

Aliah University
Spring Semester Examination-2022

Paper Name: Data Analytics
Paper Code: CSEPGOE02 (EEN & ECE)

Full Marks: 80
Time: 3 hrs

Note: Offered to Both EEN and ECE Departments, so the Examination will be on the same date and time.

Answer Any Eight (05) questions in your own words.

1. Write short notes on (i) Support Vector Machine, (ii) Nearest Neighbour, (iii) Decision Tree, and (iv) Optimization Techniques. **4+4+4+4=16**

2. Write short notes on the following terms: (a) Supervised, (b) Unsupervised, (c) Intra-class, and (d) Inter-class in pattern Recognition problems **4+4+4+4=16**

3. Give a detailed diagram of the different phases of a pattern recognition System and explain each step. What is the Curse of Dimensionality? Explain feature extraction techniques for any pattern recognition problem used in data analytics task **7+3+6=16**

4. Explain generative and descriptive solutions for pattern recognition problems in data analytics task. Explain minimum distance classifier techniques. How will you calculate eigenvalues and eigenvectors of the following 3x3 matrix? Where these are used in data analytics? **6+4+4+2=16**

-2	-4	2
-2	1	2
4	2	5

5. Explain the terms (i) Precision, (ii) Recall, (iii) Accuracy, (iv) F1-score, (v) true positive rate. Suppose you have three (03) classes. Each class has five samples. A feature vector of dimension 3 represents each sample. The description of each class is shown below, where C1, C2, and C3 are classes, and f1, f2, and f3 are featured. So, find the belonging of a test sample (2,-1,0) to its classes C1, C2, and C3 using the minimum distance classifier (MDC) technique. **(2 x 5)+6=16**

C1		
f1	f2	f3
-2	-4	2
-2	1	2
4	2	5
1	3	1
2	4	5

C2		
f1	f2	f3
1	2	1
0	1	3
2	2	0
1	4	2
-1	-1	1

C3		
f1	f2	f3
2	2	5
0	5	2
1	1	1
3	0	-2
1	1	3

6. Explain some real-life applications of data analytics task using pattern recognition techniques. Explain different methods of feature extraction techniques used in data analytics tasks. What are the feature selection methods used in data science techniques? **3+7+6=16**

M.Tech Examination-2022
Electronics and Communication Engineering
(Even Semester Regular)
Artificial Intelligence (ECEPGPE09)

Full Marks: 80

Time: 3.00 Hrs

- *Answer any five 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. Which of the following is True/False. | 6 |
| (a) We can get multiple local optimum solutions if we solve a linear regression problem by minimizing the sum of squared errors using gradient descent. | |
| (b) When a decision tree is grown to full depth, it is more likely to fit the noise in the data. | |
| (c) When the hypothesis space is richer, over fitting is more likely. | |
| (d) When the feature space is larger, over fitting is more likely. | |
| (e) We can use gradient descent to learn a Gaussian Mixture Model | |
| (f) In a machine learning algorithm, if the number of parameters grow with the amount of training data, then the model is non-parametric. | |
| B. Answer the followings | 2×5=10 |
| a. Define a knowledge Base: | |
| b. What is Heuristic function? | |
| c. What are fuzzy sets? | |
| d. Give the decision tree to represent $A \&\& \neg B$ | |
| e. What is meta-knowledge? | |
| 2. (a) What is Artificial Intelligence? Exemplify the necessary components to define AI problem with an example. | 6 |
| (b) Explain A* searching technique in detail with example. Discuss conditions for the optimality of this technique. | 10 |
| 3. (a) What is Machine Learning? List out any four applications of machine learning. | 5 |
| (b) What do you understand by supervised and unsupervised learning? What are the characteristics and differences between them? | 8 |
| (c) Explain regression with an example. | 3 |
| 4. (a) Describe the Find-s algorithm. Explain by taking EnjoySport concept and training instance given below | 16 |

Example	Sky	AirTemp	Humidity	Wind	Water	Forecast	EnjoySports
1	Sunny	Warm	Normal	Strong	Warm	Same	Yes
2	Sunny	Warm	High	Strong	Warm	Same	Yes
3	Rainy	Cold	High	Strong	Warm	Change	Yes
4	Sunny	Warm	High	Strong	Coll	Change	Yes

5. (a) Distinguish between overfitting and underfitting. How it can affect model generalization? 4
 (b) Define Hidden Markov Model. What is meant by evaluation problem and how is this solved? 4
 (c) Explain back propagation algorithm for neural nets. 8
6. Consider the following set of training examples. Compute the following: 16
 (i) What is the Entropy of this collection of training example w.r.t the target function classification?
 (ii) What are the information gain of a_1 and a_2 relative to these training examples?

