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Periyanaickenpalayam, Coimbatore – 641020

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

QUESTION BANK

II YEAR

EVEN SEMESTER

ACADEMIC YEAR 2024 – 2025

INDEX

HEAD OF THE DEPARTMENT

ACOE **PRINCIPAL** **CHAIRMAN**

EC3452

ELECTROMAGNETIC FIELDS

UNIT I

INTRODUCTION

Electromagnetic model, Units and constants, Review of vector algebra, Rectangular, cylindrical and spherical coordinate systems, Line, surface and volume integrals, Gradient of a scalar field, Divergence of a vector field, Divergence theorem, Curl of a vector field, Stoke's theorem, Null identities, Helmholtz's theorem, Verify theorems for different path, surface and volume.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	Define divergence and curl of a vector field.	1	1	2
2.	What is the physical significance of gradient?	1	2	2
3.	State and explain the Divergence theorem.	1	1	2
4.	What are null identities?	1	1	2
5.	Define the Helmholtz theorem.	1	1	2
6.	What are the different coordinate systems used in EMF?	1	2	2
7.	Write the mathematical expression for Stoke’s theorem.	1	1	2
8.	What is line, surface, and volume integrals?	1	2	2
	PART B			
1.	Explain in detail the different coordinate systems used in electromagnetic fields with examples.	1	2	16
2.	Derive and explain the Divergence theorem and Stoke’s theorem with proof.	1	4	16
3.	Explain the concept of gradient, divergence, and curl of a vector field with applications.	1	3	16
4.	Prove Helmholtz's theorem and verify the theorems for different paths, surfaces, and volumes.	1	5	16

UNIT II

ELECTROSTATICS

Electric field, Coulomb's law, Gauss's law and applications, Electric potential, Conductors in static electric field, Dielectrics in static electric field, Electric flux density and dielectric constant, Boundary conditions, Electrostatics boundary value problems, Capacitance, Parallel, cylindrical and spherical capacitors, Electrostatic energy, Poisson's and Laplace's equations, Uniqueness of electrostatic solutions, Current density and Ohm's law, Electromotive force and

Kirchhoff's voltage law, Equation of continuity and Kirchhoff's current law

Q.No	Question	CO	BTL	Marks
	PART A			
1.	State Coulomb's law and its significance.	2	1	2
2.	Define electric flux density and dielectric constant.	2	1	2
3.	What are the boundary conditions for electric fields?	2	2	2
4.	Define capacitance and write the expression for parallel plate capacitance.	2	1	2
5.	What is Poisson's equation and Laplace's equation?	2	2	2
6.	State and explain Gauss's law.	2	1	2
7.	Define electrostatic energy.	2	1	2
8.	What is the uniqueness theorem in electrostatics?	2	2	2
	PART B			
1.	Derive Poisson's and Laplace's equations and discuss their applications in electrostatics.	2	2	16
2.	Explain the concept of electric potential and derive the expressions for capacitance in parallel plate, cylindrical, and spherical capacitors.	2	2	16
3.	Derive the boundary conditions for electrostatic fields and explain their significance.	2	2	16
4.	Explain the concept of electrostatic energy and derive an expression for stored energy in an electric field.	2	2	16

UNIT III

MAGNETOSTATICS

Lorentz force equation, Ampere's law, Vector magnetic potential, Biot-Savart law and applications, Magnetic field intensity and idea of relative permeability, Calculation of magnetic field intensity for various current distributions Magnetic circuits, Behaviour of magnetic materials, Boundary conditions, Inductance and inductors, Magnetic energy, Magnetic forces and torques

Q.No	Question	CO	BTL	Marks
	PART A			
1.	Define Lorentz force and write its equation.	3	1	2

2.	What is the Biot-Savart law?.	3	1	2
3.	State Ampere's Circuital law and its applications	3	1	2
4.	What is vector magnetic potential?	3	1	2
5.	Define inductance and write the formula for self-inductance	3	1	2
6.	What are magnetic boundary conditions?	3	2	2
7.	Differentiate between electric and magnetic fields.	3	2	2
8.	What is the physical significance of permeability?	3	2	2

PART B

1.	Derive and explain Ampere's Circuital law and Biot-Savart law with applications.	3	2	16
2.	Explain the behaviour of different magnetic materials and their boundary conditions.	3	2	16
3.	Explain the concept of inductance and derive an expression for the inductance of different geometries.	3	2	16
4.	Derive the expression for magnetic energy and explain its physical significance.	3	2	16

UNIT IV

TIME-VARYING FIELDS AND MAXWELL'S EQUATIONS

Faraday's law, Displacement current and Maxwell-Ampere law, Maxwell's equations, Potential functions, Electromagnetic boundary conditions, Wave equations and solutions, Time-harmonic fields, Observing the Phenomenon of wave propagation with the aid of Maxwell's equations

Q.No	Question	CO	BTL	Marks

PART A

1.	State Faraday's law of electromagnetic induction.	4	1	2
2.	What is displacement current?	4	1	2
3.	Write Maxwell's equations in differential form.	4	1	2
4.	Define potential functions in electromagnetic fields.	4	2	2
5.	What are electromagnetic boundary conditions?	4	2	2
6.	State Maxwell's Ampere law.	4	1	2

7.	What is the significance of the wave equation?	4	2	2
8.	Define time-harmonic fields.	4	1	2

PART B

1.	Derive Maxwell's equations and explain their physical significance.	4	2	16
2.	Explain the concept of displacement current and how it leads to the modification of Ampere's law.	4	2	16
3.	Explain the formation of the wave equation and derive its solution for different field components.	4	2	16
4.	Discuss the phenomenon of wave propagation using Maxwell's equations with examples.	4	2	16

UNIT V

PLANE ELECTROMAGNETIC WAVES

Plane waves in lossless media, Plane waves in lossy media (low-loss dielectrics and good conductors), Group velocity, Electromagnetic power flow and Poynting vector, Normal incidence at a plane conducting boundary, Normal incidence at a plane dielectric boundary

Q.No	Question	CO	BTL	Marks

PART A

1.	Define plane waves and their characteristics.	5	1	2
2.	Differentiate between lossless and lossy media.	5	2	2
3.	What is the significance of the Poynting vector?	5	2	2
4.	Define group velocity and its importance in wave propagation.	5	1	2
5.	Explain the concept of normal incidence at a plane dielectric boundary.	5	2	2
6.	What is meant by wave attenuation in lossy media?	5	2	2
7.	What is meant by good conductor approximation?	5	1	2
8.	Write the equation for electromagnetic power flow.	5	1	2

