

BT-4/M-26

44156

APPLIED AND COMPUTATIONAL MATHEMATICS

Paper-BS-207A

Time : Three Hours]

[Maximum Marks : 75

Note : Attempt *five* questions in all, selecting at least *one* question from each unit. Each question carries equal marks (15 marks).

UNIT-I

- Solve : $(a^2 - 2xy - y^2)dx - (x + y)^2 dy = 0$.
 - Solve : $\frac{d^2y}{dx^2} - 6 \frac{dy}{dx} + 9y = e^{3x}$.
- Solve the partial differential equation $(p - q)z = z^2 + (x + y)^2$.
 - Find the complete solution of $x^2 p^2 + y^2 q^2 = z$.

UNIT-II

- Find by double integration, the area lying between the curves $y = 4x - x^2$ and $y = x$.
 - Prove that the volume enclosed between the cylinder $x^2 + y^2 = 2ax$ and $z^2 = 2ax$ is $\frac{128a^2}{15}$.
- Find the directional derivative of $\Phi = x^2 - y^2 + 2z^2$ at the point P (1, 2, 3) in the direction of the line PQ, where Q is the point (5, 0, 4).
 - Verify Green's theorem for $\oint_C [(xy + y^2)dx + x^2 dy]$, where C is bounded by $y = x$ and $y = x^2$.

UNIT-III

5. (a) Find the Laplace transform of $\left[\frac{e^t - \cos 5t}{t} \right]$.
- (b) Find the inverse Laplace transform of $\log \left(\frac{1+s}{s} \right)$.
6. (a) Using Convolution theorem, find $L^{-1} \left\{ \frac{1}{s^2(s^2 + 2^2)} \right\}$.
- (b) Solve the differential equation by using Laplace transform $\frac{d^2x}{dt^2} - 2 \frac{dx}{dt} + x = e^t$, where $x(0) = 2$, $x'(0) = -1$.

UNIT-IV

7. (a) Find a real root of the equation $3x = \cos x + 1$ by using the Newton-Raphson method correct to four decimal places.
- (b) Evaluate the integral $\int_0^1 \frac{x^2}{1+x^3} dx$ using Simpson's 1/3rd rule. Compare the error with the exact value.
8. (a) Find by Taylor's series method, the values of y at $x = 0.1$ and $x = 0.2$ to four places of decimals from $\frac{dy}{dx} = xy - 1$, $y(0) = 1$.
- (b) Solve $\frac{dy}{dx} = x^2 - y$, $y(0) = 1$, to find $y(0.2)$ by taking $h = 0.1$ using Runge-Kutta method of order 4.
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44157

DIGITAL COMMUNICATION

Paper-EC-202 A

Time : Three Hours]

[Maximum Marks : 75

Instruction : Attempt any five questions. One question from each unit is compulsory.

UNIT-I

- (a) State and prove the Sampling Theorem. Determine the Nyquist rate and Nyquist interval for

(i) $m(t) = 5 \cos 1000 \pi t \cos 400 \pi t$

(ii) $m(t) = \sin \frac{200 \pi t}{\pi}$

(iii) $m(t) = \sin \left(\frac{200 \pi t}{\pi t} \right)^2$ (8)

- (b) What is aliasing? Explain the effect of aliasing on sinusoidal signal in time and frequency domains. (7)

- (a) In a binary PCM system, the output signal to quantizing ratio is to be held to a minimum of 40dB. Determine the number of required levels, and find the corresponding output signal-to-quantizing noise ratio. (5)

- (b) Explain the Time Division Multiplexing technique. (5)

- (c) Describe the algorithm of Delta modulations. What are the different type of quantization errors that occur in Delta modulation techniques? (5)

UNIT-II

3. (a) What is Intersymbol Interference? What is its effect in PAM System? (8)
(b) What is an ideal Nyquist channel? Give its properties and Limitations. (7)
4. Draw a block diagram of an adaptive Equalizer. Explain it works. How the Least Mean Squares Algorithm is used in an Adaptive Equalizer. (15)

UNIT-III

5. (a) Describe the process of coherent detection of signals in a noisy environment. Explain how the probability of error is minimized in decision making process with the help of maximum likelihood decoding. (8)
(b) Discuss the Gram-Schmidt orthogonalization process that is used to represent any modulated Signal in Signal space. (7)
6. (a) Explain ASK transmission technique. What is the effect of ISI on ASK. (8)
(b) Explain the recursive algorithm for maximum Estimation of the Carrier Phase. (7)

UNIT-IV

7. (a) Mention the need of synchronization. Discuss two modes of synchronization that may be required at the receiver and transmitter. (8)

- b) Mention the algorithm of Maximum Likelihood Sequence estimation. Draw a block diagram of MLSI Equalizer along with its working. (7)

Write a short note on the need of trade-off among various parameters used to choose an adequate digital modulation technique. (15)

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44158

ANALOG CIRCUITS

Paper-EC-206A

Time : Three Hours]

[Maximum Marks : 75

Note : Attempt any *five* questions, selecting atleast one question from each unit.

