

**B.L.D.E.A's V.P.Dr.P.G.HALAKATTI COLLEGE OF ENGINEERING
AND TECHNOLOGY VIJYAPUR 586103**

INDEX FILE 7 & 8th SEMESTER QUESTION PAPERS JAN/FEB 2023

5th, 7TH and 8th SEMESTER

ELECTRONICS AND COMMUNIATION DEPARTMENT

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Seventh Semester B.E. Degree Examination, Jan./Feb. 2023
Microwave and Antennas

Time: 3 hrs.

Max. Marks: 80

*Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Use of Smith Chart is permitted.*

Module-1

- 1 a. Explain the Reflex Klystron operation with mode. (06 Marks)
- b. Derive the expression for reflection coefficient and transmission coefficient. (06 Marks)
- c. List the characteristics of Smith Chart. (04 Marks)

OR

- 2 a. A line of $Z_0 = 400\Omega$ is connected to a load of $200 + j300\Omega$ which is excited by matching generator at 800MHz. Find the location and length of a single stub nearest to the load to produce impedance match. Make use of Smith Chart and show all the values. (08 Marks)
- b. A transmission line has the following parameters:
 $R = 2\Omega/m$ $G = 0.5\text{mho/m}$ $f = 1\text{GHz}$ $L = 8\text{nH/m}$ $C = 0.23\text{PF}$.
Calculate the: i) Characteristic impedance ii) Propagation constant. (04 Marks)
- c. With neat block diagram, explain the typical microwave system. (04 Marks)

Module-2

- 3 a. Illustrate the following s-parameter properties i) Symmetry of [s] for a reciprocal network
ii) unitary property for lossless junction. (08 Marks)
- b. List the characteristics of Magic Tees along with s-matrix relation. (08 Marks)

OR

- 4 a. List the significance of following microwave passive device: i) Attenuators ii) Phase shifter. (04 Marks)
- b. The S-parameter of a two-port network are given by
 $S_{11} = 0.2 \angle 0^\circ$, $S_{22} = 0.1 \angle 0^\circ$, $S_{12} = 0.6 \angle 90^\circ$, $S_{21} = 0.6 \angle 90^\circ$
Prove that i) The network is reciprocal but not lossless ii) Find the return loss at port 1 when port 2 is short circuited. (04 Marks)
- c. Explain E-plane tee and H-plane tee along with s-matrix relation. (08 Marks)

Module-3

- 5 a. A lossless parallel strip line has a conducting strip width W. The substrate dielectric separating the two conducting strips has a relative dielectric constant ϵ_{rd} of 6 and a thickness d of 4mm.
Calculate:
i) The required width W of the conducting strip in order to have a characteristic impedance of 50Ω .
ii) The strip-line capacitance.
iii) The strip-line inductance.
iv) The phase velocity of the wave in the parallel strip line. (04 Marks)
- b. Define the following related to antenna parameter i) Directivity ii) Radiation intensity. (05 Marks)
- c. Derive the expression for effective-aperture and directivity of linear dipole $\lambda/2$ antenna. (07 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and/or equations written e.g. $42 \div 8 = 50$, will be treated as malpractice.

OR

- 6 a. Briefly discuss losses in microstrip line. (03 Marks)
- b. A radio link has a 15-W transmitter connected to an antenna of 2.5m^2 effective aperture at 5GHz. The receiving antenna has an effective aperture of 0.5m^2 and is located at a 15-km line of sight distance from the transmitting antenna. Assuming lossless, matched antennas, find the power delivered to the receiver. (04 Marks)
- c. Calculate the directivity of the source with the pattern $u = U_0 \sin^2 \theta \sin^2 \phi$ using
i) Exact method ii) Approximate method. Choose $0 \leq \theta \leq \pi$ and $0 \leq \phi \leq \pi$. (06 Marks)
- d. Explain Antenna field zones with schematic. (03 Marks)

Module-4

- 7 a. Obtain the expression for the field pattern of two isotropic point source with equal amplitude and equal phase. Assume distance between two source is $\lambda/2$. Also draw the field pattern. (08 Marks)
- b. Show that radiation resistance of short electric dipole is given by $80\pi^2 L^2$. (08 Marks)

OR

- 8 a. Derive an array factor expression in case of linear array of n-isotropic point source of equal amplitude and spacing. (08 Marks)
- b. Starting from electric and magnetic potential, obtain far field components for short electric dipole. (08 Marks)

Module-5

- 9 a. Determine the length L, H-plane aperture and flow angle θ_E and θ_H of a pyramidal horn for which E-plane aperture $a_E = 10\lambda$. The horn is fed by a rectangular waveguide with TE_{10} mode. Let $\delta = 0.2\lambda$ in the E plane and 0.375λ in the H-Plane. Also calculate its beam widths and directivity. (06 Marks)
- b. Discuss the constructional details of Log-periodic antenna. (04 Marks)
- c. Derive the field expression for small loop antenna. (06 Marks)

OR

- 10 a. Explain the constructional details of yagi-uda array. (03 Marks)
- b. Derive the expression for radiation resistance of circular loop of any radius say 'a'. (06 Marks)
- c. Obtain the expression for instantaneous electric field and magnetic field at a large distance r from a loop of any radius 'a'. (07 Marks)

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15EC72

Seventh Semester B.E. Degree Examination, Jan./Feb. 2023 Digital Image Processing

Time: 3 hrs.

Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Define digital image processing. Briefly explain the areas of applications of digital image processing. (08 Marks)
 b. With a neat block diagram, explain the fundamental steps involved in digital image processing. (08 Marks)

OR

- 2 a. Explain the following terms:
 i) Gray level resolution
 ii) Spatial resolution
 iii) Isopreference curves. (06 Marks)
 b. Let p and q be the pixels at coordinates $(12, 14)$ and $(20, 25)$ respectively. Find out which distance measure gives the minimum distance between the pixels. (06 Marks)
 c. Consider the image segment shown in Fig.Q.2(c). Compute the lengths of the shortest 4-, 8- and m -path between p and q for the set $V = \{2, 3\}$. If path does not exist between p and q points, explain why.

			(q)	
	4	2	3	2
	3	3	1	3
	2	3	2	2
(p)	2	1	2	3

Fig.Q.2(c)

(04 Marks)

Module-2

- 3 a. Explain the basic intensity transformation functions with necessary graphs. (08 Marks)
 b. The histogram of the 8-level of size 64×64 is shown in Fig.Q.3(b).



Fig.Q.3(b)

Draw the histogram of the equalized image.

(08 Marks)

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OR

- 4 a. Using the second derivative, develop a Laplacian mask for image sharpening. (08 Marks)
b. Explain the homomorphic filtering approach for image enhancement. (08 Marks)

Module-3

- 5 a. Define the process of restoration. Explain the order statistics filter for restoring images in the presence of noise. (08 Marks)
b. Explain how a Wiener filter achieves restoration of a given degraded image. (08 Marks)

OR

- 6 a. Describe the most common noise PDFs found in image processing. (08 Marks)
b. Explain the methods used to estimate the degradation function in image processing. (08 Marks)

Module-4

- 7 a. Briefly explain any two types of color model. (08 Marks)
b. Define wavelet transform and Multi Resolution theory. Explain the scaling function fundamental requirements of Multi Resolution Analysis (MRA). (08 Marks)

OR

- 8 a. Briefly explain the basic pseudocolor image processing techniques. (08 Marks)
b. Briefly explain the erosion and dilation operation of morphology. (08 Marks)

Module-5

- 9 a. With the help of basic formulation explain the concept of region splitting and merging. (08 Marks)
b. Explain the Minimum-Perimeter Polygons (MPP) algorithm. (08 Marks)

OR

- 10 a. What is Thresholding? Describe the algorithm used for basic global thresholding. (08 Marks)
b. Explain Fourier descriptors for boundary sequence. Also mention the basic properties of Fourier descriptors for $s(k)$. (08 Marks)

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Seventh Semester B.E. Degree Examination, Jan./Feb. 2023
Power Electronics

Time: 3 hrs.

Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. List the classification of power converters. Explain in brief with relevant circuit diagram and waveforms. (08 Marks)
- b. Compare power BJTs with power MOSFETs. (08 Marks)

OR

- 2 a. With the help of a neat block diagram, explain the functional elements of power electronics system. (06 Marks)
- b. Sketch and explain switching behavior of power MOSFET (06 Marks)
- c. A bipolar transistor is operated as a chopper switch at a frequency of $f_c = 10\text{kHz}$. The DC voltage of chopper is $V_s = 220\text{V}$ and the load current is $I_L = 100\text{A}$. $V_{CE(sat)} = 0\text{V}$. The switching times are $t_d = 0$; $t_r = 3\mu\text{s}$ and $t_f = 1.2\mu\text{s}$. Determine the values of i) L_s ii) C_s iii) R_s . Where L_s is series snubber element and C_s and R_s shunt snubber to limit di/dt and dv/dt respectively. (04 Marks)

Module-2

- 3 a. With a neat sketch describe the two transistor model of thyristor and obtain expression for anode current. (08 Marks)
- b. Design UJT triggering circuit for SCR. Given $-V_{im} = 20\text{V}$, $\eta = 0.6$, $I_p = 10\mu\text{A}$, $V_V = 2\text{V}$, $I_V = 10\text{mA}$. The frequency of oscillation is 100Hz . The triggering pulse width should be $50\mu\text{sec}$. (08 Marks)

OR

- 4 a. With a neat sketch, explain the turn-on and turn-off characteristics of SCR. (06 Marks)
- b. Calculate the conduction time of SCR and peak SCR current that flows in the circuit employing series resonant commutation (self commutation or class A commutation). If the supply voltage is 300V , $C = 1\mu\text{f}$, $L = 5\text{mH}$, $R_s = 100\Omega$. Assume the circuit initially relaxed. (06 Marks)
- c. Differentiate between natural and forced commutation. (04 Marks)

Module-3

- 5 a. With the help of a neat circuit diagram describe the operation of a single phase fully controlled rectifier with RL load. Sketch the associated waveforms. Derive expression for average output voltage. (08 Marks)
- b. An AC voltage controller has a resistive load of $R = 10\Omega$ and rms input voltage $V_s = 120\text{V}$, 50Hz . The thyristor switch is on for $n = 25$ cycles and is off for $m = 75$ cycles. Determine: i) The RMS output voltage ii) The output power factor iii) The average and rms current of thyristors. Derive an expression of the rms output voltage and average and rms thyristor current. (08 Marks)

1 of 2

OR

- 6 a. A single phase semiconverter is operated from 120V, 50hz supply. The load resistance is 10Ω . If the average output voltage is 25% of the maximum possible average output voltage, determine: i) Firing angle ii) rms and average output current iii) rms and average thyristor current. (08 Marks)
- b. With the help of suitable circuit diagram and relevant waveforms, explain the operation of bidirectional AC voltage controller using phase control. Also derive an expression for rms output voltage. (08 Marks)

Module-4

- 7 a. With a neat circuit diagram, explain the operation of buck-boost regulator. (08 Marks)
- b. For the stepdown chopper having resistive load derive the expression for the following:
 i) Average output voltage
 ii) Rms output voltage
 iii) Chopper efficiency
 iv) Effective input resistance of chopper. (08 Marks)

OR

- 8 a. Input to the step up chopper is 200V. The output required is 600V. If the conducting time of thyristor is 200 μ sec compute
 i) Chopper frequency
 ii) If the pulse width is halved for constant frequency operations find new output voltage. (06 Marks)
- b. With a neat circuit diagram and relevant waveforms explain class D chopper operation. (06 Marks)
- c. A buck regulator has an input voltage of $V_s = 12V$. The required average output voltage is $V_o = 5V$ at $R = 500\Omega$ and the peak to peak output ripple voltage is limited to 0.8A, determine: i) The duty cycle 'K' ii) The filter inductance 'L' and the filter capacitance 'C'. (04 Marks)

Module-5

- 9 a. With a neat circuit diagram and relevant waveforms explain the operation of a full bridge inverter with 'R' load. Derive an expression for rms output voltage. (08 Marks)
- b. With a neat circuit diagram and relevant waveforms explain single-phase thyristor AC switch. What are the differences between AC and DC switches? (08 Marks)

OR

- 10 a. With a neat circuit diagram, explain the operation of a CSI (Current Source Inverter). (06 Marks)
- b. A single phase half bridge inverter has a resistive load of 2Ω . The dc supply is 24V calculate: i) RMS output voltage at fundamental frequency ii) Output power iii) Average and peak load current. (04 Marks)
- c. Draw the schematic of a photovoltaic relay and briefly explain its operation. Mention its advantages and over electromechanical relays. (06 Marks)

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Seventh Semester B.E. Degree Examination, Jan./Feb. 2023 Real Time System

Time: 3 hrs.

Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Define Real Time System, Real Time Programm and Time Constraints. (03 Marks)
 b. Classify the RTS based on time constraints. (06 Marks)
 c. Explain with neat sketch Typical Chemical batch process. (07 Marks)

OR

- 2 a. Explain briefly the terms batch, continuous and laboratory. (06 Marks)
 b. Explain with neat sketch Historical Background of Real Time System (RTS). (07 Marks)
 c. Explain briefly PID control algorithm. (03 Marks)

Module-2

- 3 a. What is the necessity of using specialized processors in RTS? Explain the different forms of parallel computer architecture. (10 Marks)
 b. Explain different types of LAN topologies. (06 Marks)

OR

- 4 a. Explain with neat sketch General purpose computer. (07 Marks)
 b. Explain single chip Micro Computer and Micro Controller. (04 Marks)
 c. Explain with neat sketch pulse interface. (05 Marks)

Module-3

- 5 a. Explain the following terms :
 (i) Security
 (ii) Readability
 (iii) Portability
 b. Explain overview of Real Time Languages. (06 Marks)
 c. Explain Co-routines. (04 Marks)

OR

- 6 a. Explain the following with respect to programming languages :
 (i) Scope and Visibility of variables.
 (ii) Exception Handling.
 (iii) Derived data types.
 (iv) Printers (12 Marks)
 b. Explain Global and Local Variables. (04 Marks)

Module-4

- 7 a. Explain with neat sketch typical structure of RTOS (Real Time Operating System). (08 Marks)
 b. Explain the general structure of Input/Output sub system. (05 Marks)
 c. Write a note on Semaphores. (03 Marks)

OR

- 8 a. List the basic functions of Task Management. Explain the task states with the help of Task State diagram. (10 Marks)
- b. Explain with neat sketch Code Sharing. (06 Marks)

Module-5

- 9 a. Explain Foreground/Background approach. (08 Marks)
- b. Explain Mutual Exclusion using condition flags. (08 Marks)

OR

- 10 a. Summarize various methodologies used for designing Real Time System. (06 Marks)
- b. Explain the general arrangements of an Drying oven with functional specification. (07 Marks)
- c. Explain Yourdon methodology. (03 Marks)

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15EC752

Seventh Semester B.E. Degree Examination, Jan./Feb. 2023
IOT and Wireless Sensor Networks

Time: 3 hrs.

Max. Marks: 80

Note: Answer FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Explain the major components of IOT system with necessary diagrams. (10 Marks)
- b. Explain the sources of IOT development board which can be used for prototype development. (06 Marks)

OR

- 2 a. Explain OSI model the IOT/M2M systems with necessary diagram. (08 Marks)
- b. Explain with a neat diagram constrained RESTful environment (CORE) protocol. (08 Marks)

Module-2

- 3 a. Explain with a neat diagram, internet based communication. (10 Marks)
- b. Describe IP addressing in the IOT. (06 Marks)

OR

- 4 a. Explain cloud computing paradigm for data collection, storage and computing. (10 Marks)
- b. Mention the features and advantage of cloud computing. (06 Marks)

Module-3

- 5 a. Explain Programming Embedded device Arduino platform using IDE. (06 Marks)
- b. Explain five levels for software development for applications and services in the IOT or M2M. (10 Marks)

OR

- 6 a. Discuss the vulnerabilities of IOT. (06 Marks)
- b. Explain Layered Attacker Model. (10 Marks)

Module-4

- 7 a. Explain Main sensor node hardware components with necessary diagram. (10 Marks)
- b. List the transceiver tasks and characteristics. (06 Marks)

OR

- 8 a. Explain energy consumption of sensor nodes for operation states with different power consumption. (10 Marks)
- b. Explain three types of mobility. (06 Marks)

Module-5

- 9 a. Explain S-MAC protocols in detail. (08 Marks)
- b. Explain LEACH protocols in detail. (08 Marks)

OR

- 10 a. Explain energy efficient unicast protocols in detail. (10 Marks)
- b. Explain Position Based Routing. (06 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
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17EC71

Seventh Semester B.E. Degree Examination, Jan./Feb. 2023
Microwave & Antennas

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Explain Reflection Klystron amplifier with neat diagram. (06 Marks)
- b. A Reflex Klystron is to be operated at 10 GHz with dc beam voltage of 300 V, repeller space of 0.1 cm for $1\frac{3}{4}$ mode. Calculate $P_{r,max}$ and corresponding repeller voltage for a beam current of 20 mA. (06 Marks)
- c. Define Reflection coefficient, transmission coefficient and SWR. Also derive the equation for reflection coefficient at the load end. (08 Marks)

OR

- 2 a. Explain mode curves of reflex klystron and also mention applications in the design of microwave receiver and transmitter circuits. (06 Marks)
- b. Derive transmission line equations to find voltage and current in terms of Z and L. (08 Marks)
- c. A transmission line has a characteristic impedance of $100\angle 53.13^\circ$. It is terminated with load impedance. The transmission coefficient is $1.09\angle 35.54^\circ$. Find reflective coefficient and load impedance. (06 Marks)

Module-2

- 3 a. Explain Z, Y and ABCD parameters used for analysis of Radio frequency circuits and its disadvantages. Derive S-matrix of two port network. (08 Marks)
- b. Write neat diagram of E plane Tee junction and matrix. Analyse 3 dB splitter property. (05 Marks)
- c. The S parameters of two port network are given by,
- $$[S] = \begin{bmatrix} 0.1\angle 0 & 0.8\angle -45 \\ 0.8\angle 45 & 0.2\angle 0 \end{bmatrix}$$
- (i) Determine whether the network is reciprocal and not lossless.
- (ii) If Port 2 is terminated with a matched load, calculate return loss at Port 1.
- (iii) When Port 2 is short circuited, find return loss at Port 1. (07 Marks)

OR

- 4 a. Write neat diagram for two port network and indicate incident, reflected wave and power. Define insertion loss, transmission loss, return loss in terms of S-parameters. (06 Marks)
- b. Prove S matrix for MAGIC Tee junction. (08 Marks)
- c. Write short notes on Coaxial connectors and adapters. (06 Marks)

Module-3

- 5 a. Explain the following terms as related to antenna system:
 (i) Directivity (ii) Beam efficiency (iii) Effective aperture (iv) Half power beam width. (08 Marks)
- b. Discuss different types of losses in microstrip lines. (07 Marks)
- c. Find the maximum directivity of an antenna whose radiation intensity $U = r^2 W_{rad} = A_0 \sin \theta$. Write an expression for the directivity as a function of the directional angle θ and ϕ . (05 Marks)

1 of 2

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OR

- 6 a. Write neat diagram and derive Friss transmission formula and indicate all the antenna parameters clearly. (06 Marks)
- b. Consider isotropic radiator in polar coordinate showing incremental angle dA on the surface of a sphere of radius r and derive inverse square law of radiation equation. Also write E-plane and H-plane patterns in two-dimensional (2D) plots by considering two orthogonal principal plane cuts of the 3D pattern of a half wave dipole. (08 Marks)
- c. Explain different types of striplines and highlight the importance of dielectric constant in the design of striplines. (06 Marks)

Module-4

- 7 a. Derive radiation resistance of short electric dipole (R_r). (06 Marks)
- b. Explain different types of antenna array and explain the principle of pattern multiplication with the help of suitable example. (08 Marks)
- c. A Hertzian dipole of length $dl = 0.5$ m is radiating into free space. If dipole current is 4 A and frequency is 10 MHz. Calculate the highest power density at a distance of 2 km from the antenna. (06 Marks)

OR

- 8 a. Derive an array factor expression in the case of linear array of n isotropic point sources of equal amplitude and spacing. (08 Marks)
- b. Derive directivity of short dipole antenna. (08 Marks)
- c. Determine total field pattern using principle of pattern multiplication. For 2 sources separated $\frac{\lambda}{2}$ apart and $\delta = 0$ with individual source pattern given by $E = E_0 \cos \phi$. (04 Marks)

Module-5

- 9 a. Derive an expression for far fields E_θ and H_ϕ for small loop antenna. (10 Marks)
- b. Write short note on :
 (i) Parabolic antenna.
 (ii) Yagi-Uda antenna. (10 Marks)

OR

- 10 a. Show that the radiation resistance of small loop single turn antenna is $31,200 \left(\frac{A}{\lambda^2} \right)^2$.

Calculate the radiation resistance for 50 turns if $\frac{C}{\lambda} = 0.1$. Where C is the circumference of circular loop antenna. (10 Marks)

- b. Write note on log periodic antenna. (05 Marks)
- Write neat diagram of pyramidal horn antenna and determine the length L , H-plane aperture and flare angle θ_e and θ_h in E and H plane respectively. E plane aperture $A_e = 10 \lambda$. The horn is fed by a rectangular waveguide with TE_{10} mode. Let $\delta = 0.2\lambda$ in the E plane and 0.375λ in the H plane. Calculate H plane aperture. Also calculate beamwidth and directivity. (05 Marks)

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17EC72

Seventh Semester B.E. Degree Examination, Jan./Feb. 2023 Digital Image Processing

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1. a. Explain the various components of Image Processing System, with neat block diagram. (08 Marks)
- b. Explain the process of Image Acquisition, using sensor strips to generate 2D - Image. (08 Marks)
- c. Image transmission is done in packets. A packet consists of a start bit, a byte of data and a stop bit. Find
 - i) How many minutes would it take to transmit a 512×512 image with 256 grey levels at 300 baud rate.
 - ii) What would be the time at 9600 baud? (04 Marks)

OR

2. a. Explain the importance of brightness adaption and discrimination in Image processing. (08 Marks)
- b. List four major applications of Image processing. (04 Marks)
- c. For $V = \{2, 3, 4\}$, compute the lengths of shortest 4, 8, m paths between p and q in the following image. If a particular path does not exist between these three points, explain why. Repeat for $V = \{0, 1, 2, 4\}$. (08 Marks)

	3	4	1	2	0	
	0	1	0	4	2	(q)
	2	2	3	1	4	
(p)	2	0	4	2	1	
	1	2	0	3	4	

Module-2

3. a. Explain the power law transformation and piece - wise linear bit plane slicing with a neat graphical illustration. (10 Marks)
- b. Explain the sharpening of Image in frequency domain using :
 - i) Ideal High pass filter
 - ii) Butterworth High pass filter
 - iii) Gaussian High pass filter. (10 Marks)

OR

4. a. Explain with a block diagram, the basic steps for image filtering frequency domain. (06 Marks)
- b. Perform the histogram equalization of 8 level image of size 64×64 whose data is shown in table Q4(b).

Grey level r_k	0	1	2	3	4	5	6	7
Number of Pixels	123	78	281	417	639	1054	816	688

Table Q4(b)

- c. Explain 2D - DFT and mention Translation and Symmetry properties of 2D - DFT. (08 Marks)

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**Module-3**

- 5 a. With neat block diagram and relevant mathematical expressions, explain Image Degradation / Restoration model. (06 Marks)
- b. Explain Alpha Trimmed mean filter with necessary equations. (06 Marks)
- c. Show the effect of 3×3 midpoint, min max and median filter on an given Image Segment.

0	1	2	3	4
5	6	7	8	9
5	5	5	9	9
5	5	5	9	9
5	5	5	9	9

(08 Marks)

OR

- 6 a. With necessary diagrams and relevant equations, explain any four noise probability density functions. (10 Marks)
- b. Explain with necessary expression the Periodic Noise reduction by frequency domain filtering. (10 Marks)

Module-4

- 7 a. Explain with necessary diagram, the RGB colour model. (08 Marks)
- b. Explain the conversion of RGB to HSI color model and HSI to RGB colour model. (08 Marks)
- c. Explain Boundary Extraction using Morphological Algorithm. (04 Marks)

OR

- 8 a. Write a note on Pseudo colour Image Processing. Explain Intensity slicing as applied to pseudo colour Image Processing. (10 Marks)
- b. Explain Erosion and Dialation in Image Processing. (10 Marks)

Module-5

- 9 a. Explain Segmentation with respect to an Image. Write note on applications of Image Segmentation. (08 Marks)
- b. Explain Global thresholding using Otsu's method. (08 Marks)
- c. Define Length and diameter of a boundary with respect to image. (04 Marks)

OR

- 10 a. Write short notes on Image Segmentation by region splitting and merging. (06 Marks)
- b. Explain Boundary representation by Chain codes. (08 Marks)
- c. Explain Point detection with respect to Image Segmentation. (06 Marks)

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17EC73

Seventh Semester B.E. Degree Examination, Jan./Feb. 2023 Power Electronics

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Explain different types of power electronic circuits. (10 Marks)
- b. Explain peripheral effects of power electronic components and equipment and mention how to reduce them with a neat block diagram. (10 Marks)

OR

- 2 a. List different types of power MOSFET and explain p-channel depletion type in detail. (10 Marks)
- b. Explain the features and structure of IGBT. (10 Marks)

Module-2

- 3 a. Explain two transistor model of SCR and derive an expression for anode current in terms of transistor parameters for a thyristor. (10 Marks)
- b. Explain static anode-cathode characteristics of SCR. (10 Marks)

OR

- 4 a. Explain gate characteristics of SCR with a neat diagram. (10 Marks)
- b. Explain different turn-on methods of SCR. (05 Marks)
- c. Differentiate between natural and forced commutation. (05 Marks)

Module-3

- 5 a. Explain single phase full converter with the help of circuit diagram and waveforms. (10 Marks)
- b. The single phase dual converter is operated from a 120V, 60hz supply and the load resistance is $R = 10\Omega$. The circulating inductance is $L_r = 40\text{mH}$ delay angles are $\alpha_1 = 60^\circ$ and $\alpha_2 = 120^\circ$. Calculate the peak circulating current and the peak current of converter 1. (10 Marks)

OR

- 6 a. An on-off type ac regulator is operating with a resistive load of $R = 10\Omega$ and the rms supply v/g is 230V. The controller remains on for 40 cycles and is off for 60 cycles. Determine:
 - i) rms load v/g
 - ii) Input power factor.(10 Marks)
- b. Explain the principle of phase controlled converter operation. (10 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and/or equations written eg. 42+8 = 50, will be treated as malpractice.