PART B

1.	Explain the behaviour of plane waves in lossless and lossy media with necessary equations.	5	2	16
2.	Derive the Poynting theorem and explain its significance in energy transfer.	5	2	16

3.	Discuss the concept of normal incidence at a plane conducting boundary and dielectric boundary.	5	2	16
4.	Explain the concept of electromagnetic power flow and group velocity with examples.	5	2	16

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EC3401

NETWORKS AND SECURITY

UNIT I

NETWORK MODELS AND DATALINK LAYER

Overview of Networks and its Attributes – Network Models – OSI, TCP/IP, Addressing – Introduction to Data link Layer – Error Detection and Correction – Ethernet (802.3)- Wireless LAN – IEEE 802.11, Bluetooth – Flow and Error Control Protocols – HDLC – PPP

Q.No	Question	CO	BTL	Marks
	PART A			
1.	Compare between point-to-point and multipoint connections in network.	1	2	2
2.	How can you represent the number – 6 in one's complement arithmetic using only four bits?	1	1	2
3.	State the purpose of layering in networks.	1	1	2
4.	List out the issues in data link layer.	1	1	2
5.	If the data link layer can detect the errors between hops, why do you think we need another checking mechanism at the transport layer?	1	2	2
6.	Write a note on IEEE 802.11.	1	1	2
7.	Define hamming distance.	1	1	2
8.	What do you mean by error detection and error control?	1	1	2
	PART B			
1.	Explain in detail about the seven layers of the OSI – architecture model with neat diagram.	1	2	16
2.	(i) Explain in detail about TCP / IP network models. (ii) Explain in detail about the various addresses in a TCP / IP.	1	2	8 8
3.	(i) Describe the basic concepts of error detection and error correction. (ii) Outline the working principle of Bluetooth Technology.	1	2	8 8
4.	Explain in detail about: (i)HDLC (ii)PPP	1	2	16

UNIT II

NETWORK LAYER PROTOCOLS

Network Layer – IPv4 Addressing – Network Layer Protocols (IP, ICMP and Mobile IP) Unicast and Multicast Routing – Intra domain and Inter domain Routing Protocols – IPv6 Addresses – IPv6 –Datagram Format – Transition from IPv4 to IPv6.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	What is the difference between the delivery of a frame in the data link layer and the delivery of a packet in the network layer?	2	1	2
2.	Compare Interdomain and Intradomain routing protocols.	2	2	2
3.	Give an IPv6 datagram format.	2	1	2
4.	Differentiate between IPv4 addresses and IPv6 addresses.	2	2	2
5.	Compare unicast, multicast and broadcast routing.	2	2	2
6.	Define fragmentation.	2	1	2
7.	What are DHCP and ICMP?	2	1	2
8.	What is the major drawback of IPv4 in terms of security? How it is rectified?	2	1	2
	PART B			
1.	(i) Summarize the basic principles of network protocols. (ii) Write short notes on : (a) DHCP (b) ICMP	2	2	8 8
2.	An IPv4 datagram has arrived with the following information in the header (in hexadecimal): O x 45 00 00 54 00 03 58 50 20 06 00 00 7C 4E 03 02 B4 OE OF 02 (a) Is the packet corrupted? (b) Is the packet fragmented? (c) What is the size of the data? (d) How many more routers can be packet travel to? (e) What is the identification number of the packet? (f) What is the type of service?	2	4	16
3.	Explain in detail the various aspects of IPv6 and transition from IPv4 and IPv6.	2	2	16
4.	Illustrate IPv6 datagram packet format with neat diagram.	2	2	16

UNIT III

TRANSPORT AND APPLICATION LAYERS

Transport Layer Protocols – UDP and TCP Connection and State Transition Diagram - Congestion Control and Avoidance (DEC bit, RED) - QoS – Application Layer Paradigms – Client – Server Programming – Domain Name System – World Wide Web, HTTP, and Electronic Mail.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	What are the advantages of using UDP over TCP?	3	1	2
2.	Differentiate between connectionless and connection oriented service.	3	2	2
3.	What are the techniques to improve QoS?	3	1	2
4.	Why do we need a DNS system when we can directly use an IP address?	3	1	2
5.	What is SMTP and HTTP?	3	1	2
6.	What is the difference between a User Agent (UA) and Mail Transfer Agent (MTA)?	3	1	2
7.	Define fast retransmit and fast recovery.	3	1	2
8.	Differentiate between delay and jitter.	3	2	2
	PART B			
1.	Illustrate the basic concept of congestion control and avoidance.	3	2	16
2.	Explain in detail about User Datagram Protocol (UDP) with neat diagram.	3	2	16
3.	Explain in depth about WWW and HTTP protocol.	3	2	16
4.	(i) Exemplify in detail about Domain Name System. (ii) Explain in detail about client server programming.	3	2	8 8

UNIT IV

NETWORK SECURITY

OSI Security Architecture – Attacks – Security Services and Mechanisms – Encryption – Advanced Encryption Standard – Public Key Cryptosystems – RSA Algorithm – Hash Functions – Secure Hash Algorithm – Digital Signature Algorithm.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	Define weak collision property of a hash function.	4	1	2
2.	What are the types of attacks on encrypted messages?	4	1	2
3.	Why is the Caesar cipher substitution technique vulnerable to a brute-force cryptanalysis?	4	1	2

4.	List the security services in network.	4	1	2
5.	What are security service and its categories?	4	1	2
6.	Which type of algorithms does a digital signature consist of?	4	1	2
7.	Define the terms threat and attack.	4	1	2
8.	What is digital signature and it uses?	4	1	2

PART B

1.	Explain in detail about OSI security architecture model with diagram.	4	2	16
2.	Write down the RSA algorithm and illustrate with an example.	4	2	16
3.	Explain the working nature of Secure Hash Algorithm (SHA).	4	2	16
4.	Exemplify in detail about Advanced Encryption Standards (AES).	4	2	16

UNIT V

HARDWARE SECURITY

Introduction to hardware security, Hardware Trojans, Side – Channel Attacks – Physical Attacks and Counter measures – Design for Security. Introduction to Block-chain Technology