UNIT-I

1. (a) Explain different types of amplifiers namely voltage amplifier, current amplifier, transconductance amplifier and trans-resistance amplifier. Compare them on the basis of input impedance, output impedance and gain characteristics. (8)
- (b) Using the small signal r_e model, derive the expression for the voltage gain of a Common Emitter (CE) amplifier. Clearly state the assumptions made in the derivation. (7)
2. (a) Explain the small signal analysis of a Common Source (CS) JFET amplifier. Derive expressions for voltage gain, input resistance and output resistance. (8)
- (b) A Common Emitter amplifier uses a transistor with the following parameters : Small signal emitter resistance $r_e = 26 \Omega$, Collector resistance $R_C = 2.2 \text{ k}\Omega$.
Assuming the emitter bypass capacitor provides a low impedance path for AC signals, calculate the voltage gain of the amplifier. (7)

UNIT-II

3. (a) Explain the operation of Class A, Class B and Class C power amplifiers. Derive the expression for maximum efficiency of a Class B amplifier. (8)
- (b) A Class B push-pull amplifier delivers an output power of 25 W to the load when operating at its maximum theoretical efficiency.
- Calculate;
- (i) The input power supplied to the amplifier.
- (ii) The power dissipated in the amplifier. (7)
4. (a) Explain different types of feedback in amplifiers : Voltage series feedback, Voltage shunt feedback, Current series feedback and Current shunt feedback. Discuss the effect of feedback on gain, bandwidth, input impedance and output impedance. (8)
- (b) An amplifier has the following cutoff frequencies :
Lower cutoff frequency $f_L = 200$ Hz
Upper cutoff frequency $f_H = 120$ kHz
- Determine :
- (i) The bandwidth of the amplifier.
- (ii) The midband frequency range. (7)

UNIT-III

5. (a) State and explain the Barkhausen criterion for oscillations. Discuss the conditions required for sustained oscillations. (8)
- (b) Explain the working of RC Phase Shift Oscillator using a BJT amplifier. Derive the expression for its frequency of oscillation. (7)

6. (a) Explain the Wien Bridge Oscillator with the help of a circuit diagram and derive the expression for its frequency of oscillation. (8)
- (b) Explain the construction and working of the following oscillators :
- (i) Hartley Oscillator.
- (ii) Colpitts Oscillator. (7)

UNIT-IV

7. (a) Explain the operation of the 555 timer as an astable multivibrator. Draw the circuit diagram and explain its working principle. (8)
- (b) Explain the operation of the 555 timer as a monostable multivibrator with suitable diagram and timing waveform. (7)
8. (a) Explain the working of a differential amplifier. Derive expressions for differential gain, common mode gain and Common Mode Rejection Ratio (CMRR). (8)
- (b) A differential amplifier has the following parameters :
- Differential gain $A_d = 250$
- Common mode gain $A_C = 0.5$
- Calculate :
- (i) The CMRR.
- (ii) The CMRR in decibels (dB). (7)
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44159**MICROPROCESSORS AND MICROCONTROLLERS**

Paper-EC-210A

Time : Three Hours]

[Maximum Marks : 75

Note : Attempt any *five* questions, selecting at least *one* question from each unit.

UNIT-I

1. Explain the architecture of 8086 with a neat block diagram. Describe the functions of BIU and EU and explain the concept of instruction queue. 15
2. Discuss the pin configuration of 8086. Explain the functions of important pins and signals used in System operation. 15

UNIT-II

3. Explain the architecture of 8051 with a neat block diagram. Describe internal RAM, ROM, SFRs and general purpose registers. 15
4. Describe the pin diagram of 8051 microcontroller and explain the functions of ports, control pins and oscillator connections 15

UNIT-III

5. Explain the instruction format and addressing modes of 8086 with suitable examples. 15

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6. Describe the 8086 instruction groups with examples :

- (a) Data transfer instructions.
- (b) Arithmetic instructions.
- (c) Logical instructions.
- (d) Control transfer instructions.

15

UNIT-IV

7. Explain the Intel 8255 programmable peripheral interface. Describe its architecture and interfacing With 8086 microprocessor. 15

8. Explain interfacing of the following with 8051 microcontroller:

- (a) Matrix Keyboard.
 - (b) ADC.
 - (c) DAC.
 - (d) Stepper motor.
 - (e) Temperature sensor.
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44160

ELECTROMAGNETIC FIELD THEORY

Paper-EC-214A

Time : Three Hours]

[Maximum Marks : 75

Note : Attempt *five* questions in total selecting at least *one* question from each unit.