Instance	1	2	3	4	5	6	7	8	9
a_1	T	T	T	F	F	F	F	T	F
a_2	T	T	F	F	T	T	F	F	T
Target class	+	+	-	+	-	-	-	+	-

7. (a) Discuss commonly used signal functions to model the activation of neural networks. 8
 (b) Distinguish between a single layer feed-forward network, Multilayer feed-forward network and recurrent network. 8
8. Explain the concept of a Perceptron with a neat diagram. Implement XOR function using MP (McCulloch Pitts) neuron (consider binary data). 6+10
9. Consider a medical diagnosis problem in which there are two alternative hypotheses: 1. that the patient has a particular form of cancer (+) and 2. That the patient does not (-). A patient takes a lab test and the result comes back positive. It is known that the test returns a correct positive result in only 98% of the cases and a correct negative result in only 97% of the cases. Furthermore, only 0.008 of the entire population have this disease. Determine whether the patient has Cancer or not using MAP hypothesis. 16
10. (a) Write down the major differences between K-means clustering and hierarchical clustering. 4
 (b) Use K Means clustering to cluster the following data into two groups. Assume cluster centroid are $m_1=2$ and $m_2=4$. The distance function used is Euclidean distance. { 2, 4, 10, 12, 3, 20, 30, 11, 25 } 12
11. (a) 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: 6
 (i) linear activation function without threshold
 (ii) sigmoidal activation function
 (iii) thresholded activation function using threshold 0.25
 (b) Write short note on (any one) i) Genetic Algorithm ii) Gradient Descent and Delta Rule 10

12. Give Decision trees for the following set of training examples

16

Day	Outlook	Temperature	Humidity	Wind	PlayTennis
D1	Sunny	Hot	High	Weak	No
D2	Sunny	Hot	High	Strong	No
D3	Overcast	Hot	High	Weak	Yes
D4	Rain	Mild	High	Weak	Yes
D5	Rain	Cool	Normal	Weak	Yes
D6	Rain	Cool	Normal	Strong	No
D7	Overcast	Cool	Normal	Strong	Yes
D8	Sunny	Mild	High	Weak	No
D9	Sunny	Cool	Normal	Weak	Yes
D10	Rain	Mild	Normal	Weak	Yes
D11	Sunny	Mild	Normal	Strong	Yes
D12	Overcast	Mild	High	Strong	Yes
D13	Overcast	Hot	Normal	Weak	Yes
D14	Rain	Mild	High	Strong	No

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M.Tech. Examination-2022
Electronics and Communication Engineering
(Even Semester Regular and Supplementary)
Advanced Communication and Networks (ECEPGPC03)

Full Marks: 80

Time: 3.00 Hrs

- *Answer any four 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. (a) Write down the desired properties of line code. The binary data 110110011 is to be transmitted over a baseband channel. Draw the waveform for the transmitted data using the following line coding format- i) Unipolar NRZ ii) Unipolar NRZ iii) Polar RZ iv) Polar RZ v) Bipolar RZ vi) Split phase Manchester coding 10
- (b) Define Inter symbol interference (ISI) and write down the expression of it. Discuss the baseband binary data transmission with respect to ISI. 10
2. (a) Discuss Nyquist criterion for distortion less binary data transmission system. Explain the ideal Nyquist channel. Draw and explain the raised cosine spectrum. 5+5
- (b) Explain the optimum receiver for an AWGN channel with ISI using relevant mathematical expressions and block diagram. 10
3. (a) Explain the QPSK modulation and demodulation mechanism by mentioning necessary signal space diagram. 10
- (b) Explain the Quadrature amplitude modulation technique and also derive the expression for minimum Euclidian distance of M-QAM system. 10
4. (a) Briefly explain the necessity of Multiplexing. Write down the comparisons between FDM and TDM. 10
- (b) Derive the mathematical model of a linear filter channels with additive noise by mentioning necessary expressions for various communication scenarios. 10
5. (a) Draw the block diagram of digital communication system and explain the functionality of each block in detail. Write down the advantages and disadvantages of digital communication system. 6+4
- (b) Explain the orthogonality principle of signals. Write down the relationship between bit error rate and symbol error rate. 5+5
6. (a) Explain the block diagram of FFT based multicarrier communication system in detail. Write down the various advantages and disadvantages of multicarrier communication system 10
- (b) Explain the effects of peak-to-average power ratio (PAPR) in OFDM system. Explain how OFDM combats multipath fading. 5+5
7. (a) In a digital CW communication system, the bit rate of NRZ data streams is 1Mbps and carrier frequency of transmission is 100 MHz. Find the symbol rate of Transmission and band width requirement of the channel in following systems. (i) BPSK system (ii) QPSK system. 10
- (b) Write down the significant properties of matched filter. Prove that impulse response of a matched filter is matched to input pulse signals. 5+5

M.Tech. Examination-2022
 Electronics and Communication Engineering
 (Even Semester Regular and Supplementary)
 VLSI Architecture for DSP (ECEPGPC04)

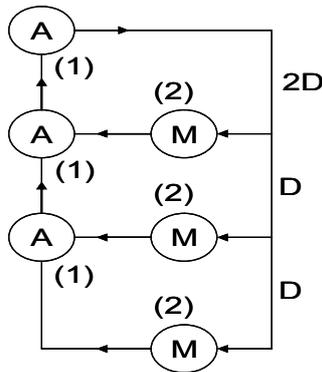
Full marks: 80

Time : 3.00 Hrs

- *Answer any five questions.*
- *Figures on the right hand side margin indicate full marks.*
- *Symbols have their usual meanings*
- *Assume all necessary parameters*

		Marks
1	(a) State few differences between the Standard Cell based and Gate Array based designs.	4
	(b) What are the differences between PLA and PLD based Gate Array cells?	2
	(c) Given are the Boolean equations $y_1=ab+c'$, and $y_2=abc+c'+a'b$. Show their implementations using PLA, PAL, PROM, and 4-input LUT.	10
2.	(a) What is Shannon's expansion rule?	3
	(b) Consider the Boolean equations given in 1(c). Implement them simultaneously using minimum number of 2-input multipliers.	5
	(d) What are the methods and the issues of programming pre-wired Gate Array cells?	8
3	Describe the architecture of a XC3000/XC4000 family of Xilinx CPLD devices.	16
4	(a) Describe the 32-bit IEEE 754-1985 floating point format.	6
	(b) Convert decimal number -52.21875 to 32-bit IEEE-754 format.	4
	(c) Describe NVIDIA TensorFloat-32 format.	4
	(d) Show with proper diagram, how a 32-bit IEEE-754 number can be converted in to TensorFloat-32 format, and vice versa.	2
5	(a) How can a Fixed Point multiplier be implemented using a 2's complement integer multiplier? Explain with proper diagram.	6
	(b) Describe the modified Booth-encoding technique? What are the impacts of applying Booth encoding on a Fixed Point multiplier architecture?	6+4
6	(a) Derive expressions of G(Generate Carry) and P(Propagate carry) signals from the truth table of Full Adder.	4
	(b) Derive the equations to systematically combine two group level (G, P) signals into (G, P) signals of a larger group.	4
	(c) Describe the graphical representation of an 8- or 16-bit Sklansky tree adder using the equations derived in 6(b).	8
7	(a) Compare the advantages and disadvantages of the Static Timing Analysis (STA) method over SPICE simulation for design timing closure. What is static in STA?	6
	(b) Define setup time, hold time, clock-to-Q delay, reset recovery time and reset removal time parameters.	6
	(c) What are the static and transient factors that impact the timing parameters of a logic gate.	4

- 8 (a) How clock network is synthesized in a clock domain of a sequential design? What are source latency and network delay? 6
- (b) What is the need for clock gating in a sequential design? 4
- (c) Design a clock gating scheme in a single clock domain, based on AND logic. Explain the operation with the circuit and timing diagrams. 6
- 9 (a) In the the data flow graph of the feedback DSP architecture in the figure below, the processors 'A(adder)' and 'M(ultiplier)' have computation-times of $1 \mu\text{s}$ and $2 \mu\text{s}$, respectively. A weight of 'D' on an edge represents delay of one cycle. No weight on an edge indicates zero cycle delay. Determine the minimum sampling time of the architecture using Minimum Cycle Mean algorithm. 10



- (b) Consider the data flow graph of 9(a). The computation times of 'A' and 'B' remain the same. 5+1
- (i) Applying cut-set retiming technique, reduce the critical path delay to $2 \mu\text{s}$.
- (ii) What is the sampling time of the retimed DFG?

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M.Tech. Examination-2022
 Electronics and Communication Engineering
 (Even Semester Regular and Supplementary)
 IoT and Sensor Wireless Networks (ECEPGPE07)

Full Marks: 80

Time: 3.00 Hrs

- *Answer any five 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. Answer any <u>Four</u> questions	Marks
(a) What are the various IEEE 802.15.4 network types?	4
(b) Differentiate between PAN coordinator , router and a device in IEEE 802.15.4	4
(c) What are the various IEEE 802.14.5 frame types?	4
(d) Differentiate between structured and unstructured data.	4
(e) Differentiate between sensors and actuators.	4
(f) Differentiate between scalar and vector sensors.	4
(g) Explain sensor node Hardware components.	4
2. (a) Define IoT and explain the vision of IoT.	4
(b) With neat sketch describe the architecture of IoT.	6
(c) Explain different development tools and open source implementation of IoT	6
3. (a) Explain the main feature of IPv6 protocol.	8
(b) Explain MQTT protocol for IoT.	8
4. (a) Write and explain modified OSI model for the IoT/M2M systems	10
(b) Describe the M2M network paradigm.	6
5. (a) Explain the characteristics requirements for a Wireless Sensor Network.	8
(b) With a neat diagram, describe single node architecture in a Wireless Sensor Network.	8
6. (a) What is RFID? Explain its working principle.	6
(b) Differentiate between active and passive RFID.	5
(c) List some of the typical application of RFID.	5
7. (a) Explain the protocol stack of Zigbee.	5
(b) Elaborate on the various network topologies of Zigbee.	5
(c) Describe the Zigbee network layer.	6
8. Write short notes (any two)	
(a) LoRA	8
(b) ISO-OSI model	8
(c) Architecture of WSN	8
(d) IoT networking Components.	8

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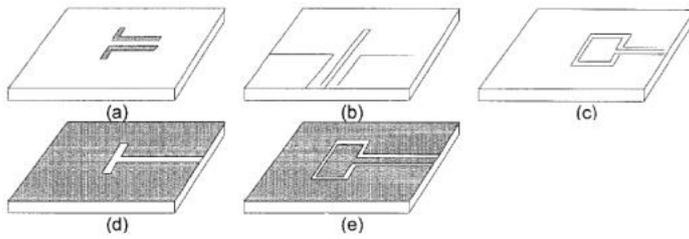
M.Tech. Examination-2022
 Electronics and Communication Engineering
 (Even Semester Regular and Supplementary)
 Microwave Integrated Circuits (ECEPGPE10)

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. (a) What do you mean by strip line? Explain the construction, field configuration and different types of losses occurring in strip line. 5
 (b) A 50-ohm microstrip needs to be designed using a sheet dielectric material having $\epsilon_r = 50$ ohm and $h = 1.52$ mm. Determine the trace width, wavelength and effective dielectric constant 5
 2. (a) What are the properties of $\lambda_g/2$, $\lambda_g/4$, $\lambda_g/4$ transmission line? 4
 (b) Write the ABCD parameters of shunt admittance. 2
 (c) Convert the ABCD parameter of shunt admittance to S-parameters. 4
 3. (a) What are the parameters for selection of transmission line structure? 4
 (b) Calculate the characteristic impedance, phase velocity and effective dielectric constant of transmission line. 6
 4. (a) What are the difference between strip line and suspended strip line ? 2
 (b) Show the field lines and application of microstrip line. 4
 (c) Also calculate the characteristic impedance (Z_0) and Effective permittivity (ϵ_{eff}) of microstrip line. 4
 5. (a) Write mathematically how the microstrip line can be designed. 4
 (b) What are the frequency limitations of microstrip line 2
 (c) What are the losses and power handling of microstrip line? 4
 6. (a) Show the field lines (E-field and H-field) of slot line. 3
 (b) What are the advantages and disadvantages of slot line? 3
 (c) Comparison between slot line and microstrip line. 4
 7. (a) Explain the coplanar wave guide (CPW) operation in term of field lines. 3
 (b) Calculate the characteristic impedance (Z_0) and Effective permittivity (ϵ_{eff}) of CPW line 3
 (c) What are the advantages, disadvantages and application of CPW line? 3
 8. (a) Write the difference between CPW line and Coplanar strip line in terms of field lines. 5
 (b) Calculate the characteristic impedance (Z_0) and Effective permittivity (ϵ_{eff}) of coplanar strip line. 5
 9. (a) What are the difference between hybrid MICs and Monolithic MICs. 2
 (b) Explain the fabrication process of MMICs. 4
 (c) What are the advantages of MICs? 2
 (d) What are the difficulties of making MICs? 2

10.



(a) Draw the equivalent circuit of the planar structures shown above. 5

(b) Draw the equivalent circuit model of microstrip patch antenna and explain. 5

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