Q.No	Question	CO	BTL	Marks

PART A

1.	What are the types of hardware Trojans?	5	1	2
2.	Who are the potential adversaries to implant a hardware Trojan?	5	1	2
3.	What is probe attack in network security?	5	1	2
4.	Differentiate between a virus and Trojan.	5	2	2
5.	What is KYC in block-chain?	5	1	2
6.	How potential vulnerabilities can be introduced by design flaws?	5	1	2
7.	Define non-invasive and invasive attacks.	5	1	2
8.	What are side channel attacks?	5	1	2

PART B

1.	Explain in detail about hardware security.	5	2	16
2.	Explain the basic principle of channel attacks and explain various attacks.	5	2	16
3.	Explain in detail about block chain technology and its features.	5	2	16
4.	The RSA-T 100 Trojan is triggered when a 32-bit specific plaintext is applied. Calculate the probability of triggering this Trojan if one uses random patterns as plaintext.	5	4	16

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EC3451

LINEAR INTEGRATED CIRCUITS

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UNIT I

BASICS OF OPERATIONAL AMPLIFIERS

Current mirror and current sources, Current sources as active loads, Voltage sources, Voltage References, BJT Differential amplifier with active loads, Basic information about op-amps – Ideal Operational Amplifier - General operational amplifier stages -and internal circuit diagrams of IC 741, DC and AC performance characteristics, slew rate, Open and closed loop configurations – MOSFET Operational Amplifiers – LF155 and TL082.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	Draw the equivalent circuit of OP amp	1	1	2
2.	Define slew rate .what causes the slew rate?Mention significant of slew rate.	1	1	2
3.	Compare open loop and closed loop operation of an operational amplifier.	1	1	2
4.	Why IC 741 is not used for high frequency applications?	1	1	2
5.	What is the advantage of Widlar current source over constant current source?	1	1	2
6.	Define CMRR. A Differential amplifier has a differential voltage gain of 2000 and a common mode gain of 0.2. Determine the CMRR in db.	1	1	2
7.	Mention the application of LF155.	1	1	2
8.	Define (a) Thermal Drift (b) Roll off and Bandwidth (c) Corner frequency and unity gain bandwidth.	1	1	2
	PART B			
1.	Explain different parameters of DC and AC characteristics of an OP amp.	1	4	16
2.	(i) Explain the methods for increasing the input resistance of an op amp (ii) An op amp has a slew rate of 2V/ µ s. Find the rise time, maximum frequency and full power bandwidth for an output of voltage lOV amplitude.	1	4	16
3.	Construct the BJT differential amplifier with active load and Discuss its operating principle.	1	2	16
4.	Discuss about LF155 MOSFET operational amplifier.	1	2	16

UNIT II

UNIT II

APPLICATIONS OF OPERATIONAL AMPLIFIERS

Sign Changer, Scale Changer, Phase Shift Circuits, Voltage Follower, V-to-I and I-to-V converters, adder, subtractor, Instrumentation amplifier, Integrator, Differentiator, Logarithmic amplifier, Antilogarithmic amplifier, Comparators, Schmitt trigger, Precision rectifier, peak detector, clipper and clamper, Low-pass, high-pass and band-pass Butterworth filters.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	Sketch the circuit of current to voltage converter using Opamp	2	1	2
2.	What is the output of sign changer circuit?	2	1	2
3.	Draw the diagram of OPAMP as integrator and differentiator.	2	1	2
4.	How does a precision rectifier differ from an ordinary rectifier?	2	1	2
5.	Write down the applications of precision diode.	2	1	2
6.	Mention the limitations of the basic differentiator circuit.	2	1	2
7.	Draw the circuit of clipper using op-amp.	2	1	2
8.	Give the schematic of Op-amp based voltage to current to converter.	2	1	2
	PART B			
1.	(i)Draw the circuit of integrator using op-amp and explain.	2	4	8
	(ii) Explain the operation of a differential amplifier with neat sketch.	2	4	8
2.	What is the difference between clipper and clamper? Explain the circuit operations for positive clipping, negative :clipping, positive clamping and negative clamping using op-amp.	2	4	16
3.	Analyze the first order Low pass and High pass Butterworth filter and derive its voltage gain	2	4	16
4.	With a suitable circuit diagram, explain the operating principle of an instrumentation amplifier and derive its gain.	2	4	16

UNIT III
ANALOG MULTIPLIER AND PLL

Analog Multiplier using Emitter Coupled Transistor Pair - Gilbert Multiplier cell – Variable transconductance technique, analog multiplier ICs and their applications, Operation of the basic PLL, Closed loop analysis, Voltage controlled oscillator, Monolithic PLL IC 565, application of PLL for AM detection, FM detection, FSK modulation and demodulation and Frequency synthesizing and clock synchronization

Q.No	Question	CO	BTL	Marks
	PART A			
1.	Define Capture range and Lock range of PLL.	3	1	2
2.	Draw the circuit diagram of AM detector using PLL.	3	1	2
3.	List analog multiplier IC's.	3	1	2
4.	Draw the pin diagram of IC565.	3	1	2
5.	What is a compander IC? Give some examples.	3	1	2
6.	What is the need for frequency synthesizer	3	1	2
7.	Mention two applications of analog multiplier	3	1	2
8.	What is Gilbert Multiplier Cell?	3	1	2
	PART B			
1.	Illustrate the operation of VCO with neat block diagram .also derive expression for f_0. Also give the pin details of IC565.	3	3	16
2.	Illustrate in detail about the various ways in which frequency synthesizers can be made from phase locked loops. Also discuss their applications.	3	3	16
3.	Explain about analog multiplier IC's with one application.	3	4	16
4.	Determine the change in DC Control voltage V_c during lock, if input signal frequency, f_s = 20 KHz, the free running frequency is 21 KHz and the V/F transfer Coefficient of VCO is 4 KHz	3	4	16

