BharatiyaVidyaBhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

(Government Aided Autonomous Institute)
Munshi Nagar, Andheri (W) Mumbai – 400058

End Semester Examination June 2024

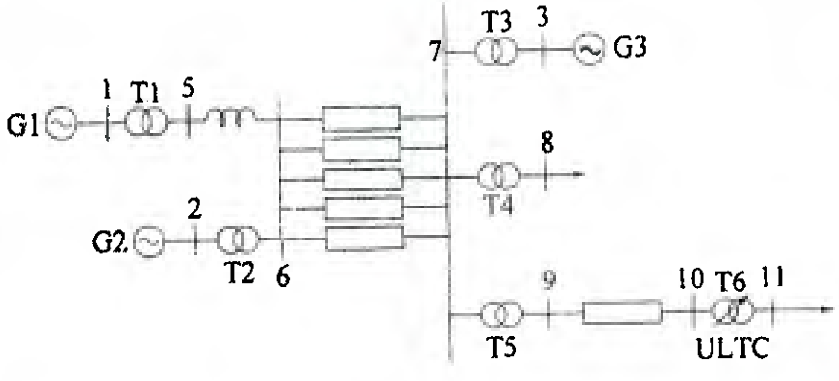
7/6/24

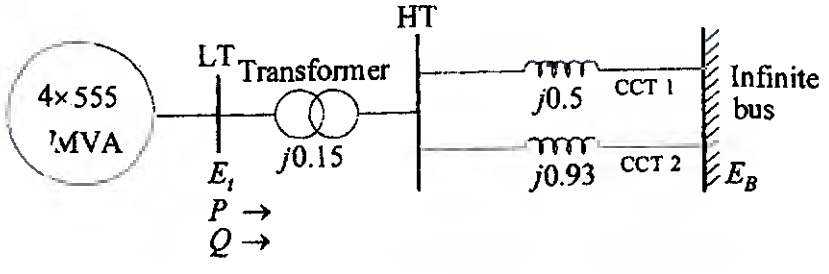
Program: B. Tech. (Electrical)
Course Code: PE-BTE801
Course Name: Power system dynamics and control

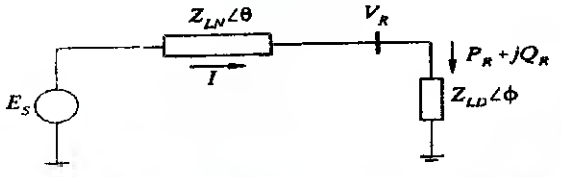
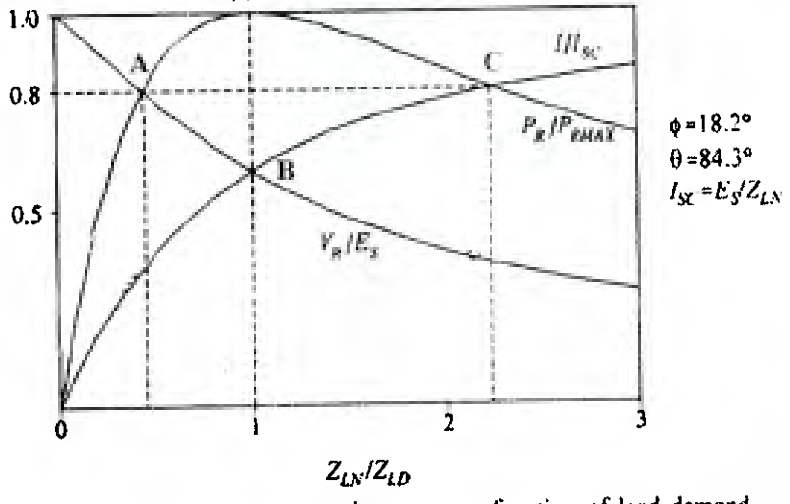
Duration: 3 hrs.
Maximum Points: 100
Semester: VIII

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	Mod. No.
1.(a)	With the help of Fig.1 comment on voltage stability of each bus bar if the outage of one of the transmission line between bus bar no. 6 & 7 take place.  Fig. 1	**10**	3	L3	**6**
(b)	Which are methods of transient stability enhancement? Explain in detail Steam turbine fast valving.	**10**	1	L2	**7**
2.	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**

3.	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. The first transmission circuit has R = 0 and a reactance of 0.2 pu and second transmission circuit has R = 0 and a reactance of 0.3 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 second transmission line**. Plot swing curves over the period of 0.5 second if the fault is sustained using **Runge-Kutta (Order-2)** method.	**20**	2	L4	**5**
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	**1,2**
5.	Fig.2 shows the system representation applicable to thermal generating station consisting of four 555 MVA, 24 KV, 60 Hz units  Fig. 2 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) $E_t = 1.0\angle 36^0$ $E_B = 0.995\angle 0^0$ 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) : $(i)\ K_D = 0$ $(ii)\ K_D = -10.0$ $(iii)\ K_D = 10.0$	**20**	2	L4	**3**

