Q. No. ECC - 401

109

ND/B.Tech./Even

Reg/2022-23

2022-23

ANALOG COMMUNICATION

ECC - 401

Full Marks : 25 Time : Ninety Minutes

The figures in the margin indicate full marks.

Answers *all* the questions.

1. (a) A low pass signal $x(t)$ having a bandwidth of 10 KHz is multiplied by $\cos \omega_c t$ to produce $x_c(t)$. Find the value of f_c so that the bandwidth of $x_c(t)$ is 1% of f_c.

   (b) A given AM broadcast station transmits a total power of 50 kW for single tone modulation with modulation index, $m = 0.7071$. Find carrier power and transmission efficiency.

   (c) State and prove sampling theorem. 1+2+2 [CO1; CO2]

2. (a) The modulating signal, $x(t) = 2\cos 2000\pi t$, is applied to a DSB modulator operating with a carrier frequency of 100 KHz. Sketch the spectrum of modulated signal and determine the power needed at the modulator.

   (b) For demodulating the generated AM signal using an envelope detector, find the range of the time constant RC of the detector circuit. 3+2 [CO1; CO2]

P.T.O.

3. (a) Is $x(t) = \cos t + 3\cos 2t$ a power or energy signal? Find the corresponding power or energy of the signal.

   (b) An AM signal contains 500W at its carrier frequency and 100W in each of its sidebands. (i) Determine the percent modulation of the AM signal. (ii) Find the allocation of power if the per cent modulation is changed to 60%.

   3+2=5 [CO1; CO2]

4. (a) Show that if a signal is d.c. then it has a single frequency at zero with the help of inverse Fourier transform.

   (b) Describe ground wave propagation with suitable diagram. What is the motivation for using microwave band for satellite comm? 2+3=5 [CO1; CO2]

5. (a) What is Multiplexing? Define FDM and TDM.

   (b) Draw the block diagram of an SSB-SC transmitter employing side band suppression filter and expain. Why and where is VSB modulation used?

   2+3=5 [CO1; CO2]

Course Outcomes :

- CO1 : Define and state the elements of communication systems and issues related to transmission of signals through communication channels, radio wave propagation.

- CO2 : Explain time the frequency domain equations for all forms of amplitude modulation schemes and corresponding circuits, signals and spectra.
- CO3 : Use various analog pulse communication systems and solve problems related to FDM and super heterodyne receiver.
- CO4 : Formulate time and frequency domain equations for angle modulation systems and justify related circuits, signals and spectra.
- CO5 : Differentiate between various types of noise, and compare noise resistance, noise figure and noise temperature and discuss probability theory, random variables and random processes with related significance in communication systems.
- CO6 : Assemble complete analog communication system and formulate the expression of figure of merit for different schemes of modulation.

24.02.23

124

Q. No. ECC - 402

ND/B.Tech./Even

Reg/2022-23

2022-23

DIGITAL CIRCUITS AND SYSTEMS

ECC - 402

Full Marks : 25 Time : Ninety Minutes

The figures in the margin indicate full marks.

Answers *all* the questions.

1. Design an implement a full adder circuit using two half adders and OR gate, also explain its truth table. 5 [CO; CO3]

2. The four inputs to a circuit *(A, B, C, D)* represent an 8-4-2-1 binary-coded-decimal digit. Design the circuit (Using logic gate and truth table) so that the output (Z) is 1 if the decimal number represented by the inputs is exactly divisible by 3. Assume that only valid *BCD* digits occur as inputs.

5 [CO2; CO3]

3. Design and implement 4 to one line multiplexer using AND-OR-NOT logic gate. 5 [CO2]

4. Find the minimum sum of products and the minimum product of sums for each function:

(a) $F(A,B,C,D) = \Pi M(0,1,6,8,11,12).\Pi D(3,7,14,15).$

P.T.O.

(b) $F(A,B,C,D) = \sum m(1,3,4,11) + \sum d(2,7,8,12,14,15)$

2.5×2 [CO2]

5. For this function, find a minimum sum-of-products solution, using the Quine-McCluskey method.

$F(A,B,C,D) \sum m(0,3,4,5,7,9,11,13)$ 5 [CO1, CO2]

Course Outcomes :

- CO1 : Understand rules of Boolean Algebra and use it for logic synthesis.
- CO2 : Design sequential logic circuits using switches. transistors and integrated circuit building blocks.
- CO3 : Understand binary number system and design corresponding arithmetic circuits.
- CO5 : Learn sequential circuit building blocks and implement Finite State Machines.