UNIT IV

ANALOG TO DIGITAL AND DIGITAL TO ANALOG CONVERTERS

Analog and Digital Data Conversions, D/A converter – specifications - weighted resistor type, R-2R Ladder type, Voltage Mode and Current-Mode R - 2R Ladder types - switches for D/A converters, high speed sample-and-hold circuits, A/D Converters – specifications - Flash type - Successive Approximation type - Single Slope type – Dual Slope type - A/D Converter using Voltage-to-Time Conversion - Over-sampling A/D Converters, Sigma – Delta converters.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	Calculate the values of LSB and MSB for an 8-bit DAC for 0V to 10V range.	4	1	2
2.	Which is the fastest ADC and why?	4	1	2
3.	Why inverted R-2R DAC is preferred than R-2R DAC?	4	1	2
4.	What are the specifications of digital to analog Converter?	4	1	2
5.	Define resolution of a data c Converter.	4	1	2
6.	What is a sample/hold circuit? Draw its circuit.	4	1	2
7.	What would be produced by a DAC whose output range is 0-10V and whose input binary number is 10111100(for a 8 bit DAC).	4	2	2
8.	Estimate the conversion time of a 10 bit successive approximation Analog to Digital Converter, if the input clock is 5 MHz.	4	2	2
	PART B			
1.	Construct the functional diagram of the dual slope ADC and explain with its integrated output waveform. Also compare dual slope ADC with successive approximation ADC.	4	3	16
2.	Calculate the step change in output voltage on input varying from 0000 to 1111 for a 4-bit R-2R ladder DAO Converter. Assume the full scale voltage is 16 V .	4	4	16
3.	Draw the circuit of 4-bit binary weighted resistor DAC and explain with its input output timing diagram.	4	4	16
4.	With block diagram, explain the working of Dual Slope ADC and Successive Approximation ADC.	4	3	16

UNIT V

WAVEFORM GENERATORS AND SPECIAL FUNCTION ICS

Sine-wave generators, Multivibrators and Triangular wave generator, Saw-tooth wave generator, ICL8038 function generator, Timer IC 555, IC Voltage regulators – Three terminal fixed and adjustable voltage regulators - IC 723 general purpose regulator - Monolithic switching regulator, Low Drop – Out(LDO) Regulators - Switched capacitor filter IC MF10, Frequency to Voltage and Voltage to Frequency converters, Audio Power amplifier, Video Amplifier, Isolation Amplifier, Opto- couplers and fibre optic IC

Q.No	Question	CO	BTL	Marks
	PART A			
1.	Mention the features of isolation amplifier.	5	1	2
2.	State the applications of multi vibrator.	5	1	2
3.	How current boosting is done in voltage regulator?	5	1	2
4.	Sketch the circuit of sine wave generator.	5	1	2
5.	What are limitations of IC723 general purpose regulator?	5	1	2
6.	List the merits of IC voltage regulators.	5	1	2
7.	Define slope overload noise and granular noise.	5	1	2
8.	What are opto couplers? Mention its applications.	5	1	2
	PART B			
1.	Sketch the circuit of monostable multivibrator and explain. Also derive the expression for time period.	5	3	16
2.	Describe the internal functional block diagram of IC723 Voltage Regulator. Also explain how positive voltage is provided by IC723 with appropriate circuit.	5	2	16
3.	What are the types of voltage regulators? Discuss the operation of fixed and adjustable voltage regulators.	5	2	16
4.	With neat circuit diagram explain the operation of frequency to voltage and voltage to frequency converter using op amp.	5	3	16

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EC3492

DIGITAL SIGNAL PROCESSING

UNIT I

DISCRETE FOURIER TRANSFORM

Sampling Theorem, concept of frequency in discrete-time signals, summary of analysis & synthesis equations for FT & DTFT, frequency domain sampling, Discrete Fourier transform (DFT) - deriving DFT from DTFT, properties of DFT - periodicity, symmetry, circular convolution. Linear filtering using DFT. Filtering long data sequences - overlap save and overlap add method. Fast computation of DFT - Radix-2 Decimation-in-time (DIT) Fast Fourier transform (FFT), Decimation-in-frequency (DIF) Fast Fourier transform (FFT). Linear filtering using FFT

Q.No	Question	CO	BTL	Marks
	PART A			
1.	State Sampling theorem.	1	1	2
2.	What is twiddle factor? Find the twiddle factor for an 8 point DFT.	1	1	2
3.	What is zero padding? What is the purpose of it?	1	1	2
4.	What is meant by bit reversal and In Place Computation as applied to FFT.	1	1	2
5.	Find the circular convolution of x(n)={1,2,5,6} ; h (n)={1 ,0, -1,-2}.	1	1	2
6.	Prove circular time shift property of DFT.	1	2	2
7.	What is the relation between DTFT and DFT?	1	1	2
8.	What are the applications of FFT algorithms?	1	1	2
	PART B			
1.	Compute the eight point DFT of the sequence (i) x(n)={1 ,1,1,1,1,1,0,0} DIF FFT algorithm. (ii) x (n)=Cos(nΠ/4) where n =0,1,2,...7 use DIT FFT algorithm.	1	3	16
2.	Find the eight point IDFT using the DIT algorithm for the following input (i) $X(k) = \{20, -5.828 - j2.279, 0, -0.172 - j0.279, 0, -0.172 + j0.279, 0, -5.828 + j2.279\}$. (or) Two finite duration sequence are given by x(n)=sin(nΠ/2) for n=0,1,2,3 ;h(n)=2n for n=0,1,2,3.Find the circular convolution using DFT&IDFT method.	1	1	16

	(ii) Find the circular convolution of the three point sequences x(n)={1,3,-4} and h(n)={-2,1,2}			
3.	Construct the Butterfly diagram of the 8 point radix 2 DIT&DIF FFT algorithm and fully label it. (or) Draw radix 4butterfly structure for(DIT)FFT,and (DIF)FFT algorithm.	1	3	16
4.	State and explain any eight properties of DFT.	1	1	16

UNIT II
INFINITE IMPULSE RESPONSE FILTERS

Characteristics of practical frequency selective filters. characteristics of commonly used analog filters - Butterworth filters, Chebyshev filters. Design of IIR filters from analog filters (LPF, HPF, BPF, BRF) - Approximation of derivatives, Impulse invariance method, Bilinear transformation. Frequency transformation in the analog domain. Structure of IIR filter - direct form I, direct form II, Cascade, parallel realizations.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	What are the important features of the IIR filters?	2	1	2
2.	Give the expression for location of poles of a Chebyshev type 1 filter.	2	2	2
3.	Write Significance of impulse invariant method**.**	2	1	2
4.	What is bilinear transformation?	2	1	2
5.	What are the requirements for converting a stable analog filter into a stable Digital filter?	2	1	2
6.	What are the advantages of Cascade realization?	2	1	2
7.	List the properties of Butterworth filter.	2	1	2
8.	What is known as warping effect? Discuss the need for prewarping?	2	1	2
	PART B			
1.	Explain the steps involved in design if IIR filter using bilinear transformation.	2	2	16
2.	Obtain the direct form I, direct form II, cascade and parallel form realization for the system y(n)=-0.1y(n-1)+0.2y(n-2)+3x(n)+3.6x(n-1)+0.6x(n-2) .	2	3	16
3.	(i)Design a low pass Butterworth IIR filter for the following specifications: Passband edge frequency: 1000 Hz	2	3	16

Stopband edge frequency: 3000 Hz
Passbandripple:2 dB
Stopband ripple: 20 dBs. Assume a sampling frequency is 8kHz and use the bilinear transformation.