6. (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**
7.(a)	Write short note on 1. V-Q Sensitivity analysis 2. Q-V model analysis	**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).  (a) Schematic diagram  (b) Receiving end voltage, current and power as a function of load demand	**10**	2	L3	**6**

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END SEMESTER EXAMINATION JUNE 2024

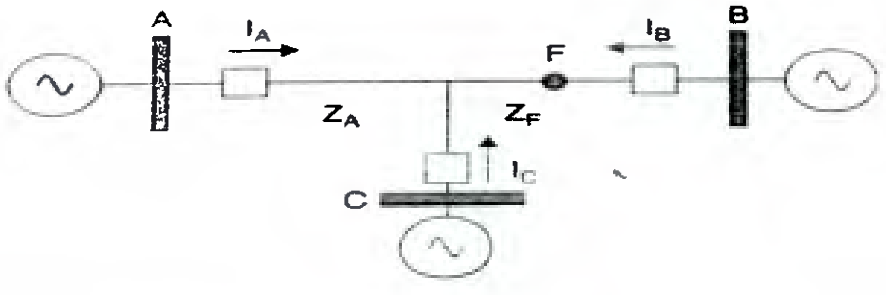
7/6/24

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

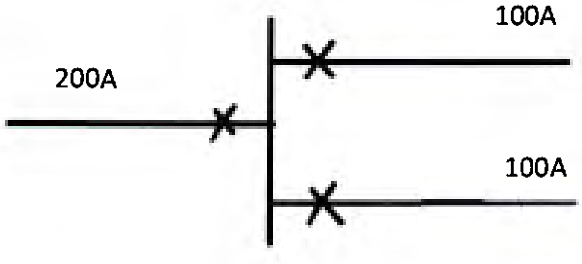
Course Code: PE- BTE 808 **Maximum Points:100**

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

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

Q. No.	Question	Points	CO	BL	Mo. No.
1a	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	2	1,3	6
1b	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. Where, m = $(Z_0 - Z_1)/Z_1$	10	1	2	4
2a	Draw and explain block diagram of Numerical relay. What is the role of Anti-aliasing filter? Is it analogue or digital filter?	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	What is CCVT? Draw and explain basic CCVT operation. What is the role of tuning reactor?	8	1	2,3	1
3b	We have studied how to apply DFT full cycle algorithm on discrete samples to get a phasor of the fundamental frequency. Can it be applicable for signal with 2nd harmonic? How will be the modified formula? Only write the first equation.	5	2	2,3, 4	3

3c	Show that the impedance measured by Distance Relay is inversely proportional the apparent power flowing on the line. Hence explain load encroachment problem of distance relay and remedy for the same.	7	1	2,3, 4	4
4a	Explain the travelling wave phenomena in case receiving end of the transmission line is short circuited.	10	2	2,3	5
4b	Prove that travelling wave can be used for fault location identification in case a fault occurs on transmission line. Further solve the following Given length of line L = 350 km, time difference measured by travelling wave protective device = 1 millisecond, Velocity of the wave = 3 X 10^8 meter/sec, Find the location of the fault on transmission line from sending end.	10	2	3,4	5
5a	Draw the typical Architecture (topology) of a Wide Area Measurement System. What are the functions of PMU and PDC? Compare WAMS with SCADA system.	10	2	2,5	7
5b	How can we distinguish a power swing from fault? Explain the principle of working of: 1) Out of step blocking relays 2) Out of step tripping relays How can OST differentiate between stable swing and unstable swing?	10	1	2, 3,4	
6a	What is the impact of loss of excitation on the Synchronous Generator? With the capability curve of generator, suggest how to use Mho relay as a protection against loss of excitation?	10	1	2,3	5
6b	For 50 MVA, 11kV/ 220kV Delta/ Star transformer, select suitable CTs and draw the interconnection diagram for biased differential protection. Show that with selected CTs, there will be no current in the differential relay coil under normal condition.	10	1	6	5
7	Design suitable protection for the following bus-bar arrangement against the bus-bar fault. Redraw the circuit with proper CT connections. Rated currents are already mentioned on the lines. First select CTs based on line rated currents and show that relay trips under normal condition. What is the solution? Prove that with this solution relay does not trip under normal condition.	20	1	6	5



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END SEM EXAMINATION JUNE 2024