Module-4

- 7 a. Explain buckboost regulator with neat circuit diagram and waveforms. (10 Marks)
 b. The buck regulator has an input v/g of $V_s = 12V$. The required average o/p v/g is $V_a = 5V$ at $R = 500\Omega$ and the peak to peak o/p ripple v/g is $20mV$. The switching frequency is $25kHz$. If the peak to peak ripple current of inductor is limited to $0.8A$. Determine: i) Duty cycle K ii) The filter inductance iii) The filter capacitor C and iv) Critical values of L and C . (10 Marks)

OR

- 8 a. Explain different dc converter classification. (10 Marks)
 b. The step down dc converter has a resistive load $R = 10\Omega$ and the input voltage is $V_s = 220V$, when the converter switch remains on its v/g drop is $u_{ch} = 2V$ and the chopping frequency $f = 1kHz$. If the duty cycle is 50% , determine: i) average output v/g v_a ii) rms o/p v/g v_o iii) Converter efficiency. (10 Marks)

Module-5

- 9 a. Explain single phase half bridge inverter with neat circuit diagram and waveforms. (10 Marks)
 b. The single-phase half-bridge inverter has a resistive load of $R = 2.4\Omega$ and the dc i/p v/g $V_s = 48v$. Determine i) the rms o/p v/g at the fundamental frequency V_{o1} , ii) the output power P_{o1} iii) average and peak currents of each transistor iv) the peak reverse blocking voltage V_{BR} of each transistor. (10 Marks)

OR

- 10 a. Explain dc switches with neat circuit diagram. (06 Marks)
 b. Outline various performance parameters used for inverters. (08 Marks)
 c. Explain single phase AC switches. (06 Marks)

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17EC743

Seventh Semester B.E. Degree Examination, Jan./Feb. 2023 Real Time Systems

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Define Real time system, explain computer control system with hardware and software interface. (10 Marks)
- b. State timing constraints involved in Real time system and explain classification of programs in Real time system. (10 Marks)

OR

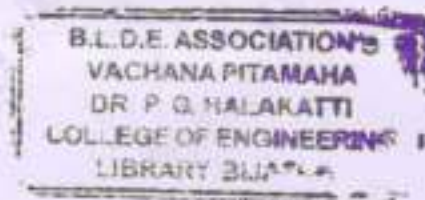
- 2 a. Explain: i) Self tuning adaptive control ii) Model reference adaptive control. (10 Marks)
- b. Explain sequential control of chemical reactor vessel process. (10 Marks)

Module-2

- 3 a. Classify different types of parallel computer architecture and explain multiple instruction streams and multiple data stream (MIMD) architecture. (10 Marks)
- b. State different types of process related interfaces. Explain digital input and output interface. (10 Marks)

OR

- 4 a. Explain general purpose digital computer. (10 Marks)
- b. Explain pulse input and output interface. (10 Marks)



Module-3

- 5 a. State and explain structured program constructs. (10 Marks)
- b. Explain:
- i) Security
 - ii) Readability
 - iii) Flexibility
 - iv) Portability
 - v) Efficiency of a real time programming language. (10 Marks)

OR

- 6 a. Explain compilation of modular programs. (06 Marks)
- b. Explain:
- i) Exception handling (10 Marks)
 - ii) Coroutines (04 Marks)
- c. Write a short note on Declaration of variables.

Module-4

- 7 a. Explain :
i) Multi user operating system
ii) Multi tasking operating system. (10 Marks)
b. Explain the need of task management with different task states of typical task state diagram. (10 Marks)

OR

- 8 a. Explain :
i) Serially reusable code
ii) Re-entrant code (10 Marks)
b. State and explain priority structures in RTOS. (10 Marks)

Module-5

- 9 a. Explain planning phase of a real time system design. (10 Marks)
b. Explain Foreground/background approach in real time system. (10 Marks)

OR

- 10 a. Explain software modeling in real time system development. (10 Marks)
b. Outline the abstract modeling approach of Ward and Mellor. (10 Marks)

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Seventh Semester B.E. Degree Examination, Jan./Feb. 2023 IOT and Wireless Sensor Network

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Explain ORACLE IOT conceptual framework with equation. (10 Marks)
 b. Explain CO-AP/MQ and COAP/SMS messaging protocol (10 Marks)

OR

- 2 a. Explain the features of MQTT protocol. (10 Marks)
 b. Explain the function of data-management and consolidation function With respect to IOT. (10 Marks)

Module-2

- 3 a. Explain IP addressing in the IOT. (10 Marks)
 b. List the features of Nimbits. (10 Marks)

OR

- 4 a. Explain 6 LOW PAN protocol used in data adaptation layer. (10 Marks)
 b. Explain cloud computing, services features and concerns. (10 Marks)

Module-3

- 5 a. Write a program to read analog sensor data (temperature) at SPI port using Arduino board. (10 Marks)
 b. Explain security tomography of large network and layered attack model. (10 Marks)

OR

- 6 a. Explain Prototyping Embedded Device using Arduino. (10 Marks)
 b. What are the security requirements in IOT architecture and threat analysis using microsoft threat model. (10 Marks)

Module-4

- 7 a. Explain the challenges with respect to characteristics and the required mechanism in Wireless Sensor Network. (10 Marks)
 b. Explain energy consumption of sensor node. (10 Marks)

OR

- 8 a. Explain design principles for Wireless Sensor Network. (10 Marks)
b. Explain Gateway concept used in communication. (10 Marks)

Module-5

- 9 a. Explain energy problems in MAC protocol. (06 Marks)
b. Explain TRAMA protocol. (06 Marks)
c. Explain any two consideration in energy efficient Unicast Routing with example. (08 Marks)

OR

- 10 a. Explain simple forwarding strategies and its problems in Geographical routing. (10 Marks)
b. With neat schematic diagram, explain CSMA protocol. (10 Marks)

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18EC71

Seventh Semester B.E. Degree Examination, Jan./Feb. 2023
Computer Networks

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. What is Physical Topology? With a neat diagram, explain the various types of physical topologies available in computer networks. (10 Marks)
- b. With a neat diagram, explain the significance of layers in TCP/IP protocol suite. (10 Marks)

OR

- 2 a. Explain LAN and WAN with the help of neat diagrams. (06 Marks)
- b. With a neat diagram, explain the five components of Data Communication. (06 Marks)
- c. Explain encapsulation and decapsulation in TCP/IP model with the help of a neat diagram. (08 Marks)

Module-2

- 3 a. What is an ARP? Explain the operation of ARP and its packet format with suitable diagrams. (10 Marks)
- b. Explain stop and wait protocol with a neat FSM diagram. Also explain how sequence and acknowledge numbers prevent duplication of frames with necessary diagrams. (10 Marks)

OR

- 4 a. A slotted ALOHA network transmits 200 bit frames using a shared channel with a 200 kbps bandwidth. Find the throughput if the system produces
(i) 1000 frames per second (ii) 500 frames per second (iii) 250 frames per second? (06 Marks)
- b. Explain CSMA/CA protocol with a flow diagram. (08 Marks)
- c. Explain the Ethernet Frame format of standard Ethernet. (06 Marks)

Module-3

- 5 a. Explain with a neat diagram, the virtual circuit packet switched network and its various phases of operation. (10 Marks)
- b. With a neat diagram explain IPv4 Datagram format. (10 Marks)

OR

- 6 a. Explain with an example, the Distance Vector Routing algorithm. (10 Marks)
- b. Explain with an example, Link State Routing and also apply Dijkstra algorithm to find least cost path tree. (10 Marks)

Module-4

- 7 a. Explain connectionless and connection oriented protocols in transport layer. (10 Marks)
- b. With a neat diagram, explain state transition diagram of TCP. (10 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg. 42+8 = 50, will be treated as malpractice.



18EC71

OR

- 8 a. Explain Go-Back-N protocol along with sliding window diagrams. (10 Marks)
- b. Explain TCP connection establishment using three way hand shaking. (10 Marks)

Module-5

- 9 a. Explain World Wide Web and Web documents with necessary diagrams. (10 Marks)
- b. Explain the Architecture of Electronic mail with a neat diagram. (10 Marks)

OR

- 10 a. Explain with an example, the working of Hyper Text Transfer Protocol. (10 Marks)
- b. What is Name-address resolution? With a neat diagram, explain the various types of resolution that are available. (10 Marks)

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18EC72

Seventh Semester B.E. Degree Examination, Jan./Feb. 2023
VLSI Design

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. With neat graph define Moore's law. Explain the history of integrated structures. (06 Marks)
 b. Realize CMOS logic structure for the Boolean expressions :
 i) $y = \overline{(a-b)} + (c-d)$ ii) $y = a \cdot (b + c)$. (06 Marks)
 c. With neat diagrams, explain 3 regions of operations of nMOS transistor. (08 Marks)

OR

- 2 a. List the any three non ideal features of transistors. Explain each in detail. (06 Marks)
 b. Draw the diagram of general logic gate structure. Explain 2-input CMOS NAND gate functioning using truth table. (06 Marks)
 c. Draw schematic diagram of CMOS inverter. Explain the graphical derivation of CMOS inverter DC characteristics. (08 Marks)

Module-2

- 3 a. With neat diagrams, explain the complete CMOS fabrication process. (12 Marks)
 b. Using relevant equations explain full scaling (constant field scaling) applied to
 length ii) Channel depth iii) Oxide thickness iv) Junction depth v) Supply
 vi) Threshold voltage vii) Doping densities N_A, N_D . (08 Marks)

OR

- 4 a. Write a short note on timing analyzer. (06 Marks)
 b. With neat diagrams, explain the lumped representation of parasitic MOSFET capacitances. (08 Marks)
 c. Draw and explain layout rules for transistors. (06 Marks)

Module-3

- 5 a. Explain various stages of timing optimization in VLSI design. (08 Marks)
 b. With equations explain the calculation of inverter delay. (06 Marks)
 c. Estimate the propagation delay t_{pd} for unit inverter driving 'm' identical unit inverters using Elmore delay. (06 Marks)

OR

- 6 a. Draw the diagram of photo masking with a negative resist and explain. (08 Marks)
 b. What is logical effort? Explain HI-Skew inverter construction by down sizing of nMOS transistor. (06 Marks)
 c. Explain pseudo nMOS inverter with schematic diagram and DC transfer characteristics. (06 Marks)

Module-4

- 7 a. Draw and explain the functioning of pulse generators. (08 Marks)
b. Explain the working of resettable flip-flops and latches. (12 Marks)

OR

- 8 a. Draw and explain the features of C²MOS latch. (08 Marks)
b. With neat circuit diagrams, explain 4 transparent latches. Write the advantage and disadvantage of each. (12 Marks)

Module-5

- 9 a. Draw the diagram of 4 bit × 4 bit NOR based ROM array, explain the functioning. (08 Marks)
b. What is static RAM? With neat diagram explain any 3 static RAM circuits. (12 Marks)

OR

- 10 a. Write a short note on design for testability. (06 Marks)
b. Explain manufacturing test principles in detail. (06 Marks)
c. Explain the logic verification principles. (08 Marks)

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18EC733

Seventh Semester B.E. Degree Examination, Jan./Feb. 2023 Digital Image Processing

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. With a block diagram, explain the fundamental steps involved in Digital Image Processing. (10 Marks)
- b. Explain the process of image acquisition using a single sensor. (06 Marks)
- c. A common measure of transmission for digital data is baud rate (number of bits/Sec.). Each packet consists of byte, a start bit and a stop bit. How many minutes would it take to transmit a 1024×1024 image with 256 gray levels using : i) 33.6K baud modem ii) 200K baud modem. (04 Marks)

OR

- 2 a. Explain the components of a general purpose image processing system, with block diagram. (08 Marks)
- b. Explain with neat diagram, how image is acquired using Linear Sensor Strip. (06 Marks)
- c. Explain the importance of brightness adaptation and discrimination in image processing. (06 Marks)

Module-2

- 3 a. Explain the process of image sampling and quantization with an example. (07 Marks)
- b. Perform histogram equalization of a 10×10 , 3 - bit image having following distribution. Plot the input and output histogram. (07 Marks)

Gray level	0	1	2	3	4	5	6	7
Number of pixels	50	25	15	10	0	0	0	0

- c. Explain image sharpening in spatial domain using second order Laplacian derivative. (06 Marks)

OR

- 4 a. Explain the concept of : i) Gray level slicing ii) Bit plane slicing. (08 Marks)
- b. Compute the lengths of the shortest 4-, 8- and m-path between p and q in the image segment shown in Fig.Q4(b) by considering $V = \{1, 2\}$. (06 Marks)

	3	1	2	1	(q)
	2	2	0	2	
	1	2	1	1	
(p)	1	0	1	2	

Fig.Q4(b)

- c. Explain image negative. Determine the negative of a 4 bit image shown in Fig.Q4(c). Plot the histogram of the original image and its negative. (06 Marks)

0	12	14	11
5	10	4	8
4	9	7	5
2	15	8	1

Fig.Q4(c)

(06 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-3

- 5 a. Explain Homomorphic filters for image enhancement with necessary equations, block diagram and transfer function. (10 Marks)
- b. State the following properties of 2D – DFT.
i) Translation ii) Periodicity iii) Rotation iv) Convolution theorem. (04 Marks)
- c. Compare an Ideal Lowpass filter with a Butterworth Lowpass filter. (06 Marks)

OR

- 6 a. Explain with a block diagram, the basic steps for image filtering in frequency domain. (06 Marks)
- b. Explain sharpening of images in frequency domain using Ideal, Butterworth and Gaussian Highpass filter. (09 Marks)
- c. State and prove linearity property of 2D – DFT. (05 Marks)

Module-4

- 7 a. With necessary equations and graph, explain the following noise probability density functions :
i) Gaussian Noise ii) Exponential Noise iii) Uniform Noise. (06 Marks)
- b. What is inverse filtering? What are its disadvantages? How are they eliminated using Weiner filtering? (08 Marks)
- c. Explain Adaptive local noise reduction filter. (06 Marks)

OR

- 8 a. Assuming only the presence of noise in an image, explain the following mean filters.
i) Arithmetic mean filter. (06 Marks)
- ii) Geometric mean filter.
- b. Apply a 3×3 median filter for the marked pixels in the image shown in Fig.Q8(b) and write the result of the filtering.

