CBCS SCHEME

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15EC71

Seventh Semester B.E. Degree Examination, July/August 2022
Microwaves 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.

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-1

1 a. With the aid of neat sketches, describe Reflex Klystron operation. What do you understand by velocity modulation? **(10 Marks)**

b. Derive the expressions for attenuation and phase constants for RF lines. **(06 Marks)**

OR

2 a. Describe the importance and significance of transit time and mode curve of reflex Klystron tube. **(08 Marks)**

b. A lossless line of characteristic impedance $R_0 = 50\Omega$ is to be matched to a load $Z_L = 50/(2+J(2+\sqrt{3})$ ohms by means of a lossless short circuitedstub. The characteristic impedance of the stub is 100Ω. Find the stub position (closest to the load) and length so that a match is obtained (using smith chart). **(08 Marks)**

Module-2

3 a. Justify "Microwave circuits are analysed using scattering parameters and not by the measurement of z, y and ABCD parameters". **(06 Marks)**

b. Show that impedance and admittance matrices are symmetrical for a reciprocal junction. **(04 Marks)**

c. With the aid of neat sketch, explain the working of a Magic–Tee. What are the applications of Magic Tee? **(06 Marks)**

OR

4 a. State and prove symmetry and phase shift property of S-parameters, for junction of ports having common characteristic impedance. **(08 Marks)**

b. A lossless air filled rectangular waveguide has internal dimensions of 'a' cm X 'b' cm. If a = 2b and the cut off frequency of the TE_{02} mode is 12 GHz. Find the cut off frequency of dominant mode. **(04 Marks)**

c. Describe the working of microwave phase shifters. **(04 Marks)**

Module-3

5 a. Write a brief note on coplanar and shielded strip lines. **(06 Marks)**

b. Prove that effective height and effective aperature are related via radiation resistance and the intrinsic impedance of the space. **(06 Marks)**

c. Define directivity and HPBW of an antenna. **(04 Marks)**

OR

6 a. Obtain the expressions for characteristic impedance and attenuation losses of a parallel strip lines. **(06 Marks)**

b. Derive Frii's transmission formula. **(06 Marks)**

c. Define aperture efficiency of an antenna. **(04 Marks)**

Module-4

7 a. A source with a unidirectional radiation intensity pattern is given by :
$U = U_m COS\theta$
where n is any number n = 1, 2, 3 . . .
Show that the directivity of the source is D = 1(n + 1). **(04 Marks)**

b. Derive expression for total field at par point 'P' when two point sources with currents in equal magnitude but in opposite phase and are separated by $\lambda/2$ apart. Draw the field pattern. **(10 Marks)**

c. What are parasitic arrays? **(02 Marks)**

OR

8 a. Using electric and magnetic potentials obtain the far field components of a short dipole. **(08 Marks)**

b. Write the far – field E_θ of a symmetrical, center fed thin linear antenna. Write pattern factors for $\lambda/2$, full wave, three half wave antenna. **(08 Marks)**

Module-5

9 a. Derive the instantaneous electric field at a large distance 'r' from a loop antenna of any radius a. **(08 Marks)**

b. Describe Log-periodic array geometry. What is the basic concept of LPDA? What is YUCOLP array? **(08 Marks)**

OR

10 a. Discuss the practical design considerations for the axial mode helical antenna. List the important applications of helical antenna. **(08 Marks)**

b. With the aid of diagram, explain Fermat's principle as applicable to the horn antenna design. **(06 Marks)**

c. What is Aperture matched horn? **(02 Marks)**

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15EC72

Seventh Semester B.E. Degree Examination, July/August 2022
Digital Image Processing

Time: 3 hrs. Max. Marks: 80

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

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-1

1 a. With a neat block diagram, explain the fundamental steps involved in digital image processing. **(10 Marks)**

b. Let p and q be the pixels at coordinates (10, 12) and (15, 20) respectively. Find which distance measure gives the minimum distance between the pixels. **(06 Marks)**

OR

2 a. Explain in brief how an image can be sensed and acquired using multiple arrays. **(10 Marks)**

b. Consider the two image subsets S_1 and S_2, shown in Fig.Q2(b), for V = {1}, determine whether two subsets are (i) 4-adjacent (ii) 8-adjacent (iii) m-adjacent.

