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SJC INSTITUTE OF TECHNOLOGY

(An Autonomous Institute under VTU, Belagavi)

1st SEMESTER M.Tech DEGREE SEMESTER END EXAMINATIONS APRIL 2025

Course:	ADVANCED MACHINE LEARNING & DEEP LEARNING			
Course Code:	MEC101	Program:	M.Tech in Digital Communication & Networking	
Max Marks:	100		Duration:	03 Hours

Note:

1. Answer ONE question from each MODULE and Question 1 & 2 is compulsory.
2. Any missing Data can be suitably assumed.

Q.No.		Module - 1	Marks	CO	RBTL
Q1	a	List the key differences between Linear regression and ridge regression.	4	1	L1
	b	Compare classification and regression in the context of supervised learning.	8	1	L2
	c	Build a k-neighbors regression model using scikit-learn and analyze the effect of different values of n_neighbors on the results.	8	3,4	L3
		Module – 2			
Q2	a	What are the strengths and weaknesses of the lasso regression method.	4	1	L1
	b	Explain the main challenges associated with unsupervised learning and how they differ from supervised learning.	8	1	L2
	c	Apply ridge regression on a dataset and interpret how the value of alpha affects the model's coefficients.	8	3,4	L3
		Module – 3			
Q3	a	Recall the Convolution Operation along with an example of 2-D convolution without kernel-flipping.	6	1	L1
	b	Illustrate Variants of the Basic Convolution Function.	6	1	L2
	c	Apply Structured Outputs with the effect of zero padding on network size.	8	2	L3
		OR			
Q4	a	How pooling function is used to modify the output of the layer at third stage of convolution network.	6	1	L1
	b	Interpret how the Neuro scientific basis for Convolutional Networks.	6	1	L2
	c	Organize Random or Unsupervised features along with three basic strategies.	8	2	L3

Module – 4					
Q5	**a**	Recall Recurrent Neural Networks with examples.	**6**	**1**	**L1**
	b	Summarize important design patterns for recurrent neural networks with necessary equations.	**6**	**1**	**L2**
	c	Model the Recursive Neural Networks.	**8**	**2,5**	**L3**
OR					
Q6	**a**	Construct Encoder-Decoder Sequence-to-Sequence Architectures	**6**	**1**	**L1**
	b	Infer the Long Short-Term Memory and Other Gated RNNs.	**6**	**1**	**L2**
	c	Build Optimization for Long-Term Dependencies.	**8**	**2,5**	**L3**
Module – 5					
Q7	**a**	Define n-grams in Natural Language Processing.	**6**	**2**	**L1**
	b	Apply Large-Scale Deep Learning for accuracy and the improvement of the complexity.	**6**	**1**	**L3**
	c	Analyze speech recognition to map acoustic signal containing a spoken natural language utterance into the corresponding sequence.	**8**	**4**	**L4**
OR					
Q8	**a**	What is class-based language model.	**6**	**2**	**L1**
	b	Construct Computer Vision along with its preprocessing.	**6**	**1**	**L3**
	c	Examine various applications of deep learning.	**8**	**4**	**L4**

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1st SEMESTER M.Tech DEGREE SEMESTER END EXAMINATIONS APRIL 2025

Course:	ADVANCED EMBEDDED SYSTEM		
Course Code:	MEC102	Program:	M.Tech in Digital Communication & Networking
Max Marks:	100	Duration:	03 Hours

Note:

1. Answer ONE question from each MODULE and Question 1 & 2 is compulsory.
2. Any missing Data can be suitably assumed.

Q. No.		Module - 1	Marks	COs	RBTL
Q1	a	Describe the purpose of embedded system.	6	1	L2
	b	Give the comparison between RISC and CISC architecture.	6	1	L2
	c	Analyze the key functionalities of the I2C protocol in embedded systems.	8	1	L4
		Module – 2			
Q2	a	Outline the fundamental issues in hardware -software co design.	6	1	L2
	b	Distinguish data flow graph (DFG) and Control Data Flow Graph (CDFG)mode?	6	1	L2
	c	Develop the FSM model of seat belt alarm warning system.	8	1	L3
		Module – 3			
Q3	a	Explain the purpose of registers R13, R14, and R15 in the ARM Cortex-M3 architecture.	6	2	L2
	b	Describe the reset sequence of ARM Cortex-M3.	6	2	L2
	c	Analyze the architecture of ARM Cortex-M3 and identify how the various functional units interact during program execution.	8	2	L4
		OR			
Q4	a	Explain PRIMASK, FAULTMASK, BASEPRI, CONTROL registers.	6	2	L2
	b	List and explain the ARM Cortex-M3 processor registers.	6	2	L2
	c	Analyze the internal working of the stack during PUSH and POP operations in ARM Cortex-M3.	8	2	L4
		Module – 4			
Q5	a	Illustrate any four arithmetic operations in ARM cortex M3	4	2	L2
	b	If R1 = 0X8A129BCD, find the value of R0, after execution of: i) SXTB R0,R1 ii) SXTH R0,R1 iii) SXTB R0, R1 iv) UXTB R0,R1	8	2	L3
	c	Develop ARM Cortex-M assembly language program to compute the sum of the first 10 natural numbers (sum = 1 + 2 + ... + 10), utilizing register-based operations and efficient looping constructs.	8	4	L4
		OR			

Q6	**a**	Illustrate any four logical operations in ARM cortex M3	**4**	**2**	**L2**
	b	If register R1 contains the value 0xB65812C7, determine the value of R0 after executing the following ARM Cortex-M3 instructions i) REV.W R0 , R1 ii) REV16.W R0 , R1 iii) REVSH.W R0 , R1 iv) RBIT.W R0 , R1	**8**	**2**	**L3**
	c	Develop C Program for the ARM Cortex-M3 Microcontroller to blink an LED using GPIO.	**8**	**4**	**L4**
Module – 5					
Q7	**a**	Differentiate between Monolithic and Micro-kernel	**4**	**3**	**L2**
	b	What is inter-process communication? Discuss message passing and the shared memory concept of IPC.	**8**	**3**	**L2**
	c	Three processes with process IDs P1,P2,P3 with estimated completion time 10,5,7 milliseconds respectively enters the ready queue together in the order P1,P2,P3 .Calculate the waiting time and Turn Around Time (TAT) for each process and the average waiting time and Turn Around time using FCFS scheduling algorithm.	**8**	**3**	**L4**
OR					
Q8	**a**	Define Real-Time Operating System (RTOS) and differentiate between Hard RTOS and Soft RTOS.	**4**	**3**	**L2**
	b	With a neat diagram, explain the states of a process with a transition diagram.	**8**	**3**	**L2**
	c	Three processes with process IDs P1,P2,P3 with estimated completion time 10,5,7 milliseconds respectively enters the ready queue together in the order P1,P2,P3 .Calculate the waiting time and Turn Around Time (TAT) for each process and the average waiting time and Turn Around time using SJF scheduling algorithm.	**8**	**3**	**L4**

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1st SEMESTER M.Tech DEGREE SEMESTER END EXAMINATIONS APRIL 2025

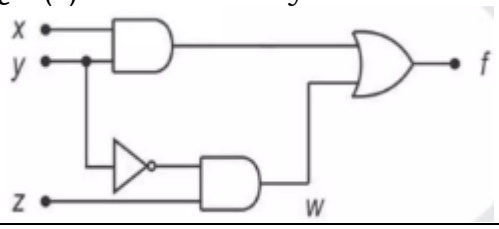
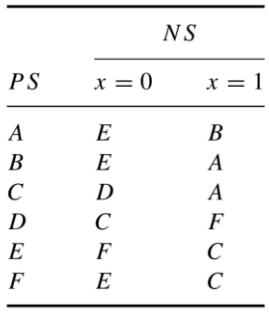
Course:	**DIGITAL CIRCUITS AND LOGIC DESIGN**			
Course Code:	**MEC103**	**Program:**	**M.Tech in Digital Communication & Networking**	
Max Marks:	**100**		**Duration:**	**03 Hours**

Note:

1. Answer ONE question from each MODULE and Question 1 & 2 is compulsory.
2. Any missing Data can be suitably assumed.

Q. No.		Module - 1	Marks	CO	RBTL
Q1	a	Explain the static hazard with an example	4	1	L1
	b	Comparison between Mealy and Moore State Machines	8	1	L3
	c	Examine whether the function f (x1,x2,x3) = ∑(0,1,3) is a threshold function, and, if it is, find a weight-threshold vector	8	1	L3
		Module – 2			
Q2	a	Explain the concept of threshold logic.	4	2	L1
	b	Make use of the function f (x1 , x2, x3,x4) = ∑ (0,1,3,4,5,6,7,12,13). Realize it using a threshold element and find its weight threshold vector.	8	2	L3
	c	Apply threshold-logic realization of all basic logic gates using Threshold gate.	8	2	L3
		Module – 3			
Q3	a	Explain the Boolean differences with an example.	4	3	L1
	b	Outline the different properties of Boolean difference	8	3	L2
	c	For the incompletely specified machine shown in Table.Q3(c), Calculate a minimum-state reduced machine containing the original one.	8	3	L3
		OR			
Q4	a	Explain the preset experiments with examples.	4	3	L1

PS	NS, Z		
	I1	I2	I3
A	C,0	E,1	--
B	C,0	E,1	--
C	B, -	C,0	A, -
D	B,0	C, -	E, -
E	--	E,0	A, -

	b	Outline the merger graph in detail with a suitable example	**8**	**3**	**L2**
	c	Apply the Boolean difference method to test of the circuit shown in Fig.Q.4(c) with a fault y- SA0 	**8**	**3**	**L3**
Module – 4					
Q5	**a**	Define the Following with respect to sequential machine (i) Closed partition (ii) Lattice	**4**	**4**	**L1**
	b	Illustrate Autonomous clock in the sequential machines	**8**	**4**	**L2**
	c	Solve the Π - lattice of the machine shown Table – 5(c) below 	**8**	**4**	**L3**
OR					
Q6	**a**	Define the Following with respect to sequential machine (i) implication graph (ii) partition pair	**4**	**4**	**L1**
	b	Illustrate how the state assignment can reduce the structure of a sequential machine	**8**	**4**	**L2**
	c	Derive the following theorems: i) The equivalence partition is unique. ii) If two states $\mathbf{S_i}$ and $\mathbf{S_j}$ of machine 'M' are distinguishable, then they are distinguishable by a sequence of length **n - 1** or less, where **n** is the number of states in 'M'	**8**	**4**	**L3**
Module – 5					
Q7	**a**	Define the following (i) Input-consistent (ii) Output-consistent with respect to machines and explain.	**4**	**5**	**L1**
	b	Make use of the general procedure for the fault detection experiment for the machine that has a distinguishable sequence with repeated symbols.	**8**	**5**	**L3**
	c	Examine the diagnosable sequence machine and construct the testing table and graph for machine shown in Table Q.7(c).	**8**	**5**	**L4**

PS	NS, Z	
	X=0	X=1
A	B,0	D,0
B	A,0	B,0
C	D,1	A,0
D	D,1	C,0

<table>
<tr><td colspan="6">OR</td></tr>
<tr><td rowspan="3">Q8</td><td>a</td><td>Explain an experiment and classify the types of experiments</td><td>4</td><td>5</td><td>L1</td></tr>
<tr><td>b</td><td>Draw the homing tree of machine 'M' shown in Table Q.8(b) and explain it. Analyze the response of machine ‘M' to the homing sequence
<table>
<tr><td rowspan="2">PS</td><td colspan="2">NS, Z</td></tr>
<tr><td>X=0</td><td>X=1</td></tr>
<tr><td>A</td><td>B,0</td><td>D,0</td></tr>
<tr><td>B</td><td>A,0</td><td>B,0</td></tr>
<tr><td>C</td><td>D,1</td><td>A,0</td></tr>
<tr><td>D</td><td>D,1</td><td>C,0</td></tr>
</table></td><td>8</td><td>5</td><td>L3</td></tr>
<tr><td>c</td><td>Derive the theorem:
If an n-state machine has a synchronizing sequence, then it has one such sequence whose length is at most
$$\frac{n(n-1)^2}{2}$$</td><td>8</td><td>5</td><td>L2</td></tr>
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SJC INSTITUTE OF TECHNOLOGY

