

B.Tech Examination-2022
Electronics and Communication Engineering
(Even Semester Regular and Supplementary)
Wireless and Mobile Communication (ECE 402)

Full Marks: 80

Time: 3.00 Hrs

- **Answer any eight questions.**
- *Answer all parts of a question in same place.*
- *Figures on the right-hand side margin indicate full marks.*
- *Symbols have their usual meaning*

1. Define the following terms-

- | | | |
|-----|--------------------------------|---|
| (a) | Multipath fading | 3 |
| (b) | Frequency selective fading | 3 |
| (c) | Non-frequency selective fading | 2 |
| (d) | Time variant fading | 2 |

2. In a digital cellular system if $f_c = 900$ MHz and the mobile velocity is 70 km/hour, Calculate the received carrier frequency if the mobile moves

- | | | |
|-----|--|---|
| (a) | Directly toward the transmitter | 2 |
| (b) | Directly away from the transmitter | 2 |
| (c) | In a direction perpendicular to the direction of the arrival of the transmitted signal | 4 |
| (d) | Explain Doppler shift. | 2 |

3. Calculate the channel capacity for the following system:

- | | | |
|-----|------|---|
| (a) | CDMA | 4 |
| (b) | TDMA | 3 |
| (c) | FDMA | 3 |

- | | | |
|--------|--|---|
| 4. (a) | What do you mean by frequency reuse technique in cellular communication systems? | 2 |
| (b) | Write down the rule for assignment of co-channel in cellular communication system. | 2 |
| (c) | Draw a cluster of hexagonal cells for $N=7$. Repeat the structure for 3 clusters. | 6 |

- | | | |
|--------|---|---|
| 5. (a) | Write down the expression for the maximum number channels (N) that can be supported by FDMA? | 2 |
| (b) | In US AMPS, 416 channels are allocated to various cellular operators. The channel bandwidth between them is 30 KHz with the guard band of 10 KHz. Calculate the spectrum allocation given to each operator? | 8 |

- | | | |
|--------|---|---|
| 6. (a) | Explain the terms: i) Scattering, ii) Reflection, iii) Diffraction in the context of propagation mechanism. | 6 |
| (b) | Calculate the excess path difference and phase difference associated with diffraction? | 4 |

7. Explain the following:
- (a) **Okumura** model in the context of path loss. 5
 - (b) **Hata** model in the context of path loss. 5
8. (a) What is channel assignment strategies? 2
- (b) What is fixed channel assignment (FCA)? 4
 - (c) What is dynamic channel assignment (DCA)? 4
9. A unit gain antenna with a maximum dimension of 1 m produces 50 W power at 900 MHz
- (a) Find the transmit power in dBm and dB. 5
 - (b) Find the received power at a free space distance of 5 m and 100 m. 5
10. Write short-note on the following topics-
- (a) Bluetooth 3
 - (b) W-LAN 3
 - (c) Zigbee 4
11. Write short-note on the following in the context of path loss-
- (a) Log-distance pathloss model. 3
 - (b) Partition Losses Between Floors (Inter-floor). 4
 - (c) Partition Losses Inside a Floor (Intra-floor). 3
12. (a) What is frequency hopping multiple access techniques (FHMA)? 4
- (b) Compare between FDD and TDD. 4
 - (c) Features of 5G mobile communication. 2

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B.Tech. Examination-2022
Electronics and Communication Engineering
(Even Semester Regular and Supplementary)
Soft Computing (ECE412)

Full Marks: 80

Time: 3.00 Hrs

- *Answer any eight questions.*
- *Answer all parts of a question in same place.*
- *Figures on the right hand side margin indicate full marks.*
- *Symbols have their usual meaning*

Marks

1. (a) Let X be the universe of satellites of interest, as defined below: 6

$$X = \{a12, x15, b16, f4, f900, v222\}$$
 Let A be the fuzzy set of INSAT-V satellite: $A = \left\{ \frac{0.2}{a12} + \frac{0.3}{x15} + \frac{1}{b16} + \frac{0.1}{f4} + \frac{0.6}{f900} + \frac{0.5}{v222} \right\}$
 Let B be the fuzzy set of INSAT-B satellite: $A = \left\{ \frac{0.1}{a12} + \frac{0.25}{x15} + \frac{0.9}{b16} + \frac{0.7}{f4} + \frac{0.3}{f900} + \frac{0.2}{v222} \right\}$
 Find the following sets of combinations for these two sets:
 i) $A \cup B$ ii) $A \cap B$ iii) $\overline{A \cup B}$ iv) $\overline{A \cap B}$ v) $\overline{A \cup B}$ vi) $\overline{A \cap B}$ vii) $A|B$
 viii) $B|A$
- (b) What are Modus Ponens and Modus Tollens? 4
2. (a) Fuzzy sets A and B are defined on the universe $X = [0, 5]$ where $\mu_A(x) = 2^{-x}$ and $\mu_B(x) = \frac{2x}{x+5}$. For each of the fuzzy sets i) sketch the membership functions ii) find the λ -cuts at $\lambda = 0.2$ and $\lambda = 0.5$. Are they fuzzy numbers? 6
- (b) Explain First, Second and total projections of fuzzy relation. Compute first, second and total projections of the fuzzy relation given below: 4
- | | | | | | | |
|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| $R \triangleq$ | Y | Y ₁ | Y ₂ | Y ₃ | Y ₄ | Y ₅ |
| | X | | | | | |
| | X ₁ | 0.1 | 0.4 | 1 | 0.5 | 0.4 |
| | X ₂ | 0.2 | 0.5 | 0.7 | 0.9 | 0.6 |
| | X ₃ | 0.3 | 0.6 | 1 | 0.7 | 0.3 |
3. (a) What is fuzzy system? Give a block schematic of a fuzzy system and describe each elements of it. 2+4
- (b) Two fuzzy sets A and B are given. $A = \left\{ \frac{0.1}{0} + \frac{0.5}{20} + \frac{0.6}{40} + \frac{0.8}{60} + \frac{0.9}{80} + \frac{1}{100} \right\}$ and $B = \left\{ \frac{0.2}{1} + \frac{0.5}{2} + \frac{0.8}{3} + \frac{1}{4} + \frac{0.9}{5} + \frac{0.4}{6} \right\}$. Find $R = A \times B$. Find $R_{0.8}$ 4
4. Consider a local area network (LAN) of interconnected workstations that communicate using Ethernet protocols at a maximum rate of 12 Mbit/s. The two fuzzy sets given below represent the loading of the LAN: 10

$$\mu_S(x) = \left\{ \frac{1.0}{0} + \frac{1.0}{1} + \frac{0.8}{2} + \frac{0.2}{5} + \frac{0.2}{7} + \frac{0.0}{9} + \frac{0.0}{10} \right\}$$

$$\mu_C(x) = \left\{ \frac{0.0}{0} + \frac{0.0}{1} + \frac{0.0}{2} + \frac{0.5}{5} + \frac{0.7}{7} + \frac{0.8}{9} + \frac{1.0}{10} \right\}$$

Where S represents silent and C represents congestion. Perform algebraic sum, algebraic product, bounded sum and bounded difference over the two fuzzy sets.

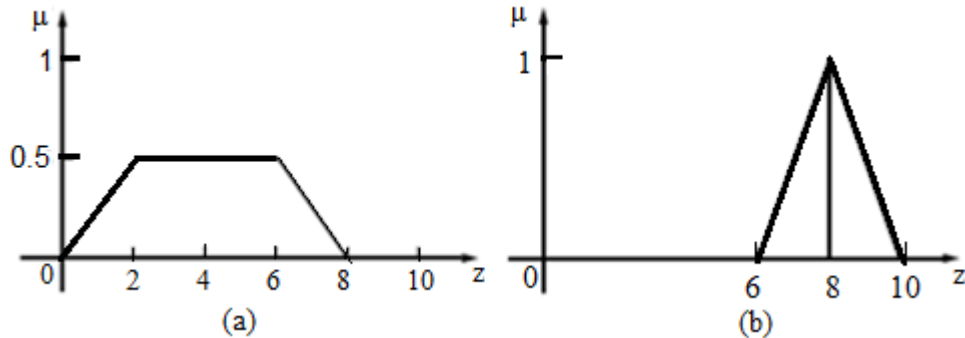
5. (a) What are the learning methods available for neural networks? Discuss in brief. 6
 (b) Develop simple ANNs to implement the two input AND functions using MP neurons 4
6. Define λ -cut set. Two fuzzy sets both are defined on x as follows: 10

$\mu(x_i)$	x_1	x_2	x_3	x_4	x_5	x_6
A	0.1	0.6	0.8	0.9	0.7	0.1
B	0.9	0.7	0.5	0.2	0.1	0

Express the following λ -cut sets using Zadeh's notation

(i) $(A \cap B)_{0.6}$ (ii) $(\overline{A \cap B})_{0.7}$ (iii) $(\overline{A} \cup \overline{B})_{0.7}$ (iv) $(A \cap \overline{A})_{0.7}$

7. For the logical union of the membership functions shown below, find the defuzzified value using following defuzzification methods i) Centroid method ii) Center of Sums iii) Weighted average method and iv) First of Maxima. 10



8. Consider the problem of controlling the speed of motor. Two variables related to this problem are speed (in rpm) and load (torque), resulting in the following two fuzzy membership functions 10

$$S = \left\{ \frac{0.2}{x_1} + \frac{0.6}{x_2} + \frac{1.0}{x_3} + \frac{0.7}{x_4} + \frac{0.5}{x_5} \right\} \quad \text{and}$$

$$L = \left\{ \frac{0.3}{y_1} + \frac{0.4}{y_2} + \frac{0.7}{y_3} + \frac{1.0}{y_4} + \frac{0.7}{y_5} + \frac{0.4}{y_6} + \frac{0.1}{y_7} \right\}$$

Where, S in a universe X and L in a universe Y.

- i) Find a fuzzy relation that relates two variables $R = S \times L$
 Now consider another relation, say the fuzzy current I, that relates elements in the universe Y to the elements in Z, as given here

$$I = \begin{matrix} & z_1 \\ y_1 & \left[\begin{array}{c} 0.2 \\ 0.4 \\ 0.7 \\ 0.2 \\ 0.5 \\ 0.8 \\ 1.0 \end{array} \right] \\ y_2 & \\ y_3 & \\ y_4 & \\ y_5 & \\ y_6 & \\ y_7 & \end{matrix}$$

ii) Find $I \circ R$ using max-min composition to relate elements in X to elements in Z

9. (a) Discuss commonly used signal functions to model the activation of neural networks. 5
 (b) Distinguish between a single layer feed-forward network, Multilayer feed-forward network and recurrent network. 5

10. Implement XOR function using MP (McCulloch Pitts) neuron (consider binary data). 10

11. In the field of computer networking there is an imprecise relationship between the level of use of a network communication bandwidth and the latency experienced in peer-to-peer communications. Let X be a fuzzy set of use levels (in terms of the percentage of full bandwidth used) and Y be a fuzzy set of latencies (in milli seconds) with the following membership functions: 10

$$X = \left\{ \frac{0.2}{10} + \frac{0.5}{20} + \frac{0.8}{40} + \frac{1.0}{60} + \frac{0.6}{80} + \frac{0.1}{100} \right\} \text{ and } Y = \left\{ \frac{0.3}{0.5} + \frac{0.6}{1} + \frac{0.9}{1.5} + \frac{1.0}{4} + \frac{0.6}{8} + \frac{0.3}{20} \right\}$$

- i) Find the Cartesian product represented by the relation $R = X \times Y$.
 ii) Now suppose we have a second fuzzy set of the bandwidth usage given by

$$Z = \left\{ \frac{0.3}{10} + \frac{0.6}{20} + \frac{0.7}{40} + \frac{0.9}{60} + \frac{1.0}{80} + \frac{0.5}{100} \right\}$$

Find $S = Z \circ R$ using Max-product composition.

