



**SOMAIYA**  
**VIDYAVIHAR**

**K J Somaiya Institute of Engineering and Information Technology**  
An Autonomous Institute permanently affiliated to University of Mumbai.  
Accredited with A grade by NAAC, approved by AICTE, new Delhi.

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**Class: TY-ETRX**

**Department of Electronics Engineering**  
**Basic VLSI Design**

**Course Code: 1UETC601**

**Semester: VI**

**Question Bank for Basic VLSI Design**

1. Define scaling and state its types.
2. Show analytically effect of constant voltage scaling and full scaling on different MOSFET parameters.
3. Compare types of scaling.
4. What is different small geometry effect. Explain any one of them in detail.
5. What is DIBL.
6. What is punch through effect?
7. Draw Lumped representation of the parasitic MOSFET capacitances.
8. Write note on MOSFET capacitances.
9. List the types of MOSFET capacitances and explain it in details.
10. Write short note on MOSFET Model.
11. Write short note on interconnect scaling.
12. What is crosstalk.
13. Compare BJT and MOS technologies.
14. Explain VLSI Design flow.
15. Explain fabrication process flow of N-channel MOSFET
16. Explain fabrication process flow of CMOS.
17. What is stick diagram. Write stick diagram rules.
18. Explain in details lambda-based design rules.
19. Show different type MOSFET biased capacitances.
20. Show Y chart of VLSI Design flow.
21. List types of MOSFET Inverter and compare them.
22. Draw Resistive Load Inverter and its VTC characteristics.
23. Show effect of  $K_n.R_L$  on VTC characteristics.
24. Derive voltage parameters ( $V_{OL}, V_{OH}, V_{IL}, V_{IH}$ ), DC power dissipation of Resistive Load Inverter.
25. Show trade-off between the DC power dissipation and the area occupied by the resistive load inverter circuit.
26. Calculate the critical voltages ( $V_{OL}, V_{OH}, V_{IL}, V_{IH}$ ) on the VTC and find the noise margins of the resistive load inverter circuit.
27. Define Noise margin, power dissipation, chip area.
28. Draw and Explain CMOS Inverter and its Voltage Transfer curve with respect to different regions of operation.

29. Derive voltage parameter ( $V_{OL}, V_{OH}, V_{IL}, V_{IH}, V_{TH}$ ) of CMOS Inverter.
30. Calculate the critical voltages ( $V_{OL}, V_{OH}, V_{IL}, V_{IH}$ ) on the VTC and find the noise margins of the CMOS inverter circuit.
31. Show effect of different KR ratio on VTC characteristics of CMOS Inverter.
32. Design CMOS Inverter.
33. Draw Voltage transfer characteristics of a CMOS inverter, obtained with different power supply voltage levels.
34. Draw stick diagram of CMOS Inverter.
35. Draw Layout diagram of CMOS Inverter.
36. What is rise time, fall time and propagation delay.
37. Derive rise time and fall time of CMOS inverter.
38. Derive Switching Power Dissipation of CMOS Inverters.
39. Solve numerical on: Calculation of rise time, fall time and propagation delay
40. What is static cmos logic, explain with help of generalized circuit diagram.
41. What is pass transistor logic. What are the drawbacks of pass transistor logic and what is remedy of it?
42. What transmission gate.
43. Explain working principle of transmission gates.
44. What pseudo NMOS logic. Why it is called ratioed logic. Compare static cmos logic and pseudo nmos logic.
45. Explain C2MOS logic with help of generalized structure.
46. What is dynamic CMOS logic. What are the drawbacks of dynamic cmos logic.
47. How to avoid drawback of dynamic CMOS logic.
48. What is domino logic.
49. What NORA logic. Why NORA logic is called pipeline architecture.
50. What is zipper design style.
51. Difference between NORA and zipper logic.
52. Draw 2 input CMOS NOR gate and derive it's equivalent CMOS Inverter.
53. Derive switching threshold voltage of 2 input CMOS NOR gate.
54. Draw 2 input CMOS NAND gate and derive it's equivalent CMOS Inverter.
55. Derive switching threshold voltage of 2 input CMOS NAND gate.
56. Draw layout of CMOS logic gates.
57. Draw stick diagram of CMOS logic gates.
58. Draw layout of given Boolean expression.
59. Draw stick diagram of given Boolean expression.
60. The simplified layout of a CMOS complex logic circuit is given below. Draw the corresponding circuit diagram, and find an equivalent CMOS inverter circuit for simultaneous switching of all inputs, assuming that  $(W/L)_p = \text{for all pMOS transistors}$  and  $(W/L) = \text{for all nMOS transistors}$ .
61. Draw schematic of Boolean expression using static cmos logic, pseudo nmos logic, dynamic cmos logic, domino logic, C2MOS logic
62. Draw schematic of logic gates, multiplexer using pass transistor logic.
63. Draw schematic of logic gates, multiplexer using transmission gates.
64. Draw schematic of SR latch, JK flipflop, D flipflop, 1 bit shift register using given MOS design style.
65. Draw combination circuits using given MOS design style.
66. Implement Half adder/Full adder using given MOS design style.