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1st SEMESTER M.Tech DEGREE SEMESTER END EXAMINATIONS APRIL 2025

Course:	**ADVANCED SIGNAL PROCESSING**			
Course Code:	**MEC114C**	**Program:**	**M.Tech in Digital Communication & Networking**	
Max Marks:	**100**		**Duration:**	**03 Hours**

Note:

1. Answer ONE question from each MODULE and Question 1 & 2 is compulsory.
2. Any missing Data can be suitably assumed.

Q. No.		Module - 1	Marks	CO	RBTL
Q1	a	Relate Sampling Theorem to Digital Signal Processing	4	1	L1
	b	Interpret the direct form I and direct form II filter realizations. $$H(z) = \frac{0.5 - 0.5z^{-2}}{1 + 1.3z^{-1} + 0.36z^{-2}}$$	8	1	L2
	c	Analyze the Convolution output for the following input x(n) and h(n) using Formula Method x[n] =2δ[n+2] – δ[n+1] + δ[n]+2 δ[n-1] +2 δ[n-2] h[n]=-3δ[n+2] – 2δ[n+1] + 2 δ[n-1]-2 δ[n-2]	8	1	L3
		Module – 2			
Q2	a	List any 4 types of window functions with formula used in FIR filter design.	4	2	L1
	b	Design a second-order digital lowpass Butterworth filter with a cutoff frequency of 3.4 kHz at a sampling frequency of 8,000 Hz.	6	2	L2
	c	The normalized lowpass filter with a cutoff frequency of 1 rad/sec is given as $H_P(S)=1/(s+1)$. Use the $H_P(S)$ and the Bilinear Transformation to construct a corresponding digital IIR LPF with a cutoff frequency of 15 Hz and a sampling rate of 90 Hz.	10	2	L3
		Module – 3			
Q3	a	Show any 4 applications of multi-rate signal processing.	4	3	L1
	b	Make use of neat block diagram and sampling rate conversion by a factor L/M.	8	3	L2
	c	Develop an expression for the spectrum of a down sampler with necessary equations and show the effect of aliasing through waveforms	8	3	L3
		OR			
Q4	a	Define Interpolation with a neat block diagram.	4	3	L1
	b	Explain Transform domain analysis of Interpolation with Necessary Mathematical expression	8	3	L2

	c	Model CD audio system working using principles of the up sampling and interpolation-filter processes	**8**	**3**	**L3**
Module – 4					
Q5	**a**	List 4 Practical Application of Filter Banks in Audio Coding.	**4**	**4**	**L1**
	b	Explain Polyphase Filter Structure and Implementation.	**8**	**4**	**L2**
	c	Analyze the adapter filtering method in Linear Predictive Coding (LPC) to encode speech signal.	**8**	**4**	**L3**
OR					
Q6	**a**	Define DFT filter bank.	**4**	**4**	**L1**
	b	Illustrate the sub band coding of speech signals.	**8**	**4**	**L2**
	c	Derive necessary equations in matrix for the two-channel quadrature mirror filter banks with the help of neat block diagram.	**8**	**4**	**L3**
Module – 5					
Q7	**a**	Define and Sketch 2D Impulse Function.	**4**	**5**	**L1**
	b	Summarize the properties of the 2D DFT i) Periodicity ii) Conjugate Symmetry iii) Separable iv) Product	**10**	**5**	**L2**
	c	Analyze the mathematical foundation of the Karhunen-Loève Transform (KLT). Given the matrix X = X = [4 -2 -1 3] determine its covariance matrix, eigen values, eigen vectors, and the corresponding KLT kernel.	**6**	**5**	**L3**
OR					
Q8	**a**	List the steps involved in Walsh Hadamard Transform	**4**	**5**	**L1**
	b	Summarize Linear shift Invariant (LSI) systems with an example of an discrete image f[m, n].	**6**	**5**	**L2**
	c	Given an 8×8 grayscale image, apply the 2D Discrete Cosine Transform (DCT) and systematically analyze the impact of quantization on image compression.	**10**	**5**	**L3**

