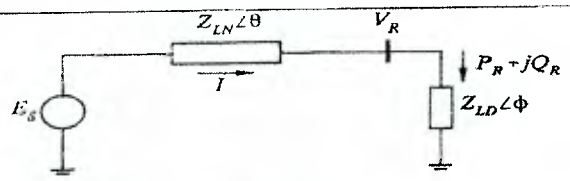
Final Year Sem-(VIII) (Elect)

Notes:

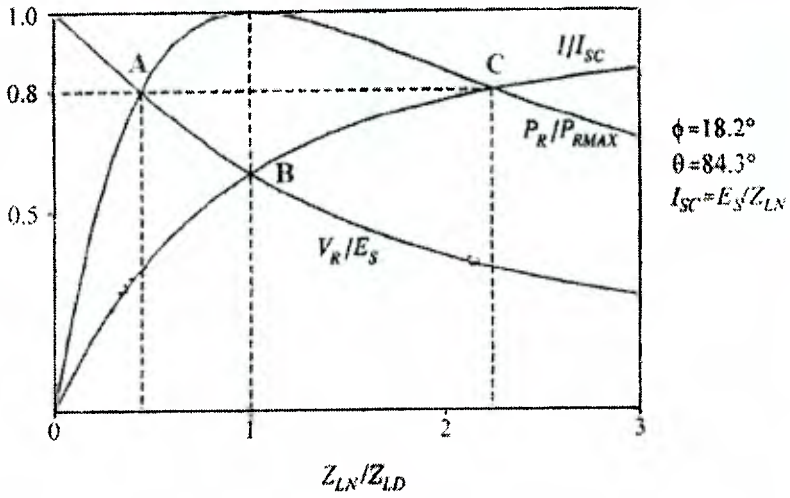
1. Question number 1 compulsory.
2. Attempt any **four** questions out of remaining **six**.
3. Draw neat diagrams.
4. Assume suitable data if necessary.

Q. No.	Questions	Pts.	CO	BL	Mod. No.
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 $= 1.0\angle 0^0$. 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 at 2.5 cycles using **Runge-Kutta (Order-2)** method.	**20**	2	L4	**5**
2.	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	**1,2**
3.	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	**20**	2	L4	**3**

	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) $E_t = 1.0\angle 36^0$ $E_B = 0.995\angle 0^0$ 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/ pu speed) : $(i)\ K_D = 0$ $(ii)\ K_D = -10.0$ $(iii)\ K_D = 10.0$				
4. (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	**4**
(b)	Explain in detail working of **power system stabilizer** in transient stability enhancement.	**10**	1	L2	**7**
5.	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	**3**
6.(a)	Write short note on 1. P-V Curve 2. Q-V Curve 3. P-Q Curve	**10**	1	L2	**6**
(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	**6**



(a) Schematic diagram



(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	**7**
(b)	Write short note on 1. V-Q Sensitivity analysis 2. Q-V model analysis	**10**	1	L2	**6**

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END SEMESTER EXAMINATION JUNE 2023

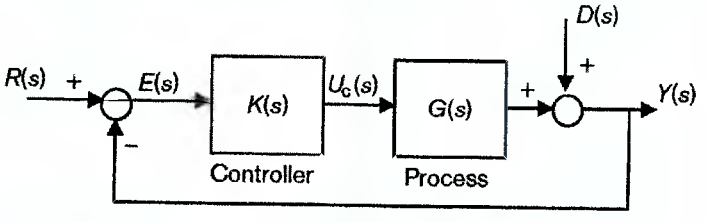
Program: B. Tech (Electrical) **Duration: 3 Hr.** 12/6/23

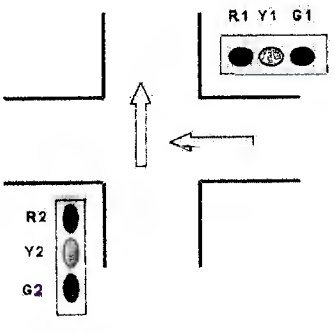
Course Code: PE-BTE806 **Maximum Points: 100**

Course Name: Industrial Automation **Semester: VIII**

Note: a) In the absence of any data, make suitable assumptions and justify the same.
b) Solve any five questions.