UNIT-I

1. (a) A point charge of $5 \mu\text{C}$ is located at $(2, 0, 0)$. Find electric field intensity at $(0, 3, 4)$.
(b) Using Gauss's law, determine electric field inside and outside a uniformly charged solid sphere of radius $r = 0.2 \text{ m}$ with volume charge density $3 \mu\text{C}/\text{m}^3$. Find potential difference between $r = 0.1 \text{ m}$ and $r = 0.5 \text{ m}$. ($6+9=15$)
2. (a) A linear dipole of moment 10^{-8} cm is placed along z -axis. Find electric field at $r = 2 \text{ m}$, $\theta = 45^\circ$.
(b) Verify divergence theorem for vector field $\mathbf{D} = 3x^2 \mathbf{a}_x + 2yz \mathbf{a}_y$ over cube of side 1 m . ($7+8=15$)

UNIT-II

3. (a) Using Biot-Savart law, calculate magnetic field at center of circular loop of radius 0.1 m carrying 5 A .
(b) Determine boundary conditions for $\mathbf{E}_2$ at dielectric interface if $\epsilon_{r1} = 2$, $\epsilon_{r2} = 5$ and incident field is $\mathbf{E}_1 = 2.3\mathbf{a}_x + 10\mathbf{a}_y + 5.6\mathbf{a}_z \text{ V/m}$. ($7+8=15$)
4. (a) Given potential $V = 5x^2 - 3y^2 + 2z$, verify whether it satisfies Laplace equation?

- (b) From Maxwell's equations, calculate displacement current density when electric field is $E = 100 \cos(10^8 t - \beta z) a_x$ V/m. Determine conduction current density in copper ($\sigma = 5.8 \times 10^7$ S/m). (7+8=15)

UNIT-III

5. (a) A plane wave propagates in free space with $E = 50 \cos(\omega t - \beta z) a_x$ V/m.
Find :
(i) Magnetic field H.
(ii) Intrinsic impedance.
(iii) Power density.
- (b) Determine propagation constant and skin depth for copper at 10 MHz. (9+6=15)
6. A plane wave is normally incident from air onto dielectric ($\epsilon_r = 4$). Calculate :
(a) Reflection coefficient.
(b) Transmission coefficient.
(c) Reflected Power.
(d) Brewster angle for dielectric ($\epsilon_r = 9$).
(e) Determine relaxation time of medium ($\sigma = 10^{-3}$ S/m, $\epsilon_r = 4$). (5×3=15)

UNIT-IV

7. (a) A transmission line has : $Z_0 = 50 \Omega$, $Z_L = 100 + j50 \Omega$, length = 0.25λ .
Calculate :
(i) Reflection coefficient.
(ii) Standing Wave Ratio.
(iii) Input impedance.

- (b) A circular waveguide made of perfect conductor has an internal radius of 3 cm and is filled with air. It operates in the dominant mode. (9+6=15)

8. (a) A rectangular waveguide has dimensions $a = 3$ cm, $b = 2$ cm. Calculate cutoff frequency for TE_{10} mode. If operating frequency is 10 GHz, calculate guide wavelength and phase velocity. 9

- (b) A lossless transmission line has the following distributed parameters :

- $L = 250$ nH/m
- $C = 100$ pF/m

The line operates at 100 MHz and is terminated with a load impedance $Z_L = 100 + j50 \Omega$.

Calculate :

- (i) The characteristic impedance Z_0 .
 - (ii) Phase velocity v_p .
 - (iii) Propagation constant β .
 - (iv) Reflection coefficient at the load Γ_L .
 - (v) Standing Wave Ratio (SWR).
 - (vi) Positions of first voltage maximum and minimum from the load. 6
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44161

BASICS OF ANALOG COMMUNICATION

Paper-ES-208A

Time : Three Hours]

[Maximum Marks : 75

Note : Attempt any five questions. One question from each unit is compulsory.

UNIT-I

1. (a) Draw a basic block diagram of a communication system. Explain the need of each block. (5)
- (b) Define Signal-to-Noise ratio. What is the noise figure? Derive an equation to calculate the Noise Figure. (10)
2. (a) What is Modulation? What are the needs of modulation? Explain four basic reasons. (7)
- (b) The antenna current of an AM transmitter is 8 Amperes (A) when only the carrier is sent, but it increases to 8.93A when the carrier is modulated by a single sine wave. Find the percentage modulation. Determine the antenna current when the percentage of modulation changes to 0.8. (8)

UNIT-II

3. (a) Give the difference between low-level and high-level modulation. (4)

- (b) What are the basic functions of the RF section in an AM receiver? (3)
 - (c) Draw and explain the working of a Balanced Modulator. (8)
4. (a) In a broadcast superheterodyne receiver having no RF amplifier, the loaded Q of the antenna coupling circuit (at the input to the mixer) is 100. If the intermediate frequency is 455 kHz, calculate (a) the image frequency and its rejection ratio at 1000 kHz, and (b) the image frequency and its rejection ratio at 25 MHz. (8)
- (b) Draw a Practical Diode detector and explain its working along with principle of simple Automatic Gain Control. (7)

UNIT-III

5. (a) What is Frequency Modulation? Derive the Equation to calculate the modulation Index m_f in FM. (8)
- (b) Explain Varactor Diode Modulator. (4)
- (c) What is the bandwidth required for an FM signal in which the modulating frequency is 2 kHz and the maximum deviation is 10 kHz? (3)
6. (a) Explain the working of a FM receiver using a block diagram. (8)
- (b) Draw the circuit diagram of the Ratio Detector and explain its working. (7)

UNIT-IV

7. (a) Explain the phase shift method of SSB generation along with the output equation and a proper block diagram. (8)
- (b) What are the applications of AM and FM in TV transmission? (7)
8. (a) What is the Nyquist criterion of sampling? Explain PAM in detail. (7)
- (b) What is PWM? Explain with proper diagrams and wave forms. (8)
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46257

CONTROL SYSTEM ENGINEERING

Time : Three Hours]

[Maximum Marks : 75

Note : Attempt *Five* questions in all, selecting at least *one* question from each Unit.