(ii)Using the bilinear transform design a high pass filter, monotonic in pass band with cut-off frequency of 1000 Hz and down 10 Db at 350 Hz.The sampling frequency is 5000Hz.

4.	Design a Butterworth filter using Impulse invariant method for the following specifications: (i) $0.8 \le \left\|H\left(e^{j\omega}\right)\right\| \le 1 \qquad 0 \le \omega \le 0.2\,\pi$ $\left\|H\left(e^{jw}\right)\right\| \le 0.2 \qquad 0.6\,\pi \le \omega \le \pi$ (or) Design an analog Butterworth filter that has $\alpha_p = 0.5dB,\ \alpha_s = 22dB,$ $f_p = 10kHz$ and $f_s = 25kHz$.	2	3	16
	(ii)Discuss the properties of Butterworth and Chebyshev filter.	2	2	16

UNIT III

FINITE IMPULSE RESPONSE FILTERS

Design of FIR filters - symmetric and Anti-symmetric FIR filters - design of linear phase FIR filters using Fourier series method - FIR filter design using windows (Rectangular, Hamming and Hanning window), Frequency sampling method. FIR filter structures - linear phase structure, direct form realizations

Q.No	Question	CO	BTL	Marks
	PART A			
1.	State Gibbs phenomenon.	3	1	2
2.	Compare Hamming window with Blackman window. Why window techniques needed for FIR filter design.	3	2	2
3.	Mention the design techniques for FIR filters. What are the advantages and disadvantages of FIR filters?	3	2	2
4.	What is the condition for linear phase of a digital filter?	3	1	2

What are the possible types of impulse response for linear phase FIR filter?

5.	Obtain cascade realization with minimum number of multipliers. $H(z)=\frac{1}{2}+\frac{1}{4}z^{-1}+\frac{1}{4}z^{-2}+\frac{1}{2}z^{-3}$	3	2	2
6.	State the effect of having abrupt discontinuity in frequency response of FIR filters.	3	1	2
7.	Draw the Direct form implementation of the FIR system having difference equation. Y(n)=x(n)-2x(n-1)+3x(n-2)-10x(n-6)	3	3	2
8.	What are the features of FIR filter design using the KAISER'S approach.	3	1	2

PART B

1.	(i)Design an ideal high pass filter using Hanning window with a frequency response. $H_d(e^{jw})=\{1;\ \pi/4\leq\|w\|\leq\pi\ \ \&\ 0;\ \|w\|\leq\pi/4$.assume N=11.	3	3	16
	Design an ideal low pass filter with a frequency response $H_d(e^{j\omega})=1\ for\ \frac{-\pi}{2}\leq\omega\leq\frac{\pi}{2}$ $H_d(e^{j\omega})=0\ for\ \frac{\pi}{2}\leq\|\omega\|\leq\pi$ Find the values of h (n) when N=7.			16
	(ii) Construct a digital FIR BPF with lower cut of frequency 2000Hz and upper cut of frequency 3200 Hz using Hamming window where N=7 ,sampling rate 1000 Hz. Discuss in detail about FIR filter design using windows.			
2.	Design a linear phase FIR filter with a cut off frequency of $\pi/2$ r/sec. Take N=17 using frequnecy sampling techniques.	3	3	16
3.	The desired impulse response of a certain FIR low pass filter is given by $H(f)=1\ \ for\ \ 0\leq f\leq 1\ kHz$ $=0\ \ for\ f>1\ kHz$ For a sampling rate of 10kHz and impulse response of 1ms duration. Compute the impulse response of the FIR filter	3	2	16
4.	(i) Realize an FIR system mentioned below : $y(n)+2y(n-1)+3y(n-2)=4x(n)+5x(n-1)+6x(n-2)$ Using the transposed form structure.	3	2	16
	(ii)Find the output noise power in the direct form I and II			

realizations of the transfer function

$$H(z)=\frac{Y(z)}{X(z)}=\frac{0.6}{(1-0.9z^{-1})(1-0.8z^{-1})}$$ 3 2 16

UNIT IV

FINITE WORD LENGTH EFFECTS

Fixed point and floating point number representation - ADC - quantization - truncation and rounding - quantization noise - input / output quantization - coefficient quantization error - product quantization error - overflow error - limit cycle oscillations due to product quantization and summation - scaling to prevent overflow.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	What are the errors that arise due to truncation in floating point numbers?	4	1	2
2.	What is product round off noise?	4	1	2
3.	What do you mean by limit cycle oscillation in digital filter? What are the two kinds of limit cycle behaviour in DSP?	4	1	2
4.	What is the effect of Quantization? Draw the quantization noise model for a first order system.	4	1	2
5.	Define the terms i)dead band.(ii)scaling (iii)truncation	4	1	2
6.	What is the need of anti-aliasing filter?	4	1	2
7.	Compare fixed point and floating point arithmetic.	4	2	2
8.	What are the methods used to prevent overflow?	4	1	2
	PART B			
1.	(i)Determine the variance of the noise in the output due to the quantization of the input for the first order filter. Y(n)=c y(n-1)+x(n),0<|c|<1 (ii)Find the steady state variance of the noise in the output due to quantization of input for the first order filter $y(n)=ay(n-1)+x(n)$	4	5	16

