

Roll No.

Total Pages : 03

BT-4/M-24

44156

APPLIED AND COMPUTATIONAL
MATHEMATICS
BS-207-A

Time : Three Hours]

[Maximum Marks : 75

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

Section A

1. (i) Solve the differential equation :

$$x \frac{dy}{dx} + y \log y = xye^x$$

- (ii) Solve :

$$x^2(y - px) = yp^2$$

2. By using Charpit's method, solve the differential equation

$$(p^2 + q^2)y = qz.$$

Section B

3. (i) Evaluate :

$$\int_0^1 \int_{x^2}^x (x^2 + y^2)^{-\frac{1}{2}} dy dx$$

by changing the order of integration.

- (ii) Evaluate $\iiint_R (x^2 + y^2 + z^2) dx dy dz$, R denotes the region bounded by :

$$x = 0, y = 0, z = 0 \text{ and } x + y + z = a (a > 0).$$

4. Show that the vector field $\vec{F} = 2x(y^2 + z^3)\hat{i} + 2x^2y\hat{j} + 3x^2z^2\hat{k}$ is conservative. Find its scalar potential and the work done in moving a particle from $(-1, 2, 1)$ to $(2, 3, 4)$.

Section C

5. (i) Find the Laplace transform of $t^2 \cos at$.
(ii) Find the inverse of the Laplace transform

$$\frac{2s-5}{4s^2+25} + \frac{4s-18}{9-s^2}.$$

6. Using the Laplace transform, solve the initial value problem :

$$\frac{d^2y}{dt^2} + 2\frac{dy}{dt} + 2y = 5 \sin t$$

where $y(0) = y'(0) = 0$.

Section D

7. (i) Compute real root of $x \log_{10} x - 1.2 = 0$.
- (ii) Find the approximate value, correct to three places of decimals, of the real root which lies between -2 and -3 of the equation $x^3 - 3x + 4 = 0$, using the method of false position three times in succession.
8. Apply Taylor series method of second order to integrate $y' = 2t + 3y$, $y(0) = 1$, $t \in [0, 0.1]$ with $h = 0.1$.

Roll No.

Total Pages : 03

BT-4/M-24

44157

DIGITAL COMMUNICATION

EC-202 A

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. (a) State and prove sampling theorem for baseband signals. A narrowband signal has a bandwidth of 10 kHz centred at a carrier frequency of 100 kHz. What is the minimum sampling rate that can be used to represent signal in discrete form ? **5**
- (b) Explain in detail Pulse Code Modulation scheme. **10**

2. (a) Describe algorithm of Delta Modulation. Illustrate two different types of quantization errors that may occur in delta modulation technique. A signal is given by $e(t) = 20 \cos (1000\pi t) + 15 \cos (1500\pi t)$. The signal is quantized using delta modulation. Select an appropriate sampling rate and step size to transmit the signal avoiding slope overload. **10**

- (b) Draw a neat and clean block diagram of TDM system. Explain the working of each block in detail.

5

Unit II

3. (a) State and justify with the help of derivation the purpose of using matched filter at receiver. 8
- (b) What is ideal Nyquist channel ? Enlist properties of ideal Nyquist channel. Also mention the limitations faced by it. 7
4. (a) State the significance of correlative level coding. Briefly discuss the principle of duobinary signaling scheme. 8
- (b) Describe Least Mean Square algorithm used to provide optimum equalization at receiver. 7

Unit III

5. (a) Express mathematically QPSK signals. Discuss the signal space representation of QPSK. Discuss generation and detection of QPSK signals. 8
- (b) Discuss Gram Schmidt orthogonalization process that is used to represent any modulated signal in signal space. 7

6. (a) Discuss QAM signals. Draw signal space representation of QAM signals. How does QAM signals differ ASK signals ? 10
- (b) Describe FSK modulation technique in detail. 5

Unit IV

7. (a) Mention algorithm of Maximum Likelihood Sequence estimation. Draw block diagram of MLSE equalizer alongwith its working. 7
- (b) What is an equalizer ? What is its purpose ? Describe working of tapped delay line equalizer. 8
8. (a) Enlist the factors among which tradeoff is to be followed while choosing a digital modulation technique. Explain reasons for tradeoff. 10
- (b) Mention need of synchronization. Discuss two modes of synchronization that may be required at receiver and transmitter. 5

Roll No.

