

Instructions:

1. Question No. 1 is compulsory.
2. Answer any **three** from the remaining **five** questions
3. Figures to the right indicate full marks.

- 1 Solve any four:- (5 x 4)
- a) Justify the statement, 'Divergence of curl of a quantity is zero.'
 - b) What is high dielectric constant material? Describe its advantages.
 - c) State and explain Biot Savart's law and Ampere circuital law.
 - d) Derive point form of continuity equation.
 - e) Enlist five properties of electromagnetic waves.
- 2 a) Derive an electric field intensity due to an infinite line having density ρ_l (C/m). (10)
- b) Evaluate both sides of the divergence theorem for the electric flux density $\vec{D} = 3xy\vec{a}_x + x^2\vec{a}_y$ C/m² and the rectangular parallelepiped formed by the planes $x=0$ and 2 , $y=0$ and 3 , $z=0$ and 4 . (10)
- 3 a) Derive boundary condition at the interface of two dielectric materials. (10)
- b) Three equal point charges of $2\mu\text{C}$ are in free space at $(0,0,0)$, $(2,0,0)$ and $(0,2,0)$ respectively. Find net force on the fourth charge of $5\mu\text{C}$ at $(2,2,0)$. (10)
- 4 a) Determine \vec{H} on the axis of a circular current loop of radius 'a'. Specialize the result at the center of the loop. (10)
- b) The electric field intensity \vec{E} in time varying field is given by $\vec{E} = E_m \sin(\omega t - \beta z)\vec{a}_y$ in free space. Determine \vec{D} , \vec{B} and \vec{H} . (10)
- 5 a) Derive Maxwell's equations and tabulate them in the time domain and frequency domain. (10)
- b) Formulate inductance of a solenoid and a toroid with circular cross section. (10)
- 6 a) Derive wave equation and explain wave in a dielectric and conducting medium. (10)
- b) Find the propagation constant at 400MHz for a medium in which $\epsilon_r=16$, $\mu_r=4.5$ and $\sigma=0.6$ S/m. Find the ratio of the velocity v to free-space velocity c . (10)

QP Code:584401

(3 Hours)

[Total Marks :80

N.B. : (1) Question No. 1 is **compulsory**.

(2) Answer any **three** from the remaining **five** questions.

(3) **Assume** suitable **data** if necessary and justify the same.

(4) **Figures** to the **right** indicate the marks.

1. Solve any **four**. All the questions carry equal marks. **20**
 - (a) State and explain the application of controlled rectifier and Inverter.
 - (b) Compare the performance of MOSFET, BJT and IGBT with respect to voltage rating, current rating, switching frequency, power application and gating.
 - (c) Explain the principle of operation of power MOSFET.
 - (d) Explain the effect of freewheeling diode in single-phase half-wave rectifier with RL load.
 - (e) Why there is restriction on firing angle in case of AC Voltage Controller feeding highly inductive load.

2.
 - (a) State the limitation of R-firing circuit and explain the working of RC half wave triggering circuit. **10**
 - (b) Explain the constructional detail of IGBT with equivalent circuit and discuss its characteristics. **10**

3.
 - (a) Draw a neat circuit and explain the working of fully controlled 6-pulse 3-phase bridge converter with resistive load. Draw the corresponding input and output voltage waveforms when the firing angle is 60 degrees. Also obtain the expression for output voltage. **10**
 - (b) Explain 1-phase Half controlled rectifier with RL load with and without freewheeling diode. **10**

4.
 - (a) Explain the operation of three-phase bridge inverter for 120° conduction mode, draw the necessary waveform for line voltage and phase voltage. Justify it. **10**
 - (b) Discuss the different method of Harmonic reduction. **10**

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5. (a) Explain with a neat circuit diagram and relevant waveforms the working of BOOST regulator and derive the expression for output voltage filter capacitance and filter inductance. 10
- (b) A buck regulator has an input voltage of $V_s=14V$. The required average output voltage is $V_0 = 6V$ and peak to peak output ripple voltage is $15mV$. The switching frequency is $30kHz$. If the peak to peak ripple current of inductor is limited to $0.6 A$. Determine (a) the duty cycle α , (b) the Filter Inductor L , and (c) the filter capacitor C . 10
6. (a) Explain in detail with circuit diagram and waveforms, single phase cycloconverter. 10
- (b) Explain with circuit diagram and waveform the working of single-phase bidirectional phase control type AC voltage controller connected to RL load. 10

QP CODE : 584301

(3 Hours)

[Total Marks: 80]

- N.B: (1) Question No.1 is compulsory.
 (2) Answer any three from remaining five questions.
 (3) Figures to the right indicate full marks.
 (4) Assume the data if it is necessary.

- 1 Attempt any four of the following. (5*4)
- (a) What is Entropy of an information source. When is Entropy maximum.
 (b) Define Code rate, Hamming weight, Hamming distance. Also explain the role of ' d_{min} ' in determining the Error in a code word.
 (c) Differentiate between Analog communication and Digital communication.
 (d) Explain how Power and Bandwidth saving is achieved using SSB system.
 (e) Draw PCM Transmitter and Receiver.
 (f) Explain the role of AGC and Ganged tuning in AM reception.
- 2 (a) Explain Medium power AM modulator circuit with its waveform. 20
 (b) Explain FET Reactance modulator for FM generation
- 3 20
 (a) Explain Delta modulation transmitter and receiver with the help of neat block diagram. Also explain Slope overload distortion and Granular noise.
 (b) The voice signal in a PCM system is quantised in 16 levels with the following probabilities.
 $P_1=P_2=P_3=P_4=0.1$, $P_5=P_6=P_7=P_8=0.05$,
 $P_9=P_{10}=P_{11}=P_{12}=0.075$, $P_{13}=P_{14}=P_{15}=P_{16}=0.025$. Calculate the Entropy and information rate. Assume $f_m=3\text{khz}$
- 4 (a) Draw and Explain the Balance slope detection circuit. Also explain the Distortions in it. 20
 (b) Explain regarding DPSK (i) Transmission (ii) Reception (iii) waveform for data bit sequence $b(t) = 1011001$. Also plot frequency spectrum.

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- 5 An error control code has the following parity check matrix 20

$$H = \begin{bmatrix} 101100 \\ 110010 \\ 011001 \end{bmatrix}$$

- 1) Determine the generator matrix(G)
- 2) Find the code word that begin with 101
- 3) Decode the received code word 110110. Comment on the error detection capability of the code.

(b) Draw the TRF receiver and give disadvantages of TRF receiver. Also explain Superhetrodyne receiver

- 6 Write short notes on (any two) 20

Optical Fiber Communication

Pre-Emphasis and De-Emphasis.

Advantages of Digital Communication Systems