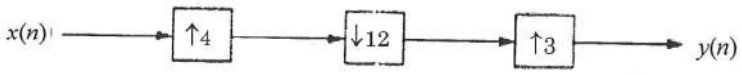
2.	Consider the following function. (i) $H(z)=\frac{1}{(1-0.943z^{-1})(1-0.902z^{-1})}$ (cascade form) $=\frac{1}{1-1.845z^{-1}+0.850586z^{-2}}$ (direct form) If the coefficients are quantized by truncation or rounding so that they can be expressed in six bit binary form in which two bits are used to represent integers (including the sign bit)and four bits to represent fractions, Find the pole positions for the cascade and direct forms with quantized coefficients. (ii)Consider the following second order IIR filter H (z), Find the effect of quantization on pole locations of the given system function in direct form and in cascade form. Take b=3 bits $H(z)=\frac{1}{(1-0.5z^{-1})(1-0.45z^{-1})}$	4	1	16
3.	(i)Write in detail about Finite word length Effects. (ii)Give the effect of quantization noise in signal processing and also mention input/output quantization.	4	2	16
4.	Explain the characteristics of limit cycle oscillation with respect to the system described by the difference equation:y(n)=0.95y(n-1)+x(n). Determine the dead band.	4	2	16

UNIT V

DSP APPLICATIONS

Multirate signal processing: Decimation, Interpolation, Sampling rate conversion by a rational factor – Adaptive Filters: Introduction, Applications of adaptive filtering to equalization- DSP Architecture- Fixed and Floating point architecture principles

Q.No	Question	CO	BTL	Marks
	PART A			
1.	Define sub band coding.	5	1	2
2.	Define decimator and interpolator.	5	1	2
3.	What is echo cancellation?	5	1	2
4.	What is the need for anti –aliasing and anti-imaging filters in down sampling and Up-sampling of a signal respectively?	5	1	2
5.	Define adaptive filtering. What is the use of adaptive filters?	5	1	2

6.	Define sampling rate conversion. Define multi sampling rate.	5	1	2
7.	What is the use of a TDM serial port?	5	1	2
8.	For the multi rate systems shown in the figure below, develop an expression for the output y (n) as a function of the input x (n). 	5	2	2

PART B

1.	Discuss sampling rate conversion by rational factor. (or) Find the representation for the spectrum of a down sampled signal.	5	6	16
2.	Explain in detail about DSP architecture. (or) Explain the architecture of TMS320 C50	5	2	16
3.	Discuss the features of adaptive filters and any two applications of adaptive filters.	5	6	16
4.	Discuss the poly phase structure of interpolator and decimator.	5	6	16

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EC3491

COMMUNICATION SYSTEMS

UNIT I

AMPLIUDE MODULATION

Review of signals and systems, Time and Frequency domain representation of signals, Principles of Amplitude Modulation Systems- DSB, SSB and VSB modulations. Angle Modulation, Representation of FM and PM signals, Spectral characteristics of angle modulated signals. SSB Generation – Filter and Phase Shift Methods, VSB Generation – Filter Method, Hilbert Transform, Pre-envelope & complex envelope AM techniques, Superheterodyne Receiver.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	Define super heterodyne receiver and give a brief on its characteristics	1	1	2
2.	What is modulation?	1	1	2
3.	What is the Hilbert transform of an impulse function, $\delta(t)$?	1	1	2
4.	Define the term modulation index for AM.	1	1	2
5.	What is the need for modulation?	1	1	2
6.	What is the limitation of a Square Law Demodulator for amplitude demodulation?	1	1	2
7.	State Carsons rule	1	1	2
8.	Problems (each 2 marks) (i) A 500 W carrier is modulated to a depth of 60%.Determine the percentage of Power saved in DSB-SC compared to conventional AM. (ii) Find the frequency deviation Δf and bandwidth using Carson's rule ,for the FM signal s(t)=100cos[2Π*500t+3sin(2Π*200t)] (iii) In DSB-SC AM system the message signal is given by m(t)=sin(50t) and modulates carrier signal is given by c(t)=2cos(1000t).Plot the spectrum of the modulated signal y(t)	1	2	2
	PART B			
1.	**AM** (i) With suitable block diagram and equations how will you generate and detect: DSBSC,SSB-SC and VSB signals. (ii)Derive the mathematical expressions for DSB,DSB-SC and SSB-SC modulated signals (iii)Elaborate on Pre-envelope and Complex envelope of Modulation technique (iv)State and Illustrate Hibert Transform and prove its properties	1	2	16

	(v) Compare the characteristics of DSBFC, DSBSC, SSBSC, VSB schemes.			
2.	Explain Super heterodyne receiver and its advantages over Tuned Radio Frequency receivers	1	2	16
3.	**FM and PM** Explain in detail about generation and deduction of FM and PM with necessary equation. Compare AM,FM and PM	1	2	16
4.	Problems a)An AM signal is given by the following expression: $s(t)=[20+12\cos(\Pi*10^4t)+16\cos(2\pi*10^4t)].\cos(2\Pi*10^6t)$ .Find the following: (i) modulation index, (ii) bandwidth, (iii) total power, (iv) sideband power, (v)modulation efficiency. Also, plot its spectrum. b) A sinusoidal carrier of 20 volts, 5 MHz is frequency modulated by a message signal of 10 volts, 25 kHz, with a frequency sensitivity of 12.5 kHz/volt. (i)Find the maximum frequency deviation, modulation index, bandwidth, and normalized power. (ii)What happens to the above parameters if the message signal amplitude is doubled? (c)Calculate Hilbert transform of the function $f(t)=\cos(\omega_1t+\sin\omega_2t)$ Find the Hilbert transform of the function $g(t)=m(t)\sin(2\Pi f_ct)$. given that $m(t)\leftrightarrow M(f)$	1	3	16

UNIT II
RANDOM PROCESS & SAMPLING

Review of probability and random process. Gaussian and white noise characteristics, Noise in amplitude modulation systems, Noise in Frequency modulation systems. Pre-emphasis and De- emphasis, Threshold effect in angle modulation. Low pass sampling – Aliasing- Signal Reconstruction-Quantization - Uniform & non-uniform quantization - quantization noise - Nyquist criterion- Logarithmic Companding –PAM, PPM, PWM, PCM – TDM, FDM

Q.No	Question	CO	BTL	Marks
	PART A			
1.	What is PAM, PPM and PWM?	2	1	2

2.	Define Sampling theorem. State the significance of Sampling theorem	2	1	2
3.	Elucidate aliasing effect and elaborate the remedies to control it	2	1	2
4.	Explain the term white noise and additive white Gausian noise (AWGN)	2	1	2
5.	What is the use of Compander?	2	1	2
6.	State threshold effect in AM .	2	1	2
7.	Compare uniform & non uniform quantization.	2	2	2
8.	What are Time Division Multiplexing and Frequency Division Multiplexing?	2	1	2

