CBCS SCHEME

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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 $P_{Rf\,max}$ 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,

$$[S] = \begin{bmatrix} 0.1\angle 0^\circ & 0.8\angle -45^\circ \\ 0.8\angle 45^\circ & 0.2\angle 0^\circ \end{bmatrix}.$$

(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)**

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 $E = E_o \cos\phi$. **(04 Marks)**

Module-5

9 a. Derive an expression for far fields E_ϕ and H_θ 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)**

c. 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) **(08 Marks)**

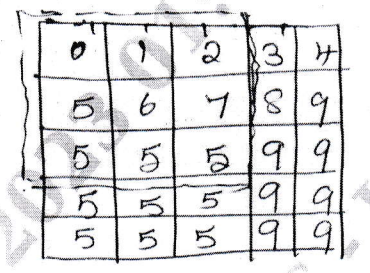
c. Explain 2D – DFT and mention Translation and Symmetry properties of 2D - DFT. **(06 Marks)**

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.



(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 Errosion 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 = 10Ω. The circulating inductance is L_r = 40mH delay angles are $\alpha_1 = 60°$ and $\alpha_2 = 120°$. 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 = 10Ω 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)**

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 Vs = 12V. The required average o/p v/g is Va = 5V at R = 500Ω 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 = 10Ω and the input voltage is Vs = 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 va ii) rms o/p v/g vo 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 = 2.4Ω and the dc i/p v/g Vs = 48v. Determine i) the rms o/p v/g at the fundamental frequency V_{01}, ii) the output power P_0 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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