10	11	12	13	14	15
11	255	45	30	23	32
12	23	22	0	22	34
13	12	24	22	12	12

Fig.Q8(b)

- c. Explain the estimation of degradation function using :
i) Observation (06 Marks)
- ii) Experimentation. (08 Marks)

Module-5

- 9 a. What is Pseudo color image processing? Explain intensity slicing as applied to pseudo color image processing. (06 Marks)
- b. With necessary expressions explain erosion and dilation. (08 Marks)
- c. Explain RGB color model. (06 Marks)

OR

- 10 a. With necessary expressions explain opening and closing operations. List the properties of opening and closing operations. (10 Marks)
- b. Write the equations for converting colors from
i) RGB to HSI ii) HSI to RGB. (10 Marks)

CBCS SCHEME

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18EC741

Seventh Semester B.E. Degree Examination, Jan./Feb. 2023 IoT and Wireless Sensor Networks

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Define IoT. Write an equation representing actions and communication of data at various levels in IoT and explain. (05 Marks)
- b. Draw a neat diagram showing various blocks and subsystems of an IoT framework suggested by IBM and explain in brief. (10 Marks)
- c. What is the significance of MQTT protocol in IoT? Explain the functionalities of MQTT Broker. (05 Marks)

OR

- 2 a. With a neat diagram, explain IoT reference model suggested by CISCO. (08 Marks)
- b. Explain the following functionalities of gateway at data adaption layer.
 - i) Transcoding
 - ii) Privacy
 - iii) Security
 - iv) Data enrichment and consolidation. (06 Marks)
- c. What is Constrained Application Protocol (COAP) in IoT? Briefly discuss features of COAP. (06 Marks)

Module-2

- 3 a. Write a neat diagram, showing how the four layers of TCP/IP suite generates data for the network and physical layer during internet communication. List various actions that occur during transmission of data. (08 Marks)
- b. Explain various classes of IP addresses with an example for each and also specify total number of bits required for Net ID and Host ID. (06 Marks)
- c. Briefly explain different types of cloud deployment models with suitable examples. (06 Marks)

OR

- 4 a. Draw a neat diagram showing various fields of IPv4 header and explain them in detail. (08 Marks)
- b. Draw an DODAG data flow graph for RPL network assuming routing nodes at Four ranks (levels) 0, 1, 2 and 3 consisting of 3, 6, 3 and 6 nodes respectively. Also list the characteristics of DODAG. (Destination oriented directed Acyclic Graph). (06 Marks)
- c. What are various cloud service models explain each of them with examples. (06 Marks)

Module-3

- 5 a. Explain how to program an embedded devices on Arduino platform using IDE? (05 Marks)
- b. Write a program for Arduino controlled traffic lights at a road junction with three traffic lights RED, YELLOW and GREEN to be controlled on each side of the four sides North, East, West and South clock wise path ways. (10 Marks)
- c. Explain how data is read from sensors and devices using :
- ADC analog input
 - The timers
 - Operating system
 - Software serial library
 - The libraries.
- (05 Marks)

OR

- 6 a. List out the vulnerabilities identified by Open Web Application Security Project (OWASP) for IoT Applications/Services. (05 Marks)
- b. What are the five functional components required to secure an IoT architecture. Explain them in brief. (05 Marks)
- c. Explain layered attacker model with possible attacks and suggest the solutions for mitigating the attacks on the layers. (10 Marks)

Module-4

- 7 a. Describe the characteristics of wireless sensor networks. (08 Marks)
- b. What are sensor networks? With a neat diagram explain various hardware components of sensor node. (06 Marks)
- c. Write a neat diagram showing the structure of transceiver and also explain various operational states of transceiver. (06 Marks)

OR

- 8 a. Explain following programming paradigms.
- Concurrent programming
 - Process based programming
 - Event based programming.
- (06 Marks)
- b. What are the three types of mobility in wireless sensor networks? Explain. (06 Marks)
- c. Explain various optimization goals and figure of merits in WSN's. (08 Marks)

Module-5

- 9 a. Explain low duty cycle and wakeup concepts in WSN's. (06 Marks)
- b. With a neat diagram, explain working principle of CSMA protocol. (08 Marks)
- c. Explain basic working principle of S – MAC protocol. (06 Marks)

OR

- 10 a. What are the factors that influences the design of physical layer in WSN's? (04 Marks)
- b. Explain in detail working principle of LEACH Routing protocol in WSN. (08 Marks)
- c. Write short notes on :
- Energy Efficient Routing
 - Geographical Routing.
- (08 Marks)

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18EC751

Seventh Semester B.E. Degree Examination, Jan./Feb. 2023 Communication Theory

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Define the following:

(i) Signal	(ii) Electromagnetic wave	(iii) Decibel	
(iv) Baseband signal	(v) Modulation		(05 Marks)
- b. Describe in brief history of electronic communication system. (08 Marks)
- c. Consider three voice signals, each having frequency of 300 - 3400 Hz, which is frequency division multiplexed using 12 kHz, 16 kHz and 20 Hz analog carrier signal. Illustrate the resultant spectrum at the output of FDM with the help of functional diagram and also find the guard band between the channels. (07 Marks)

OR

- 2 a. Explain in detail the types of communication channels and modes of communications used for transmission of data from source to destination. (10 Marks)
- b. Explain the different types of propagation techniques/mechanisms that is used for transmission of signals. (10 Marks)

Module-2

- 3 a. Explain each of the internal noise listed below:

(i) Shot noise		
(ii) Thermal noise		(05 Marks)
- b. Derive the equations for the following AM power distribution parameters:

(i) Lower sideband power		
(ii) Upper sideband power		(05 Marks)
- c. With a neat functional block diagram, explain:

(i) Low level AM Transmitter		
(ii) High level AM Transmitter		(10 Marks)

OR

- 4 a. Explain in detail the principles of angle modulation in terms of V_{FM} , V_{PM} and $X_C(t)$. (10 Marks)
- b. Explain in detail the principle of amplitude modulation with AM envelope, time domain analysis of AM and modulation index of a given signal. (10 Marks)

Module-3

- 5 a. Define Pulse Amplitude Modulation. Explain the process of generation and demodulation of PAM signal with necessary block diagrams and mathematical equations. (10 Marks)
- b. Explain Robust Quantization with neat block diagram and waveform. (06 Marks)
- c. An analog information signal at the input to a μ -law compressor ($\mu = 255$) is positive, with its voltage level one-half of the maximum value. What proportion of the maximum output voltage level would be produced at the output of compressor? (04 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and/or equations written eg. 42+8 = 50, will be treated as malpractice.

OR

- 6 a. Define sampling and obtain the equation of sampling theorem for baseband signal with necessary waveforms in terms of Fourier transform. (10 Marks)
- b. Define pulse position modulation. Explain with a neat diagram, the generation and demodulation of PPM signals. (10 Marks)

Module-4

- 7 a. With a neat block diagram, explain BFSK modulator and demodulator. (10 Marks)
- b. Explain Shannon's source coding theorem and also obtain the expression for coding efficiency for M-ary source. (06 Marks)
- c. Consider there are 4 messages generated by a source having their respective probabilities of occurrence as $1/2, 1/4, 1/8, 1/8$. Assuming noiseless channel, compute the coding efficiency if a binary code is applied for coding the messages. (04 Marks)

OR

- 8 a. With a neat block diagram and waveforms, explain QPSK modulator and demodulator. (10 Marks)
- b. Explain in brief the error detection and error correction technique used in data communication. (10 Marks)

Module-5

- 9 a. List out the advantages and disadvantages of wireless communication. (06 Marks)
- b. Explain in detail the different applications of wireless communications. (08 Marks)
- c. Explain in detail the concept of frequency reuse in the cellular communication system. (06 Marks)

OR

- 10 a. Explain in brief the wireless network generations with respect to cellular systems. (08 Marks)
- b. List out the different steps involved in allocating cochannel cells and explain in brief. (08 Marks)
- c. Determine the number of cells in clusters for the following values of the shift parameters i and j in a regular hexagonal geometry pattern: (i) $i = 2$ and $j = 4$ (ii) $i = 3$ and $j = 3$ (04 Marks)

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Eighth Semester B.E. Degree Examination, Jan./Feb. 2023
Fiber Optics and Networks

Time: 3 hrs.

Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Explain Optical Fiber Communication System, with suitable block diagram. (08 Marks)
b. Describe what is implied by the term Photonic Crystal fiber and explain Index guiding Photonic Crystal fiber with a suitable diagram. (08 Marks)

OR

- 2 a. Explain briefly about Fiber Materials used in Optical communication. (06 Marks)
b. What are the advantages of Optical Fiber Communication? (04 Marks)
c. A silica optical fiber with a core diameter large enough to be considered by ray theory analysis has a core refractive index of 1.50 and a cladding refractive index of 1.47. Determine: i) The critical angle at the core cladding interface ii) The NA for the fiber iii) The acceptance angle in air for the fiber. (06 Marks)

Module-2

- 3 a. Explain Linear and Non Linear Scattering losses in Optical fibers. (08 Marks)
b. What are the different types of Splicing and explain the techniques for tube splicing of Optical fibers. (08 Marks)

OR

- 4 a. With a neat diagram, explain different types of Bending losses in fiber. (06 Marks)
b. Explain the different types of Mechanical Misalignment between two fibers. (05 Marks)
c. What are the principal requirements of a Good Connector design. (05 Marks)

Module-3

- 5 a. Explain Electron Recombination and Associated Photon Emission for Direct and Indirect band-gap material. (06 Marks)
b. Explain Reach – through avalanche photodiode, with a neat diagram. (05 Marks)
c. Explain the Three key transition process involved in laser action. (05 Marks)

OR

- 6 a. With the help of a neat diagram, explain High – Radiance Surface Emitting LED. (06 Marks)
b. With schematic, explain Reverse biased pin photodiode. (05 Marks)
c. With a neat diagram, briefly discuss the possible sources of noise in optical fiber receiver. (05 Marks)

Module-4

- 7 a. Explain the Operational principles and implementation of WDM Network with diagram. (08 Marks)
b. Explain the Amplification mechanism in EDFA amplifier, with the help of energy level diagram. (08 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and/or equations written eg. 42+8 = 50, will be treated as malpractice.

OR

- 8 a. Describe the principles of working of Isolators and Circulators with a neat diagram. (08 Marks)
- b. With a neat diagram, explain the principle of operation of Optical Add / Drop Multiplexers in an Optical network. (04 Marks)
- c. Briefly explain the basic operation of a Generic optical amplifier, with a neat diagram. (04 Marks)

Module-5

- 9 a. Explain Optical Fiber Network Evolution, with a neat diagram. (06 Marks)
- b. Explain an Optical packet switched network packet format, with a neat diagram. (05 Marks)
- c. Briefly explain Wavelength routing and the selection of a path in a WDM Network. (05 Marks)

OR

- 10 a. Explain the different types of Optical Networking Node Elements with a suitable diagram. (08 Marks)
- b. Explain the concept of Optical Burst Switching Networks. (08 Marks)

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Eighth Semester B.E. Degree Examination, Jan./Feb. 2023 Micro Electro Mechanical Systems (MEMS)

Time: 3 hrs.

Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Explain the difference between microsystem and microelectronics. (08 Marks)
- b. Explain the multidisciplinary nature of microsystem. (08 Marks)

OR

- 2 a. Explain the difference between MEMS and microsystem. (08 Marks)
- b. Give atleast four distinct advantages of miniaturization of machine device. (08 Marks)

Module-2

- 3 a. What are the principal applications of microsensors and actuators? (08 Marks)
- b. Describe in detail about optical sensor and chemical sensors. (08 Marks)

OR

- 4 a. Explain in detail pressure sensors and acoustic wave sensors. (08 Marks)
- b. Describe the four popular actuation techniques for micro devices. (08 Marks)

Module-3

- 5 a. Derive a formula for estimating the natural frequency of a micro accelerometer with negligible damping effect. (08 Marks)
- b. Determine the equivalent spring constant K and the natural frequency ω_n of a cantilever beam element in a microaccelerometer as shown in Fig.Q5(b). The beam is made up of silicon with Young's modulus of 190,000 MPa.

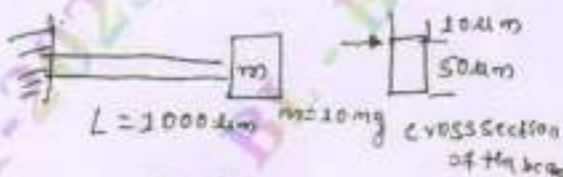


Fig.Q5(b)

(08 Marks)

OR

- 6 a. Describe static bending of thin plates. (08 Marks)
- b. Describe the thin film mechanics. (08 Marks)

Module-4

- 7 a. Describe scaling in fluid mechanics with respect to MEMS. (08 Marks)
- b. Describe force scaling vector and obtain scaling factors:
 - i) Acceleration
 - ii) Time
 - iii) Power density P/V_0 (08 Marks)

OR

- 8 a. Obtain the scaling in electrostatic forces. (08 Marks)
b. Obtain the scaling factors in
i) Scaling of heat flux ii) Scaling in thermal conductivity in submicrometer regime. (08 Marks)

Module-5

- 9 a. What are the limitations of the height of microstructures that can be produced by bulk manufacturing technique? (08 Marks)
b. Describe the DRIE process. How can DRIE achieve virtually perfect vertical etching? (08 Marks)

OR

- 10 a. List the principal advantages and disadvantages of LIGA process. (08 Marks)
b. Why electroplating necessary in LIGA process? (08 Marks)

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17EC81

Eighth Semester B.E. Degree Examination, Jan./Feb. 2023 Wireless Cellular and LTE 4G Broadband

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Explain the key enabling features used in LTE design technology. (06 Marks)
- b. Explain flat LTE – SAE architecture. (08 Marks)
- c. Explain briefly the multiantenna techniques used in LTE. (06 Marks)

OR

- 2 a. Briefly explain the cellular concept. Discuss how interfacing can be reduced in cellular communication. (10 Marks)
- b. With the help of block diagram, explain AMC. (10 Marks)

Module-2

- 3 a. Explain the different multiple access system which can be implemented with OFDM. (10 Marks)
- b. Discuss the significance of PAR problem in LTE. Briefly explain PAR reduction technique. (10 Marks)

OR

- 4 a. Explain SC – FDE system with a principle difference of SC – FED performance versus OFDM. (10 Marks)
- b. Explain open-loop MIMO in spatial multiplexing. (10 Marks)

Module-3

- 5 a. Discuss the basic principles involved in designing the LTE network architecture. (10 Marks)
- b. Explain the different transport channels supported in LTE for uplink and downlink. (10 Marks)

OR

- 6 a. Explain the hierarchical channel structure of LTE. (10 Marks)
- b. Explain the H – ARQ in the downlink. (10 Marks)

Module-4

- 7 a. Explain in detail the uplink control information. (10 Marks)
- b. Explain in detail about frequency hopping in LTE. (10 Marks)

OR

- 8 a. Explain the functions of H – HRQ in uplink and downlink transmission. (10 Marks)
- b. Discuss the power control schemes used in LTE. (10 Marks)

Module-5

- 9 a. Explain briefly the functional overview of PDCP and RLC layer. (10 Marks)
- b. Explain RRC states and its functions. (10 Marks)

OR

- 10 a. Explain mobility management over the SI interface. (10 Marks)
- b. Explain the basic approaches to mitigate ICI in the downlink. (10 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and/or equations written e.g. 42+8=50, will be treated as malpractice.