PART B

1.	Draw and explain PPM and PWM signal generation circuit for PAM. Compare PAM,PPM, PWM	2	2	16
2.	Differentiate between TDM ,FDM .Give one application of each	2	2	16
3.	What is pre-emphasis and de-emphasis? Why are these required? Explain in detail.	2	2	16
4.	Derive the output signal to noise ratio for an AM receiver using envelop detection and hence obtain the figure of merit, assuming that the noise is additive ,white and Gaussian.	2	2	16
5.	Problems a)Determine the Nyquist sampling rate for the signal given below: i) $x(t) = \sin(200\pi t) \sin c\ (900\ t)/\pi t$ ii)$x(t)=[\sin(100\Pi t)*\text{sinc}\ (200t)]/\Pi t$ iii) Consider the signal $x(t)=e^{j20\pi t} + e^{j30\pi t}$,where 't' is in seconds. A new signal $y(t)=x(2t+6)$ is formed .Find out Nyquist sampling rate of y(t)	2	2	16

UNIT III

DIGITAL TECHNIQUES

Pulse modulation Differential pulse code modulation. Delta modulation, Noise considerations in PCM,, Digital Multiplexers, Channel coding theorem - Linear Block codes - Hamming codes - Cyclic codes - Convolutional codes - Viterbi Decoder

Q.No	Question	CO	BTL	Marks

PART A

1.	What is Hamming bound?	3	1	2
2.	State any properties of a (n,k) linear block code	3	1	2
3.	Write the properties of line coding	3	1	2
4.	Define code efficiency.	3	1	2
5.	Define and classify pulse modulation	3	1	2
6.	What is Pulse code modulation? List the advantages of delta modulation over PCM.	3	1	2
7.	What is difference between Linear block codes and convolutional codes?	3	2	2
8.	A telephone line of 4 MHz bandwidth is having SNR of 38dB.What is the channel capacity?	3	1	2

PART B

1.	i.Derive the expressions for quantization noise and receiver noise and overall SNR of DM system or Explain the noises in delta modulation systems. How to overcome this effect in Delta modulation? ii. What is DM? Explain the transmitter and receiver of DM system	3	2	16
2.	Explain a DPCM system with the expressions and block diagram. Show that SNR of DPCM is better than that of PCM.	3	2	16
3.	Explain detail Viterbi Alorithm	3	2	16
4.	Explain the operation of a cyclic code (7,3) with suitable generator polynomial	3	2	16
5	**Problems** a) Consider a (7, 4) linear block code whose parity check matrix is given by H = 1 1 1 0 1 0 0 1 1 0 1 0 1 0 1 0 1 1 0 0 1 (i)Find the generator matrix. (ii) How many errors this code can detect? (iii) How many errors can this code be corrected? (iv)Draw circuit for encoder and syndrome computation. b)The generator polynomial of a (7, 4) Hamming code is defined by g(D) = 1 + D2 + D3 . Develop the encoder and syndrome calculator for this code. c)Consider the (n=7,k=4) cyclic code defined by the generator polynomial $g(x)=1+x^2+x^3$ i)Develop the encoder ii)Determine the generator matrix C and Parity Check matrix H	3	3	16

iii)Determine the systematic code word of the message sequence (1100)
iv)Suppose a codeword is sent over a noisy channel with the receive word as 1001001 .What would be the error polynomial e(x)?

UNIT IV

DIGITAL MODULATION SCHEME

Geometric Representation of signals - Generation, detection, IQ representation, PSD & BER of Coherent BPSK, BFSK, & QPSK - QAM - Carrier Synchronization - Structure of Non-coherent Receivers Synchronization and Carrier Recovery for Digital modulation, Spectrum Analysis – Occupied bandwidth – Adjacent channel power, EVM, Principle of DPSK

Q.No	Question	CO	BTL	Marks
	PART A			
1.	What is DPSK? Explain with its explain	4	1	2
2.	Bring out the difference between career recovery and clock recovery.	4	2	2
3.	Differentiate between coherent and non coherent receiver	4	2	2
4.	What is minimum shift keying?	4	1	2
5.	What are the digital band pass modulation techniques?	4	1	2
6.	Define QAM. Draw the constellation diagram of 8-QAM	4	1	2
7.	Define bit error rate(BER) and explain BER Vs SNR plot in judging the efficiency of a digital system.	4	2	2
8.	A BPSK system makes errors at the average rate of 1000 errors per delay. Data rate is 1 kbps . The single-sided noise power spectral density is 10-20 W/Hz. Assuming the system to be wide sense stationary, what is the average bit error probability?	4	2	2
	PART B			
1.	Explain and derive the bit error rate for the Binary Frequency Shift Keying modulation scheme.	4	2	16
2.	i) Explain in detail QAM with a neat sketch and draw signal constellation diagram for2,4 and 16-QAM.	4	2	16
3.	i)Explain and derive the bit error rate for the QPSK modulation scheme ii)Compare BFSK and QPSK w.r.t PSD and BER with	4	2	16

	essential illustration iii) What is the difference between M-ary QAM and M-ary PSK explain it using the constellation diagram for the different values of m= 2,4,16.			
4.	Explain in detail about DPSK	4	2	16
5	Problems i) A message signal of $10\cos[(2\Pi*10^4)t$ is given to 1024 level PCM system. The resulting signal is transmitted through free space by using binary signalling technique is (i)ASK and (ii) BPSK	4	2	16

UNIT V

DEMODULATION TECHNIQUES

Elements of Detection Theory, Optimum detection of signals in noise, Coherent communication with waveforms- Probability of Error evaluations. Baseband Pulse Transmission- Inter symbol Interference, Optimum demodulation of digital signals over band-limited channels.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	What is base band pulse transition?	5	1	2
2.	What are the formats used for representing the data over a base band channel?	5	1	2
3.	What is inter symbol interference ?Illustrate with a sample data	5	1	2
4.	Define correlation receiver	5	1	2
5.	What is the meaning of the term “likelihood” in maximum likelihood decoding?	5	1	2
6.	Mention the purpose of using an eye pattern.	5	1	2
7.	Why we need equalization is base band transmission.	5	1	2
8.	State NRZ is it polar format and draws its format for 110011	5	2	2
	PART B			
1.	What is matched filter receiver? Derive the expression for impulse response of matched filter receiver	5	2	16
2.	What is ISI? What are the ways to reduce ISI Discuss in detail. State and Prove Nyquist criterion for zero ISI	5	2	16
3.	Discuss different modulation schemes in digital communication and derive the probability of error for any bandwidth efficient modulation technique	5	2	16
4.	Demonstrate about the optimum detection of signals in noise	5	2	16

