



Indian Institute of Information Technology, Surat
भारतीय सूचना प्रौद्योगिकी संस्थान, सूरत
(Institute of National Importance under Act of Parliament)

Examination: End-Semester

Semester: 5th

Department: ECE

Subject: Nanoscale Device Engineering (EC-502)

Academic Year: 2024-25

Full Marks: 100

Time: 3 hours

Answer all questions:-

1(a)	Discuss the optical properties of nanoscale materials in detail. What are the various phenomena responsible for colour generation in nanoscale structures?	10 Marks
1(b)	Discuss the following: i. Biomimetic materials ii. Self-assembled nanomaterials iii. Surface plasmons iv. Ferrofluids	10 Marks
2(a)	What do you understand about microscopy? Categorize it and discuss the operation of Scanning Probe Microscope (SPM) in detail with diagrams. Also, mention its limitations.	10 Marks
2(b)	Discuss the various steps of the Twin-well CMOS fabrication process with diagrams.	10 Marks
3(a)	Discuss the various gas-phase bottom-up methods for fabricating nanomaterials.	6 Marks
3(b)	Draw the layout of CMOS inverter circuit mentioning each layer.	5 Marks
4(a)	What are the various short channel effects? Discuss two of them in detail.	7 Marks
4(b)	Draw the common source amplifier circuit and write down the SPICE code netlist to obtain its VTC curve. Also, draw its VTC curve.	7 Marks
4(c)	Discuss subthreshold conduction in MOSFETs.	5 Marks
5(a)	How is nanotechnology helpful in the treatment of ocular diseases?	7 Marks
5(b)	Discuss the role of metal nanoparticles in the remediation of contaminated groundwater and soil.	8 Marks
6(a)	What is the application of TiO ₂ and ZnO semiconductor nanoparticles in photocatalytic remediation?	7 Marks
6(b)	Explain that the nanocrystals can improve the conversion efficiency of solar energy as compared to the conventional photovoltaic cell.	8 Marks

***** Best Wishes *****

Silicon Wafer
Oxidation
Photolith
Etching
Diffusion
Ion Implantation
CVD
Metallization
Packaging

Roll No. _____

Indian Institute of Information Technology Surat
Computer Science and Engineering Department
B.Tech-III (Semester V) End Semester Examination
Course: Object Oriented Programming (CS 516)

Time: 10:00 AM to 1:00 PM

Date: 9th December 2024

Marks : 100

- Note: 1. All questions are mandatory
2. Make a necessary assumptions wherever required
3. Write all sub parts of questions together.

Q.1	Answer the following [5x2M = 10]
	a) Name the two methods defined in java.util. EventObject
	b) Name the two ways to create a thread in Java.
	c) What are the two key features of swing?
	d) How the exception handling is managed?
	e) What is Garbage collection?
Q.2	Answer any 5 of the following [5x4M = 20]
	a) Write a Java program to copy the data from one file to another file.
	b) Write a Java code using do-while loop that counts down to 1 from 10 printing exactly ten lines of —hello
	c) Write a Java program to accept 'n' names, store it in an array, sort the names in alphabetic order and display the result. Use classes and methods.
	d) Explain the characteristics of OOPs
	(e) How AWT is different from Swing?
	f) How to create a thread. Write its syntax in java.
Q.3	Answer the following [10+10+10= 30]
	a) What Is Applet, Types and Life Cycle Of An Applet in java? and what are the disadvantages advantages Of Java Applets
	b) Write a GUI program called SwingTemperature to convert temperature values between Celsius and Fahrenheit. User can enter either the Celsius or the Fahrenheit value, in floating-point number.
	c) Write a Swing application called SwingAdder as shown. The "ADD" button adds the two integers and display the result. The "CLEAR" button shall clear all the text fields.

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Q.4	Answer the following [5+15=20M]
	a) Write a Java program to accept two square matrices, store them in an array, add the matrices and display the result. Use classes and methods.
	b) Write an address book class that manages a collection of personal objects. An address book will allow a person to add, delete, or search for a person object in the address book. <ul style="list-style-type: none"> • add method : it should add a person object to the address book. • Delete method: it should remove the specified person object from the book. • search method: it searches the address book for a specified person and returns the list of persons matching the specified criteria. The search can be done either by first name, last name or person id.
Q.5	Answer the following [6+14=20M]
	a) What is thread? Explain the life cycle of threads.
	b) Write a Java program to calculate electricity bills using inheritance. The program should get the inputs of watts per hour and unit rate. Check your program for the following case: Assume a consumer consumes 5000 watts per hour daily for one month. Calculate the total energy bill of that consumer if per unit rate is 7 [1 unit = 1k Wh].