Total Pages : 03

BT-4/M-24

44158

ANALOG CIRCUITS

EC-206A

Time : Three Hours]

[Maximum Marks : 75

Note : Attempt *Five* questions in all, selecting at least *one* question from each Unit. Each question carries 15 marks.

Unit I

1. (a) Differentiate between transconductance and transresistance amplifiers. 10
- (b) Draw the circuit of two stage R-C coupled transistor amplifier and explain the working of it. 5
2. (a) Derive expression for A_v and R_o for common source JFET amplifier 8
- (b) Show that total gain is equal to the product of gains of individual stages in a multi-stage amplifier. 7

Unit II

3. (a) Draw the circuit diagram of class B push pull amplifier and explain its operation. Also prove that its conversion efficiency is 78.5%. 10

- (b) Explain the frequency response of amplifier in different regions. **5**
4. An amplifier has a mid band gain of 125 and a bandwidth of 250 kHz. If 4% negative Feedback is introduced, find the new bandwidth and gain. What are the advantages and disadvantages of the introduction of negative feedback in amplifiers ? Explain. **15**

Unit III

5. (a) In a Colpitt's oscillator, the values of the inductors and capacitors in the tank circuit are $L = 30 \text{ mH}$, $C_1 = 200 \text{ pF}$, $C_2 = 400 \text{ pF}$. **10**
- (i) Find the frequency of oscillation.
- (ii) If the output voltage is 15 V, find the feedback voltage.
- (iii) Find the minimum gain, if the frequency is changed by changing 'L' alone.
- (iv) Also find the new frequency of oscillation.
- (b) Derive conditions for sustained oscillations in a RC Phase shift oscillator. **5**
6. What is 555 timer ? Draw and explain its pin diagram. Explain the working and applications of 555 timer monostable multivibrator. **15**

Unit IV

7. (a) Explain the hysteresis plot generated by Schmitt trigger along with its applications. 7
- (b) Draw the circuit of differential amplifier with one Op-Amp and derive the expression voltage gain. 8
8. (a) Explain and derive the current expression of current mirror circuit diagram. 5
- (b) Briefly explain summing amplifier. Draw an adder circuit for the given expression : 10

$$V_0 = - (0.1 V_1 + V_2 + 5V_3)$$

Roll No.

Total Pages : 03

BT-4/M-24

44159

**MICROPROCESSORS AND
MICROCONTROLLERS
EC-210A**

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. Draw the architecture of 8085 and 8086 microprocessors. Explain in detail the various tasks performed by BIU and EU. 15
2. Draw and discuss the typical maximum mode 8086 system with a read-and-write cycle timing diagram in maximum mode. 15

Unit II

3. (a) Draw the pin diagram of 8051 and explain the function of each pin in detail. 10

- (b) Explain the internal RAM organization of 8051 with a suitable diagram. **5**
4. (a) Explain the function of each flag in PSW. What are the applications of carry and overflow flags ? **5**
- (b) Discuss the function of each bit of TCON and TMOD register in 8051. **10**

Unit III

5. (a) Assume that XTAL = 11.0592 MHz, and write an assembly program to generate a square wave of 10 kHz frequency on pin P1.0. **10**
- (b) Calculate the delay for the following program; Assume the frequency of 11.0592 MHz : **5**

Machine Cycle

DELAY : MOV R2, #200

GO :	NOP	1
	NOP	1
	NOP	1
	DJNZ R2, GO	4

6. (a) Using contents of various registers given below. **10**

Offset(displacement)-4000H, [AX]-1500H, [BX]-1000H, [SI]-2500H, [DI]-3500H, [BP]-4000H, [SP]-

5000H, [CS]-0000H, [DS]-1000H, [SS]-2500H, [IP]-6000H

Form effective addresses for Register relative, Register indirect, Based Indexed, Relative based Indexed and Direct addressing mode.

- (b) Write an ALP to perform multiplication and division of two 8-bit data 21H and 17H in 8051. **5**

Unit IV

7. Design an interface between 8086 CPU and two chips of $4K \times 8$ RAM and two chips of $4K \times 8$ ROM. Select the starting address of ROM and RAM memories suitably. **15**
8. Explain the operation and interfacing diagram of LCD with 8051. Also developing an assembly program to display the message 'HELLO' at the beginning of the first line. **15**

24

Roll No.