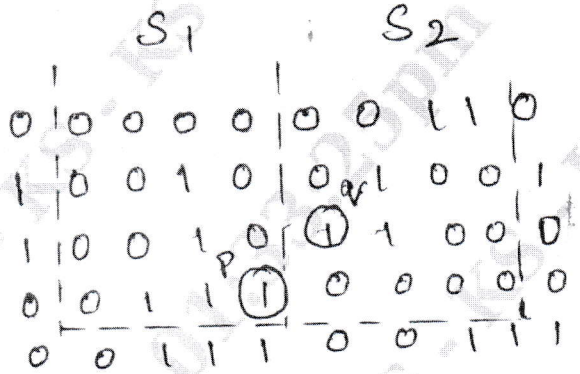

Fig.Q2(b) **(06 Marks)**

Module-2

3 a. Explain the basic gray level transformation functions with necessary graphs. **(08 Marks)**

b. The histogram of 3-bit image of 64 × 64 pixels is shown in Fig.Q3(b). Construct the histogram of original image and equalized histogram.

r_k	0	1	2	3	4	5	6	7
n_k	790	1023	850	656	329	245	122	81

Fig.Q3(b) **(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. With a neat diagram, explain a model of the image degradation/restoration process. **(04 Marks)**

b. Explain common noise probability density functions in image processing. **(04 Marks)**

c. Explain the ordered statistic filters used for image restoration. **(08 Marks)**

OR

6 a. Explain the following methods to estimate the degradation function used in image restoration:
(i) Estimation by image observation
(ii) Estimation by experiment **(08 Marks)**

b. Explain the inverse filtering and Weiner filtering image restoration. **(08 Marks)**

Module-4

7 a. Explain the procedure in converting colors from RGB to HSI. **(08 Marks)**

b. Name the different techniques of wavelet coding and explain in brief any one techniques of wavelet coding of an image. **(08 Marks)**

OR

8 a. Explain the different methods of pseudocolor image processing. **(08 Marks)**

b. Explain the following basic morphological algorithms:
(i) Convex hull
(ii) Thinning
(iii) Pruning
(iv) Skeleton **(08 Marks)**

Module-5

9 a. What is thresholding? Describe the algorithm used for basic global thresholding. **(08 Marks)**

b. With the help of basic formulation, explain the concept of region splitting and merging. **(08 Marks)**

OR

10 a. With a neat sketch illustrate boundary-following algorithm and explain. **(08 Marks)**

b. Briefly explain the watershed segmentation algorithm. **(08 Marks)**

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15EC73

Seventh Semester B.E. Degree Examination, July/August 2022
Power Electronics

Time: 3 hrs. Max. Marks: 80

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

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

1 a. Explain five different types of power electronics converter circuits with their input and output wave forms. **(10 Marks)**

b. A BJT switch has β in the range of 8 to 40, calculate (i) The value of R_B that will result in saturation with an overdrive factor of 5 (ii) The forced beta β_f and the power loss in the transistor. $V_{CC} = 200$ V, $V_{bb} = 10$ V, $V_{be(sat)} = 1.5$ V, $V_{ce(sat)} = 1$ V, $R_C = 10\ \Omega$. **(06 Marks)**

OR

2 a. Explain any five power electronics devices with VI characteristics and their symbols. **(10 Marks)**

b. An IGBT switch has $t_{ON} = 3\ \mu$sec, $t_{OFF} = 1.2\ \mu$sec , duty cycle D = 0.7, $V_{CE(sat)} = 2$ V, $f_s = 1$ kHz. Determine

(i) Average load current.
(ii) Conduction power loss.
(iii) Switching power loss during turn on and turn off. **(06 Marks)**

Module-2

3 a. With two transistor analogy, explain the working of a Thyristor and obtain the equation for anode current. **(08 Marks)**

b. Distinguish between holding current and latching current of a Thyristor. **(02 Marks)**

c. A SCR circuit operates from 300 V DC supply has series inductance of 4 μH. A resistance of 4 Ω and capacitance of 0.2 μF is connected across the SCR. Calculate the safe $\frac{dv}{dt}$ and $\frac{di}{dt}$ ratings of SCR. **(06 Marks)**

OR

4 a. With necessary circuit diagram and waveforms explain the resonant pulse commutation. **(08 Marks)**

b. The resonant pulse commutation circuit has a capacitance of C = 30 μF and L = 4 μH . The initial capacitor voltage is $V_0 = 200$ V. Determine the circuit turn-off time for the load current $I_m = 250$ A. **(08 Marks)**

Module-3

5 a. With neat circuit diagrams and suitable waveforms explain the working of a single phase dual converter. **(06 Marks)**

b. Derive an expression for RMS output voltage of a single phase full controller having inductive load for discontinuous load current. Draw the relevant wave forms. **(06 Marks)**

c. A single phase full wave ACVC has a resistive load of R = 10 Ω and the input voltage is $V_S = 200$ V rms/ 60 Hz. The firing angles of T_1 and T_2 are $\alpha_1 = \alpha_2 = \frac{\pi}{2}$. Determine (i) RMS output voltage V_0 (ii) Input PF (iii) The average current of thyristors I_a. (iv) The rms current of the thyristor. **(04 Marks)**

OR

6 a. With the help of neat circuit diagram and wave forms explain the operation of single phase full wave bidirectional controller using diode bridge and single SCR with R load. Derive the equation for V_O(RMS). **(10 Marks)**

b. Obtain an expression for RMS value of load voltage in on-off A.C. voltage controller. For a 230 V/50 Hz ON-OFF controller ON time is 10 cycles and off time is 4 cycles. Calculate $V_{0(RMS)}$ output voltage. **(06 Marks)**

Module-4

7 a. Explain the working of step-down choppers with necessary circuit diagram and waveforms. Derive the equation for $V_{O(av)}$ and V_{ORMS}. **(06 Marks)**

b. Give the classification of chopper. Explain briefly each one of them. **(10 Marks)**

OR

8 a. With the help of circuit diagram and waveforms, explain the operation of step-up chopper. **(06 Marks)**

b. With a neat circuit diagram and wave forms explain the working principle of Buck regulator. Derive the expression for peak to peak ripple voltage of the capacitor, present across the load. **(10 Marks)**

Module-5

9 a. With circuit diagram and waveforms explain the working of a single phase full bridge inverter with RL load. **(10 Marks)**

b. With neat circuit diagram, explain the variable DC link inverter. **(06 Marks)**

OR

10 a. With neat circuit diagram, explain the working of a transistorized current source inverter. **(06 Marks)**

b. Explain the working of a solid state relay with suitable diagram. **(06 Marks)**

c. Considering a single phase bridge inverter, if the DC voltage is 200 V and the required RMS fundamental output voltage is 90 V, determine the delay angle β. **(04 Marks)**

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15EC744

Seventh Semester B.E. Degree Examination, July/August 2022
Cryptography

Time: 3 hrs. Max. Marks: 80

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

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

1 a. Explain the concept of Greatest Common Divisor with respect to Euclidean Algorithm with suitable example. **(05 Marks)**

b. Briefly explain the properties of modular arithmetic, write the table of addition modulo 8. **(07 Marks)**

c. Find GCD (2740, 1760). **(04 Marks)**

OR

2 a. Discuss the properties of Groups, Rings and Fields. **(06 Marks)**

b. What are finite fields of the form GF(P) and explain finding the multiplicative inverse in GF(P). **(05 Marks)**

c. Write a note on Finite field of the form $GF(2^n)$. **(05 Marks)**

Module-2

3 a. Explain with a neat sketch the symmetric Cipher model. **(05 Marks)**

b. List out various techniques used in symmetric ciphers. Explain the substitution technique with an example. **(06 Marks)**

c. Encrypt the plain text "SECURITY" using Hill Cipher technique key $= \begin{bmatrix} 9 & 4 \\ 5 & 7 \end{bmatrix}$. **(05 Marks)**