Unit I

1. (a) Explain the difference between open-loop and closed-loop control systems with suitable examples. 7
- (b) Derive the transfer function of a stepper motor and discuss its limitations in precision control. 8
2. (a) Using block diagram reduction technique, determine the overall transfer function of a multi-loop feedback system shown in Fig. 1 : 7

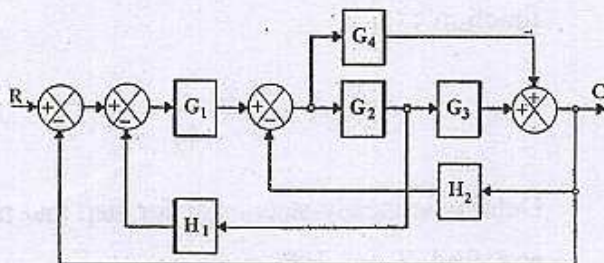


Fig. 1

- (b) Derive Mason's Gain Formula and apply it to determine the transfer function of a given signal flow graph in Fig. 2 : 8

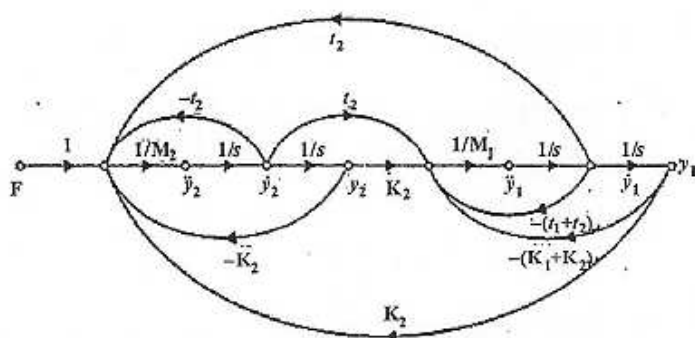


Fig. 2

Unit II

3. (a) Explain the effect of damping ratio on peak overshoot, settling time and rise time. 7
- (b) A unity feedback system has open loop transfer function :

$$G(s) = \frac{K}{s(s+4)}$$

Determine steady-state error for step and ramp inputs and find K for 10% overshoot. 8

- (a) Using the Routh Stability Criterion determine the range of K for stability of the system : 7

$$s^4 + 3s^3 + 5s^2 + 2s + K = 0$$

- (b) Sketch the root locus of : 8

$$G(s)H(s) = \frac{K}{s(s+2)(s+4)}$$

and comment on stability.

Unit III

5. (a) Explain correlation between time response and frequency response using necessary expressions. 7
(b) Draw the Bode plot for :

$$G(s) = \frac{10}{s(1+0.1s)}$$

and determine Gain Margin and Phase Margin. 8

6. Using Nyquist criterion, determine stability of : 15

$$G(s)H(s) = \frac{K}{s(s+1)(s+2)}$$

Unit IV

7. (a) Explain necessity of compensation in control systems. 5

- (b) A unity feedback control system has the open-loop transfer function :

10

$$G(s) = \frac{K}{s(s+4)(s+10)}$$

Design a suitable compensated system using BODE plot such that the system must satisfy the following specifications :

- (i) Phase Margin (PM) $\geq 45^\circ$
 - (ii) Gain Crossover Frequency $\omega_{gc} \approx 5$ rad/s.
8. Consider the linear time-invariant system represented in state space form :

$$\dot{x}(t) = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -6 & -11 & -6 \end{bmatrix} x(t) + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u(t)$$

$$y(t) = [1 \ 0 \ 0] x(t)$$

Determine the eigenvalues of the system matrix. Check whether the system is Completely controllable or completely observable ? Determine the state transition matrix $\Phi(t)$? Find the response $x(t)$ for zero input with Initial condition $x(0) = [1 \ 0 \ 0]^T$.



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46258

VERILOG HDL

Time : Three Hours]

[Maximum Marks : 75

Note : Attempt *Five* questions in all, selecting at least *one* question from each Unit.

Unit I

1. Explain ASIC Design and Development flow in detail. 15
2. Explain the following terms in detail : 15
 - (i) Data types
 - (ii) Test bench
 - (iii) Scalars and Vectors

Unit II

3. (a) Design full subtractor circuit and also write its verilog code using gate level modeling. 10
(b) Explain net data types. 5

4. (a) Explain initial and always construct construct with syntax and example. 5
- (b) Design up-down counter and also write its verilog code using behavioural modeling. 10

Unit III

5. Explain different type of operators with examples. 15
6. (a) Design 3 input NAND gate using nmos and write verilog code for it using switch level modeling. 10
- (b) Explain pull up and pull down. 5

Unit IV

7. (a) Explain User-defined primitives and write a UDP for 2-input OR gate. 10
- (b) Explain functions with example. 5
8. Explain the following : 7,8
 - (a) Parameters
 - (b) Compiler directives



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46186

ORGANIZATIONAL BEHAVIOUR

Time : Three Hours]

[Maximum Marks : 75

Note : Attempt *Five* questions in all. Selecting at least *one* from each Unit. All questions carry equal marks (15).