Total Pages : 02

BT-4/M-24

44160

ELECTROMAGNETIC FIELD THEORY

Paper : EC-214-A

Time : Three Hours]

[Maximum Marks : 75

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

Unit I

1. (a) Write short notes on Gradient, Divergence and curl of a vector along with their physical significance.
(b) Write short notes on Gauss Divergence theorem and Stokes theorem. 15

2. State and explain the Gauss's law. Explain the applications of Gauss's law with example. 15

Unit II

3. Write short notes on the following : 15
 - (a) Biot-Savart's Law
 - (b) Amperes's Law
 - (c) Faraday's Law
 - (d) Lenz's Law.

4. Explain boundary conditions for magnetic field. 15

Unit III

5. Explain reflection and refraction of uniform plane wave. 15
6. Derive the wave equations from the Maxwell's equations for conducting space. 15

Unit IV

7. Explain the model of Transmission Line. Also explain transmission line equations. 15
8. What do you understand by TE, TM and TEM mode? Also write short notes on the following : 15
Cut-off and Guided Wavelength in Waveguide.

Roll No.

Total Pages : 03

BT-4/M-24

44161

BASICS OF ANALOG COMMUNICATION

EEN-202A

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. (a) What is meant by Noise ? Classify different types of Noise. Also mention reasons for these noises. Calculate thermal noise power available from any resistor at room temperature 290 K for a bandwidth of 2 MHz and also calculate noise voltage at 100 Ω resistor. 7
- (b) Define noise figure. Calculate noise figure as function of additional noise. 8
2. (a) Derive an expression for AM wave signal. Draw the spectrum. Label different components of the spectrum. 7
- (b) Differentiate between NBFM and WBFM. Explain, how WBFM can be generated through NBFM. 8

Unit II

3. (a) Discuss square law modulation technique for AM generation. **5**
- (b) What are SSB signals ? Derive an expression for SSB signal. Explain the Frequency discrimination method for generating AM signals. **10**
4. (a) Draw block diagram of Superheterodyne AM receiver and explain the function of each block. **8**
- (b) Discuss working of envelope detectors used to detect AM signals. What types of distortions are produced due to presence of diode in it ? **7**

Unit III

5. (a) Explain direct method of FM generation. **8**
- (b) In frequency modulation, explain frequency deviation, percent modulation, phase deviation and modulation index. **7**
6. (a) Explain the functionality of each block of phase shift discriminator. **7**
- (b) What does a noise triangle illustrate ? How does pre-emphasis and de-emphasis help in reducing noise ? Draw circuits for pre-emphasis and de-emphasis and explain their working. **8**

Unit IV

7. (a) Describe phase shift method of SSB generation. 7
(b) Write down expression for VSB-SC signals. Draw its spectrum and label it. Explain, how VSB signals are used in TV transmission. 8
8. (a) What are PAM signals ? Derive an expression for PAM signal. 8
(b) Differentiate between PPM and PWM signals. 7

Roll No.

Total Pages : 2

46186

BT-6/M-24

ORGANIZATIONAL BEHAVIOR

Paper : HM-901A

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. What is workforce diversity? Describe how organizations manage diversity effectively. Also recognize stereotypes and understand how they function in an organizational setting. 15
2. Define Organizational Behavior. Outline the challenges and opportunities for OB practitioners today's culturally diverse organizations. 15

UNIT-II

3. Are emotions rational? What functions do they serve? What is the evidence for and against the existence of emotional intelligence? What are the sources of emotions and moods? 15
4. What is personality? What factors determine personality? What are the personality traits? Besides the Big Five, what other personality traits are relevant to OB? 15

UNIT-III

5. Define group. What are the different types of groups? What are the five stages of group development? 15
6. What are the three key elements of motivation? What are some early theories of motivation? How applicable are they today? 15

UNIT-IV

7. Identify the main factors responsible for creating organizational stress. Represent a stress mode diagrammatically. What are the individual and organizational approaches to managing stress? 15
8. Differentiate between formal and informal communication. Explain the barriers to effective communication in detail. 15

UNIT-II

BT-6/M-24

CONTROL SYSTEM ENGINEERING

Paper : EC-302A

Time : Three Hours]

[Maximum Marks : 75

Note : Attempt five questions in all, selecting at least one question from each unit.

UNIT-I

- 1. (a) Find the overall transfer function by using Mason's gain formula for the signal flow graph shown below in Fig. 1. 7

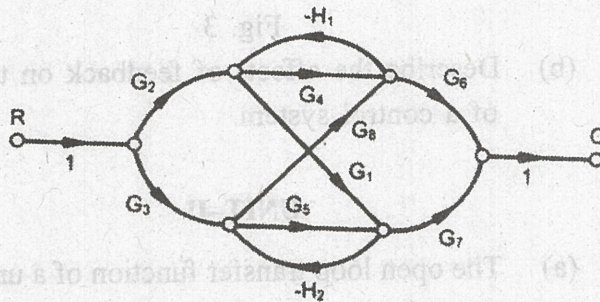


Fig.1

- (b) Draw force-voltage analogy of the mechanical system shown below in Fig. 2. 8

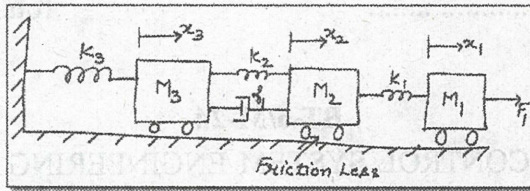


Fig. 2

2. (a) Obtain the transfer function of the system given below in Fig. 3 using block diagram reduction method. 9

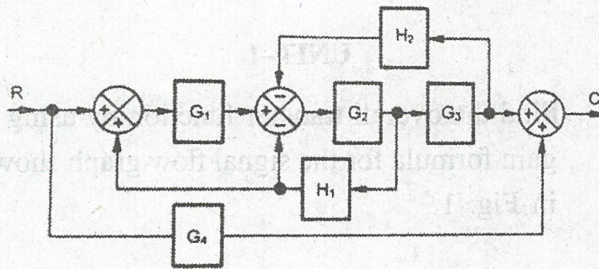


Fig. 3

- (b) Describe the effects of feedback on time constant of a control system. 6

UNIT-II

3. (a) The open loop transfer function of a unity feedback control system is given by :

$$G(s) = \frac{20}{S(S + 2)} \quad 8$$

- (b) The input to the system is given by

$$r(t) = a_0 + a_1 t + \frac{a_2}{t} t^2.$$

Determine the generalized error coefficients and expression for steady state error? 7

4. (a) Comment on the stability of the system described by following polynomial using Routh Criterion :

$$S^6 + S^5 + 3S^4 + 3S^3 + 3S^2 + 2S + 1 = 0. \quad 5$$

- (b) Consider a unity feedback control system with an open loop transfer function

$$G(s) = \frac{K}{(S)(S + 3)(S^2 + 2S + 2)}$$

- (i) Draw the root locus of the system as gain 'K' is varying from 0 to ∞ .
- (ii) Determine the asymptotes, centroid, breakaway point and the gain at which root locus crosses imaginary axis. 10

UNIT-III

5. Sketch the BODE plot for the following transfer function

$$G(s) = \frac{50}{S(1 + 0.25S)(1 + 0.1S)}$$

Determine the

- (i) Gain Crossover Frequency.
- (ii) Phase Cross Over frequency.
- (iii) Phase Margin.
- (iv) Gain Margin.
- (v) Stability of the System. 16

6. Sketch the Nyquist plot and determine the stability of a unity feedback control system whose open loop transfer function is as follows :

$$G(s) = \frac{1 + 4S}{S^2(1 + S)(1 + 2S)} \quad 15$$

UNIT-IV

7. (a) Obtain the state model for the given transfer function

$$G(s) = \frac{Y(s)}{U(s)} = \frac{K(C_2S + C_1)}{(S^3 + a_3S^2 + a_2S + a_1)} \quad 8$$

- (b) A system is characterized by the following transfer function :

$$\frac{Y(s)}{u(s)} = \frac{20(10S + 1)}{(s^3 + 3s^2 + 2s + 1)}$$

Find the state and output equation in matrix form and also test the controllability and observability of the system? 7

8. The open loop transfer function of an uncompensated system is

$$G(s) = \frac{K}{S(S + 2)(S + 20)}$$

Design a lag compensator for the system so that the static velocity error constant $K_v = 20 \text{ sec}^{-1}$, the phase margin $\geq 35^\circ$ 15

Roll No.

Total Pages : 2

46258

BT-6/M-24

VERILOG HDL

Paper : EC-306A

Time : Three Hours]

[Maximum Marks : 75

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

UNIT-I

1. (a) Discuss the conventional approach to digital design. 8
(b) Explain scalars and vectors with illustrations. 7
2. (a) Write about "Module" in details. 8
(b) List and explain various numbers used in Verilog HDL. 7

UNIT-II

3. (a) Using Gate level modelling, write and explain Verilog program for A-O-I gate circuit : 8

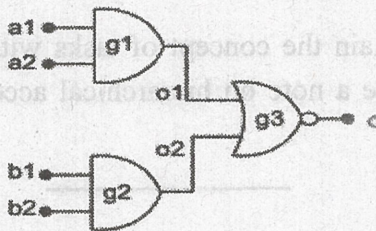


Fig 1: A-O-I gate circuit

- (b) Explain functional bifurcation in details. 7
4. (a) Using Gate level modelling, write and explain Verilog program of 4 : 16 decoder. 8
- (b) Explain case statement with an example. 7

UNIT-III

5. (a) Describe delays and continuous assignments in detail. 8
- (b) List and explain various types of basic transistor switches. 7
6. (a) List and explain various types of operators used in Verilog HDL. 8
- (b) Describe instantiations with strengths and delays. 7

UNIT-IV

7. (a) Explain the concept of functions with examples. 8
- (b) Write a note on compiler directives. 7
8. (a) Explain the concept of tasks with examples. 8
- (b) Write a note on hierarchical access. 7

Roll No.

Total Pages : 2

46259

BT-6/M-24

ANTENNAS AND PROPAGATION

Paper-ECP-6A

Time : Three Hours]

[Maximum Marks : 75

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

UNIT-I

1. Explain the various terms used in antenna :
 - (i) Directive Gain.
 - (ii) Power Gain.
 - (iii) Directivity.
 - (iv) Beam width.
 - (v) Antenna Temperature. (15)
2. Find the expression of radiated fields by Hertzian Dipole antenna. (15)

UNIT-II

3. Find the expression of radiated fields Due to N element antenna array. Also find the condition for maximum radiation for N element antenna array. (15)
4. Write short notes on :
 - (i) Yagi-Uda Antenna.
 - (ii) Turnstile Antenna.
 - (iii) Loop Antenna. (15)

46259/300/KD/1087

263 [P.T.O.
23/6

UNIT-III

5. Write short notes on :
- (i) Horn antenna.
 - (ii) Reflector antenna. (15)
6. Explain Advantages and basic Configurations of Patch antenna. Also explain different feeding techniques of Patch antenna. (15)

UNIT-IV

7. Write short notes on :
- (a) Maximum usable frequency.
 - (b) Fading.
 - (c) Skip distance.
 - (d) Virtual height. (15)
8. Explain various techniques of radio wave propagation. (15)

Roll No. Total Pages : 2

46264

BT-6/M-24

MULTIMEDIA COMMUNICATION

Paper-ECO-6A

Time : Three Hours]

[Maximum Marks : 75

- Note :** (i) There are eight questions in this paper. Each question carries 15 marks.
- (ii) Attempt *five* questions, selecting at least *one* question from each unit.

SECTION-I

1. (a) What is multimedia communication? Explain data networks and its packet mode of operation with the help of diagram. (10)
- (b) Differentiate between MOD and NMOD with the help of suitable diagrams. (5)
2. (a) What is digitization? Why is it required? Draw the waveforms of conversion of an analog signal in to digital signal. (10)
- (b) Discuss the representation of text and audio signal. (5)

SECTION-II

3. (a) With the help of examples explain run length encoding and differential encoding. (5)

- (b) The probabilities of the characters A to D are $A = 0.1$, $B = 0.25$, $C = 0.50$ and $D = 0.15$. Derive the Huffman coding tree and also derive the code words of characters A to D during transmission. (10)
4. With the help of block diagram, explain in detail all the steps of JPEG encoder. Also differentiate between LZ and LZW encoding. (15)

SECTION-III

5. (a) What are the limitations of DPCM? How they are overcome by ADPCM? Explain with the help of their block diagrams and working. (10)
- (b) Explain linear predictive encoder with the help of block diagram. (5)
6. Differentiate between motion estimation and compensation. Differentiate between I and P frames of Video compression with the help of their block diagrams. (15)

SECTION-IV

7. (a) Write a detailed note on pack architecture. (5)
- (b) Explain multimedia synchronization. What are the requirements of multimedia synchronization? (10)
8. With the help of block diagram explain the working of CBIR system. Why these systems are required? What are the main features that are extracted from these systems and also name some feature extraction techniques. (15)

Roll No.

Total Pages : 3

47297

BT-7/M-24

**INTELLECTUAL PROPERTY RIGHTS FOR
TECHNOLOGY DEVELOPMENT & MANAGEMENT**

Paper : HM-904-A

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. (a) Define each type of intellectual property (patents, designs, trademarks, and copyright) and discuss their respective scopes of protection. Provide examples to illustrate the differences between them. (10)
- (b) Analyze the importance of international cooperation on intellectual property rights. Discuss how collaboration between countries and organizations such as WIPO benefits the global intellectual property landscape? (5)
2. (a) Describe the procedure for the grant of patents, including the requirements for patentability, the patent application process, and the examination procedure. Discuss the significance of patent search and prior art analysis in the patenting process. (10)

47297/50/KD/1126

[P.T.O.
12/6

- (b) Discuss the advantages and disadvantages of patenting under the Patent Cooperation Treaty (PCT). (5)

UNIT-II

3. Define the scope of patent rights and discuss the exclusive rights granted to patent holders. Provide examples to illustrate the types of activities covered by patent rights and the limitations of these rights. (15)
4. Explain the process of licensing and transfer of technology in the context of patent rights. Discuss the benefits of technology transfer agreements for both licensors and licensees, and highlight the key considerations involved in negotiating and drafting such agreements. (15)

UNIT-III

5. Trace the historical evolution of copyright law in India, focusing on the development of the Copyright Act, 1957. Discuss the key provisions of the Act, including the meaning of copyright, ownership of copyrights, and criteria of infringement. (15)
6. (a) Explain the concept of copyright in the context of computer programs. Discuss the challenges and opportunities associated with copyright protection for software in India. Provide examples of landmark cases related to copyright infringement in the software industry. (8)

- (b) Analyze the rights and obligations of patentees under the Patents Act, 1970. Discuss the duration of patents, considering both legal and policy considerations. (7)

UNIT-IV

7. (a) Analyze new developments in intellectual property rights (IPR) related to biological systems and computer software. Discuss the implications of emerging technologies and innovative business models on patent law and policy. (10)
- (b) Examine the issue of traditional knowledge in the context of intellectual property rights (IPR). Provide case studies to illustrate the challenges of protecting traditional knowledge and the role of IPR in preserving cultural heritage and biodiversity. (5)
8. Write notes on the following :
- (a) Define Intellectual Property (IP) and discuss its importance in the modern economy. Provide examples of different types of intellectual property rights.
- (b) Explain the concept of patentability criteria. Discuss in detail the novelty and nonobviousness requirements for obtaining a patent.
- (c) Discuss the role of trademarks in protecting brand identity and goodwill. Explain the process of trademark registration and the benefits it offers to trademark owners. (5×3=15)

Roll No.

Total Pages : 3

47298

BT-7/M-24

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? (8)

(b) What is meant by fiber splices? List different methods of splicing. Explain mechanical splicing in detail. (7)

UNIT-II

3. (a) Explain the reasons responsible for intrinsic absorption in optical fibers. A continuous 12 km long optical fiber link has a loss of 1.5 dB/km. What is the minimum optical power level that must be launched into the fiber to maintain an optical power level of 0.3 μW at the receiving end? (5)
- (b) Discuss in detail scattering losses in optical fibers. (10)
4. Explain the different dispersion mechanisms in optical fibers alongwith the reasons responsible for them. Derive an expression for pulse spreadening due to intermodal dispersion. How does dispersion effect the data rate that can be transmitted through fiber. A multimode graded index fiber exhibits total pulse broadening of 0.1 μs over a distance of 15 km. Estimate :
- (i) The maximum possible bandwidth without ISI.
- (ii) Pulse dispersion per unit length. (15)

UNIT-III

5. (a) What is the population inversion? Explain the different methods of achieving population inversion in LASER. (7)
- (b) Explain the working principle of LED. How the quantum efficiency of a LED is defined? Derive expression for quantum efficiency of LED. (8)

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 2×2 star coupler. (7)
(b) What is WDM? Define. (8)
8. Write short note on :
(a) Single hop and multihop networks. (7)
(b) LDC. (8)
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Roll No.

Total Pages : 3

BT-8/M-24

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) What is Artificial Intelligence? Give an overview of its application areas.
(b) What is logistic regression and how does it differ from linear regression? What are the assumptions underlying logistic regression?
2. (a) How does the Naïve Bayes classifier handle categorical features?
(b) How does SVM handle non-linearly separable data? Discuss.

UNIT-II

3. (a) How does the K-Means algorithm work? What are the advantages and disadvantages of the K-Means algorithm?

- (b) How does dimensionality reduction help in detecting patterns in unsupervised learning?
- 4. (a) What techniques can be used for feature selection in multivariable regression? Discuss.
- (b) What are the key assumptions of linear regression? How do you evaluate the performance of a regression model?

UNIT-III

- 5. (a) What is a Genetic Algorithm (GA) and how does it differ from traditional optimization algorithms?
- (b) How do crossover and mutation operations contribute to generating diverse bit patterns?
- 6. (a) How do colorspace like HSV or YUV aid in object tracking? What are the advantages of using colorspace for object tracking?
- (b) How can adaptive background subtraction improve object tracking?

UNIT-IV

- 7. (a) What is a Perceptron and how does it work? How do you train a Perceptron to classify linearly separable data?

- (b) How is the Exploration-Exploitation trade-off managed in Reinforcement Learning?
- 8.
- (a) How are State, Réward and Policy defined in a Reinforcement Learning problem?
 - (b) How is back propagation used to train multilayer Neural Networks? Discuss.

Roll No.

Total Pages : 3

BT-8/M-24

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) Explain the concept of Machine-to-Machine (M2M) communication and its significance in IoT.
(b) What are the privacy and security concerns associated with IoT in healthcare, and how can they be addressed?
2. (a) How does IoT contribute to the concept of smart cities and urban planning?
(b) What is Software-Defined Networking (SDN)? Explain the key components of an SDN infrastructure and their roles in Network Management.

UNIT-II

3. (a) What wireless communication protocols are commonly used in IoT weather monitoring? How does IoT

48310/K/1105/150

P. T. O.

support real-time data transmission and what challenges does it address in weather monitoring?

- (b) Describe the process of connecting and reading data from sensors using a Raspberry Pi.
4. (a) How are IoT sensors powered, and what are the considerations for Power Management in battery-operated Sensors?
- (b) How does an Arduino board interact with various sensors and actuators in Electronic projects?

UNIT-III

5. (a) How does cloud computing facilitate scalability and resource allocation?
- (b) What challenges do IoT devices face when using IPv4 addresses? Explain the advantages of IPv6 in terms of security for IoT devices and Networks.
6. (a) How does fog computing address latency and bandwidth challenges in distributed systems?
- (b) What considerations should IoT manufacturers and service providers take into account to ensure compliance with privacy regulations? Discuss.

UNIT-IV

7. (a) Describe the process of defining and using functions in Python.

- (b) What is a dictionary in Python, and how is it structured? How do you add, access, and modify key-value pairs in a Python dictionary?
- 8.
- (a) How can Python be used to interact with sensors and actuators in IoT projects?
 - (b) What are the privacy and security concerns associated with IoT in healthcare, and how can they be addressed?

Roll No.

Total Pages : 2

BT-8/M-24

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. (a) Discuss in detail the Kepler's 1st and 2nd laws of Orbital Mechanics. Draw diagrams where necessary.
- (b) The apogee and perigee distances of a satellite orbiting in an elliptical orbit are respectively 50,000 km and 8000 km. Determine the following:
 - (i) Semi-major axis of the elliptical orbit.
 - (ii) Orbit eccentricity.
 - (iii) Distance between the centre of the Earth and the centre of the elliptical orbit. 15
2. What are Look Angles? Derive the equation for the generation of Elevation angle. Also, discuss about subsatellite point. 15

48312/K/890/250

P. T. O.

UNIT-II

3. Discuss in detail TTC& M system with the help of a block diagram. 15
4. (a) Write a short on Power system of a Satellite System.
(b) What are Transponders? Discuss the working of Bent Pipe and double conversion Transponder. 15

UNIT-III

5. (a) Derive and explain the basic transmission theory using the link equation.
(b) Write the steps for Communication Link design procedure. 15
6. Derive the relation between system noise temperature and G/T ratio. Also, discuss the types of RF to IF conversion systems used in this using suitable diagrams. 15

UNIT-IV

7. Write short notes on the following :
(a) GPS (b) DBS-TV. 15
8. What are Multiple Access Techniques? Compare FDMA TDMA and DAMA techniques with necessary diagrams. 15

Roll No.