67. Draw 6T SRAM Cell/ Full CMOS SRAM Cell.
68. Explain read/write operations of 6T SRAM Cell.
69. Write short note on 6T SRAM Cell.
70. Explain 1 T DRAM Cell.
71. Explain 3T DRAM Cell with its read, write and refresh operation.
72. Draw 4X4 NAND based ROM array.
73. Draw 4X4 NOR based ROM array.
74. Explain programming techniques of flash memory cell.
75. Explain NOR based flash memory cell.
76. Explain NAND based flash memory cell.
77. Explain basic principle operation of flash memory cell.
78. Write short note on non-volatile memories.
79. Write short note on MRAM.
80. Write short note on ReRAM.
81. State drawbacks of RCA.
82. Explain basic principle of operation of CLA.
83. Draw 4-bit CLA using static CMOS logic.
84. Draw 4-bit CLA using dynamic CMOS logic.
85. Explain basic principle/4 bit Manchester carry chain adder.
86. Draw 4-bit Manchester Carry Chain Adder.
87. List and Explain High Speed adders.
88. Draw carry save adder.
89. Draw 4X4 Array Multiplier.
90. Draw and explain barrel shifter with respect to its mode of operation.



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**Academic Year: 2021-22(Even Sem)-TY-ETRX**

**Question Bank**

**Subject: CCN**

<b>Module 1: 1.Introduction to Network Architectures, Protocol Layers, and Service models</b>	CO	BT level
What are the functions of layers in the OSI model.	CO1	Un
Explain the various connecting devices used in computer networks.	CO1	Un
Write a short note on network topologies.	<b>CO1</b>	<b>Un</b>
Which are the various types of addresses used in the OSI model.	<b>CO1</b>	<b>Un</b>
Compare circuit switching, Packet switching and Message switching	CO1	<b>Un</b>
<b>Module 2: Physical Layer</b>		
List the categories of UTP cables.How is noise interference minimized in twisted pair cables.	<b>CO2</b>	<b>Un</b>
Compare Router and Switch.	<b>CO2</b>	<b>An</b>
Draw and discuss the Ethernet frame format.	<b>CO2</b>	<b>Un</b>
Explain the various physical media with the help of neat diagrams	<b>CO2</b>	<b>Un</b>

What is the difference between unicast, multicast, and broadcast addresses?	CO2	Un
How is the preamble field different from the SFD field?	CO2	Un
Compare the data rates for standard Ethernet, Fast Ethernet, Gigabit Ethernet and 10 Gigabit Ethernet.	CO2	An
If an Ethernet destination address is 07:01:02:03:04:05, what is the type of the address?  (unicast, multicast, and broadcast addresses) and explain each type of address with an example.	CO2	Un
<b>Module 3: Data Link Control</b>		
Distinguish between Go Back N ARQ and Selective Reject ARQ.	<b>CO3</b>	<b>Un</b>
<b>Define piggybacking and its benefits.</b>	<b>CO3</b>	<b>R</b>
Explain the various station types, configurations, response modes and frame formats in HDLC.	<b>CO3</b>	<b>Un</b>
Explain stop and wait ARQ protocol for error control	<b>CO3</b>	<b>Un</b>
List and explain different ARQ techniques. Specify the maximum window size for each with justification	<b>CO3</b>	<b>An</b>
Classify the various multiple access methods and explain CSMA-CA in detail	<b>CO3</b>	<b>Un</b>
.Define the utilization or efficiency of the line and derive the expression for stop and wait flow control. Calculate the maximum link utilization for following cases:  i) stop and wait flow control	<b>CO3</b>	<b>Ap</b>



<p>ii) Sliding window flow control with window sizes of 4 &amp; 7</p> <p>Link specification:</p> <p>Frame length=1000 bits/frame</p> <p>Velocity of propagation= <math>2 \times 10^8</math> m/s, Link distance=20km, Data rate=20 Mbps</p>		
<p>What are the conditions to be satisfied by a good CRC generator polynomial? For generator divisor=<math>x^5+x^4+x^2+1</math> and data block=1010001101, Find CRC. If the second digit from the left is changed, then how does the receiver come to know that there is an error.</p>	CO3	Ap
<p>A pure ALOHA network transmits 800-bit frames on a shared channel of 1000kbps. What is the throughput if the system (all stations together) produces.</p> <p>a) 4000 frames per second b) 2000 frames per second</p>	CO3	Ap
<p>A slotted ALOHA network transmits 200 bit frames using a shared channel with a 200kbps bandwidth. Find the throughput if the system produces</p> <p>a. 1000 frames per second b. 500 frames per second c. 250 frames per second</p>	CO3	Ap
<p>Explain the various station types, configurations, response modes and frame formats in HDLC</p>	CO3	Un
<p><b>Module 4: Network Layer</b></p>		
<p>Explain about IPV4 datagram format.</p> <p>What is subnetting? List advantages and disadvantages of the same.</p>	CO4	Un
<p>Differentiate between IPv4 and IPv6 addressing schemes .</p>	CO4	Un

<p>Determine the class and network address for the following IP addresses by using default mask,</p> <ol style="list-style-type: none"> <li>1. 84.42.58.11</li> <li>2. 195.38.14.13</li> <li>3. 144.62.12.9</li> </ol>		
<p>In IPv4 datagram which fields are related to fragmentation, Explain it with an example.</p>	CO4	Un
<p>Explain the different classes of IP addresses. Define the type of following destination addresses:</p> <ol style="list-style-type: none"> <li>1) 4A:30:10:21:10:1A</li> <li>2) FF:FF:FF:FF:FF:FF</li> <li>3) 47:20:1B:2F:08:EE</li> </ol>	CO4	Un
<p>Find the class of each address:</p> <ol style="list-style-type: none"> <li>a. 227.12.14.87</li> <li>b. 193.14.56.22</li> <li>c. 14.23.120.8</li> <li>d. 252.5.15.111</li> </ol> <p>Also perform CIDR Aggregation of following:</p> <p>128.56.24.0/24</p> <p>128.56.25.0/24</p> <p>128.56.26.0/24</p> <p>128.56.27.0/24</p> <p>What is the hexadecimal equivalent of the Ethernet address 01011010 00010001 01010101 00011000 10101010 11111111?</p>	CO4	Ap
<p>An address in a block is given as 180.8.17.9. Find the number of addresses in the block, the first address, and the last address</p>	CO4	Ap
<p>A router receives a packet with the destination address 201.24.67.32. Show how the router finds the network address of the packet</p>	CO4	Ap