Unit I

1. How attitude is formed ? Discuss the types of attitude and explain the impact of values on individual's attitude.
2. Explain the stages of learning. Also discuss the cognitive and behavioural theory of learning.

Unit II

3. How perception and individual decision making are interrelated ? Discuss the factors influencing perception.
4. Different leadership styles exist among leaders in different times and in different situations'. Discuss and give the important leadership styles with their merits and demerits.

Unit III

5. How MBO is significant in business organization ? Explain the process of MBO and its relationship with goal setting theory.
6. How group is different from team ? Explain the types of groups and stages of group development.

Unit IV

7. How the different types of stress have an impact on organizations ? Explain the stress management techniques.
8. Why is organizational change often resisted by individuals in organization ? How can this resistance to change be managed ?



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Total Pages : 03

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46259

ANTENNAS AND PROPAGATION

Time : Three Hours]

[Maximum Marks : 75

Note : Attempt any *Five* questions selecting at least *one* question from each Unit.

Unit I

1. (a) Derive the expression for the fields radiated by a Hertzian Dipole and obtain the far-field components.
(b) Derive radiation resistance of a short dipole and compare it with that of a half-wave dipole. 7+8=15
2. (a) Define and derive expressions for Directivity, Power Gain, Beamwidth and Antenna Efficiency.
(b) Explain antenna temperature and its significance in communication systems. 8+7=15

Unit II

3. (a) Derive the array factor for a Uniform Linear Array of N isotropic elements.

- (b) Compare Broadside and End fire arrays with necessary field expressions.
 - (c) Design a 4-element broadside array with $\lambda/2$ spacing and sketch its radiation pattern. 5+5+5=15
4. (a) Describe construction and working of Yagi-Uda antenna and its application in TV reception.
- (b) Derive the condition for Binomial array and compare it with Chebyshev array in terms of sidelobe level. 7+8=15

Unit III

5. (a) Using Huygens' principle, derive the radiation pattern of a rectangular aperture with uniform distribution.
- (b) Explain working of Horn antenna and discuss its advantages over simple aperture antenna. 7+8=15
6. (a) Explain the frequency independent concept based on Rumsey's principle.
- (b) Describe the structure and operation of Log-periodic antenna with design equations. 7+8=15

Unit IV

7. (a) Explain Ground wave, Space wave and Sky wave propagation with neat diagrams.

- (b) Define Virtual Height, Critical Frequency and derive expression for MUF. 7+8=15

8. (a) Discuss Flat Earth and Curved Earth concepts in space wave propagation.
- (b) Explain Duct propagation and Troposcatter propagation mechanisms. 7+8=15

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46264

MULTIMEDIA COMMUNICATION

Three Hours]

[Maximum Marks : 75

Attempt *Five* questions in all, selecting at least *one* question from each Unit. All questions carry equal marks.

Unit I

Define Multimedia Communication. Explain the components of a multimedia system and its applications in modern communication networks. 8

Explain the digitization principles of multimedia signals. Describe how text, image, audio and video are represented in digital form. 7

Explain the architecture and working of Multimedia Networks. Compare telephone networks, data networks and television networks in multimedia communication. 8

- (b) Discuss Interactive Multimedia Applications over the Internet with suitable examples such as streaming services, online education and entertainment platforms. 7

Unit II

3. (a) Explain the concept of Text Compression. Describe Static Huffman Coding and Dynamic Huffman Coding with suitable examples. 8
- (b) Discuss Arithmetic Coding and Lempel-Ziv (LZ) compression techniques. Explain, how these methods improve compression efficiency. 7
4. (a) Explain Image Compression techniques and the need for image compression in multimedia systems. 8
- (b) Write short notes on GIF (Graphics Interchange Format), TIFF (Tagged Image File Format), JPEG (Joint Photographic Experts Group). 7

Unit III

5. (a) Explain Audio Compression techniques. Describe the working of Differential Pulse Code Modulation (DPCM) and Adaptive Differential PCM (ADPCM).

8

- (b) Discuss Linear Predictive Coding (LPC) and its role in efficient audio compression. 7
- (a) Explain the basic principles of Video Compression. Discuss the role of temporal and spatial redundancy in reducing video data size. 8
- (b) Describe Frame types (I-frames, P-frames and B-frames) and explain their role in video compression standards such as H.261 and H.263. 7

Unit IV

- (a) Explain the concept of Multimedia Synchronization. Discuss its requirements and importance in multimedia communication systems. 8
- (b) Explain the role of Time Stamping and Packet Architecture in maintaining synchronization of multimedia streams. 7
- (a) Explain the following Internet Applications used in multimedia communication : 8
- (i) Domain Name System (DNS)

(ii) Electronic Mail

(iii) Internet Telephony.