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17EC831

Eighth Semester B.E. Degree Examination, Jan./Feb. 2023 Micro Electro Mechanical Systems

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Analyze the functions of various components of a microsystem. (07 Marks)
- b. List the applications of MEMS and Microsystems in,
 - (i) Space Hardware. (10 Marks)
 - (ii) Aerospace industry. (10 Marks)
- c. Outline the difference between microelectronics and microsystems. (03 Marks)

OR

- 2 a. Examine the multidisciplinary nature of Microsystems design and manufacturing. (10 Marks)
- b. Explain actuation of microdevice components using electrostatic force. (06 Marks)
- c. Explain the need for miniaturization. (04 Marks)

Module-2

- 3 a. List the technical issues involved in the applications of MEMS in biomedicine and write short notes on biomedical sensors. (10 Marks)
- b. Explain the working principle of electrostatic micromotors along with the schematic of microrotary motor. (10 Marks)

OR

- 4 a. Explain the working principle of optical sensors with neat schematic diagram. (10 Marks)
- b. With a neat schematic, explain the working principle of,
 - (i) Plasma generator. (10 Marks)
 - (ii) Electrophoretic pumping. (10 Marks)

Module-3

- 5 a. Make use of the principle of micro pressure sensor to examine the concept of static bending of thin plates with special consideration to circular and square plates. (10 Marks)
- b. Develop an expression for damping coefficient 'h' and explain the effect of damping on the amplitude of vibration of mass. (10 Marks)

OR

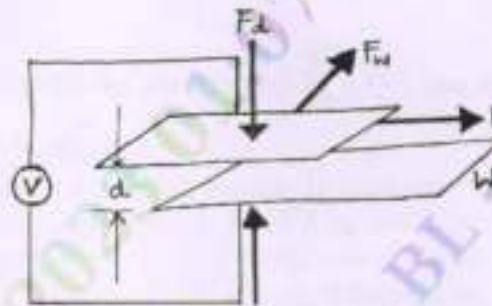
- 6 a. Explain the effect of following on micromachines and devices :
 - (i) Creep deformation. (10 Marks)
 - (ii) Thermal stress in thin plates. (10 Marks)
- b. Describe the overview of finite element stress analysis. (10 Marks)

Module-4

- 7 a. Explain scaling in Electromagnetic force. (10 Marks)
- b. Derive the expression for the following with respect to scaling in Rigid Body dynamics:
 - (i) Dynamic force. (10 Marks)
 - (ii) Power density P/V_0 . (10 Marks)

OR

- 8 a. Obtain the scaling factors in fluid mechanics. (10 Marks)
 b. Find the reduction of electrostatic forces generated by a pair of parallel-plate electrodes as illustrated in Fig. Q8 (b) if both the length 'L' and the width 'W' of these plates are reduced by a factor of 10. (04 Marks)



Electrostatic forces in charged parallel plates.

Fig. Q8 (b)

- c. Estimate the reduction of torque required in turning a micromirror with a reduction of 50% in the dimensions. (Shown in Fig. Q8 (c)). (06 Marks)



Fig. Q8 (c)

Module-5

- 9 a. Define the following :
 (i) Isotropic etching
 (ii) Selectivity ratio.
 (iii) Aspect ratio of a MEMS component
 (iv) Etch stop
 (v) DRIE process. (05 Marks)
- b. Write short notes on : (i) Electrochemical etch stop (ii) Plasma etching
 (iii) Electroplating (15 Marks)

OR

- 10 a. Explain the fabrication steps involved in the LIGA process with neat diagrams. (10 Marks)
 b. Write short notes on :
 (i) Interfacial stresses
 (ii) Stiction. (10 Marks)

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18EC81

Eighth Semester B.E. Degree Examination, Jan./Feb. 2023 Wireless and Cellular Communication

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Explain path loss model for free space propagation with equations. (08 Marks)
- b. Explain Doppler Spread and Coherence time. (06 Marks)
- c. Find a Fraunhofer distance for an antenna with maximum dimension of 1 meter and operating frequency of 900 MHz. If antennas have unity gain, calculate path loss. (06 Marks)

OR

- 2 a. Explain two ray models of ground reflections with necessary equations. (08 Marks)
- b. Explain cell splitting and cell sectoring. (06 Marks)
- c. Explain static channel models. (06 Marks)

Module-2

- 3 a. Explain the various logical channels used in GSM. (08 Marks)
- b. List out ten operations in a call set up in GSM system. Explain in detail authentication and Ciphering mode operations. (12 Marks)

OR

- 4 a. Describe GSM protocols and signaling model with neat diagram. (06 Marks)
- b. Explain the TDMA hyperframe structure with diagram in detail. (07 Marks)
- c. Explain steps involved during Intra-BSC handover. (07 Marks)

Module-3

- 5 a. Explain the basic spectrum spreading operation. (07 Marks)
- b. Explain the generation of CDMA paging channels. (06 Marks)
- c. Explain network nodes found in CDMA2000 wireless system. (07 Marks)

OR

- 6 a. Explain with block diagram the generation of CDMA forward traffic control with power control for 14.4 kbps traffic. (12 Marks)
- b. Explain typical components of cdmaOne network. (08 Marks)

Module-4

- 7 a. Explain the advantages of OFDM leading to its selection of LTE. (06 Marks)
- b. Explain OFDM baseband and passband transmitter with block diagram. (07 Marks)
- c. Compare OFDM and SCFDE. (07 Marks)

OR

- 8 a. Explain with block diagram, flat LTE SAE architecture. (06 Marks)
b. Explain peak to Average Power Ratio (PAR). (07 Marks)
c. Explain SC-FDE system description. (07 Marks)

Module-5

- 9 a. Explain SCFDMA uplink transmitter and receiver with neat block diagrams. (12 Marks)
b. Explain Hierarchical channel structure of LTE. (08 Marks)

OR

- 10 a. Explain OFDMA downlink and uplink transmitter with diagram. (12 Marks)
b. Explain frame structure used in LTE. (08 Marks)

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18EC822

Eighth Semester B.E. Degree Examination, Jan./Feb. 2023 Micro Electro Mechanical Systems

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Explain MEMS as a microsensor and microactuator with neat block diagram. (10 Marks)
- b. Describe the applications of Microsystems in health, aerospace and consumer product industry. (10 Marks)

OR

- 2 a. With a neat figure explain the role of principle science and engineering disciplines involved in design and manufacture of microsystem design. (10 Marks)
- b. Explain the difference between MEMS and microsystems. (06 Marks)
- c. Give atleast four distinct advantages of miniaturization of machines and devices. (04 Marks)

Module-2

- 3 a. Explain the working principles of a common surface acoustic wave sensor using piezoelectric crystal as transmission medium. (08 Marks)
- b. Explain the working principle of different chemical sensor. (08 Marks)
- c. Calculate the capacitance of a parallel plate capacitor. The two plates have identical dimensions of $L = W = 1000\mu\text{m}$ with gap $d = 2\mu\text{m}$. The air is the dielectric medium. (04 Marks)

OR

- 4 a. Explain the operating principle of micropressure sensor with required schematic diagrams and mathematical equations. (08 Marks)
- b. Explain the working principle of:
 - i) Thermocouple
 - ii) Thermopiles with relevant mathematical equations. (06 Marks)
- c. Describe in detail about the actuation using shape memory alloys. (06 Marks)

Module-3

- 5 a. Explain the concept of bending of square plates with all Edges fixed. Give equations for maximum stress, maximum deflection, stress at the center of the plate and strain at center of the plate. (06 Marks)
- b. Determine the minimum thickness of the circular diaphragm of a micro pressure sensor made of silicon shown in Fig.Q5(b). The diaphragm has a diameter of $600\mu\text{m}$ and its edge is rigidly fixed to the silicon die. The diaphragm is designed to with stand a pressure of 20MPa without exceeding the plastic yielding strength of 7000MPa. Assume Young's modulus, $E = 190,000\text{MPa}$ and Poisson's ratio, $\nu = 0.25$.



Fig.Q5(b)

- c. Explain the input information to FEA and output in stress analysis from FEA along with equations. (08 Marks)

OR

6. a. Derive an expression for the frequency of the vibrating mass. (06 Marks)
 b. Determine the equivalent spring constant K and the natural frequency ω_n of a cantilever beam element in an accelerometer shown in Fig.Q6(b). The beam is made of silicon with a Young's modulus of 190,000MPa.



Fig.Q6(b)

- c. Write short notes on Thin – Film mechanics. (08 Marks)

Module-4

7. a. Derive the expressions for scaling Acceleration a time t and power density P/V_0 of a system in motion by using Trimmer force scaling vector. (08 Marks)
 b. Derive the expression of scaling in electricity. (08 Marks)
 c. Derive equation for the effective heat flux, considering gas flow in a micro – channel. (04 Marks)

OR

8. a. Estimate the reduction of torque required in turning a micro mirror placed in a switch if the dimensions are reduced to 50 percent. Assume the dimensions of micro – mirror are represented as in Fig.Q8(a), t – thickness, b – height of the mirror and c – width of mirror.



Fig.Q8(a)

- b. Explain scaling in electrostatic forces with respect to MEMS. (04 Marks)
 c. Write short notes on : (08 Marks)
 i) Scaling of heat flux
 ii) Scaling in thermal conductivity in sub micrometer regime
 iii) Scaling in effect of heat conduction in solids of MESO – and micro – scales
 Give required equations. (08 Marks)

Module-5

9. a. Explain Isotropic and Anisotropic Etching process of Bulk Micro manufacturing. (08 Marks)
 b. Explain the DIRE process and advantages of DIRE process compared with plasma etching. (08 Marks)
 c. Give comparison of wet versus dry etching process in bulk micro manufacturing. (04 Marks)

OR

10. a. Demonstrate production of cantilever beam by surface micro-machining technique. (10 Marks)
 b. Explain LIGA process used in micro manufacturing. (10 Marks)

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Fifth Semester B.E. Degree Examination, Jan./Feb. 2023
Technological Innovation Management and
Entrepreneurship

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Explain the various functions of Management. (07 Marks)
- b. Describe the various roles of a Manager. (07 Marks)
- c. Distinguish between Management and Administration. Draw the diagram for time spent in administrative and managerial functions at different levels. (06 Marks)

OR

- 2 a. Define planning. Describe the importance of planning. (08 Marks)
- b. Explain all the steps in Rational Decision making with a neat diagram. (08 Marks)
- c. Give the differences between programmed and non-programmed decisions. (04 Marks)

Module-2

- 3 a. Explain the span of management concept its meaning and importance. (05 Marks)
- b. Define committee. Explain the different types of committees. (05 Marks)
- c. What is Recruitment? Explain the steps in the selection process. (10 Marks)

OR

- 4 a. Write about the requirements of effective direction. (08 Marks)
- b. Discuss Autocratic, Democratic and Free rein Leadership styles. (08 Marks)
- c. Explain the meaning of control. Write the benefits of control. (04 Marks)

Module-3

- 5 a. Explain the meaning of social responsibility. Describe the social responsibilities of Business towards consumer and community. (06 Marks)
- b. What is Social Audit? What are its benefits and limitations? (07 Marks)
- c. What is Corporate Governance? List the benefits of good Corporate Governance. (07 Marks)

OR

- 6 a. Define Entrepreneurship. Explain the different types of Entrepreneurs. (08 Marks)
- b. Explain Entrepreneurial development cycle. (07 Marks)
- c. List and explain any five characteristics of an entrepreneur. (05 Marks)

Module-4

- 7 a. Define Family Business. Explain the characteristics of a family owned business in India. (07 Marks)
- b. Explain the various types of family businesses. (07 Marks)
- c. Write the contributions of family businesses in India. Also explain the stages of development of family business. (06 Marks)

OR

- 8 a. Explain the ways of generating business ideas. (08 Marks)
b. Explain how to identify a business opportunity. (06 Marks)
c. Explain the concept of Financial Feasibilities. (06 Marks)

Module-5

- 9 a. What is the purpose of a Business plan? Explain. Also write the reasons for preparing a business plan. (07 Marks)
b. Why do some business plans fail? Explain. (07 Marks)
c. Explain the following terms:
i) Venture capital
ii) Angel Investing (06 Marks)

OR

- 10 a. Explain the six stages of venture capital financing as identified by Tyebjee and Bruno. (08 Marks)
b. Discuss the steps in PERT network analysis technique. What are its advantages? (08 Marks)
c. List differences between PERT and CPM. (04 Marks)

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18EC52

Fifth Semester B.E. Degree Examination, Jan./Feb. 2023

Digital Signal Processing

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. State and prove circular time shift property. (06 Marks)
- b. Find the 4-point DFT of the sequence $x(n) = \cos\left(\frac{\pi}{4}n\right) + \sin\left(\frac{\pi}{4}n\right)$ use linearity property. (08 Marks)
- c. Consider 4-point sequences $x(n) = \cos\left(\frac{\pi n}{2}\right); 0 \leq n \leq 3$
 $h(n) = 2^n; 0 \leq n \leq 3$
 Compute circular convolution. Using concentric circle method. (06 Marks)

OR

- 2 a. State and prove Parseval's theorem. (06 Marks)
- b. Find 6-point DFT of the sequence $x(n) = n; 0 \leq n \leq 5$
 $= 0; \text{ otherwise}$ (08 Marks)
- c. Find the IDFT of the DFT $X(K) = \{6, -2 + j2, -2, -2 - j2\}$. (06 Marks)

Module-2

- 3 a. Consider a FIR with filter whose impulse response $h(n) = \{3, 2, 1, 1\}$ if the input is $x(n) = \{1, 2, 3, 3, 2, 1, -1, -2, -3, 5, 6, -1, 2, 0, 2, 1\}$, find the output using overlap add method assuming the length of block as 7. (10 Marks)
- b. Develop Radix-2 DIT-FFT algorithm and draw complete signal flow graph for $N = 8$. (10 Marks)

OR

- 4 a. Find the output $y(n)$ of a filter whose impulse response in $h(n) = \{1, 1, 1\}$ and the input signal to the filter is $x(n) = \{3, -1, 0, 1, 3, 2, 0, 1, 2, 1\}$. Using overlap save method. (10 Marks)
- b. First five point of the Eight point DFT of a real valued sequence is given by
 $x(0) = 0, \quad x(3) = 2 - 2j$
 $x(1) = 2 + 2j, \quad x(4) = 0$
 $x(2) = -j4$
 Determine the remaining points. Hence find the original sequence $x(n)$ using Decimation in frequency FFT algorithm. (10 Marks)

Module-3

- 5 a. List the different types of windowing techniques used in the design of FIR filters. Write the analytical equations, draw the magnitude response and show the largest side lobe value below the dc magnitude. (08 Marks)
- b. The frequency response of an FIR filter is given by
 $H(\omega) = e^{-j3\omega} (1 + 1.8 \cos 3\omega + 1.2 \cos 2\omega + 0.5 \cos \omega)$
 Determine the coefficient of the impulse response $h(n)$ of the FIR filter. (06 Marks)

- c. Determine the coefficient K_m of the lattice filter corresponding to FIR filter described by the system function $H(z) = 1 + 2z^{-1} + \frac{1}{3}z^{-2}$. And also draw the Lattice structure. (06 Marks)

OR

- 6 a. Determine the filter coefficient $h(n)$ for the desired frequency response of a Lowpass filter is given by

$$H_d(\omega) = \begin{cases} e^{-j2\omega} & ; -\frac{\pi}{4} \leq \omega \leq \frac{\pi}{4} \\ 0 & ; \frac{\pi}{4} \leq \omega \leq \pi \end{cases}$$

Find $h(n)$ and also frequency response $H(\omega)$ using Hamming window. (10 Marks)

- b. Obtain the cascade form realization of system function :

$$H(z) = 1 + 5z^{-1} + 2z^{-2} + 2z^{-3} \quad (05 \text{ Marks})$$

- c. Realize the following function in Direct form.

$$H(z) = \left(1 + \frac{1}{2}z^{-1} + z^{-2}\right) \left(1 + \frac{1}{4}z^{-1} + z^{-2}\right) \quad (05 \text{ Marks})$$

Module-4

- 7 a. Discuss the general procedure for IIR filter design using Bilinear transformation. (06 Marks)
- b. An analog filter is given by $H_a(s) = \frac{s+0.1}{(s+0.1)^2 + 16}$. Obtain digital IIR filter using bilinear transformation method. Digital filter is to have resonant frequency $\omega_c = \frac{\pi}{2}$ radians. (08 Marks)
- c. Compare FIR and IIR filter. (06 Marks)

OR

- 8 a. Design a Butterworth digital low pass filter with the following specifications.
 i) 3dB attenuation at the passband frequency of 1.5KHz
 ii) 10dB stopband attenuation at the frequency of 3KHz
 iii) Sampling frequency of 8000Hz. (10 Marks)
- b. A system is represented by a transfer function $H(z)$ is given by $H(z) = 1 + \frac{4z}{z - \frac{1}{2}} - \frac{2}{z - \frac{1}{4}}$
 i) Does this $H(z)$ represent a FIR or IIR filter? Why?
 ii) Draw direct form - I and Direct form - II realization by showing all differences equations? (10 Marks)

Module-5

- 9 a. Explain IEEE floating point formats using :
 i) Single precision format ii) Double precision format. (08 Marks)
- b. Discuss briefly multiplier and Accumulator unit in Digital signal processor hardware units. (04 Marks)
- c. Draw the block diagram to TMS320C3X floating point digital signal processor. (08 Marks)

OR

- 10 a. With block diagram explain Digital signal processor based on Harvard architecture. (06 Marks)
- b. Convert the Q-15 signed number to decimal numbers.
 i) 1.110101110000010 ii) 0.100011110110010 (04 Marks)
- c. Explain the basic architecture of TMS320CS54X used in fixed point Digital signal processor. (10 Marks)

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Fifth Semester B.E. Degree Examination, Jan./Feb. 2023 Principles of Communication Systems

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1.
 - a. With proper necessary equations, explain the time domain and frequency domain expressions for an AM wave. Outline the waveforms and spectrum. (08 Marks)
 - b. Explain the generation of AM wave using switching modulator with neat block diagram and relevant equations. (08 Marks)
 - c. An audio frequency signal $10\sin 2\pi(500t)$ is used to amplitude modulate a carrier signal of $50\sin 2\pi(10^5 t)$. Assume modulation index as 0.2. Determine
 - (i) Side band frequencies.
 - (ii) Amplitude of each sideband.
 - (iii) Band width required. (04 Marks)

OR

2.
 - a. What is a coherent detector used for DSB-SC? Why it is so named? Explain its working with a neat block diagram. What can be the problems in a coherent detector? (08 Marks)
 - b. Compare and contrast standard AM, DSB-SC, SSB-SC and VSB-SC (at least 5 points in each) (05 Marks)
 - c. When the modulation percentage is 75 an AM transmitter produces 10 kW. How much of this is carrier power? Determine the percentage of power saving if the carrier and one of the sidebands were suppressed before transmission took place. (07 Marks)

Module-2

3.
 - a. From the fundamentals deduct an expression of WBFM and plot its frequency spectrum. (10 Marks)
 - b. What is frequency modulation? Deduct the expression for a narrow band FM signal. Represent a narrow band FM signal with neat phasor diagram. (08 Marks)
 - c. A FM signal has sinusoidal modulation with $W = 15$ kHz and modulation index $\beta = 2$. Using Carson's rule determine the transmission bandwidth and deviation ratio. Assume $\Delta f = 75$ kHz. (02 Marks)

OR

4.
 - a. With relevant mathematical analysis and block diagrams show the reconstruction of message signal from FM wave using PLL. (10 Marks)
 - b. Explain the generation of FM wave using a neat block diagram and necessary equations. (06 Marks)
 - c. A Carrier is frequency modulated by a sinusoidal modulating signal of frequency 3 kHz resulting in a frequency deviation of 10 kHz.
 - (i) What is the bandwidth occupied by the modulated waveform?
 - (ii) If the amplitude of the modulating signal is increased by a factor of 2 and its frequency is lowered to 1 kHz. Determine the new bandwidth. (04 Marks)

Module-3

5. a. What is thermal Noise? List out different characteristics of thermal Noise. (08 Marks)
b. What is white noise? Deduct the power spectral density and auto-correlation function for RC-Low pass filtered white Noise. Also find the Noise equivalent bandwidth for the same and show its relationship with normal bandwidth. (08 Marks)
c. Explain the applicability of pre-emphasis and de-emphasis with respect to FM system. (06 Marks)

OR

6. a. Determine the FOM for a DSB-SC receiver. (08 Marks)
b. Determine the FOM for a standard AM receiver. (08 Marks)
c. Explain capture effect and threshold effect with respect to FM receiver. (04 Marks)

Module-4

7. a. What are the advantages of digital modulation techniques over analog? (04 Marks)
b. What is sampling theorem? Explain sampling with neat sketches and equations. What are the challenges faced with Nyquist criteria of sampling? (08 Marks)
c. What is Flat top sampling write PAM. Explain the same with neat waveforms and derive the equation for flat-top sampled PAM. (08 Marks)

OR

8. a. What is multiplexing and why it is required in communication? Explain the working of TDM with neat block diagram. (08 Marks)
b. What is pulse position modulation? Explain the generation of a PPM wave with neat block diagram and necessary waveforms. (08 Marks)
c. What is aperture error in PAM? How to minimize it? (04 Marks)

Module-5

9. a. What is Quantization? Why it is required in digital communication? Explain symmetric quantizer of midtread and midrise type. (08 Marks)
b. With neat block diagram, explain the working of PCM system. (08 Marks)
c. What is companding? Explain different laws of companding. (04 Marks)

OR

10. a. What is Quantization noise? Derive the expression for O/P signal to Noise Ratio of a Quantizer. Consider a sinusoidal modulating signal of amplitude A_m which uses all representation levels provided. Calculate the $(SNR)_0$ for the O/P of quantizer of the above signal. (08 Marks)
b. What is Delta modulation? Explain the same with block diagrams. (06 Marks)
c. Write a note on Vocoders. (06 Marks)

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Fifth Semester B.E. Degree Examination, Jan./Feb. 2023
Information Theory & Coding

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Define the followings:
 - (i) Entropy
 - (ii) Information rate.
 - (iii) Self information (06 Marks)
- b. A binary source is emitting an independent sequence of 0's and 1's with probability of P and 1-P respectively. Plot the Entropy of this source versus P (0 < P < 1). (06 Marks)
- c. For the first order Markov statistical model shown in Fig. Q1 (c). Compute
 - (i) Probabilities of each state.
 - (ii) $H(s)$ and $H(s^{-1})$

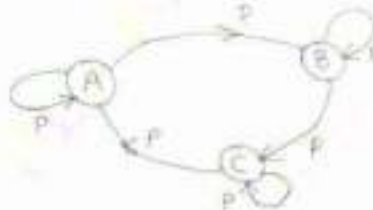


Fig. Q1 (c)

(08 Marks)

OR

- 2 a. For the first order Markoff model shown in Fig. Q2 (a). Find
 - (i) Entropy of each state.
 - (ii) Entropy of the source.
 - (iii) Prove that $G_1 \geq G_2 \geq H$
- Assume $P(1) = P(2) = P(3) = \frac{1}{3}$



Fig. Q2 (a)

(12 Marks)

- b. The international Morse code uses a sequence of dots and dashes to transmit letters of the English alphabets. The dash represented by a current pulse that has a duration of 3 units and the dot has a duration of 1 unit. The probability of a dash is $\frac{1}{3}$ of the probability of occurrence of a dot.
 - (i) Calculate the information content of a dot and a dash.
 - (ii) Calculate $H(s)$ in the dot-dash code.
 - (iii) Assume that the dot lasts 1 msec. Which is the same time interval as the pause between symbols? Find the average rate of information transmission. (08 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
 2. Any revealing of identification, appeal to evaluator and/or equations written eg, 42 x 8 = 50, will be treated as malpractice.

Module-2

3. a. Construct a binary Shannon encoding algorithm for the following source with probabilities $S = \{A, B, C, D, E\}$ and $P = \{0.4, 0.25, 0.15, 0.12, 0.08\}$. Also compute the code Efficiency.
- b. What is prefix of a code and explain with example.
- c. Construct a Ternary code using Huffman Encoding algorithm for the source given with probabilities and move the composite symbol as low as possible.

Symbol	A	B	C	D	E	F	G
Probabilities	$\frac{1}{3}$	$\frac{1}{27}$	$\frac{1}{3}$	$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{27}$	$\frac{1}{27}$

Also find the code efficiency.

(08 Marks)
(04 Marks)

(08 Marks)

OR

4. a. Check the following codes given in Table (1) are instantaneous or not with the help of KMI.

Symbols	Code A	Code B	Code C
A	0	0	00
B	10	11	01
C	110	100	10
D	1110	110	111
E	1111	1011	0110

Table (1)

(09 Marks)

- b. Design a source Encoder using Shannon encoding algorithm for the information source shown in Fig.Q4 (b). Compute the average output bit rate and efficiency of the code for $N = 1$. Assume $P_1 = P_2 = \frac{1}{2}$.



Fig. Q4 (b)

(11 Marks)

Module-3

5. a. Define the followings:
- Channel matrix.
 - Joint probability matrix.
 - Input entropy.
 - Output entropy.
- b. What is mutual information? Prove that $I(X, Y) \geq 0$.
- c. Determine the capacity of the channel shown in Fig. Q5 (c).