OR

4 a. Compare Stream Cipher with Block Cipher. **(04 Marks)**

b. Briefly explain with relevant diagrams the Feistel encryption and decryption. **(06 Marks)**

c. What is DES? Explain in detail the DES encryption algorithm. **(06 Marks)**

Module-3

5 a. List difference between DES and AES. **(03 Marks)**

b. With a neat sketch, explain in detail the steps involved in encryption and decryption process of AES. **(09 Marks)**

c. Write a note on AES key expansion algorithm. **(04 Marks)**

OR

6 a. Explain the importance of Linear congruential generators. Why these generators cannot be used for cryptography. **(04 Marks)**

b. What are linear feed back shift generators? List different types available. **(05 Marks)**

c. Explain with relevant sketches : (i) Geffe Generator (ii) Gollmann cascade. **(07 Marks)**

Module-4

7 a. If 'P' is prime and 'a' is a positive integer not divisible by 'P'. Then, prove $a^{P-1} \cong 1 (\text{mod } P)$. **(05 Marks)**

b. Write an explanatory note on Chinese Remainder Theorem. **(05 Marks)**

c. Briefly explain the concept of Discrete Logarithm and show how it is useful in cryptography. **(06 Marks)**

OR

8 a. What is Public Key Cryptography. With relevant steps explain the concept of RSA key generation, encryption and decryption. **(05 Marks)**

b. Users A and B use D-H key exchange technique with common prime $Q = 353$ and primitive root $\alpha = 3$. A and B selects their secret keys as $X_A = 97$ and $X_B = 233$ respectively, then compute the public keys Y_A and Y_B also calculate the common secret key 'K'. **(06 Marks)**

c. Write a note on Elleptic curve cryptography. **(05 Marks)**

Module-5

9 a. What are Hash functions, explain in detail SNEFRU? **(05 Marks)**

b. With a suitable diagram, Explain the concept of MD5. **(05 Marks)**

c. Explain with a neat diagram, one SHA operation. **(06 Marks)**

OR

10 a. Explain the steps involved in generation of DSA signature. **(06 Marks)**

b. Give details about security of DSA. **(05 Marks)**

c. Write a note on Discrete Logarithm signature scheme. **(05 Marks)**

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15EC755

Seventh Semester B.E. Degree Examination, July/August 2022
Satellite Communication

Time: 3 hrs. Max. Marks: 80

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

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

1 a. What is satellite communication? List the application and some of the services provided by the satellite. **(06 Marks)**

b. Explain how a satellite continues to be in orbit and derive an expressions for :
(i) Satellite velocity
(ii) Orbital period **(10 Marks)**

OR

2 a. Define and explain elevation and Azimuth angles of a ground station antenna for communication with an orbiting satellite. **(10 Marks)**

b. Describe briefly the main advantages offered by satellite communication. Explain what is meant by distance in sensitive communication system. **(06 Marks)**

Module-2

3 a. Write a neat block diagram, explain tracking telemetry and command subsystems. **(08 Marks)**

b. Explain earth station types. **(08 Marks)**

OR

4 a. Explain the earth station architecture. **(08 Marks)**

b. Explain attitude and orbit control system. **(08 Marks)**

Module-3

5 a. Explain SCPC systems (Single Channel Per Carrier System) using PSK. **(08 Marks)**

b. Derive transmission equation. **(08 Marks)**

OR

6 a. Explain transponder arrangement for an SDMA system. **(06 Marks)**

b. A geostationary satellite at a distance of 36,000 km from the surface of the earth radiates a power of 10 Watts in the desired direction through an antenna having a gain of 20 dB, what would be the power density at a receiving site on the surface of the earth and also the power received by an antenna having an effective aperture of 10 m^2. **(04 Marks)**

c. Explain Ionospheric Scintillation. **(06 Marks)**

Module-4

7 a. Explain a typical satellite TV network. **(08 Marks)**

b. What are the advantages and disadvantages of satellite over terrestrial network? **(08 Marks)**

OR

8 a. Explain direct to home satellite television (DTH). **(08 Marks)**

b. Explain different types of transponders. **(08 Marks)**

Module-5

9 a. Explain the principle and operation of GPS system. **(08 Marks)**

b. Explain the principle and operation of scatarometer and altimeter. **(08 Marks)**

OR

10 a. Explain various types of sensors on board remote sensing satellites. **(10 Marks)**

b. Explain the principle of operation of Doppler effect based satellite navigation system. **(06 Marks)**

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