~~M. Tech~~/B. E. 4th ~~odd~~/even Mid Semester Examinations Jan - June 2023

Subject : Electromagnetic theory and transmission lines

Code : Ece-403,

Time 1.5 hrs. Full marks 25

All questions carry equal marks/Figures in the margin indicate full marks

half

Answer Any three (03) questions

Instructions

Question No.	Questions	Marks
1.	What are Maxwell's equations? Express them in integral forms and convert them in differential forms. Derive the wave equations for magnetic field and electric field in a homogeneous, isotropic and charge-free region.	$8\frac{1}{3}$
2.	Distinguish between conductors and dielectrics. Find out α, β, γ, v and η for the uniform plane wave propagation in a (i) good dielectric (ii) good conductor.	$8\frac{1}{3}$
3.	Prove the followings: (i) $\vec{J_c} = \sigma \vec{E}$ (ii) $\vec{D} = \epsilon \vec{E}$ (iii) $\vec{E} = -\nabla V$ (iv) $\vec{B} = \mu \vec{H}$	$8\frac{1}{3}$
4.	Write short notes on the following: (i) Equation of continuity (ii) Depth of penetration (iii) Poisson's equation and Laplace's equation. (iv) Determination of capacitance of a parallel-plate capacitor.	$8\frac{1}{3}$

Q. No. ECC 601/ 123

B.TECH/EVEN
REG/(22-23)

Even Semester Mid-term Examination, 2022-23

ANTENNA AND WAVE PROPAGATION

ECC 601

Full Marks : 25 *Time* : 90 Minutes

The figures in the margin indicate full marks.

SECTION A

Answer the following questions [5x2]

Question No.	Body of the Question	Marks	Mapped CO
1	What is 1mW in dBm? If you double the power of 1 mW, what is that in dB?	2	CO1
2.	Determine the electric field intensity at a distance of 10 km from an antenna having a directive gain of 5 dB and radiating a total power of 20 kW.	2	CO2
3.	State Helmholtz theorem for the vector field due to a finite source.	2	CO1
4.	Calculate the effective height of a half wave dipole antenna operating at λ = 1.6 m and its maximum effective area $A_{em} = 0.2\lambda^2$ and radiation resistance is 73Ω.	2	CO3
5.	What is the effective area of half-wave dipole operating at 500 MHz.	2	CO3

SECTION B

Answer the following questions [3x5]

1. A lossless resonant half-wavelength dipole antenna, with input impedance of 73ohms, is connected to a transmission line whose characteristic impedance is 50ohms. Assuming that the pattern of the antenna is given approximately by

   $U=B_0 Sin^3\theta$

   Find the maximum absolute gain of this antenna. 5 CO4

   Or,

   (a) Show that for a small electric dipole, the radiation resistance is given by $R_r = 20\pi^2 (L/\lambda)^2$. 4 CO4

   (b) A dipole of length L = 1m operates at 30 MHz. Find the radiation resistance of the dipole. 1 CO4

2. (a) Draw polar and linear plot of radiation pattern and explain different lobes, FNBW and HPBW in the plot. 3 CO1, CO2

   (b) Discuss about isotropic, directional and omni-directional patterns and give one example for each case. 2 CO1

3. A wave travelling normally outward from the page (toward the reader) is the resultant of two elliptically polarized waves, one with components of E given by $E'_y =$ 2 Cos ωt and $E'_x = 6$ Cos $(\omega t + \pi/2)$

(*Continued*)

and the other with components given by $E_y'' = 1 \text{ Cos } \omega t$ and $E_x'' = 3\text{Cos}(\omega t - \pi/2)$..

(a) What is the polarisation and axial ratio of the resultant waves'? 4 CO2

(b) Explain about the rotation of E clockwise or counter clockwise. 1 CO2

COURSE OUTCOMES

At the end of the course, a student will be able to:

CO # 1. **Explain** the concepts of antenna radiation patterns and various parameters for characterizing the antenna.

CO # 2. **Understand** different modes of radio wave propagation.

CO # 3. **Classify** various antennas on the basis of their electrical performances.

CO # 4. **Analyze** various antennas and antenna arrays.

CO # 5. **Design** antenna and antenna arrays for different applications.

———————

Q. No. ECC 602/ 105

B.TECH/EVEN
REG/(22-23)

Even Semester Mid-term Examination, 2022-23

VLSI DESIGN

ECC 602

Full Marks : 25 *Time* : 90 Minutes

The figures in the margin indicate full marks.

Graph paper shall be supplied, if required.

Answer *all* the questions.

Question No.	Body of the Question	Marks	Mapped CO
1	(a) Explain the working of n -type enhancement MOSFET and draw the transfer characteristics?	5+2	CO6
	(b) How body effect of MOSFET affects the threshold voltage?	3	CO6
2.	(a) In C-V characteristics of MOSFET or MOS cap, why capacitance curve decreases with respect to voltage in depletion region?	5	CO6
	(b) What is meant by subthreshold swing?	2	CO6
3.	(a) Draw the circuit of resistive-load inverter and explain the operation modes?	2+4	CO1, CO2
	(b) What are the different steps for IC fabrication?	2	CO1, CO2

COURSE OUTCOMES

CO1:

CO2:

CO3:
