CBCS SCHEME

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15EC71

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 exited 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:
$R = 2\Omega/m$ $G = 0.5mho/m$ $f = 1GHz$ $L = 8nH/m$ $C = 0.23PF$.
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)**

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 $u = U_m \sin\theta \sin^3\phi$ using i) Exact method ii) Approximate method. Choose $0 \le \theta \le \pi$ and $0 \le \phi \le \pi$. **(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 $80\pi^2 L_\lambda^2$. **(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 depole. **(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 yogi-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).

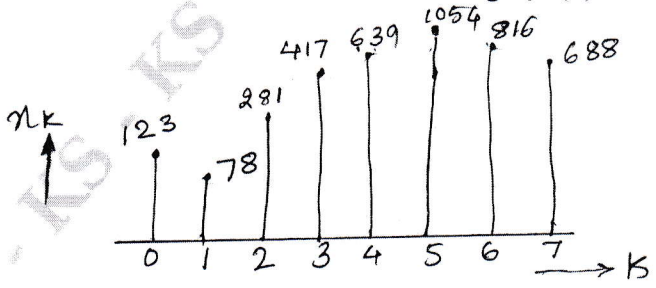

Fig.Q.3(b)

Draw the histogram of the equalized image. **(08 Marks)**

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 achiever 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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15EC73

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_s = 10kHz. The DC voltage of chopper is V_s = 220V and the load current is I_L = 100A. $V_{CE(sat)}$ = 0V. The switching times are t_d = 0; t_r = 3μs and t_f = 1.2μs. 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 $-V_{BB}$ = 20V, η = 0.6, I_P = 10μA, V_V = 2V, I_V = 10mA. The frequency of oscillation is 100Hz. The triggering pulse width should be 50μsec. **(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 = 1μf, L = 5mH, R_L = 100Ω. 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 = 10Ω and rms input voltage V_s = 120V, 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)**

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 200μsec 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_a = 5V at R = 500Ω 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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15EC744

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

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Write the Euclid's algorithm for determining the GCD of two positive integers. Find the GCD of (1970, 1066) using Euclid's algorithm. **(08 Marks)**

b. Define the following terms with necessary axioms :
(i) Groups (ii) Rings (iii) Fields **(08 Marks)**

OR

2 a. Write the extended Euclid's algorithm for determining the GCD and multiplicative inverse of two integers. Also find the GCD and multiplicative inverse of (4321, 1234). **(08 Marks)**

b. Mention the modular arithmetic properties of congruence with an example. **(06 Marks)**

c. Define relatively prime. Mention an example. **(02 Marks)**

Module-2

3 a. Draw the model of symmetric cryptosystem and explain it. **(08 Marks)**

b. Encrypt the plain text "MONDAY" using Hill Cipher with the key $\begin{bmatrix} 9 & 4 \\ 5 & 7 \end{bmatrix}$ show your calculation and cipher text. **(08 Marks)**

OR

4 a. Explain with a schematic the classical Fiestel Cipher model. **(08 Marks)**

b. Discuss the concept of play fair cipher algorithm. Using this find the plain text if Cipher text is "OFTIBLDHXM" and key is COMPUTER. **(08 Marks)**

Module-3

5 a. With a neat diagram, explain the various steps involved in AES encryption algorithm. **(08 Marks)**

b. With a neat diagram, explain linear feedback shift Registers. **(08 Marks)**

OR

6 a. With neat block diagram, explain AES key expansion. **(06 Marks)**

b. Write a note on:
(i) Stream Ciphers using LFSR's.
(ii) Design and analysis of Stream Ciphers. **(10 Marks)**

Module-4

7 a. State and prove Fermats theorem. Determine Euler's totient function $\phi(24)$ and $\phi(35)$. **(08 Marks)**

b. In a public key system using RSA, you intercept the Cipher text C = 10 sent to a user whose public key is e = 5, n = 35. What is the plain text M? **(08 Marks)**

OR

8 a. State and prove Chinese remainder theorem. Find x for the following equations: $X \equiv 2 \bmod 5$, $X \equiv 6 \text{ modulo} 9$ **(05 Marks)**

b. Explain the distribution of secret key using the public key cryptography with confidentiality and authentication. **(05 Marks)**

c. In Diffie Hellman key exchange q = 71, its primitive root α = 7. A′s private key is 5, B′s private key is 12. Find
(i) A′s public key (ii) B′s public key (iii) Shared secret key **(06 Marks)**

Module-5

9 a. Write an explanatory note on message authentication codes. **(08 Marks)**

b. Explain in detail, digital signature algorithm. **(08 Marks)**

OR

10 a. Define one way hash function. Explain the basic uses of hash function with a neat block diagram. **(10 Marks)**

b. Write a note on discrete logarithm signature scheme. **(06 Marks)**

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