- (b) Discuss the concept of Content-Based Image Retrieval (CBIR) and explain its applications in multimedia databases.

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47297

INTELLECTUAL PROPERTY RIGHTS FOR TECHNOLOGY
DEVELOPMENT AND MANAGEMENT

Paper-HM-904-A

Time : Three Hours]

[Maximum Marks : 75

Note : Attempt *five* questions in all by selecting at least *one* question from each unit. All questions carry equal marks.

UNIT-I

1. Discuss the process of patenting and product development. How do innovation and technological advancement play a role in transforming research ideas into patentable inventions? 15
2. Explain the procedure for obtaining a patent, from filing to grant. Also discuss the Patent Cooperation Treaty (PCT) and its significance for international patent protection. 15

UNIT-II

3. Discuss the process and importance of Licensing and Transfer of Technology. How do licensing agreements help in commercializing patents and promoting technological collaboration between industries and nations? 15
4. Define Geographical Indications (GIs) and discuss their purpose and significance in protecting regional products. 15

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UNIT-III

5. Explain the concept and importance of Intellectual Property. Describe its main forms and their role in the modern economy. 15
6. What are the major differences between Copyrights and Patents? Discuss their objectives, duration, scope of protection, and remedies available for infringement under Indian law. 15

UNIT-IV

7. Examine the importance of Traditional Knowledge in the context of Intellectual Property Rights (IPR). Discuss its protection mechanisms and illustrate your answer with suitable case studies. 15
 8. Define "patentable invention." Discuss the concept and historical development of patent law in India with special reference to biotechnology products and computer programs. 15
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47298

FIBER OPTIC COMMUNICATIONS

Paper-ECP-10A

Time : Three Hours]

[Maximum Marks : 75

Note : Attempt any *five* questions selecting at least *one* from each unit.

UNIT-I

1. What do you mean by acceptance angle and numerical aperture of an optical fiber, show how it is related to refractive index of core and cladding of fiber? Differentiate between the numerical aperture of meridional and skew rays. An optical fiber in air has NA 0.4 ; compare the acceptance angle for skew rays which changes direction by 100° at each reflection. 15
2. (a) What is the structure of optical fiber? Differentiate between step index and Graded index fiber. How the rays do propagates in graded index fiber? 10
(b) What do you mean by fiber splices? List different methods of splicing. Explain electric arc fusion splicing in detail. 5

UNIT-II

3. (a) What is absorption? Derive expression for absorption coefficient. Mention the reasons responsible for absorption in optical fibers. 7
(b) Define scattering. Discuss in detail the linear scattering losses in optical fibers. 8

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4. Explain the different dispersion mechanisms in optical fibers alongwith the reasons responsible for them. Derive an expression for pulse spreadening due to material dispersion.

15

UNIT-III

5. (a) What is the population inversion? Explain the different methods of achieving population inversion in LASER.

8

- (b) Explain the working principle of LED.

7

6. What do you understand by optical detector? Explain the construction and working of PIN photodetector. Also define absorption coefficient, responsivity and quantum efficiency of photodetector.

15

UNIT-IV

7. (a) Explain the working of 2x2 star coupler.

8

- (b) What is WDM? Define.

7

8. Write short note on :

- (a) Single hop and multihop networks.

8

- (b) Photonic networks.

7

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47305

DIGITAL IMAGE PROCESSING

Paper-ECP-17A

Time : Three Hours]

[Maximum Marks : 75

Note : Attempt *five* questions in all, selecting at least *one* question from each unit. All questions carry equal marks.

UNIT-I

1. Explain the following in detail :
 - (a) Sampling and Quantization.
 - (b) Relationship between pixels.
 - (c) Color Model. 15
2. (a) Explain the fundamental steps in digital image processing with a neat block diagram. 8
- (b) Discuss the procedure for conversion of an image from RGB color model to HSI color model. 7

UNIT-II

3. (a) Define Intensity transformation. Also explain the concept of Histogram equalization techniques for image enhancement. 7
- (b) Equalize the given histogram : 8

Gray level (rk)	0	1	2	3	4	5	6	7
No. of Pixel (Pk)	790	1023	850	656	329	245	122	81

4. Consider the image segment shown below and calculate the output of the pixel (2, 2) if smoothening is done using 3*3 neighborhood using all the filters below : 15

- (a) Mean Filter.
- (b) Weighted average Filter.
- (c) Median Filter.
- (d) Min Filter.
- (e) Max Filter.

1	8	8	0	7
4	7	9	5	7
5	4	6	8	6
4	2	0	1	5
0	1	0	2	0

UNIT-III

5. (a) Explain the image compression model with a block diagram. Explain Arithmetic Coding Technique in detail with example. 8
- (b) Construct a Huffman coding tree for the following symbols : 7

Symbol	A	B	C	D	E
Probability	0.4	0.2	0.2	0.1	0.1

Find the binary codes for each symbol.