Final year (Sem – VIII) (Elect)

Q. No	Questions	Points	CO	BL	Mod No.
Q1a	Explain any one tuning method in detail considering following points- i) Test input required iv) System requirement ii) Advantages v) Limitations iii) PID design rules	10	02	02	02
Q1b	What is P&ID diagram? (02) List out differences between PBD and P&ID. (02) List out uses of P&ID diagram. (02) List out any eight symbols used in P&ID diagram with their description. (04)	10	02	02	03
Q2a	What are industrial PID specifications? (03) Obtain industrial form of representation of a controller having transfer function $Gc(s) = 5 + 2s + \frac{6}{s}$ (04) What is Proportional Band? Calculate proportional Band of above controller. (03)	10	02	02	02
Q2b	Consider a first order system with $G(s) = \frac{0.5}{10s+1}$. Design a controller to ensure no steady state offset to step reference signals, to achieve a 5% settle time of less than 20 minutes and damping ratio of 0.9. 	10	02	03 04	02
Q3a	Explain in detail any of the three instructions – i) TON ii) CTU iii) SQO iv) MUL	15	03	02	03
Q3b	What is DCS? Differentiate between DCS and SCADA.	5	03	02	03
Q4a	Describe in details following terms- i) Linearity iv) Resolution ii) MTTR v) Precision	10	04	01	04

	iii) Hysteresis				
Q4b	Explain in detail about FAT and SAT.	06	04	01	04
Q4c	Find the resolution of a 10-bit ADC, if it is excited by a 10V source.	04	04	02	06
Q5c	Draw hardwired logic diagram for controlling electrical loads in following sequence i) Process starts with a NO type start push button. ii) Process stops with a NC type stop push button. iii) When the process starts an orange colored lamp is turned on and it remains on till stop button is pressed. iv) Motor 1 is turned ON, 10 seconds after the start button is pressed and remains ON till the stop button is pressed. v) When the process starts Motor 2 is turned on and it remains on for 20 second even after stop button is pressed.	10	03	04	05
Q5b	Write a PLC ladder diagram for traffic light control of two lamp posts as shown below.  Sequence of lamps Status / Duration R1- ON, G2- ON — 25 Seconds R1- ON, Y2- ON — 5 Seconds G1- ON, R2- ON — 25 Seconds Y1- ON, R2- ON — 5 Seconds Here R-Red lamp, Y- Yellow lamp and G - Green Lamp.	10	03	04	05
Q6a	What are the advantages of Industrial Automation? List any 6 advantages. Consider an electrical power utility substation. List out different automation elements, level of these elements in automation pyramid, different drawings of substation.	10	01	04	01 07
Q6b	List out functions of MES and advantages of MES. List out popular MES softwares.	10	01	01	05
Q7a	List out difference in (any two) – 1) Hub and Bridge 2) Server and PC 3) TCP and IP	08	03	02	05
Q7b	Explain following terms in detail- i) Workstation ii) Protocol	04	03	02	05
Q7c	Write short note on- i) 7-layer OSI model ii) Any two protocols	08	03	02	05

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END SEMESTER EXAMINATION JUNE 2023