11/6/24

Program: B. Tech (Elect) Sem VIII
Course Code: PE-BT E802
Course Name: Smart Grid

Duration: 03 Hour
Maximum Points: 100
Semester: VIII

Instructions:

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

Q.No.	Questions	Points	CO	BL	Module No.
Q. 1(a)	What is the need of smart grid implementation? and hence explain the barriers in implementation of smart grid in India. Discuss the important functions and opportunities of smart grid.	01+03 +06	01	L-1	01
Q. 1(b)	Discuss accurate customer to electrical system model of modern Outage Management System (OMS) to provide accurate predictions of outage locations with OMS architecture.	08+ 02+	01	L-1	02
Q. 2 (a)	Draw the architecture of sensor node used in smart grid and explain the role of different blocks used in it.	02+ 08+	01	L-1	02
2 (b)	What is the role of intelligent electronic devices in monitoring and protection of smart grid system? Draw the functional overview diagram of IED and explain it in detail.	02+ 02+06	02	L-1	03
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+ 04+ 04	02	L-1	03
Q. 3 (b)	Explain the working of Phasor Measurement Unit with block diagram in detail. State the advantages of PMU over the conventional methods. .	02+ 06+ 02	02	L-1	03
Q. 4 (a)	What are the different challenges related to protection of microgrid? Hence explain various approaches about the control	03+ 05	03	L-1	04

END SEM EXAMINATION JUNE 2024

	strategies used in microgrid.				
Q. 4 (b)	Write detail notes on the following by explaining working principle, diagram, advantages, disadvantages and application. (1) Thin film solar cells. (2) Variable speed wind generators. (3) Fuel cells.	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)	Explain the different power quality issues of grid connected renewable energy sources integrated in Smart Grid and hence explain web-based power quality monitoring.	04+ 04	03	L-1	05
Q. 6 (a)	What is the importance of information and communication technology system (ICT) in smart grid environment? Hence explain the advanced metering infrastructure (AMI) used for Smart Grid in detail. Discuss the wireless mesh network used for smart grid communication.	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 (4) Wi-Max	02+02 +02+02	04	L-1	06
Q. 7 (a)	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
Q. 7 (b)	Explain the different cloud computing opportunities and challenges. Hence explain cloud based smart meter.	04+ 04+ 02	04	L-1	07

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11/6/24

End Semester Examination
June-2024

Max. Marks: 100 Duration: **03 Hours**
Class: **B.TECH.** (Elect) Semester: **VIII** Program: **B.TECH. (Electrical)**
Name of the Course: **Advanced Electric Drives** Course Code: **PE-BTE 805**

Instructions:

- 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.	What are the benefits of dynamic model of three phase induction motor in synchronous rotating reference frame?	05	02
b.	Compare the vector control and direct torque control of three phase induction motor.	05	02
c.	Discuss the DC-DC converter for two quadrant operation of DC drive.	05	02
d.	What are the benefits of adding third harmonic voltage in modulating wave in sine–triangle PWM technique of Induction Motor?	05	01
e.	Discuss the analogy of DC drive used to develop the vector control of three phase induction motor.	05	01
Q.2 a	Draw the circuit of dc-dc converter and explain the four quadrant operation of separately excited DC motor.	08	01

b.	Develop the model of three phase induction motor in stationary reference frame. And draw the equivalent circuit.	12	03
Q.3 a	What is Stator Flux Oriented control of three phase induction motor. Compare the direct and indirect stator flux oriented control of three phase induction motor. (Note. Here the model of three phase IM in SFO reference frame is not expected).	08	02
b.	Develop the torque equation of three phase induction motor in synchronously rotating reference frame.	12	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.	What is direct torque control?. Develop the mathematical equations for the implementation of DTC of three phase IM.	12	03
b.	Discuss the Sine-Triangle PWM technique to control the inverter. Compare the magnitude of output voltage of inverter in sine-triangle PWM technique and square wave inverter technique.	08	01
6a.	In SPVM technique, what is the maximum value of space vector so that the output voltages of inverter are sinusoidal? Compare the output voltages of inverter in SPVM and square wave inverter.	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.	10	03
b.	What is the working principle of Brushless DC Motor (BLDC)? Discuss the control techniques of BLDC drive.	10	02

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END SEMESTER EXAMINATION JUNE 2024

13/6/24

Program: B.Tech. (Elect) Sem VIII **Duration: Three Hour**

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

Course Name: Robotics **Semester: VIII**

Notes:
1 Question No. 1 is compulsory.
2. Solve any four questions from remaining six.
3. Draw neat diagrams wherever necessary.
4. Assume suitable data if necessary.

Q.No.	Questions	Points	CO	BL	Module No.
1.	Solve any four.				
	a. Discuss Work Envelop Geometry of Articulated manipulator.	05	1,2	1,2,3	4
	b. Discuss briefly Composite Rotation Matrix.	05	1,3	1,2,3	2
	c. Explain Tool Configuration Vector.	05	1,3,4	1,2,3	3
	d. Define mathematically and also explain Joint Space Work Envelope.	05	1,4	2,3	4
	e Describe Joint Parameters.	05	1,3	1,2,3	2
2.	a. Describe in details classification of robotic manipulator based on different criteria.	08	1,3	1,2,3	1
	b. Derive a homogenous transformation matrix "T" that represents a rotation of α angle about the **OX** axis, followed by a translation of unit a along OX axis, followed by translation of d units along the OZ axis, followed by a rotation of θ angle about OZ axis.	07	3	2,3	2
	c. Point $a_{UVW} = (4,3,2)^T$ $b_{UVW} = (6,2,4)^T$ are to be translated a distance $+5$ units along the OX axis and -3 units along the OZ axis. Using the appropriate homogenous transformation matrix, determine the new a_{XYZ} and b_{XYZ}.	05	3	2,3	2

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END SEMESTER EXAMINATION JUNE 2024

3.	a. Write algorithm for assigning coordinate frames to the links of robotic manipulator using Denavit-Hartenberg representations.	10	1,3	2,3	2
	b. Discuss Direct Kinematics Problem.	03	1,3	2,3	2
	c. If $\mathbf{a}_{xyz} = (4,3,2)^T$ and $b_{xyz} = (6,2,4)^T$ are the coordinates with respect to the reference coordinate system OXYZ, determine the corresponding point $\mathbf{a}_{uvw}$ and $\mathbf{b}_{uvw}$ with respect to the rotated OUVW system if it has been rotated 60^0 about the OZ axis.	07	1,3	2,3	2
4.	Develop Arm Matrix for Four Axis SCARA Robot. Link coordinates for the same are given below. Use kinematic parameters given in Table.	20	1,2,3	1,2,3	2

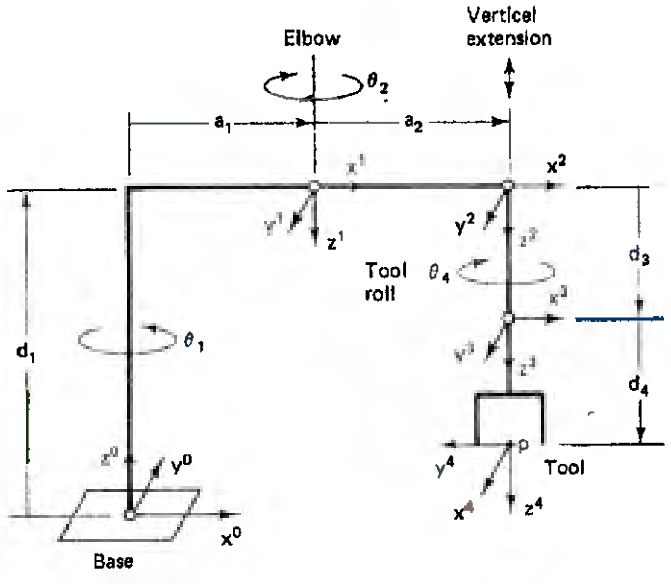

Table: Kinematic Parameters of Four Axis SCARA Robot.

Axis	θ	d	a	α	Home
1	q_1	d_1	a_1	π	0
2	q_2	0	a_2	0	0
3	0	q_3	0	0	100
4	q_4	d_4	0	0	$\pi/2$

END SEMESTER EXAMINATION JUNE 2024

5.	a. Discuss inverse Kinematics problem.	03	1,2,3	1,2	3
	b. Discuss general properties of solution of Inverse Kinematic Problem.	07	1,2,3	1,2	3
	c. Discuss Pick and Place operation in detail.	10	1,4	1,2,3	5
6.	Derive Work Envelope of a Four Axis SCARA Robot.	20	1, 4	1,2,3	4
7.	a. Discuss Task Planning with the help of task planner chart.	10	1,4	1,2,3	6
	b. Write short notes on configuration space with appropriate example.	10	1,2	1,2,3	6

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End Semester – June 2024 Examinations

13/6/24

Program: B. Tech Electrical | **Duration: 3 Hr**

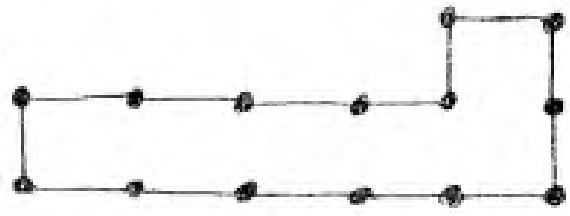
Course Code: OE-BTE805 | **Maximum Points: 100**

Course Name: Image Processing | **Semester: VIII**

Note: Q1 is compulsory. Solve any four questions out of remaining six questions

Assume suitable data if required.