5000 W x 24 x 30



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Examination: End-Semester

B.Tech: 3rd Yr

Semester: 5th

Department: ECE

Subject: Wireless Communication (EC-501)

Academic Year: 2024-25

Full Marks: 100

Time: 3 Hours

Attempt all Questions:

1. Answer the following questions:

- (a) If a signal-to-interference ratio of 21 dB is required for satisfactory forward channel performance of a cellular system, what is the frequency reuse factor and cluster size that should be used for maximum capacity if the path loss exponent is (1) $n=4$ (2) $n=3$? Assume that there are six co-channel cells in the first tier and all of them are at the same distance from the mobile. Use suitable approximations. 6.0

(b) Explain the concept of 6.0

- Cell splitting and
- Microcell zone concept

2. Answer the following questions:

- (a) Discuss the various control channels used in GSM and also discuss the forward link multi-frame for the same. 7.0

- (b) Explain the concept of Walsh code and brief the forward CDMA channel modulation process for IS-95. 7.0

- (c) What is Massive MIMO? Discuss the spatial multiplexing with advantages and challenges of MASSIVE MIMO for 5th-generation mobile technology. 7.0

3. Answer the following questions:

- (a) Two antennas are communicating in a Line-of-Sight (LOS) environment. The transmitter power is $P_t=10$ W, the gain of the transmitting antenna is $G_t=10$ dB, and the gain of the receiving antenna is $G_r=8$ dB. The distance between the antennas is $d=1$ km, and the signal frequency is $f=2$ GHz. Calculate the received power P_r at the receiver. Assume free space conditions. 4.0

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- (b) A wireless receiver observes the following multipath components with their respective delays and power levels:

Path Number	1	2	3	4
Delay (T_i), μ s	0	1	3	5
Power (P_i), dBm	-30	-20	-10	-40

Calculate:

- (i) Mean delay of the multipath signal 1.5
(ii) Delay spread of the multipath signal 2.5
(iii) 50% coherence bandwidth 1.0

Hint: $\bar{\tau} = \frac{\sum_i P_i T_i}{\sum_i P_i}$

4. Describe the process of IFFT and FFT in the generation and demodulation of OFDM symbols. 10.0

5. Answer the following questions:

- (a) Draw the architecture of UMTS and discuss the working principles. 6.0
(b) How did the LTE evolve from UMTS? 4.0

6. Figure.1 shows the 4-stage feedback shift register. The initial state of the register is 1000.
- Find the output PN sequence of the shift register. 6.0
 - Demonstrate the balance property and run property of a PN sequence. 4.0
 - Calculate the autocorrelation function of the PN sequence produced by this shift register 5.0

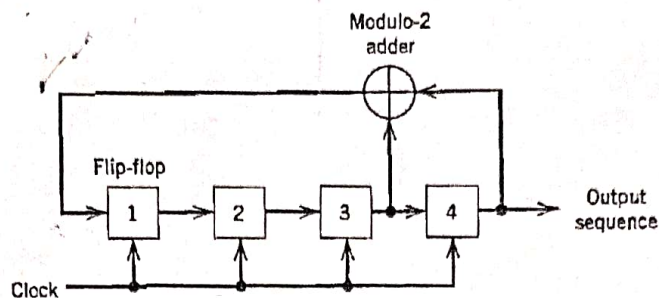


Figure. 1

7. Answer the following questions:

- The digital cellular TDMA system uses a 48.6 kbps data rate to support 3 users per frame. Each user occupies 2 of the 6 time slots per frame. What is the raw data rate provided for each user? 2.0
- In the above, assume each reverse channel frame contains 6-time slots with 324 bits per time slot, and within each time slot, assume there are 6 guard bits, 6 bits reserved for ramp-up, 28 synchronization bits, 12 control channel bits, 12 bits for supervisory control signals, and 260 data bits.
 - Determine the frame efficiency for digital cellular standard. 3.0
 - If half-rate speech coding is used, then 6 users may be supported within a frame. Determine the raw data rate and frame efficiency for users. 3.0

8. Figure. 2 depicts the direct (line-of-sight) and indirect (reflected) paths of radio links operating over a plane earth. The heights of the transmitting antenna at the base station and the receiving antenna of a mobile unit are h_b and h_m , respectively. Assume the following: 15.0
- The reflection coefficient of the ground is -1.
 - The distance d between the two antennas is large enough to make the phase difference ϕ between the reflected and direct paths small compared to 1 radian, so that we may set $\sin \phi \cong \phi$.

Hence, show that the received power P_r is given by the approximation

$$P_r = P_t G_b G_m \left(\frac{h_b h_m}{d^2} \right)^2$$

Where, P_t is the transmitted power, and G_b and G_m are the power gains of the transmitting base and mobile antennas, respectively.

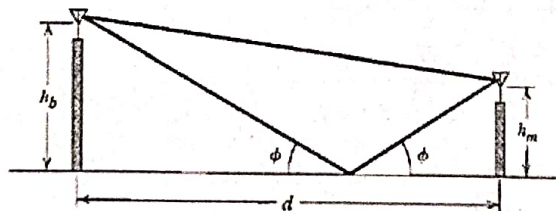


Figure. 2

Wireless
Comm.



Indian Institute of Information Technology, Surat
Department of Electronics & Communication Engineering
Image Processing and Computer Vision (EC-503)
End-Sem Exam, Date: Dec 06, 2024

Timing: 10:00 to 1:00 PM

Academic Year 2024-25, Vth Semester

Max Marks: 100

- Note: 1. All questions are compulsory.
2. Assume suitable data if required.
3. Draw suitable diagrams if needed.