<p>One of the addresses in a block is 167.199.170.82/27. Find the number of addresses in the network, the first address, and the last address.</p>	CO4	
<p>An organization is granted a block of addresses with the beginning address 14.24.74.0/24. The design a network for organisation to have 3 sub blocks of addresses to use in its three subnets as shown below:</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> One subblock of 120 addresses.</li> <li><input type="checkbox"/> One subblock of 60 addresses.</li> <li><input type="checkbox"/> One subblock of 10 addresses.</li> </ul>	CO4	Ap
<div style="text-align: center;"> </div> <p>Using Dijkstra's shortest path algorithm find the shortest path.</p>	CO4	Ap
<div style="display: flex; align-items: center;"> <div style="flex: 1;"> </div> <div style="flex: 1; margin-left: 20px;"> <p>(1,3) = 6  (1,4) = 3  (2,1) = 3  (3,4) = 2  (4,2) = 1  (4,3) = 1  (5,2) = 4  (5,4) = 2</p> </div> </div> <p>Using Bellman Ford's algorithm find the shortest path.</p>	CO4	Ap
<p>Explain the difference between distance vector and link state routing algorithm.</p>	CO4	Un
<p><b>Module 5: Transport Layer</b></p>		

What is traffic shaping? Explain leaky bucket technique and Token Bucket technique of traffic shaping.	CO5	Un
Compare TCP and UDP.	CO5	Un
Explain TCP 3-way handshaking for connection establishment and termination.	CO5	Un
Explain TCP header frame format in detail.	CO5	Un
Explain the different congestion control methods	CO5	Un
Differentiate between connection oriented and connectionless protocol.	CO5	Un
The following is the content of a UDP header in hexadecimal format: CB84000D001C001C What is the source port number? What is the destination port number? What is the total length of the user datagram? What is the length of the data? Is the packet directed from a client to a server or vice versa.	CO5	Ap
<b>Module 6: Application Layer</b>		
Compare HTTP and SMTP	CO6	Un
Explain about DHCP protocol	CO6	Un
What is the function of DNS protocol?	CO6	Un
<b>Explain about Telnet Protocol.</b>	CO6	Un





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Department of Electronics Engineering

Course: Machine Learning (Course Code: 1UETDLC6053)

ETRX-TY-Semester: VI

Questions	BT Level												
1.What are the important objectives of machine learning?	Analyzing												
2.Define Hypothesis in Machine Learning.	Remembering												
3.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. The test returns a correct positive result in only 98% of the cases in which the disease is actually present, and a correct negative result in only 97% of the cases in which the disease is not present. Furthermore, .008 of the entire population have this cancer. Determine whether the patient has Cancer or not using MAP hypothesis.	Applying												
4.What are the basic design issues and approaches to machine learning?	Remembering												
5.How do you design a checkers learning problem?	Applying												
6.Explain the various stages involved in designing a learning system	Understanding												
7.Differentiate between Supervised, Unsupervised and Reinforcement Learning	Analyzing												
8.What are the issues in Machine Learning	Remembering												
9. List out any four applications of machine learning	Remembering												
10.Briefly describe the concept on model selection and generalisation.	Understanding												
11.Explain supervised and unsupervised training with suitable examples.	Understanding												
12.Compare Classification and regression with an example	Analyzing												
13.Define Machine Learning. Discuss with examples why machine learning is important.	Understanding												
14.Describe in detail all the steps involved in designing a learning system.	Understanding												
15.Discuss the perspective and issues in machine learning.	Understanding												
16.What is Machine Learning? How it is different than Data Mining?	Remembering												
17.Explain how to choose right algorithm in ML?	Understanding												
18.Explain the steps involved in developing a ML application.	Understanding												
19.Explain simple linear regression. Find regression line $Y=aX+C$ using least square method and estimate the expenditure of company in 6 <sup>th</sup> month using line as a model. The expenditure of an organization (in thousand) for every month is shown below, <table border="1" style="margin-left: auto; margin-right: auto;"> <tbody> <tr> <td>X (month)</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> </tr> <tr> <td>Y(Expenditure)</td> <td>12</td> <td>19</td> <td>29</td> <td>37</td> <td>45</td> </tr> </tbody> </table>	X (month)	1	2	3	4	5	Y(Expenditure)	12	19	29	37	45	Applying
X (month)	1	2	3	4	5								
Y(Expenditure)	12	19	29	37	45								
20.Explain multiple linear regression. Consider the set of data as $\{(-1,-1),(2,2), (3,2)\}$ . Find the equation of regression line. Draw the scatter plot of data and regression line.	Evaluating												
21.Write short note on Linear regression and Logistic Regression	Understanding												
22.Using logistic regression a bank has to decide whether to sanction loan or not based on two attributes as person's income and his savings. The data is given in the following table where 1 represents loan is sanctioned and 0 represents loan is not sanctioned. Predict whether a person 3 will get a loan or not having annual income as 12.5 lakhs and savings as 10 lakhs.	Applying												