(08 Marks)

(08 Marks)

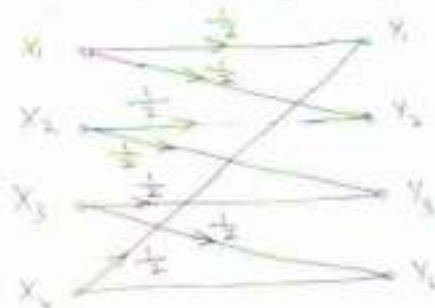


Fig. Q5 (c)
2 of 4

(04 Marks)

OR

- 6 a. Consider a channel matrix, $P(Y/X) = \begin{bmatrix} 0.6 & 0.2 & 0.2 \\ 0.2 & 0.6 & 0.2 \\ 0.2 & 0.2 & 0.6 \end{bmatrix}$

with $P(X_1) = P(X_2) = P(X_3) = \frac{1}{3}$

Find $H(X)$, $H(Y)$, $H(X,Y)$, $H(Y/X)$ and $H(X/Y)$.

(08 Marks)

- b. The noise characteristic of a channel as shown in Fig. Q6 (b). Find the capacity of a channel using Muruga's method. Assume $\gamma_s = 1500$ symbols/sec.

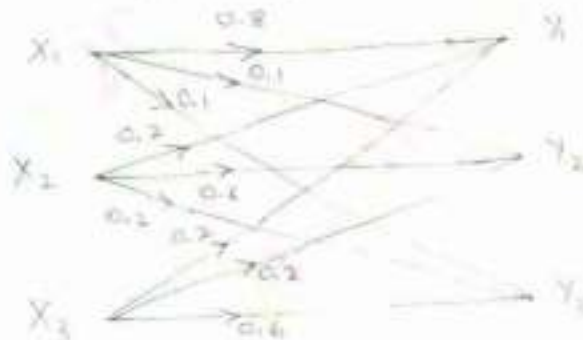


Fig. Q6 (b)

(08 Marks)

- c. Explain Binary Erasure channel.

(04 Marks)

Module-4

- 7 a. Define the following:

- Hamming weight.
- Hamming distance.
- Minimum distance.

(06 Marks)

- b. For a (6, 3) linear block code, the parity matrix is,

$$P = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 1 & 0 \end{bmatrix}$$

- Obtain the generator matrix.
- Write all possible code words.
- If the received code vector $R = 111010$, detect and correct the single error.
- Draw the encoder and syndrome calculation block diagram.

(14 Marks)

OR

- 8 a. A Generator polynomial for a (15, 7) cyclic code is $g(x) = 1 + x^4 + x^5 + x^6 + x^7$.

- Find the code vector for the message $D(x) = x^2 + x^3 + x^4$ using encoder circuit.
- Draw the syndrome calculation circuit and find the syndrome of the received polynomial.

$$z(x) = 1 + x + x^3 + x^6 + x^8 + x^9 + x^{11} + x^{12}$$

(16 Marks)

- b. Mention the advantages and disadvantages of error control coding.

(04 Marks)

Module-5

- 9 a. Consider the (3, 1, 2) convolution encoder with $g_{(1)} = 110$, $g_{(2)} = 101$ and $g_{(3)} = 111$
- (i) Draw the encoder diagram.
 - (ii) Find the code word for the message sequence (11101) using generator matrix/matrix method.
 - (iii) Find the code word for the message sequence (11101) using transform domain approach. (16 Marks)
- b. What are convolution codes? How it is different from block codes. (04 Marks)

OR

- 10 The (2, 1, 2) convolution encoder shown in Fig. Q10.
- (i) Draw state transition table.
 - (ii) State diagram.
 - (iii) Draw the code tree and find the encoder output produced by the message (110)
 - (iv) Construct a Trellis diagram and find the encoder output produced by the message (110)

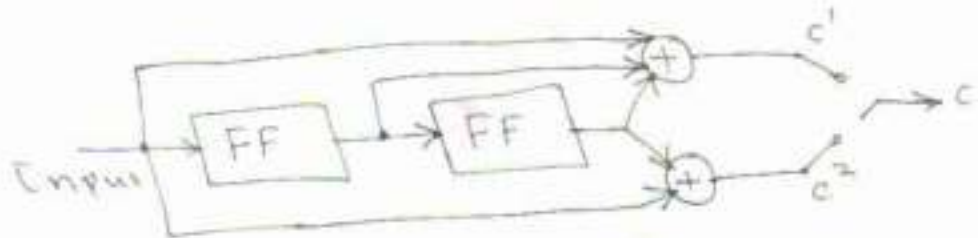
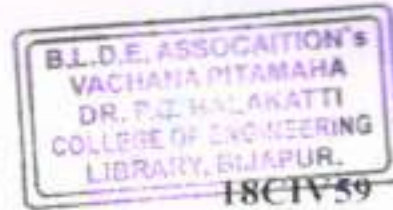


Fig. Q10

(20 Marks)

CBCS SCHEME



USN

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Question Paper Version : D

Fifth Semester B.E Degree Examination, Jan./Feb. 2023

Environmental Studies

(COMMON TO ALL BRANCHES)

Time: 2 hrs.]

[Max. Marks: 100

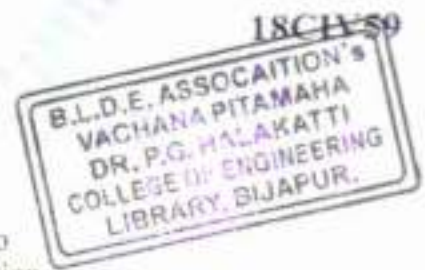
INSTRUCTIONS TO THE CANDIDATES

1. Answer all the **hundred** questions, each question carries one mark.
2. Use only **Black ball point pen** for writing / darkening the circles.
3. **For each question, after selecting your answer, darken the appropriate circle corresponding to the same question number on the OMR sheet.**
4. Darkening two circles for the same question makes the answer invalid.
5. **Damaging/overwriting, using whiteners** on the **OMR** sheets are strictly prohibited.

-
1. World Environmental day is held every year on
a) June 5th b) October 2nd c) April 22nd d) November 1st
 2. Ozone layer thickness is measured in _____
a) mm b) cm c) Dobson unit d) Db
 3. First of the major environmental protection acts to be promulgated in India was
a) The Water Act b) The Air Act
c) The Environment Act d) Noise Pollution Rules
 4. Blue baby syndrome is caused due to _____
a) Manganese b) Ozone c) Silver d) Nitrate
 5. World Earth's day is annually celebrated on
a) April 22nd b) June 5th c) January 1st d) May 1st
 6. The most important fuel used by nuclear power plant is
a) U-235 b) U-238 c) U-245 d) U-248
 7. Which of the following is a biotic component of ecosystem?
a) Fungi b) Solar light
c) Temperature d) Humidity
 8. Abiotic component includes
a) Soil b) Temperature
c) Water d) All of these

Version - D - 1 of 8

9. The word "Environment" is derived from
 a) Greek
 b) French
 c) Spanish
 d) English
10. Which of the following is absorbed by green plants from the atmosphere?
 a) Carbon dioxide
 b) Water
 c) Nutrients
 d) All of these
11. South Africa is leading exporter of which mineral?
 a) Copper
 b) Diamond
 c) Silver
 d) Gold
12. The word 'sustainable development' came into existence in the year.
 a) 1992
 b) 1978
 c) 1980
 d) 1987
13. The other word of landscaping is
 a) Reduction
 b) Restoration
 c) Removing topsoil
 d) Restore
14. Cloud seeding with silver iodide is based on the
 a) Bergeron process
 b) Collision-coalescence process
 c) Both a and b
 d) None of these
15. Environmental pollution is due to
 a) Rapid urbanization
 b) Deforestation
 c) Afforestation
 d) a and b
16. The liquid waste from bathroom and kitchen is called
 a) Sullage
 b) Domestic sewage
 c) Storm water
 d) Runoff
17. BOD means
 a) Biochemical Oxygen Demand
 b) Chemical oxygen demand
 c) Biophysical Oxygen Demand
 d) All of these
18. Which of the following source is surface water?
 a) Springs
 b) Streams
 c) Deep wells
 d) All of these
19. Which of the following is biodegradable?
 a) Plastics
 b) Domestic sewage
 c) Detergents
 d) a and c
20. Blaring sounds known to cause
 a) Mental distress
 b) High cholesterol
 c) Neurological problems
 d) All of these
21. Which of the following element make e-waste hazardous in nature?
 a) Land
 b) Glass
 c) Plastic
 d) Iron
22. What is the hazardous pollutant released from batteries?
 a) Arsenic
 b) Barium
 c) Cobalt
 d) Cadmium



23. What is the term used for reuse of sewage sludge?
a) Compost
b) Solids
c) Biosolids
d) Sludge
24. Reduction in brightness of the famous Taj Mahal is due to
a) Global warming
b) Air pollution
c) Ozone depletion
d) Afforestation
25. E.I.A. can be expanded as
a) Environment and Industrial Act
b) Environment of Impact Activities
c) Environmental Impact Assessment
d) Environmentally Important Activity
26. Organic Farming is
a) Farming without using pesticides and chemical fertilizer
b) Enhances biodiversity
c) Promotes soil biological activity
d) All of these
27. Bio-remediation means the removal of contaminants from
a) Soil
b) Wastewater
c) Groundwater
d) Both soil and ground water
28. Plants use _____ gas for photosynthesis.
a) Oxygen
b) Methane
c) Nitrogen
d) Carbon dioxide
29. What is the maximum allowable concentration of fluorides in drinking water?
a) 1.0 mg/l
b) 1.25 mg/l
c) 1.50 mg/l
d) 1.75 mg/l
30. Forest rich area in Karnataka is found in _____.
a) Western Ghats
b) Bandipur
c) Nagarhole
d) Mangalore
31. In geosynchronous orbit altitude of the satellite is about
a) 36,000 kms
b) 10,000 kms
c) 50,000 kms
d) None of these
32. The Air (Prevention and Control of Pollution) Act was enacted in the year.
a) 1987
b) 1981
c) 1991
d) 1988
33. Kudremukh Iron ore mine, Karnataka was closed due to
a) River pollution and threat to biodiversity
b) Land encroachment
c) Radioactive hazards
d) Serious health hazard
34. On the eve of Gandhi Jayanthi which andolan was launched by our Honorable Prime Minister
a) Swadeshi
b) Sarvashikshana Abhiyana
c) Suvamagrama
d) Swach Bharath

35. An international agreement signed in the year 1987, to protect stratospheric ozone is known as
a) Montreal protocol
b) Kyoto protocol
c) Earth summit
d) None of these
36. The explosion of First Atomic Bomb was done in Hiroshima and Nagasaki in
a) 1946
b) 1986
c) 1945
d) 1947
37. A dangerous pesticide which has been reported to cause physical deformities to people of Kerala and Karnataka states
a) Endosulfan
b) Fluorides
c) DDT
d) Dioxygene
38. Visible portion of EMR ranges between
a) 0.4 - 0.76 μm
b) 10.5 - 12.5 μm
c) 8.0 - 14.0 μm
d) None of these
39. Data representation in Raster data is by
a) pixel
b) points, lines and polygon
c) latitude and longitude
d) none of these
40. In water treatment, alum is used for
a) softening
b) coagulation
c) filtration
d) disinfection
41. The Karnataka State Pollution Control Board (KSPCB) was established in the year.
a) 1974
b) 1982
c) 1973
d) 1983
42. Which of the following is not a part of the hydrological cycle?
a) Precipitation
b) Infiltration
c) Transpiration
d) Perspiration
43. First International Earth Summit was hold at
a) USA
b) Russia
c) Rio-de-Janerio
d) Johannesburg
44. Which among the following has highest percentage of calorific value?
a) Anthracite
b) Peat
c) Lignite
d) Bituminous coal
45. Nitrogen fixing bacteria exists in
a) Leaf
b) Stem
c) Roots
d) Flower
46. The two major components of ecosystem are
a) Adiabatic and isotropic
b) Ecologic and climatologic
c) Cyclic and biologic
d) Abiotic and biotic
47. Geothermal energy is a
a) Heat energy
b) Wind energy
c) Current energy
d) Solar energy
48. The average life expectancy around the world is currently.
a) Decreasing
b) Increasing
c) Stabilizing
d) Not changing

63. Which among the following is a climatic factor?
 a) pressure
 b) humidity
 c) temperature
 d) all of these
64. Biodiversity can be broadly classified into how many types?
 a) 2
 b) 5
 c) 3
 d) 4
65. Hot spot areas have
 a) Low density of biodiversity
 b) Only endangered plants
 c) High density of hot springs
 d) High density of biodiversity
66. About _____ % of the earth's surface is covered by water.
 a) 53%
 b) 19%
 c) 71%
 d) 90%
67. Deforestation means
 a) preservation of forests
 b) destruction of forests
 c) monocrop cultivation
 d) agriculture
68. When did National Disaster Management Authority formed?
 a) 2000
 b) 2005
 c) 2010
 d) 2015
69. Disaster is an event arising out of
 a) result of hazard event
 b) causes of hazard event
 c) causes of disaster event
 d) all of these
70. The scientific study of earthquake is called
 a) seismograph
 b) seismology
 c) both a and b
 d) none of these
71. "Minamata Disease" is caused due to
 a) Lead
 b) Arsenic
 c) Mercury
 d) Cadmium
72. Alternative eco-friendly fuel for automobiles is
 a) Petrol
 b) Diesel
 c) CNG
 d) Kerosene
73. Population explosion will cause
 a) Biodiversity
 b) Stress on ecosystem
 c) More employment
 d) None of these
74. Which of the following is having high population density?
 a) India
 b) China
 c) USA
 d) Western Europe
75. Demography is the study of
 a) Animals behaviour
 b) Population growth
 c) River
 d) None of these
76. Forest are called as _____
 a) Air purifier
 b) Earth's lungs
 c) Oxygen reservoir
 d) CO₂ absorbers
77. Which of the following is the facility that the urban people enjoy?
 a) Better quality of air
 b) Better communication access
 c) Large land at cheap rates
 d) None of these