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GE3491

ENVIRONMENTAL SCIENCES AND SUSTAINABILITY

UNIT I

ENVIRONMENT AND BIODIVERSITY

Definition, scope and importance of environment – need for public awareness. Eco-system and Energy flow– ecological succession. Types of biodiversity: genetic, species and ecosystem diversity– values of biodiversity, India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	What is an ecosystem and what are the components of ecosystem?	1	1	2
2.	What are biotic and abiotic components of an ecosystem?	1	1	2
3.	What do you mean natural resources? Give examples.	1	1	2
4.	What are food chains and food webs and give its significance?	1	1	2
5.	Define Ecological succession.	1	1	2
6.	Differentiate between endangered and endemic species.	1	1	2
7.	Define primary succession and secondary succession	1	1	2
8.	Define key stone species with suitable example.	1	1	2
	PART B			
1.	What is an ecosystem? Describe the structure and function of an ecosystem.	1	2	16
2.	Explain the values and threats to the biodiversity	1	2	16
3.	(i)"India is a mega diversity nation"–Discuss. (ii)Brief biodiversity hotspots in India	1	2	16
4.	Explain the conservation of biodiversity.	1	2	16

UNIT II

ENVIRONMENTAL POLLUTION

Causes, Effects and Preventive measures of Water, Soil, Air and Noise Pollutions. Solid, Hazardous and E-Waste management. Case studies on Occupational Health and Safety Management system (OHASMS). Environmental protection, Environmental protection acts .

Q.No	Question	CO	BTL	Marks
	PART A			
1.	Differentiate between primary and secondary air pollutants.	2	2	2
2.	Define photochemical smog.	2	1	2
3.	What are point and non point sources of water pollution?	2	1	2
4.	Define e-waste management.	2	1	2
5.	Write the objectives of environmental acts.	2	1	2
6.	Define hazardous waste management.	2	1	2
7.	What are the effects of noise pollution?	2	1	2
8.	Write any two causes and sources of soil pollution.	2	1	2
	PART B			
1.	Describe the role of individual in the prevention of pollution. Explain the sources, effect and control methods of noise pollution	2	2	16
2.	Demonstrate with a flow sheet and explain the steps involved in Solid waste management.	2	3	16
3.	What is OHASMS? Explain it with any one case study	2	2	16
4.	Write about one of the industrial waste water treatment techniques, support with a neat schematic diagram	2	5	16

UNIT III

RENEWABLE SOURCES OF ENERGY

Energy management and conservation, New Energy Sources: Need of new sources. Different types new energy sources. Applications of- Hydrogen energy, Ocean energy resources, Tidal energy conversion. Concept, origin and power plants of geothermal energy.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	List the objectives of energy management.	3	1	2
2.	What is the significance of OTE?	3	1	2
3.	What is the important use of Artificial intelligence in energy sector?	3	1	2

4.	What is Bio-mass energy?	3	1	2
5.	Give any five applications of tidal energy conservation.	3	1	2
6.	Give some important applications of GTE.	3	1	2
7.	What is DESS? Mention its components.	3	1	2
8.	Mention the applications of hydrogen energy.	3	1	2

PART B

1.	Explain the applications of ocean energy and GTE.	3	2	16
2.	Explain the principle and various steps involved in the energy management.	3	2	16
3.	Write detailed notes on new energy sources.	3	2	16
4.	Explain the origin, concept and advantage and disadvantages of Geo thermal energy.	3	2	16

UNIT IV

SUSTAINABILITY AND MANAGEMENT

Development , GDP ,Sustainability- concept, needs and challenges-economic, social and aspects of sustainability-from unsustainability to sustainability-millennium development goals, and protocols- Sustainable Development Goals-targets, indicators and intervention areas Climate change- Global, Regional and local environmental issues and possible solutions-case studies. Concept of Carbon Credit, Carbon Footprint. Environmental management in industry-A case study.

Q.No	Question	CO	BTL	Marks

PART A

1.	What is GDP?	4	1	2
2.	Write any four millennium development goals.	4	1	2
3.	Define carbon credit.	4	1	2
4.	What are the sources of carbon foot print?	4	2	2
5.	Define environmental management.	4	1	2
6.	Mention any five important needs of sustainability.	4	1	2
7.	Write some advantages of carbon credits.	4	2	2
8.	Mention some effects of climate change.	4	1	2

PART B

1	Brief notes on (i) Millennium Development Goals (ii) Sustainability protocols.	4	2	16
2	What is environmental management? Explain the various steps of environmental management.	4	2	16
3	Write notes on concept, goal and aim of sustainable development.	4	2	16
4	What are the causes, effects and possible solutions of climate change?What is carbon credit? Explain the types and merits	4	1	16

UNIT V

SUSTAINABILITY PRACTICES

Zero waste and R concept, Circular economy, ISO 14000 Series, Material Life cycle assessment, Environmental Impact Assessment. Sustainable habitat: Green buildings, Green materials, Energy efficiency, Sustainable transports. Sustainable energy: Non-conventional Sources, Energy Cycles- carbon cycle, emission and sequestration, Green Engineering: Sustainable urbanization- Socio- economical and technological change.

Q.No	Question	CO	BTL	Marks

PART A

1.	What is zero waste and R concept?	5	1	2
2.	Define circular economy.	5	1	2
3.	What are the key elements of ISO14000?	5	1	2
4.	Mention the objectives of EIA.	5	1	2
5.	What is green engineering?	5	1	2
6.	What is meant by energy cycles?	5	1	2
7.	What is sustainable urbanization?	5	1	2
8.	Define carbon sequestration.	5	1	2

PART B

1.	Explain the various steps to achieve zero waste? Mention advantages and disadvantages of zero waste.	5	2	16
2.	What is 3R concept? Determine the concept and advantages of R concept.	5	3	16
3.	What are green materials? Explain important green building materials. What is sustainable transport? Discuss the key	5	2	16

	elements of sustainable transport.			
4.	What is sustainable urbanization? Explain the rules to develop sustainable urban.	5	3	16

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