Person	Annual income in lakhs (x1)	Savings in lakhs (x2)	Loan sanctioned? (Y)																																																									
1	14.5	12.5	1																																																									
2	8.5	4.5	0																																																									
23. Define Multiclass Classification with a neat diagram.					Remembering																																																							
24. Write short notes on A) Geometric model, b) Logical Model, C) Probabilistic model					Understanding																																																							
25. What is the significance of optimal separating hyperplane in SVM?					Remembering																																																							
26. Define clustering. What are the different types of clustering explain in detail?					Analyzing																																																							
27. Explain feature selection and feature extraction method for dimensionality reduction.					Understanding																																																							
28. Write down the major differences between K-means clustering and hierarchical clustering.					Analyzing																																																							
29. Explain how Support Vector Machine can be used for classification of linearly separable data.					Understanding																																																							
30. Define Hidden Markov Model. What is meant by evaluation problem and how is this solved?					Understanding																																																							
31. 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 }					Applying																																																							
32. Describe the random forest algorithm to improve classifier accuracy.					Understanding																																																							
32. For the given data points, construct the dendrogram using Complete Linkage method					Applying																																																							
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34. Explain the capabilities and limitations of ID3 in terms of search space and search strategy.					Understanding																																																							
35. Suppose we want ID3 to decide whether the car will be stolen or not. The target classification is "car is stolen?" which can be Yes or No.					Applying																																																							
<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Car no.</th> <th>Colour</th> <th>Type</th> <th>Origin</th> <th>Stolen?</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Red</td> <td>Sports</td> <td>Domestic</td> <td>Yes</td> </tr> <tr> <td>2</td> <td>Red</td> <td>Sports</td> <td>Domestic</td> <td>No</td> </tr> <tr> <td>3</td> <td>Red</td> <td>Sports</td> <td>Domestic</td> <td>Yes</td> </tr> <tr> <td>4</td> <td>Yellow</td> <td>Sports</td> <td>Domestic</td> <td>No</td> </tr> <tr> <td>5</td> <td>Yellow</td> <td>Sports</td> <td>Imported</td> <td>Yes</td> </tr> <tr> <td>6</td> <td>Yellow</td> <td>SUV</td> <td>Imported</td> <td>No</td> </tr> <tr> <td>7</td> <td>Yellow</td> <td>SUV</td> <td>Imported</td> <td>Yes</td> </tr> <tr> <td>8</td> <td>Yellow</td> <td>SUV</td> <td>Domestic</td> <td>No</td> </tr> <tr> <td>9</td> <td>Red</td> <td>SUV</td> <td>Imported</td> <td>No</td> </tr> <tr> <td>10</td> <td>Red</td> <td>Sports</td> <td>Imported</td> <td>Yes</td> </tr> </tbody> </table>					Car no.	Colour	Type	Origin	Stolen?	1	Red	Sports	Domestic	Yes	2	Red	Sports	Domestic	No	3	Red	Sports	Domestic	Yes	4	Yellow	Sports	Domestic	No	5	Yellow	Sports	Imported	Yes	6	Yellow	SUV	Imported	No	7	Yellow	SUV	Imported	Yes	8	Yellow	SUV	Domestic	No	9	Red	SUV	Imported	No	10	Red	Sports	Imported	Yes	
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36. Describe the ID3 algorithm for decision tree learning with example.					Understanding																																																							