78. Which of the following is an air pollutant?
 a) Carbon dioxide
 b) Oxygen
 c) Nitrogen
 d) Particulate matter
79. Cyto toxic and expired drugs are disposed of by
 a) dumping
 b) autoclave
 c) incineration
 d) chemical disinfection
80. The colour code of plastic bag for disposing of microbial laboratory culture waste.
 a) Black
 b) Red
 c) Blue
 d) White
81. Among the fresh water available in the earth the percentage of surface water is about
 a) 50%
 b) 10%
 c) 5%
 d) less than 1%
82. Hepatitis is caused by
 a) Protozoa
 b) Virus
 c) Bacteria
 d) Fungus
83. In India groundwater resources are rich in
 a) Plains of river Kaveri and Krishna
 b) The Deccan plateau
 c) The Gangetic plains
 d) The plains of Netravati and Kapila
84. The required iron content in drinking water as specified by BIS is
 a) 300 mg/l
 b) 30 mg/l
 c) 3 mg/l
 d) 0.30 mg/l
85. Molasses from sugar industry is used to generate
 a) Biodiesel
 b) Hydrogen
 c) Bioethanol
 d) Biomethanol
86. Wind Farms are located in
 a) River basin
 b) Plain area
 c) Hilly area
 d) Valley area
87. Biomass consists of
 a) Lignin
 b) Hemi cellulose
 c) Cellulose
 d) All of these
88. Natural gas contains
 a) Carbon dioxide
 b) Hydrogen
 c) Methane
 d) Nitrogen
89. Anti tobacco day is mentioned on
 a) 31st May
 b) 30th June
 c) 31st July
 d) 31st August
90. Population explosion will cause
 a) Socio-Economic Problems
 b) Food Scarcity
 c) Energy crises
 d) All of these
91. GIS stands for
 a) Geostationary Interact Sector
 b) Geographical Information System
 c) Geotechnical Information Society
 d) Geothermal Investigation Site

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Fifth Semester B.E. Degree Examination, Jan./Feb. 2023 Electromagnetic Waves

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. The three vertices of a triangle are located at $A(6, -1, 2)$, $B(-2, 3, -4)$ and $C(-3, 1, 5)$. Find (i) $R_{AB} \times R_{AC}$ (ii) Area of triangle (04 Marks)
- b. Define Electric field intensity. Derive the expression for electric field intensity due to infinite line charge. (10 Marks)
- c. Given the electric flux density $\vec{D} = 0.3r^2 \hat{a}_r \text{ nC/m}^2$ in free space.
 - (i) Find E at point $P(r = 2, \theta = 25^\circ, \phi = 90^\circ)$.
 - (ii) Find total charge within the sphere $r = 3$.
 - (iii) Find total electric flux leaving the sphere $r = 4$. (06 Marks)

OR

- 2 a. Four identical 3nC (nano Coulomb) charges are located at $P_1(1, 1, 0)$, $P_2(-1, 1, 0)$, $P_3(-1, -1, 0)$ and $P_4(1, -1, 0)$. Find the electric field intensity \vec{E} at $P(1, 1, 1)$. (10 Marks)
- b. Infinite uniform line charges of 5 nC/m lie along the (positive and negative) x and y axes in free space. Find \vec{E} at $P_A(0, 0, 4)$. (04 Marks)
- c. Define Coulomb's law. Make use of this to find the force on Q_1 . Given that the point charges $Q_1 = 50 \mu\text{C}$ and $Q_2 = 10 \mu\text{C}$ are located at $(-1, 1, -3)\text{m}$ and $(3, 1, 0)\text{m}$ respectively. (06 Marks)

Module-2

- 3 a. Explain Gauss law applicable to the case of infinite line charge and derive the relation used. (08 Marks)
- b. Evaluate both sides of the divergence theorem for the field $\vec{D} = 2xy\hat{a}_x + x^2\hat{a}_y \text{ C/m}^2$ and the rectangular parallelepiped formed by the planes $x = 0$ and 1 , $y = 0$ and 2 and $z = 0$ and 3 . (08 Marks)
- c. Given the potential field $V = 2x^2y - 5z$ and point $P(-4, 3, 6)$. (i) Find potential V at P . (ii) Field intensity \vec{E} . (iii) Volume charge density ρ_V . (04 Marks)

OR

- 4 a. Compute the numerical value for $\text{div} \vec{D}$ at the point specified below:
 $\vec{D} = (2xyz - y^2)\hat{a}_x + (x^2z - 2xy)\hat{a}_y + x^2y\hat{a}_z \text{ C/m}^2$ at $P_A(2, 3, -1)$ (04 Marks)
- b. Show that Electric field is a negative gradient of potential. (08 Marks)
- c. Let $E = y\hat{a}_x \text{ V/m}$ at a certain instant of time and calculate the work required to move a 3e charge from $(1, 3, 5)$ to $(2, 0, 3)$ along the straight line segment joining
 - (i) $(1, 3, 5)$ to $(2, 3, 5)$ to $(2, 0, 5)$ to $(2, 0, 3)$
 - (ii) $(1, 3, 5)$ to $(1, 3, 3)$ to $(1, 0, 3)$ to $(2, 0, 3)$ (08 Marks)

Module-3

- 5 a. Solve the Laplace's equation for the potential field in the homogenous region between the two concentric conducting spheres with radii 'a' and 'b' such that $b > a$, if potential $V = 0$ at $r = b$ and $V = V_0$ at $r = a$. Also find the capacitance between two concentric spheres. (10 Marks)
- b. State and explain Biot-Savart law applicable to magnetic field. (06 Marks)
- c. Calculate the value of vector current density in a rectangular coordinates at $P_A(2, 3, 4)$ if $\vec{H} = x^2z\vec{a}_x - y^2x\vec{a}_y$. (04 Marks)

OR

- 6 a. State and illustrate uniqueness theorem. (08 Marks)
- b. Define Stoke's theorem. Use this theorem to evaluate both sides of the theorem for the field $\vec{H} = 6xy\vec{a}_x - 3y^2\vec{a}_y$ A/m and the rectangular path around the region, $2 \leq x \leq 5$, $-1 \leq y \leq 1$, $z = 0$. Let the positive direction of ds be \vec{a}_z . (12 Marks)

Module-4

- 7 a. Obtain the expression for magnetic force between differential current elements. (06 Marks)
- b. Derive the boundary conditions to apply to \vec{B} and \vec{H} at the interface between two different magnetic materials. (08 Marks)
- c. The point charge $q = 18\text{nC}$ has a velocity of 5×10^6 m/s in the direction $\vec{a}_v = 0.60\vec{a}_x + 0.75\vec{a}_y + 0.30\vec{a}_z$. Calculate the magnitude of the force exerted on the charge by the field,
 (i) $\vec{B} = -3\vec{a}_x + 4\vec{a}_y + 6\vec{a}_z$ mT
 (ii) $\vec{E} = -3\vec{a}_x + 4\vec{a}_y + 6\vec{a}_z$ kV/m
 (iii) \vec{B} and \vec{E} acting together (06 Marks)

OR

- 8 a. Find the magnetization in a magnetic material, where
 (i) $\mu = 1.8 \times 10^{-5}$ H/m and $H = 120$ A/m
 (ii) $\mu_r = 22$, there are 8.3×10^{28} atoms/m³, and each atom has a dipole moment of 4.5×10^{-27} A.m²
 (iii) $B = 300 \mu\text{T}$ and $\chi_m = 15$. (06 Marks)
- b. Let permittivity be $5 \mu\text{H/m}$ in region A where $x < 0$ and $20 \mu\text{H/m}$ in region B, where $x > 0$. If there is a surface current density $\vec{K} = 150\vec{a}_x - 200\vec{a}_y$ A/m at $x = 0$, and if $\vec{H}_A = 300\vec{a}_x - 400\vec{a}_y + 500\vec{a}_z$ A/m. Compute
 (i) $|H_{Ax}|$ (ii) $|H_{Bx}|$ (iii) $|H_{Ay}|$ (iv) $|H_{By}|$ (08 Marks)
- c. State and explain Faraday's law of electromagnetic induction. (06 Marks)

Module-5

- 9 a. List and explain Maxwell's equations in point and integral form. (08 Marks)

- b. The time domain expression for the magnetic field of a uniform plane wave travelling in free space is given by,

$$H(z,t) = \hat{a}_y 2.5 \cos(1.257 \times 10^9 t - K_z z) \text{ mA/m.}$$

Compute

- The direction of wave propagation.
 - Operating frequency
 - Phase constant.
 - The time domain expression for electric field $E(z,t)$ starting from the Maxwell's equations.
 - The phasor form of both the electric and magnetic field. (10 Marks)
- c. For silver the conductivity is $\sigma = 3 \times 10^6 \text{ S/m}$. At what frequency will the depth of penetration be 1 mm. (02 Marks)

OR

- 10 a. State and explain Poynting theorem and write the equation both in point and integral form. (08 Marks)
- b. Simplify the value of K to satisfy the Maxwell's equations for region $\sigma = 0$ and $\rho_v = 0$ if $\vec{D} = 10x\hat{a}_x - 4y\hat{a}_y + kz\hat{a}_z$, $\mu\text{C/m}^2$ and $B = 2a_z$, mT. (06 Marks)
- c. A plane wave of 16 GHz frequency and $E = 10 \text{ V/m}$ propagates through the body of salt water having constant $\epsilon_r = 100$, $\mu_r = 1$ and $\sigma = 100 \text{ S/m}$. Determine attenuation constant, phase constant, phase velocity and intrinsic impedance and depth and penetration. (06 Marks)

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Fifth Semester B.E. Degree Examination, Jan./Feb. 2023

Verilog HDL

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1.
 - a. Explain typical design flow for designing VLSI circuit using the flow chart. (08 Marks)
 - b.
 - i) A 4-bit ripple carry adder (Ripple – Add) contains four 1-bit full adders (FA). Define the module FA. Do not define the internals or the terminal list. Define the module Ripple – Add. Do not define the internals or the terminal list. Instantiate four full adder of the type FA in the module Ripple-Add and call them fa0, fa1, fa2, and fa3.
 - ii) Define the module IS, using the module/endmodule keywords. Instantiate the modules MEM, Se, Xbar and call the instances mem1, se1 and Xbar 1, respectively. You do not need to define the internals. Assume that the module IS has no terminals. (06 Marks)
 - c. What are the two styles of stimulus applications? Explain each method in brief. (06 Marks)

OR

2.
 - a. Explain the trends in HDL. (04 Marks)
 - b. With a hierarchical diagram of a 4-bit ripple carry counter, explain the design hierarchy (10 Marks)
 - c. What is the difference between a module and a module instance? Explain with an example. (06 Marks)

Module-2

3.
 - a. Describe different methods of connecting parts to internal signals. (06 Marks)
 - b. Explain \$ display, \$ monitor, \$ finish and \$ stop system tasks with examples. (08 Marks)
 - c. What are the basic components of a module? Explain all the components of a verilog module with a neat diagram. (06 Marks)

OR

4.
 - a. Declare the following variables in verilog.
 - i) An 8-bit vector net called a – in
 - ii) A 16-bit hexadecimal unknown number with all x's
 - iii) A memory MEM containing 256 words of 64 bits each
 - iv) A parameter cache-size equal to 512. (04 Marks)
 - b. With example explain different types of lexical conventions. (08 Marks)
 - c. Write verilog description of SR latch. Also write stimulus code. (08 Marks)

Module-3

5.
 - a. Write a verilog dataflow description for 4-bit full adder with carry lookahead. (06 Marks)
 - b. What would be the output of the following
 $a = 4'b1010, b = 4'b1111$
 - i) $a\&b$ (ii) $a\&\&b$ (iii) $\&a$ (iv) $a\>>1$ (v) $a\>>>1$
 - (vi) $y = \{2\{a\}\}$ (vii) $a \wedge b$ (viii) $z = \{a, b\}$ (08 Marks)
 - c. What re rise, fall and Turn-off delays? How they are specified in verilog? (06 Marks)

OR

- 6 a. A full subtractor has three 1-bit inputs x , y and z (previous borrow) and two 1-bit outputs D (Difference) and B (Borrow) the logic equations are

$$D = \overline{X}YZ + X\overline{Y}Z + XY\overline{Z} + XYZ$$

$$B = \overline{X}Y + XZ + YZ$$
 (06 Marks)
 Write verilog description using dataflow modeling. Instantiate the subtractor inside a stimulus block and test all possible combinations of inputs X , Y and Z .
- b. Discuss the And/or and Not gates with respect to logic symbols, gate instantiation and truth table. (06 Marks)
- c. Design AND-OR-INVERT (AOI) based 4:1 multiplexer write verilog description for the same and its stimulus. (08 Marks)

Module-4

- 7 a. Explain the following assignment statements and non-blocking assignment statements with relevant examples. (06 Marks)
- b. Write a verilog program for 8-to-1 multiplexer using case statement. (08 Marks)
- c. Give the differences between tasks and functions. (06 Marks)

OR

- 8 a. Explain sequential and parallel blocks with examples. (06 Marks)
- b. Design a negative edge-triggered D-flipflop (DUFF) with synchronous clear, active high (D-FF clears only at a negative edge of clock when clear is high). Design a clock with a period of 10 units and test the D-flipflop. (08 Marks)
- c. Write verilog program to call a function called calc-parity which computes the parity of a 32-bit data, [31:0] Data and display odd or even parity message. (06 Marks)

Module-5

- 9 a. Write a note on :
 i) Force and release
 ii) Defparam statement
 iii) time scale
 iv) file output. (08 Marks)
- b. Write a note on verification of gate level netlist. (04 Marks)
- c. With a neat flow chart explain computer Aided logic synthesis process. (08 Marks)

OR

- 10 a. What is logic synthesis? (04 Marks)
- b. Interpret the following verilog constructs after logic synthesis.
 i) The assign statement
 ii) The if-else statement
 iii) The case statement
 iv) The always statement (10 Marks)
- c. Write RTL description for magnitude comparator. (06 Marks)