12/6/23

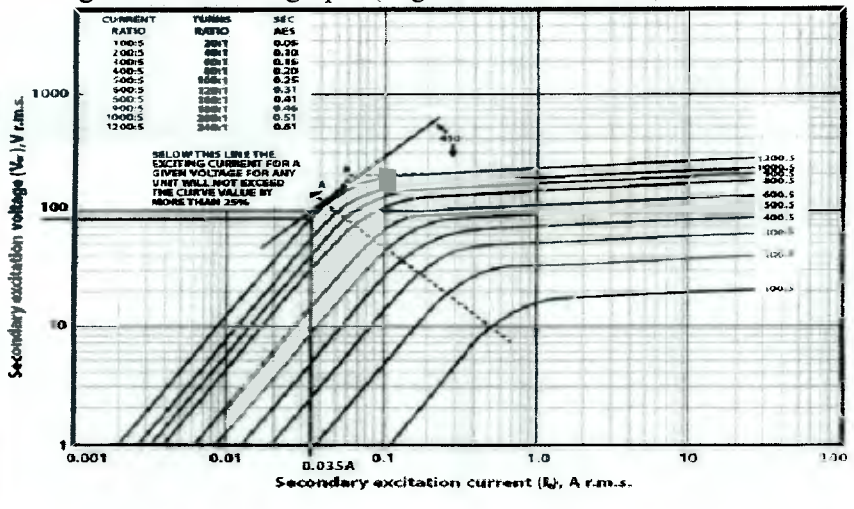
Program: B. Tech. Electrical **Duration: 3 hours**

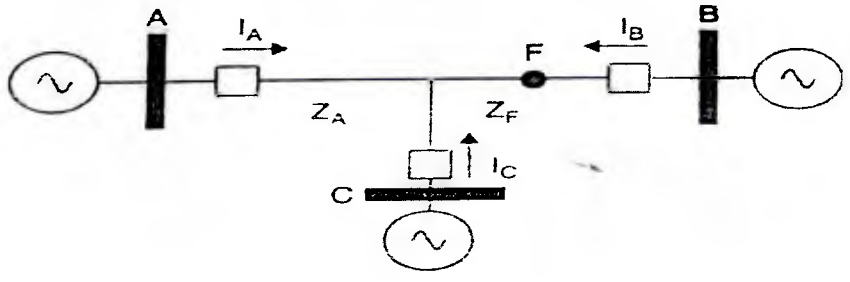
Course Code: PE- BTE 808 **Maximum Points:100**

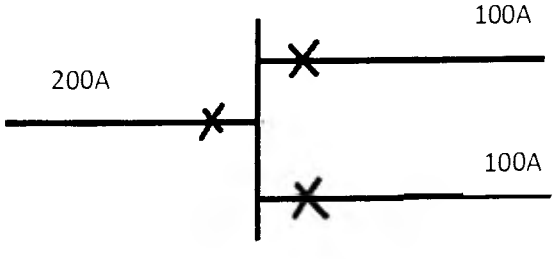
Course Name: Advance Techniques of Power System Protection **Semester:** VIII

Notes: Question 1 is compulsory. Attempt any 4 from remaining 6.

Final Year (Sem VIII) (Sleet)

Q. No.	Question	Points	CO	BL	Mo. No.
1a	A circuit has a 1200:5 C 400 CT. The maximum symmetrical fault for which the associated relays are to operate is 15,000 Amp. Find out the approximate % error if the secondary burden is 2 ohm. Comment on saturation of CT. Also find out the maximum secondary burden that can be used and still maintain rated accuracy at 20 times rated symmetrical secondary current. Refer given excitation graph. (neglect red color lines) 	10	1	3	1
1b	What is the need of a Wide Area Measurement System? What are the functions of PMU and PDC? What is the role of GPS in WAMS?	10	2	2,5	7
2a	Derive and explain full cycle DFT algorithm used for phasor estimation in numerical relay.	10	1	2	3
2b	Second order polynomial is given as $y = Ax^2 + Bx + C$ Show that curve fitting or least square method can be used to estimate A, B, C constants from the data samples of x and y.	10	1	3	2
3a	Explain adaptive relaying scheme for transformer differential protection.	10	2	2	6