37. Define (i) Prior Probability (ii) Conditional Probability (iii) Posterior Probability	Remembering																										
38. Explain Naïve Bayes Classifier with an Example.	Understanding																										
39. Explain the Gradient Search to Maximize Likelihood in a neural Net.	Understanding																										
40. Explain the concept of EM Algorithm. Discuss what are Gaussian Mixtures.	Understanding																										
41. What is Dimensionality reduction? Describe how Principal Component Analysis is carried out to reduce dimensionality of data sets.	Analyzing																										
42. Explain Steepest Descent Method for optimization.	Understanding																										
43. Explain Down Hill simplex method why it is called Derivative free method	Understanding																										
44. Draw and discuss Radial Basis Function Network. How RBFN can be used to solve non linearly separable pattern.	Understanding																										
45. Discuss Linear Discriminate Analysis algorithm with neat sketch?	Understanding																										
46. Write short note on a) Hidden Markov Model b) EM Algorithm c) Downhill Simplex Method d) ISA	Understanding																										
47. Differentiate between Derivative based and Derivative free optimization techniques.	Analyzing																										
48. Explain how regression problem can be solved using Steepest Descent Method. Write down the steps.	Understanding																										
49. Compare ISA with PCA	Analyzing																										
50. Write the joint probability $P(X_{11}, X_{12}, X_{13}, X_{21}, X_{22}, X_{31}, X_{32}, X_{33})$ factored according to the Bayes net. How many parameters are necessary to define the conditional probability distributions for this Bayesian network?	Applying																										
51. Find SVD for $A = \begin{bmatrix} 2 & 2 \\ -1 & 1 \end{bmatrix}$	Evaluating																										
52. For the given set of points identify clusters using complete link and average link using Agglomerative clustering.	Applying																										
<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th></th> <th>A</th> <th>B</th> </tr> </thead> <tbody> <tr> <td>P1</td> <td>1</td> <td>1</td> </tr> <tr> <td>P2</td> <td>1.5</td> <td>1.5</td> </tr> <tr> <td>P3</td> <td>5</td> <td>5</td> </tr> <tr> <td>P4</td> <td>3</td> <td>4</td> </tr> <tr> <td>P5</td> <td>4</td> <td>4</td> </tr> <tr> <td>P6</td> <td>3</td> <td>3.5</td> </tr> </tbody> </table>		A	B	P1	1	1	P2	1.5	1.5	P3	5	5	P4	3	4	P5	4	4	P6	3	3.5						
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P5	4	4																									
P6	3	3.5																									
53. Following table shows the midterm and final exam grades obtained for students in a database course. Use the method of least squares using regression to predict the final exam grade of a student who received 86 in the midterm exam.	Applying																										
<table border="1" style="margin-left: auto; margin-right: auto;"> <tbody> <tr> <td>Midterm exam (X)</td> <td>72</td> <td>50</td> <td>81</td> <td>74</td> <td>94</td> <td>86</td> <td>59</td> <td>83</td> <td>86</td> <td>33</td> <td>88</td> <td>81</td> </tr> <tr> <td>Final exam (Y)</td> <td>84</td> <td>53</td> <td>77</td> <td>78</td> <td>90</td> <td>75</td> <td>49</td> <td>79</td> <td>77</td> <td>52</td> <td>74</td> <td>90</td> </tr> </tbody> </table>	Midterm exam (X)	72	50	81	74	94	86	59	83	86	33	88	81	Final exam (Y)	84	53	77	78	90	75	49	79	77	52	74	90	
Midterm exam (X)	72	50	81	74	94	86	59	83	86	33	88	81															
Final exam (Y)	84	53	77	78	90	75	49	79	77	52	74	90															
54. Given the following data for the sales of car of an automobile company for six consecutive years. Predict the sales for next two consecutive years.	Applying																										
<table border="1" style="margin-left: auto; margin-right: auto;"> <tbody> <tr> <td>Years (x)</td> <td>2013</td> <td>2014</td> <td>2015</td> <td>2016</td> <td>2017</td> <td>2018</td> </tr> <tr> <td>Sales (y)</td> <td>110</td> <td>100</td> <td>250</td> <td>275</td> <td>230</td> <td>300</td> </tr> </tbody> </table>	Years (x)	2013	2014	2015	2016	2017	2018	Sales (y)	110	100	250	275	230	300													
Years (x)	2013	2014	2015	2016	2017	2018																					
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55. For an unknown tuple $t = \langle \text{Outlook} = \text{Sunny}, \text{Temperature} = \text{Cool}, \text{Wind} = \text{Strong} \rangle$ use naïve Bayes classifier to find whether the class for PlayTennis is yes or no. The dataset is given below,	Applying																										



Outlook	Temperature	Wind	Play Tennis
Sunny	Hot	Weak	No
Sunny	Hot	Strong	No
Overcast	Hot	Weak	Yes
Rain	Mild	Weak	Yes
Rain	Cool	Weak	Yes
Rain	Cool	Strong	No
Overcast	Cool	Strong	Yes
Sunny	Mild	Weak	No
Sunny	Cool	Weak	Yes
Rain	Mild	Weak	Yes
Sunny	Mild	Strong	Yes
Overcast	Mild	Strong	Yes
Overcast	Hot	Weak	Yes
Rain	Mild	Strong	No

56. For a sunburn dataset given below, construct a decision tree,

Applying

Name	Hair	Height	Weight	Location	Class
Swati	Blonde	Average	Light	No	Yes
Sunita	Blonde	Tall	Average	Yes	No
Anita	Brown	Short	Average	Yes	No
Lata	Blonde	Short	Average	No	Yes
Radha	Red	Average	Heavy	No	Yes
Maya	Brown	Tall	Heavy	No	No
Leena	Brown	Average	Heavy	No	No
Rina	Blonde	Short	Light	Yes	No

57. Use Principal Component Analysis (PCA) to arrive at the transformed matrix for the given data.

Applying

$$A = \begin{bmatrix} 2 & 1 & 0 & -1 \\ 4 & 3 & 1 & 0.5 \end{bmatrix}$$

58. Write short note on Decision Tree.

Understanding

59. Explain Rule based classification with the help of example.

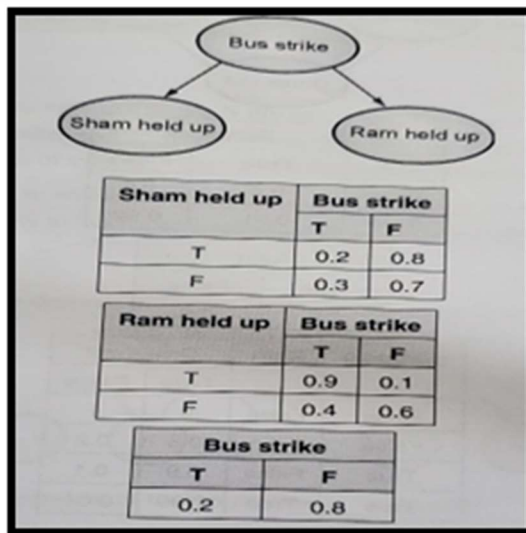
Understanding

60. Explain Bayesian Belief Network

Understanding

61. Using Bayesian Belief Network find the probability that 'Ram is held up'

Applying

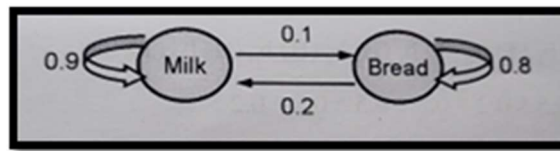


62. Write short note on Hidden Markov Model.

Understanding

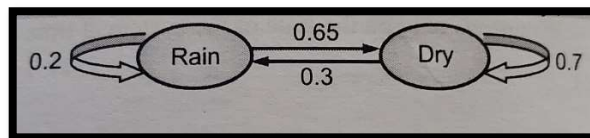
63. Suppose a person has purchased milk, then there is a 90% chance that his next purchase will also be milk. If the same person purchased bread, then there is an 80% chance that his next purchase will also be bread. Let's assume that a person currently purchased milk, what is the probability that he will purchase bread two purchases from now and three purchases from now?