Q. No	Questions	Points	CO	BL	Module no
1 a	Show that the high pass (HP) filter can be obtained as HP=ORIGINAL – LP (Assume a 3x 3 mask)	4	2	2	2
b	With an example explain 4-, 8- and m- adjacency in images.	4	1	2	1
c	Given the data sequence x(n)={x(0), x(1), x(2), x(3)} Explain and draw the flow diagram to compute DFT using Decimation in time algorithm	4	3	2	6
d	Derive an expression of optimum thresholding used in image segmentation	4	2	2	4
e	With an example explain opening algorithm used in binary image processing	4	4	3	5
2 a	How edge detection is performed in digital images using (i) Laplacian Operator (ii) Sobel Operator (iii) Prewitt Operator Compare their outcomes	7	2	3	4
b	What is edge linking? Explain the method used for edge linking? The five pixels of an image has coordinates (1,4), (2,3), (3,1), (4,1) and (5,0). Join the maximum number of pixels using edge linking algorithm..	7	2	3	4
c	How can the chain code be used to record a shape contour? Obtain the shape number for figure shown below. Use 4-	6	2	3	4

	directional chain code. 				
3 a	**Explain how biometry system for attendance marking can be developed using different image processing algorithms.**	**05**	**1**	**3**	**1**
b	**Explain any one method of JPEG image formation**	**05**	**1**	**2**	**1**
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.**	**10**	**2**	**3**	**2**
4 a	**Compute Hadamard and Discrete cosine transform for the image**	**10**	**3**	**3**	**6**

180	180	180	160	220
160	160	160	160	170
170	170	170	170	160
170	180	200	200	220
210	160	170	190	210

3	2	3	2
2	3	4	3
3	4	5	4
2	3	4	3

Compare the result.

b	**Explain the following spatial image enhancement techniques and apply the same on following image [0-7] gray levels** **(i) Image Negative** **(ii) Bit plane slicing** **(iii) Contrast stretching** **(iv) Gray level slicing** 6 2 7 6 0 2 1 2 2 1 2 3 4 5 2 0 3 2 2 1 2 6 6 5 1	**10**	**2**	**3**	**2**
5 a	**For the following image generate Huffman coding.** **Also, explain how the received code is decoded to get back the image** 180 180 180 160 220 220 160 160 160 160 170 210 170 170 170 170 160 170 170 180 210 210 220 190 210 160 170 190 210 190 210 160 170 190 210 190	**10**	**3**	**3**	**7**
c	**Explain vector quantization used for image compression. Generate codebook of size 4**	**10**	**3**	**3**	**7**

	150	150	150	150	150	150	150	150	150	100				
	150	180	180	180	180	180	180	180	150	100				
	150	180	200	200	200	200	200	180	150	100				
	150	180	200	230	230	230	200	180	150	100				
	150	180	200	230	250	230	200	180	150	100				
	150	180	200	230	230	230	200	180	150	100				
	150	180	200	200	200	200	200	180	150	100				
	150	180	180	180	180	180	180	180	150	100				
	150	150	150	150	150	150	150	150	150	100				
	100	100	100	100	100	100	100	100	100	100				

6	**With application and example explain the following morphology algorithms** 1. **Erosion** 2. **Dilation** 3. **Convex Hull** 4. **Hit or miss** 5. **Thickening** 6. **Thinning** 7. **Region filling**	**20**	**4**	**2**	**5**
7 a	**Given a spatial domain mask h(x,y) as follows:** 1/9 1/9 1/9 1/9 1/9 1/9 1/9 1/9 1/9 **Find equivalent filter in frequency domain.**	**5**	**2**	**2**	**3**
b	**Explain region growing, region splitting and region merging algorithms on the following image.** **Assume the max(g(x,y))-min(g(x,y)) ≤ 3 and any seed pixel for**	**15**	**2**	**3**	**4**

region growing algorithm

155	156	156	156	157	157	156	156
156	157	156	157	155	155	154	157
156	156	154	154	153	152	155	156
155	154	155	154	152	153	154	156
150	153	152	153	153	152	154	157
150	150	150	150	152	152	155	156
151	151	150	151	150	153	154	154
151	150	151	150	152	153	155	154