3b	Write down sequence transformation matrix by taking 'a' phase as reference and by taking 'b' phase as reference. Are they identical or not?	10	1	3,4	1
4a	Explain with the help of Bewley Lattice Diagram, how does a travelling wave based distance relay trip on forward direction fault?	10	1,2	3	5
4b	A line of surge impedance 400 ohms is charged from a battery of constant voltage 40 V. The line is 300 m long and is terminated in a resistance of 200 ohms. Plot reflection lattice and the voltage across the terminating resistance.	10	1	2	5
5a	What is meant by adaptive protection? Given below is three terminal line with a fault at point F. Suggest the adaptive settings for zone 1 of relay A in case circuit breaker at C is 1) ON & 2) OFF 	10	1,2	1,3	6
5b	Prove that for a single line to ground fault on a transmission line the impedance measured by a distance relay is given as $\frac{V_a}{Ia+mI_0} = xZ_1$ Va & Ia are phase voltage and fault current measured by relay and I_0 is zero sequence component of the fault. m = $(Z_0 - Z_1)/Z_1$	10	1	2	4
6	What is power swing? Prove that the impedance measured by distance relay is function of power angle δ? How does a power swing blocking (PSB) feature can be used to prevent distance relay from tripping under power swing? How OST function can be used to differentiate between stable and unstable swing?	20	1	1,2, 3	4
7	Design suitable protection for the following bus-bar arrangement against the bus-bar fault. Redraw the circuit with proper connections and explain the working of relay in case a fault occurs on the bus-bar. Assume fault currents to be 10 times the rated current of each line. Rated currents are already mentioned on the lines.	20	1	6	5



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END SEM EXAMINATION JUNE 2023

14/6/23

Program: B. Tech | **Duration: 03 Hour**

Course Code: PE-BTE802 | **Maximum Points: 100**

Course Name: Smart Grid | **Semester: VIII**

Instructions: Final year B.Tech (Sem - VIII) ETRX

1. Attempt **any FIVE** questions.
2. Draw neat diagrams wherever possible.

Q.No.	Questions	Points	CO	BL	Module No.
Q. 1(a)	Explain the concept of smart grid and hence discuss the evolution of electric grid. Also, state the difference between conventional grid and smart grid.	02+03 +05	01	L-1	01
Q. 1(b)	Explain the different tasks to be performed by home area network (HAN) in smart grid environment. Hence, list the different types of smart appliances used in smart home. Explain the key features of smart appliances in smart grid.	04+ 02+ 04	01	L-1	02
Q. 2 (a)	Explain the role of Plug in Hybrid Electric Vehicle (PHEV) in making greener future. Hence state advantages and disadvantages of PHEV.	04+ 03+ 03	01	L-1	02
Q. 2 (b)	Discuss accurate customer to electrical system model of modern outage management system with block diagram to provide accurate predictions of outage locations.	02+ 08	02	L-1	02
Q. 3 (a)	Explain the significance of smart storage. Hence describe superconducting magnetic energy storage (SMES) and pumped hydro compressed air energy storage with diagram.	02+ 05+ 05	02	L-1	03
Q. 3 (b)	What is the role of wide area monitoring system? Do the comparison between SCADA and WAMS system.	04+ 04	02	L-1	03

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Q. 4 (a)	How microgrid formation takes place? Hence explain different modes of operation of microgrid.	02+ 06	03	L-1	04
Q. 4 (b)	Write detail notes on the following by explaining working principle, diagram, advantages, disadvantages and application. (1) Plastic and organic solar cells. (2) Fuel cells. (3) Microturbines.	04+ 04+ 04	03	L-1	04
Q. 5 (a)	Why do you need to study/understand power quality and electromagnetic compatibility (EMC) in Smart Grid? Hence, what is power quality conditioner? Explain different power quality conditioners used in Smart Grid (**Any Two**).	03+ 01+ 04+ 04	03	L-1	05
Q. 5 (b)	Why power quality audit is necessary in smart grid? Hence explain the various steps followed to conduct power quality audit.	03+ 05	03	L-1	05
Q. 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) and do their comparative analysis.	02+ 04+ 04+ 04	04	L-1	06
Q. 6 (b)	Explain the following communication protocols/networks used in smart grid. (1) Zigbee (2) Bluetooth (3) Wi-Fi	02+02 +02	04	L-1	06
Q. 7 (a)	Explain the different cloud computing opportunities and challenges. Hence explain cloud based smart meter.	04+ 04+ 02	04	L-1	07
Q. 7 (b)	What are the different security challenges in smart grid system? Hence, explain the solution to smart grid cyber security system.	05+ 05	04	L-1	07