Applying



64. Consider Markov chain model for Rain and Dry is shown in the following figure. Two states: Rain and Dry. Transition probabilities:  $P(\text{Rain}|\text{Rain})=0.2$ ,  $P(\text{Dry}|\text{Rain})=0.65$ ,  $P(\text{Rain}|\text{Dry})=0.3$ ,  $P(\text{Dry}|\text{Dry})=0.7$ , initial probabilities say  $P(\text{Rain})=0.4$ ,  $P(\text{Dry})=0.6$ . Calculate a probability of a sequence of states {Dry, Rain, Rain, Dry}

Applying



65. Explain maximum margin linear separator in Support Vector Machine.

Understanding

66. Explain Different types of SVM Kernels.

Understanding

67. Explain K means Clustering.

Understanding

68. Given {10,4,2,12,3,20,30,11,25,31}. Assume number of clusters  $K=2$ , find final clusters.

Evaluating

69. Apply K means algorithm on the given data for  $k=3$ . Use  $c_1(2)$ ,  $c_2(16)$  and  $c_3(38)$  as initial centres.

Applying

Data: 2,4,6,3,31,12,15,16,38,35,14,21,23,25,30

70. Write short note on Radial Basis Function

Understanding

71. Case Study on Breast Cancer Prediction classification approach

Understanding

72. Case Study on Credit card fraud detection Clustering approach

Understanding

73. Case Study on Diabetes Clustering approach.

Understanding

74. Case Study on Retail Store Sales Prediction Clustering approach	Understanding
75. Explain Agglomerative Hierarchical Clustering.	Understanding
76. What is Kernel function? Explain Kernel for learning Non-Linear Functions.	Analyzing
77. Explain different learning strategies in the design of Radial Basis Function.	Understanding

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**Department of Electronics Engineering**

**Class: TY-ETRX**

**Electromagnetic Engineering**

**Course Code: 1UETC602**

**Semester: VI**

**Question Bank for Electromagnetic Engineering**

1. Show that vector  $G = yz \hat{a}_x + xz \hat{a}_y + xy \hat{a}_z$  is an irrotational or rotational vector.
2. Convert  $p(3, 45^\circ, 60^\circ)$  in:  
a. Cartesian b. cylindrical co-ordinate system.
3. State Coulomb's Law in Electrostatics
4. Determine electrostatic force experienced by a charge of  $320 \mu\text{C}$  lying at  $(2, 3, 7)$  due to presence of  $-110 \mu\text{C}$  lying at  $(-2.5, 4, 5.5)$ . If both the charges are made to contact each other and then located at same points then determine new force.
5. Given that  $D = 2/z^2 (yz \hat{a}_x + xz \hat{a}_y - 2xy \hat{a}_z)$  C/m<sup>2</sup> in the region of free space that includes volume  $2 \leq x, y, z \leq 3$ . Evaluate both sides of divergence theorem.
6. Convert  $A_{\text{cart}} = 3x\hat{a}_x + 4y\hat{a}_y + 5z\hat{a}_z$  at point  $(3, 4, 5)$  in spherical coordinates
7. Define Magnetic flux density.
8. Prove that the divergence of electric field and that of electric flux density in a charge free region is Zero.
9. Write all Maxwell equations in integral and differential form
10. Derive Poisson's and Laplace's equation.
11. Given  $D = 10x^3/3 \hat{a}_x$  C/m<sup>2</sup>. Verify Divergence Theorem both sides of volume of cube of 2m on an edge centered at origin.
12. Write all Maxwell equations in integral and differential form
13. If Magnetic field  $\vec{H} = H_0 \cos(2x)\cos(\omega t - \beta y) \hat{a}_x$  exist within dielectric of permittivity of  $\epsilon_0$ . Calculate Displacement current Density.
14. Obtain  $\vec{H}$  in free space using  $\vec{D}, \vec{D} = D_m \sin(\omega t + \beta_2) \hat{a}_x$  C/m<sup>2</sup>.
15. Derive wave equation of a wave in any dielectric medium
16. A 10GHz wave travelling in free space has an amplitude,  $E_x = 10\omega/m$ ,  $\lambda, \beta, \alpha, \eta$  and Find H? ( $\epsilon_0 = 8.854 \times 10^{-12}$ ,  $\mu = 4\pi \times 10^{-7}$ )
17. Derive the Poynting theorem and describe the significance of each of its terms
18. Explain the physical significance of term  $\alpha, \beta$  and  $\gamma$  related to wave propagation in lossy dielectrics.
19. A 10GHz wave travelling in free space has an amplitude,  $E_x = 10\omega/m$ ,  $\lambda, \beta, \alpha, \eta$  and Find H? ( $\epsilon_0 = 8.854 \times 10^{-12}$ ,  $\mu = 4\pi \times 10^{-7}$ )