6. (a) Explain how HIT-OR-MISS transformation is used for finding local patterns of pixels. 8
- (b) How to detect discontinuities by point detection, line detection and edge detection method. 7

UNIT-IV

7. Explain video formation and video frame classifications :
- (a) I frames.
 - (b) P frames.
 - (c) B frames. 15
8. (a) Describe the role of motion estimation in video compression. 7
- (b) Explain pattern recognition based on matching and describe pattern classes. 8
-

BT-7/M-26

47308

OPERATING SYSTEMS

Paper-ECO-11-A

Time : Three Hours]

[Maximum Marks : 75

Note : Attempt any *five* questions by selecting atleast *one* question from each unit. All questions carry equal marks.

UNIT-I

1. (a) Explain the key functions of an operating system.
(b) Describe the role of OS in resource management and security. (7+8=15)
2. (a) What are the major types of operating systems? Discuss with examples.
(b) Discuss various user interaction methods with operating systems (CLI vs GUI). (7+8=15)

UNIT-II

3. (a) How does a mainframe OS control I/O operations? Explain briefly.
(b) Discuss the interrupt cycle in detail. Include necessary diagrams. (7+8=15)
4. (a) Describe the structure of interrupt priority levels. How are they used by OS?
(b) Explain the concept of Interprocess Communication (IPC) with at least two methods. (7+8=15)

UNIT-III

5. (a) Describe the structure and role of Process Control Block (PCB).
(b) Explain how an OS executes a system call with respect to process management. (7+8=15)
6. (a) List and explain different process states.
(b) What are the differences between independent and cooperating processes? Provide examples. (7+8=15)

UNIT-IV

7. (a) Describe the various resource allocation strategies used in CPU scheduling.
(b) Compare and contrast First-Come First-Served (FCFS) and Priority Scheduling with examples. (7+8=15)
 8. (a) What are the necessary conditions for deadlock to occur? Explain.
(b) Describe any two methods to prevent or recover from deadlock. (7+8=15)
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Roll No.

Total Pages : 3

BT-8/M-26

48309

ARTIFICIAL INTELLIGENCE

Paper-ECP-21A

Time Allowed : 3 Hours]

[Maximum Marks : 75

Note : Attempt **five** questions in all, selecting at least **one** question from each Unit. All questions carry equal marks.

UNIT-I

1. (a) Define AI along with its applications. Differentiate between Strong with Weak AI. 10
(b) Define Intelligence using Turing test. What is the significance of the Turing test in the field of Artificial Intelligence? 5
2. Define the term data preprocessing. Explain how different classifiers like Naïve Bayes and Support Vector Machines handle data preprocessing. 15

UNIT-II

3. Differentiate between Supervised and Unsupervised Learning, providing examples of each. Explain how the K-Means algorithms is used for clustering data? 15

4. Explain the term Regression in detail along with its type. Also show the implementation of Simple Linear Regression Algorithm using Python. 15

UNIT-III

5. (a) What are Genetic Algorithms? Explain the fundamental concepts that make them effective for solving problems with predefined parameters. 8
- (b) Which of the following is a possible offspring when Uniform crossover is performed utilizing a crossover mask between the parents given below? 7

Parent 1 : [0 0 1 0 1]

Parent 2 : [0 0 1 1 1]

Mask : [1 1 1 0 1].

6. (a) Describe two different methods for object tracking, such as using colorspace or background subtraction. How do these methods differ in their approach to tracking objects? 8
- (b) Write a program to implement face detection and tracking by explaining each step in detail. 7

UNIT-IV

7. Describe how a Perceptron-based classifier works. How does it form the basis for constructing more complex single and multilayer neural networks? 15

8. (a) Define ANN. What is the role of the Activation functions in Neural Networks? 5
- (b) Explain the fundamental differences between Reinforcement Learning and Supervised Learning. Also describe the concept of function approximation in reinforcement learning. 10

BT-8/M-26

48310

INTERNET OF THINGS

Paper-ECP-22A

Time Allowed : 3 Hours]

[Maximum Marks : 75

Note : Attempt **five** questions in all, selecting at least **one** question from each Unit. All questions carry equal marks.

UNIT-I

1. (a) Define IoT. What are characteristics of IoT ? Draw six layer IoT functional diagram and explain function of each layer. 7
- (b) What is M2M ? Draw its architecture and explain working of each layer. 8
2. (a) What is SDN ? Mention the problems associated with traditional networking that are overcome by SDN. Draw architecture of SDN. Explain it in detail. 10
- (b) Compare features of IPv4 and IPv6. 5

UNIT-II

3. (a) Mention various steps involved in IoT design methodology. 10

- (b) What are Sensors? Classify Sensors based on their inputs. 5
- 4. (a) Explain Simple Network Management Protocol (SNMP) in detail. Draw its architecture and discuss it in detail. 7
- (b) Explain how embedded systems are used in development of IoT application? 8

UNIT-III

- 5. (a) Discuss REST protocol. 7
- (b) Explain in detail TCP protocol. 8
- 6. (a) What is Cloud computing? Compare features of Cloud computing with Fog computing. 8
- (b) Discuss various security challenges while designing IoT system. 7

UNIT-IV

- 7. (a) Mention various packages supported by Python. Write a Python program for blinking LED with a switch. 7
- (b) Explain different classes and data types in python. 8
- 8. With suitable scenario, explain usage of IoT in healthcare application. 15

Roll No.