Total Pages : 3

BT-8/M-24

48316

SOFT COMPUTING

Paper-ECO-13A

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) What are the applications of Soft Computing Techniques? 8
- (b) Differentiate the features of Soft Computing and Hard Computing. 7
2. (a) Classify the various types of soft computing techniques. 7
- (b) Explain any two hybrid control schemes. 8

UNIT-II

3. (a) Explain with a neat diagram the neural network architecture of multilayer feed forward network. 8
- (b) Explain the Architecture and Algorithm of standard back Propagation algorithm. 7

48316/K/964/300

P. T. O.

4. (a) Explain the single perceptron with its learning algorithm and its separability and convergence property. 7
- (b) Using McCulloch-Pitts neuron model, design a neural network for 2-input XOR functions. 8

UNIT-III

5. (a) Explain the different types of membership function used in fuzzification process. 7
- (b) Calculate (i) Complement, (ii) Union (iii) Intersection (iv) Difference (v) De Morgan's Principles for the two given fuzzy sets 8

$$\underline{A} = \left\{ \frac{1}{2} + \frac{0.3}{4} + \frac{0.5}{6} + \frac{0.2}{8} \right\}$$

$$\underline{B} = \left\{ \frac{0.5}{2} + \frac{0.4}{4} + \frac{0.1}{6} + \frac{1}{8} \right\}$$

6. (a) Discuss the methods of aggregation of Fuzzy rules. 8
- (b) Explain with neat block diagram the various components and operation of a Fuzzy logic system. 7

UNIT-IV

7. (a) Explain the convergence criteria of genetic algorithm. 8

- (b) Evaluate the various phases of GA to control a non-linear time delay system. 7
- 8. (a) With a neat flowchart, explain the algorithm of particle Swarm optimization. 7
- (b) How to implement particle Swarm optimization for Traveling Salesman problem? 8

Roll No.

Total Pages : 3

BT-8/M-24

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. (a) State and explain properties of fuzzy sets with example. 8
- (b) Write short notes on fuzzy propositions. 7
2. (a) With an example for each bring out the significance of the following as referred to Genetic Algorithm :
(i) Fitness function, (ii) Reproduction, (iii) Roulette wheel selection, (iv) Cross Over, (v) Mutation Operator and (vi) Bitwise operators. 8
- (b) Mention the role of fitness function in Genetic Algorithm. 7

UNIT-II

3. (a) Explain characteristic features, limitations and applications of associative memory. 8

48317/K/977/100

P. T. O.

- (b) Explain basic architecture, working and analysis of adaptive resonance theory. 7
4. (a) Describe the basic steps of Genetic Algorithm used for solving optimization techniques. 7
- (b) With neat architecture, explain the training algorithm of Kohonen selforganizing feature maps. 8

UNIT-III

5. (a) The discretized membership functions for a transistor and a resistor are given below : 8

$$\mu_T = \{0/0 + 0.2/1 + 0.7/2 + 0.8/3 + 0.9/4 + 1/5\}$$

$$\mu_R = \{0/0 + 0.1/1 + 0.3/2 + 0.2/3 + 0.4/4 + 0.5/5\}$$

Find the following :

- (i) Algebraic sum (ii) Algebraic product (iii) Bounded sum (iv) Bounded difference.
- (b) Discuss about the four modes of fuzzy reasoning. 7
6. (a) With suitable block diagram, explain the working principle of fuzzy inference system. 8
- (b) Discuss the design of FLC of a typical non-linear systems. 7

UNIT-IV

7. (a) Design a fuzzy logic controller to simulate a temperature control system for a room. 8

- (b) Describe the basic steps of Genetic Algorithm used for solving optimization techniques. 7
8. (a) With suitable block diagram, explain the principle involved in a liquid level controller using neurofuzzy technique. 8
- (b) Explain in detail the concept of fuzzy genetic hybrid systems. 7

Roll No.

Total Pages : 2

BT-7/M-24

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. Design MOSFET as a switch. Discuss its charge injection cancellations, speed and precision considerations. 15
2. Explain in detail Unity Gain sampler buffer and precision multiply by two circuit. 15

UNIT-II

3. Design and explain the CMOS as a comparator and discuss its functions. 15
4. Differentiate between simple PLL and charge pump PLL. Explain the operation and applications of PLL. 15

UNIT-III

5. With the help of the architecture diagram explain the operation of R-2R ladder networks in detail. 15

48319/K/1044/250

P. T. O.

6. Explain each in detail the following :

(a) Charge scaling DACs. 7½

(b) Pipeline DACs. 7½

UNIT-IV

7. Design and discuss the architecture of flash and two step flash ADCs. Also explain the applications of DACs and ADCs. 15

8. Write short notes on the following: 2×7½=15

(a) The successive approximation ADC.

(b) The oversampling ADCs.