20. State and Explain Poynting vector using modified Ampere's law, derive the pointing theorem and describe the significance of each of its terms
21. Explain and describe the importance of smith chart
22. A coaxial cable of characteristics impedance  $Z_0=75$  ohms is terminated with a load of  $Z_L=60+j30$  ohms find input impedance of line at  $f=1$  GHz and  $d=50$ cm
23. Explain the following terms with reference of transmission line
  - Uniform transmission line.
  - Terminated transmission line.
  - Terminated uniform transmission line.
  - Perfectly matched transmission line.
  - Mismatched transmission line.
24. Write the short not on smith chart
25. A transmission line of characteristics impedance of  $Z_0=50\Omega$  and length  $D=0.15\lambda$  is terminated into load impedance of  $Z_L=(25-j30)\Omega$ . Find  $\Gamma_o$ ,  $Z_{in}(d)$ , and SWR
26. Obtain S when  $Z_L=50+j150(\Omega)$   $Z_0=50(\Omega)$  find  $\Gamma$  ( using Smith Chart)
27. write short on :-Antenna parameters.
28. The height of Mono pole antenna is  $\lambda/100$  what is the radiation resistance.
29. Comparison between Gain and directivity of antenna
30. Explain effective length of Transmitting antenna
31. Calculate the minimum distance required to measure the field pattern of an antenna of diameter 2m at a frequency of 3 GHz
32. Write short note on Electrostatic discharge
33. The radiation intensity of a unidirectional antenna is  $U=U_m \cos \Theta$ ,  $0 \leq \Theta \leq \pi/2$ ,  $0 \leq \phi \leq 2\pi$ . Find (i) Exact directivity, (ii) approximate directivity
34. Drive the expression for radiation resistance ( $R_r$ ) in far field region of a dipole antenna and hence obtain radiation resistance ( $R_r$ ) for a folded dipole antenna.
35. For isotropic antenna the radiation density is  $W_{rad} = W_o a_r$
36. Write short note on Electrostatic discharge
37. Explain the different source of EMI. What is the need of electromagnetic compatibility?
38. Explain the following methods to eliminate EMI with equation 1)Shielding 2)grounding 3)Filtering 4)Bending
39. Explain the different source of EMI. What is the need of electromagnetic compatibility?
40. Convert the following points
  - a.  $P(3,2,1)$  in cylindrical coordinate
  - b.  $P_1(2,30^\circ,4)$  in spherical coordinate
  - c.  $P_2(3,60^\circ,45^\circ)$  in cylindrical coordinate
41. Given: Three line charge parallel to Z axis find E at  $P(3,4)$  having line charge  $5nC$  at  $pt(0,0), 4Nc$  at  $pt(0,4)$  and  $-5Nc$  at  $pt(0,4)$ .
42. Explain and brief Stoke's theorem
43. Verify stokes theorem for the field  $H=6xy\hat{a}_x-3xy^2\hat{a}_y$  and the rectangular path around region  $2 \leq x \leq 5$ ,  $-1 \leq y \leq 1$ ,  $z=0$ . Let positive direction of is (i.e X-Y plane is given)
44. Derive Maxwell's 4<sup>th</sup> equation for time varying field or suggest a suitable modification in Maxwell's 4<sup>th</sup> equation for time varying field.
45. Explain Electromagnetic interference and its effects.
46. Write Maxwell's equation for time varying field for free space.
47. State four Maxwell's equation in integral and explain the physical significance of it.
48. State Maxwell s equation for harmonics and time varying field.

49. State uniqueness theorem.

50. Consider a load  $Z_L = 60 + j20$  connected to a lossy transmission line

$$\sqrt{\frac{0.1 + j200}{0.05 + j0.003}}$$

Determine the reflection coefficient and SWR at load

51. Calculate the input impedance of the transmission line using equations and Smith chart, for  $Z_0=50$ ,  $Z_L = 110 + j22$ ,  $\epsilon_r = 1.0$  and the length of the line = 20 cm and operating frequency equal to 1.8 GHz.

52. Derive an expression for radiation resistance of a small loop antenna. Explain its significance.

53. Explain folded dipole antenna and its application.

54. Write short on antenna radiation efficiency.

55. Comparison between gain and directivity of antenna.

56. Explain effective length of transmitting antenna.

57. The height of a monopole antenna is  $\lambda/100$ . What is the radiation resistance?

58. Define directive gain and directivity with respect to an antenna.

59. The radiation intensity of a unidirectional antenna is  $U = U_m \cos\theta$ ,  $0 \leq \theta \leq \pi/2$ ,  $0 \leq \phi \leq 2\pi$ . Find exact directivity and approximate directivity.

60. For an isotropic antenna the radiation density  $W_{rad} = W_0$  or  $W/m^2$ , find the power radiated.

61. The radiation intensity of a unidirectional antenna is  $U = U_m \cos\theta$ ,  $0 \leq \theta \leq \pi/2$ ,  $0 \leq \phi \leq 2\pi$ . Find exact directivity and approximate directivity.

62. Explain various types of electromagnetic interference.



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Academic Year 21-22

**Semester- Even**  
**Department of Electronics Engineering**  
**Question Bank**

<b>Course Code: 1UETC604</b>	<b>Class: TY</b>	<b>Semester: VI</b>
<b>Course: Embedded Systems and Real Time Operating Systems</b>		

<b>Sr. No.</b>	<b>Questions</b>	<b>CO</b>	<b>BT Level</b>
1.	Explain various design metrics. Explain the various optimization challenges for embedded system.	CO1	<b>U</b>
2.	Define embedded system? Draw the diagram for components used in embedded system and describe each one.	CO1	<b>U</b>
3.	Define embedded system? What are the different characteristics of embedded systems?	CO1	<b>U</b>
4.	Give the classification details of embedded systems.	CO1	<b>U</b>
5.	Compare RISC and CISC cores.	CO1	<b>An</b>
6.	Define embedded system? Explain the various applications of an embedded system.	CO1	<b>U</b>
7.	Explain various design metrics. Explain the time to market in detail with suitable diagram.	CO1	<b>U</b>
8.	Explain various design metrics. Justify the need of on time entry of product to market in detail with suitable diagram.	CO1	<b>An</b>
9.	What are the different memories used in in embedded systems? Explain in detail any 2.	CO2	<b>U</b>
10.	Explain in detail different memories used in in embedded systems?	CO2	<b>U</b>



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11.	What are the different cores used in embedded systems? Explain in detail any 2.	CO2	U
12.	What are the different cores used in embedded systems? Explain in detail DSP and ASIC.	CO2	U
13.	Draw the registers used in cortex M3 and explain it in detail.	CO2	U
14.	Explain in brief a) SPI	CO2	U
15.	b) I2C	CO2	U
16.	c) USB (v2.0),	CO2	U
17.	d) Bluetooth,	CO2	U
18.	e) Zig-bee	CO2	U
19.	What are the different cores used in in embedded systems?	CO2	U
20.	What are CAN specifications? Explain CAN applicability in embedded systems.	CO2	U
21.	Write short Notes on: a) ARM CortexM3 Features	CO2	U
22.	Write short Notes on: b) ARM CortexM3 Registers	CO2	U
23.	Write short Notes on: c) ARM CortexM3 NVIC	CO2	U
24.	Justify the suitability of cortex M3 for low power embedded applications.	CO2	An
25.	Explain in detail selection criteria are used for sensors and actuators.	CO2	U
26.	Compare the RS-232 and RS-485 communication interfaces.	CO2	An
27.	Draw and explain FSM for -a) Tea coffee vending machine	CO3	Ap





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28.	Draw and explain FSM for b) G+n an elevator system	CO3	Ap
29.	What is DFG? Draw DFG for the function	CO3	U
30.	What is CDFG? Explain with Example.	CO3	U
31.	Explain various RTOS Functions	CO3	U
32.	Define context switching.	CO3	U
33.	Explain priority inversion with suitable diagram and suggest mechanism to prevent the priority inversion.	CO3	U
34.	What is shared data problem? Explain it with example and suggest the solutions to avoid it.	CO3	U
35.	Define IPC. What are the different IPCs-explain any three in detail.	CO3	U
36.	What is the necessity of task scheduling? Explain the various scheduling mechanisms.	CO3	U
37.	What are the different types of tasks? Explain each in detail.	CO3	U
38.	What are the different of task states? Draw the diagram and explain each in detail.	CO3	U
39.	Explain in brief : a) Necessity of Multitasking b) Context Switching c) Mutex	CO3	U
40.	List the Free RTOS Task Management features and Resource Management features. Explain one from each. Explain one from each.	CO4	U
41.	List the Free RTOS Task Synchronization features and Event Management features.	CO4	U
42.	Justify the need of Interrupt Management features. Explain it with suitable example.	CO4	An
43.	Non preemptive SJF scheduling examples: WT, TAT, for individual task,	CO3	Ap



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	Average WT, Average TAT		
44.	Non preemptive Round Robin scheduling examples: WT, TAT, for individual task, Average WT, Average TAT	CO3	Ap
45.	Non preemptive Priority scheduling examples: WT, TAT, for individual task, Average WT, Average TAT	CO3	Ap
46.	Preemptive SJF scheduling examples: WT, TAT, for individual task, Average WT, Average TAT	CO3	Ap
47.	Preemptive Round Robin scheduling examples: WT, TAT, for individual task, Average WT, Average TAT	CO3	Ap
48.	Preemptive Priority scheduling examples: WT, TAT, for individual task, Average WT, Average TAT	CO3	Ap
49.	tasks schedulable or not- Example 1	CO3	Ap
50.	tasks schedulable or not- Example 2	CO3	Ap
51.	tasks schedulable or not- Example 2	CO3	Ap
52.	Explain/ Compare: black box testing and white box testing.	CO5	<b>An</b>
53.	Write short note : a) Logic Analyzer	CO5	<b>U</b>
54.	Write short note : b) Hardware-Software Co-design	CO6	<b>U</b>
55.	Write short note : c) debugging	CO5	<b>U</b>
56.	Explain various debugging techniques	CO5	<b>U</b>
57.	Justify the role of EDLC in embedded systems. What are the objectives of EDLC? Draw EDLC diagram.	CO6	An
58.	Justify the role of Hardware-Software Co-design in embedded systems	CO6	An
59.	Case Study – On any topic from syllabus (highlighting i) Specification requirements (choice of components), ii)FSM	CO6	Ap



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	iii) Hardware architecture iV) Software architecture)		
60.	Case Study Automatic-d) Vending Machine (highlighting i) Specification requirements (choice of components), ii)FSM iii) Hardware architecture iV) Software architecture)	CO6	Ap

**\*U-Understand**

**\*Ap-Apply**

**\*An-Analyze**

Subject Teacher