Total Pages : 2

BT-8/M-26

48312

SATELLITE COMMUNICATION

Paper-ECP-24A

Time Allowed : 3 Hours]

[Maximum Marks : 75

Note : Attempt **five** questions in all, selecting at least **one** question from each Unit. All questions carry equal marks.

UNIT-I

1. Explain the basic satellite communication system with the help of a neat block diagram. Discuss the function of satellite transponders in detail. 15
2. What are the different types of satellite orbits? Explain GEO, MEO and LEO orbits with diagrams and mention their applications. 15

UNIT-II

3. Derive the expressions for look angles in satellite communication. Why are elevation angle and azimuth angle important for earth station alignment? 15
4. Discuss in detail the concept of satellite launching. Explain the launching vehicles and launching procedures used for placing satellites in Geostationary orbit. 15

UNIT-III

5. Derive the general link power budget equation for a satellite communication system. Explain how free space path loss and antenna parameters affect the budget? 15
6. Explain FDMA, TDMA and CDMA multiple access techniques used in satellite communication. Compare their features, advantages, and limitations. 15

UNIT-IV

7. Write short notes on the following (any three): $3 \times 5 = 15$
 - (a) VSAT systems.
 - (b) DTH satellite TV broadcast.
 - (c) GPS and satellite navigation.
 - (d) Satellite applications in Remote sensing.
8. Explain the working of a typical satellite earth station with neat diagrams. Discuss the role of antenna, low-noise amplifier and frequency converter in detail. 15

Roll No.

Total Pages : 2

BT-8/M-26

48317

NEURAL NETWORKS AND FUZZY LOGIC

Paper-ECO-14A

Time Allowed : 3 Hours]

[Maximum Marks : 75

Note : Attempt **five** questions in all, selecting at least **one** question from each Unit. All questions carry equal marks.

UNIT-I

1. Draw the block diagram of a basic Neural Network. Explain the evaluation of Neural Network Models, important technologies and various applications in Engineering. 15
2. (a) What are the advantages and limitations of Genetic Algorithms over Conventional Optimization Techniques? 8
- (b) What are the basic components of a Genetic Algorithm? Discuss how crossover and mutation help in exploring the search space ? 7

UNIT-II

3. (a) Explain the Architecture, Training algorithm and limitations of a Single-layer perceptron. 8

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- (b) Describe the working principle of the Adaptive Linear Neuron (ADALINE). 7
- 4. Discuss the Architecture and Operation of the following Associative Memory models:
 - (a) Bidirectional Associative Memory (BAM). 8
 - (b) Hopfield Network. 7

UNIT-III

- 5. What is fuzzification? Describe the process of converting crisp input values into Fuzzy values. 15
- 6. What do you mean by Fuzzy Inference Systems? Describe Fuzzy Decision Systems. 15

UNIT-IV

- 7. Explain the Architecture and Working principle of the simplified Fuzzy ARTMAP Network. 15
- 8. Discuss the main advantages, challenges, and limitations of using hybrid soft computing techniques in real-time intelligent systems. 15

Roll No.

Total Pages : 2

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48319

MIXED SIGNAL DESIGN

Paper-ECO-16A

Time Allowed : 3 Hours]

[Maximum Marks : 75

Note : Attempt **five** questions in all, selecting at least **one** question from each Unit. All questions carry equal marks.

UNIT-I

1. Analyze the Speed and Precision considerations for MOSFET switches. 15
2. Explain any two of the following in detail with suitable diagram: $2 \times 7\frac{1}{2} = 15$
 - (a) Non-inverting Amplifier.
 - (b) Switched-Capacitor Integrator.
 - (c) Unity Gain Sampler-Buffer.

UNIT-II

3. Illustrate the block diagram and explain the operation of a Simple-Pump Phase-Locked Loop, and discuss its any two key applications. 15

4. Characterize a comparator. Analyze the basic CMOS comparator design, highlighting its operation and associated design challenges. 15

UNIT-III

5. (a) Analyze the current Steering type DAC with mismatch error issues. 10
- (b) Explain Sample and Hold circuit with its characteristics. 5
6. (a) Design a 3-bit DAC using an R-2R architecture with $R = 4K\Omega$, feedback resistance (R_F) = $8K\Omega$, and reference Voltage (V_{REF}) = 6V. Assume that the resistances of the switches are negligible. Determine the value of total input current (i_{TOT}) for each digital input and the corresponding output voltage, V_{OUT} . 10
- (b) Discuss Pipeline DACs. 5

UNIT-IV

7. (a) Discuss the ADC specifications. 8
- (b) Explain the design and operation of a flash ADC. 7
8. Explain any **two** of the following in detail: 15
- (a) The Pipeline ADC
- (b) Integrating ADC
- (c) Successive Approximation ADC.