- Q 1. A Discuss how the 1st and 2nd derivative filters are used in digital image enhancement? Calculate 1st and 2nd derivative for the following horizontal intensity profile and discuss the observations based on calculations. 7

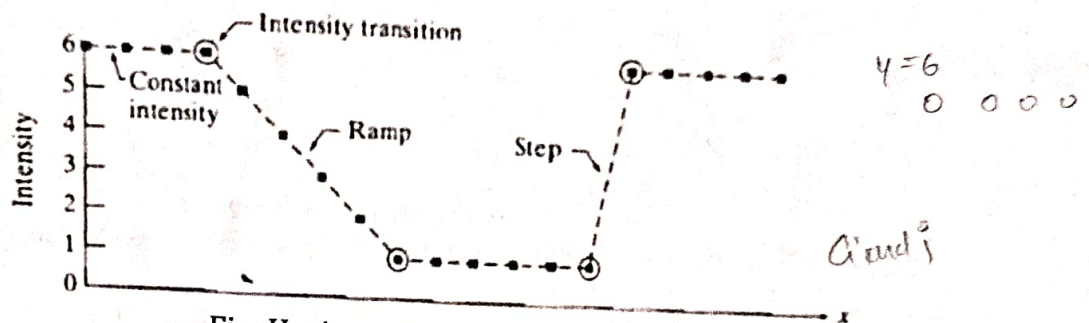


Fig: Horizontal intensity profile

- B What is unsharp masking and high boost spatial filtering? Discuss in detail with necessary equations. 7
C Discuss in detail the significance of Homomorphic filtering in image enhancement with necessary equations and also draw the block diagram of this approach. 7
Q 2. A Draw a block diagram for Basic Steps for Filtering in the Frequency Domain and discuss each and every step in detail. Also derive an equation for Butterworth low pass filter. 7
B Discuss region splitting and merging method for image segmentation in detail. Also segment the below given image using the split and merge procedure. Show the quad tree corresponding to the segmentation. 7

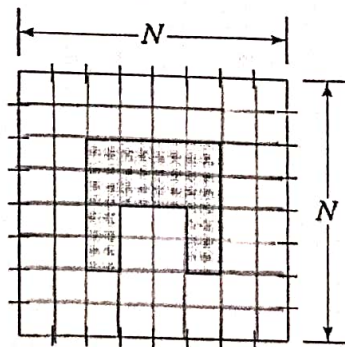


Fig: For region splitting and merging

- Explain what is meant by single linkage and complete linkage in agglomerative clustering. Consider the following distance matrix and do the clustering using both methods and compare the results and comment on it. Also draw dendrogram for them. 8

	A	B	C	D	E
A	0	7	4	11	10
B	7	0	11	10	11
C	4	11	0	15	14
D	11	10	15	0	1
E	10	11	14	1	0

- Q 3. A Perform divisive clustering on the following and draw the dendrogram and comment on the obtain results. 7

11, 16, 31, 43, 54

- B What is the Hough Transform, and why is it used in image processing? Explain in detail with necessary diagram and equations. 7

OR

Write in detail note about the Fourier descriptors.

- C Discuss the role of chain code in image segmentation. 8

(A) 0000032230032
22123211
(B) 32230032221232
1100000

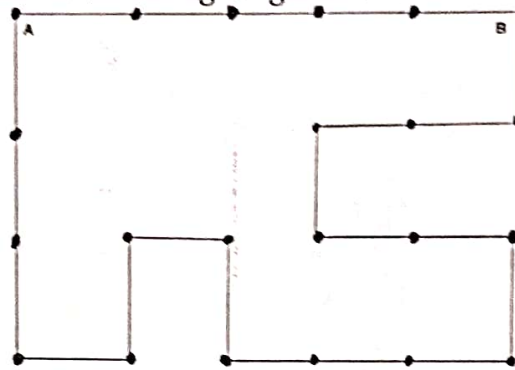


Figure: Image for chain code

Find the 4-directional chain code, first difference and shape number for the given image for the following cases:

(i) Starting point A (B) Starting point B (C) Rotated by 90° degree in clockwise direction (D) Mirror of the given image and comment about the results.

- Q 4 A Explain the morphological operation to extract the boundary of object for binary image. 6

B Explain in detail: Hit or miss transformation 6

C Explain following terms with example: a. Opening b. Closing c. Dilation 6

- Q 5 A Explain the working of adaptive median filter in detail. 6

B The input image and structuring element are given below. Find the eroded version of the input image. 5

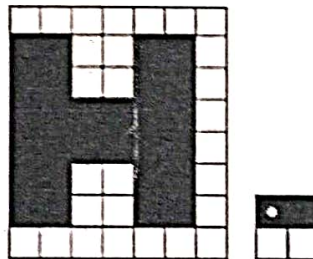


Fig: Input Image for erosion

- C Justify: Periodic noise can be analysed and filtered quite effectively using frequency domain techniques. 6

List different types of selective filters for basic periodic noise reduction. Explain any one in detail.

****Best Wishes****