12. Consider a single-layer network (perceptron) with two inputs, having weights $w_1 = 0.5$ and $w_2 = -0.25$. Determine the output of the network when given an input vector (1,1) for each of the following activation functions: 10

- (i) linear activation function without threshold
 (ii) sigmoidal activation function
 (iii) thresholded activation function using threshold 0.25

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B.Tech. Examination-2022
Electronics and Communication Engineering
(Even Semester Regular and Supplementary)
Embedded System (ECE416)

Full Marks: 80

Time: 3.00 Hrs

- Answer all parts of a question in same place.
- Figures on the right hand side margin indicate full marks.
- Symbols have their usual meaning

Group A**(Multiple choice questions)**Answer any **Ten** from the following

1. Write the correct answer out of the choices given [10X1=10]
- (i) The number of logic gates present in IC is 500. The integration type of IC is
 (a) MSI (b) LSI
 (c) SSI (d) VLSI
- (ii) Which of the following has the highest “storage performance” ?
 (a) DRAM (b) SRAM
 (c) OTP ROM (d) Masked ROM
- (iii) A micro-controller normally has which of the following devices on chip?
 (a) RAM (b) ROM
 (c) I/O (d) All of these
- (iv) Name the register holding the address of the memory location for the next instruction to fetch.
 (a) DPTR (b) PC
 (c) SP (d) None of these
- (v) The transducer must be connected to signal conditioning circuit before it is sent to the ADC.
 (a) TRUE (b) FALSE
 (c) Both (a) and (b) (d) None of these
- (vi) USB stands for
 (a) Universal serial bus (b) Uniform serial bus
 (c) Universal service bus (d) None of these
- (vii) UART stands for
 (a) Uniform Access for Receiver & Transmitter
 (b) Universal Access for Receiver Transmitter
 (c) Universal Asynchronous Receiver Transmitter
 (d) None of the above
- (viii) Automobile engine control system is the example of
 (a) Soft real time (b) Hard real time
 (c) Firm real time (d) None of these

- (ix) Which one is not embedded in a single chip in an embedded system?
 (a) Memory (b) Processor
 (c) A to D converter (d) None of these.
- (x) The number of bit of microcontroller in sophisticated embedded system is
 (a) 8 or 16 (b) 16 or 32
 (c) 32 or 64 (d) None of these
- (xi) In Harvard architecture
 (a) Separate address and data buses are used to access program and data memory
 (b) Same address and data buses are used to access program and data memory
 (c) Separate address bus but same data buses are used to program and data memory
 (d) Same address bus but separate data buses are used to access program and data memory.
- (xii) Real time means
 (a) Actual time
 (b) Time from start of task
 (c) Time measured using the system clock of RTOS
 (d) Time that has a fixed unalterable zero reference in which a clock advances at constant rate and which cannot be reloaded.

Group B

(Short type questions)

*Answer any **five** from the following*

2. What is an Embedded System? Describe the characteristics of an embedded system [5]
3. What are the design challenges of an Embedded System? [5]
4. Give the differences between embedded system and general purpose computer system. [5]
5. Explain the merits and limitations of IEEE1394 interface over USB. [5]
6. Describe the characteristics of RTOS. [5]
7. Show the schematic of a multi-thread system. [5]
8. Explain the Product Life-cycle curve of an embedded product development. [5]
9. Compare RISC and CISC architecture. [5]

Group C

(Long type questions)

*Answer any **three** from the following*

10. (a) What are the classifications of embedded system? [5]
 (b) Describe the different components of an embedded system. [5]
 (c) Explain the various purposes of embedded systems in detail with illustrative examples. [5]

11. (a) Draw and explain the internal architecture of Intel 8051 microcontroller. [7]
 (b) Explain the memory organization for 128 bytes of internal RAM for standard 8051 architecture. [4]
 (c) Write an ALP in 8051 to find out the square of a given value X by using a look up table. The table is available starting from 8000H of internal ROM memory location. Get X value from P1 and send square value from P2. [4]
12. (a) What is Cache Memory? What is its importance? [5]
 (b) With a block diagram explain the architecture of AVR microcontroller. [5]
 (c) Write a program in a microprocessor to separate odd and even numbers in a series of N data bytes. The series start from 8200H and the value of N is available at 8300H. Store the odd numbers from 8400H and even numbers from 8500H. [5]
13. (a) what is the hard real time and soft real time in embedded system? [5]
 (b) What is kernel? What are the different functions handled by a general purpose kernel? [6]
 (c) What is the advantage and disadvantages of programming using c++ in embedded system? [4]
14. (a) What is Sensor? Explain its role in Embedded System Design? Illustrate with an example. [5]
 (b) Explain the efficiency measuring parameters of an embedded system. [5]
 (c) Explain multiprocessing, multitasking and multiprogramming. [5]
15. **Write short notes on any *three* of the following:** [3x5=15]
 (a) Different types of memory used in embedded system
 (b) Features of ATmega328 microcontroller
 (c) Watchdog timer
 (d) Pipelining architecture
 (e) Development of ATmega328p based embedded board for real time Temperature monitoring
 (f) CAN

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Even Semester Examination 2021-2022
Paper Code: MS 432; Paper Name: Professional Values and Ethics
Department of ECE
Full Marks: 80
Time: 3 Hours

*(The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as possible)*

GROUP: A (Answer any Five questions) (5 x 7 = 35)
(Maximum word limit: 150 per answer)

1. Differentiate between Morality and Ethics
2. Explain the concept of Virtue
3. Define Commitment and Empathy
4. Explain Honesty and Courage
5. Describe the concept of Spirituality
6. Define Engineering Ethics?
7. What are the different types of Enquiries?

GROUP: B (Answer any three questions) (3 x 15 = 45)
(Maximum word limit: 300 per answer)

1. Describe in Detail; Human Values, evolution, types and Importance
2. Explain Moral Dilemma and Moral Autonomy. What are the steps to solve Moral Dilemma?
3. Discuss Moral Development Theories and Ethical Theories
4. Define profession and explain the characteristics and models of Professional Job

B.Tech.Examination-2022
Electronics and Communication Engineering
(Even Semester Regular and Supplementary)
Neural Networks (OEC404)

Full Marks: 80

Time: 3.00 Hrs

- *Answer all parts of a question in same place.*
- *Figures on the right hand side margin indicate full marks.*
- *Symbols have their usual meaning*

Answer any five question

		Marks
1.		
	(a) Define artificial neural network(ANN).	2
	(b) Draw the simple neural network architecture.	2
	(c) Define (i) Weights (ii) activation function (iii) bias and (iv) threshold in ANN.	8
	(d) What is learning or training of neural net. Discuss different types of learning method.	4
2.	(b) Draw the architecture of McCulloch -Pits neuron model.	2
	(a) Point out the main features of McCulloch-Pits nets.	4
	(b) Realize the X-OR function using McCulloch-Pits neurons.	6
	(c) If the net input to an output neuron is 0.64. Calculate the output when activation function is binary sigmoid.	4
3.	(a) What is Hebb rule of learning.	2
	(b) Draw the architecture of Hebb network.	2
	(c) Discuss the algorithm for Hebbian learning rule.	3
	(d) Realize a Hebb net for the AND function with bipolar inputs and targets.	6
	(e) What is linear separability in Hebbian learning.	3
4.	(c) Explain the working principle of perceptron network.	4
	(a) Write down the algorithm used for training the perceptron net.	4
	(b) State and derive the perceptron learning rule convergence theorem.	8
5.	(a) What is pattern association?	3
	(b) Mention different types of associative networks.	3
	(c) Draw the architecture of hetero-associate and auto-associative neural network.	4
	(d) For the given input vectors $S=(S_1 S_2 S_3 S_4)$ and output vector $t=(t_1,$	6

t2), find the weight matrix using hetero-associative training algorithm.

(s1 s2 s3 s4)	(t1 t2)
(1 0 1 0)	(1, 0)
(1 1 0 0)	(1 0)
(1 1 1 0)	(0 1)
(1 0 0 0)	(0 1)

6. (a) Define Bidirectional Associate Memory (BAM). 4
- (b) Use the Hebb rule to store the vector **(1 1 -1 -1)** in an auto-associative 4+8 neural network.

Also find the following

- (i) Find the weight matrix
- (ii) Test the input vector $x=(1\ 1\ -1\ -1)$
- (iii) Test the net with one mistake
- (iv) Test the net with one error

7. Write short notes on **(8×2=16)**

- (a) Kohonen self-organising maps
- (b) Back propagation network
- (c) Learning rules

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