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1st SEMESTER M.Tech DEGREE SEMESTER END EXAMINATIONS APRIL 2025

Course:	MULTIMEDIA AND APPLICATIONS			
Course Code:	MEC115C	Program:	M.Tech in Digital Communication & Networking	
Max Marks:	100		Duration:	03 Hours

Note:

1. Answer ONE question from each MODULE and Question 1 & 2 is compulsory.
2. Any missing Data can be suitably assumed.

Q. No.		Module - 1	Marks	CO	RBTL
Q1	a	Define the term 'multimedia.' Explain the basic form of representation of text, images, audio and video.	5	1	L1
	b	Explain with neat diagram, the Interactive television application for both cable and satellite network.	8	1	L2
	c	Analyze how a digital image produced by a scanner or digital camera is captured and stored within the memory of a computer.	7	1	L4
		Module – 2			
Q2	a	Define Lossless and Lossy compression and illustrate it with an example.	4	1	L1
	b	Outline the operation of arithmetic coding, consider the transmission of a message comprising a string of characters with probabilities as given below: e=0.3, n=0.3, t=0.2, w=0.1, .=0.1 Compute the word needed to be transmitted is 'went.'	8	3	L2
	c	Identify the stages involved in a JPEG encoder and explain each stage in the encoder schematic.	8	3	L3
		Module – 3			
Q3	a	What is DPCM? Explain the operation of a basic DPCM signal encoder with the help of block diagram.	5	3	L1
	b	Explain with relevant diagrams, sensitivity of the earing frequency and temporal masking used in perceptual coding.	8	3	L2
	c	Analyze the principles on which LPC codes are based, with the aid of a schematic diagram of an LPC encoder and decoder.	7	3	L4
		OR			
Q4	a	What is MPEG? Describe MPEG forward adaptive bit allocation using perceptual coder.	5	3	L1

	b	Illustrate with a neat diagram, Dolby AC-2 and hybrid backward / forward adaptive bit allocation.	**8**	**3**	**L2**
	c	Analyze the working of a signal encoder and decoder with the help of a diagram, and examine how sub-band coding ADPCM improves sound quality at the same bit rate.	**7**	**3**	**L4**
Module – 4					
Q5	**a**	What is H.263? Discuss Error resilience in H.263 standard.	**5**	**4**	**L1**
	b	Explain H.261 video compression standard with the help of macro block format and frame format.	**8**	**4**	**L2**
	c	A digitized video is to be compressed using the MPEG-1 standard. Assuming a frame sequence of: IBBPBBPBBPBBI….. and average compression ratios of 10:1 (I), 20:1 (P) and 50:1 (B), derive the average bit rate that is generated by the encoder for NTSC digitization format.	**7**	**4**	**L3**
OR					
Q6	**a**	Define Motion estimation and compensation. Explain I-frame, P-frame and B-frame sequences with an example.	**5**	**4**	**L1**
	b	Describe MPEG-7 standardization process of multimedia content with a neat diagram.	**8**	**4**	**L2**
	c	Apply the coding principles of MPEG-4 to describe its role in multimedia compression	**7**	**4**	**L3**
Module – 5					
Q7	**a**	Define the term Quality of Service (QoS). List the qualities of traffic.	**5**	**2**	**L1**
	b	Explain the operation of packet switching with a suitable diagram.	**8**	**2**	**L2**
	c	Analyze why is video encoder used to send the digital images across an Internet Protocol (IP) network? Also explain the functions of different types of VoD services.	**7**	**2**	**L4**
OR					
Q8	**a**	What is RSVP? List the features of RSVP.	**5**	**2**	**L1**
	b	Outline the operation of circuit switching with a suitable diagram.	**8**	**2**	**L2**
	c	Analyze the significance of MPEG-4 transport and examine its impact using suitable examples.	**7**	**2**	**L4**