1T01034 - S.E.(Electronics and Telecommunication)(SEM-IV)(Choice Base Credit Grading System) (R-20-21) (C Scheme) / 40821 - Engineering Mathematics-IV

QP CODE: 10015186 DATE: 08/12/2022

Duration: 3 hours **Max. Marks: 80**

N.B. (1) Question No. 1 is **COMPULSORY**.

(2) Answer **ANY THREE** questions from Q.2 to Q.6.

(3) Use of Statistical Tables permitted.

(4) Figures to right indicate full marks.

Q 1

a. Evaluate the complex line Integral $\int_0^{1+i} (x - y + ix^2)dz$ along the straight line from z=0 to z=1+i **5**

b. Find a vector orthogonal to u=(-6, 4, 2) v=(3, 1, 5) **5**

c. The equations of lines of regressions are 2x+3y+8=0 and x+2y-5=0, find means of x and y and coefficient of line of regression between x and y **5**

d. Let W be the set of 2 X 2 matrices of the form $\begin{bmatrix} a & 0 \\ 0 & b \end{bmatrix}$ where a and b are real numbers, Show that W is a subspace of space V of all 2X 2 matrices. **5**

Q 2

a. Find the Spearman's rank coefficient correlation of the following data **6**

X	32	55	49	60	43	37	43	49	10	20
Y	40	30	70	20	30	50	72	60	45	25

b. Find the extremal of $\int_{x_1}^{x_2} \frac{1+y^2}{y'^2} dx$ **6**

c. Obtain Taylor and Laurent series expansion about z=0 of function f(z)= $\frac{z-1}{z^2-2z-3}$ indicating regions of convergence **8**

Q. 3

a. A continuous random variable has probability density function as $f(x) = kx^2 \ \ 0 \le x \le 2$, find k , mean and P(0.2 <x<0.5) **6**

b. $\oint_C \frac{\sin \pi z^2 + \cos \pi z^2}{(z-2)(z-3)} dz$ where C is the circle i. |z|=1 ii. lzl=4 **6**

c. Reduce the quadratic form to canonical form, find it's rank and signature $21x_1^2+11x_2^2+2x_3^2-30\ x_1\ x_2+12\ x_1\ x_3-8\ x_3\ x_2$ **8**

Q 4 a. Using Gram-Schmidt process, construct, an orthonormal basis of (1, 1, 1), (-1, 1, 0) and (1, 2, 1) in R^3 have Euclidian inner product **6**

b. Find the probability that at most 4 defective bulbs will be found in a box of 200 bulbs, if it is known that 2% of the bulbs are defective **6**

c. By Rayleigh -Ritz method, Solve the boundary value problem $y''+y+x=0 \quad 0< x<1 \quad y(0)=y(1)=0$ **8**

Q 5 Ten students got the following percentage of marks in mathematics and statistics **6**

a.

Maths	78	36	98	25	75	82	90	62	65	39
Stats	84	51	91	60	68	62	86	58	53	47

Calculate the coefficient of correlation.

b. In a normal distribution 7% of the items are below 35 and 89% of the items are below 63. Find the mean and standard deviation **6**

c. Find the extremal of $\int_{x_1}^{x_2}(y''^2 - y^2 + x^2)dx$ **8**

Q 6 a. Verify Cauchy -Schwartz inequality for u=(1, 2, 4) and v= (-3, 2, 5) **6**

b. Evaluate $\oint_C \frac{\sin^6 z}{\left(z-\frac{\pi}{6}\right)^3} dz$ where C is a circle |z|=2 **6**

c. Find Singular value decomposition of $\begin{bmatrix} 3 & 1 & 1 \\ -1 & 3 & 1 \end{bmatrix}$ **8**

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Duration: 3 Hours **[Marks:80]**

N.B. : (1) Question No 1 is Compulsory.
(2) Attempt any three questions out of the remaining five.
(3) All questions carry equal marks.
(4) Assume suitable data, if required, and state it clearly.

1		Attempt **any FOUR**	[20]
	a	Compare Harvard and Von Neumann architecture.	
	b	Explain cache memory.	
	c	Compare microprocessor and microcontroller.	
	d	List the features of ARM7.	
	e	List the features of ATMEGA 328P.	
2	a	Explain addressing modes of 8051 with one example each.	[10]
	b	Differentiate between: i) Static and Dynamic RAM. ii) Paging and segmentation.	[10]
3	a	Explain with diagram Interfacing of electric kettle operating on 230V/ 5A to 8051 microcontroller. Write a program to make it ON and OFF depending on the status of bit, with an address 09H.	[10]
	b	Explain exceptions handling in ARM7 with reference to exception entry, return and exception priorities.	[10]
4	a	Explain serial communication in 8051 with the help of SCON register.	[10]
	b	Explain the concepts of program counter, stack and stack pointer.	[10]
5	a	What are the factors to consider while selecting microcontroller for a given application.	[10]
	b	Explain in detail with diagrams ports of microcontroller 8051.	[10]
6	a	Write an 8051 program to convert hexadecimal number stored in location 20H to unpacked decimal. Store the result at 21H, 22H and 23H.	[10]
	b	Explain ARMs programmers' model with neat diagram.	[10]

Time: 3 hours Max. Marks: 80

Instructions:

- Question No. 1 is compulsory
- Solve any 3 questions from the remaining 5
- Figures to the right indicate full marks
- Assume suitable data if necessary and mention the same in the answer sheet

	Q1. Attempt any 4	**Marks**
a)	List the ideal characteristics of Operational amplifier and give the practical values of Op-Amp IC 741.	**5**
b)	Draw a neat circuit diagram for voltage to current converter with grounded load Derive its output current expression.	**5**
c)	Differentiate between Inverting and Non-Inverting Comparator.	**5**
d)	Explain the functional block diagram of Timer IC 555.	**5**
e)	With the help of a functional block diagram explain the working of a Three terminal fixed voltage regulator.	**5**
f)	Draw the block diagram of Voltage Controlled Oscillator and explain its working.	**5**
Q2a)	Draw a neat circuit of an instrumentation amplifier using 3-Op-Amps & derive its output equation.	**10**
Q2b)	What are the limitations of an ideal differentiator using op-amp? Draw the circuit diagram of a practical differentiator and explain how it overcomes the limitations.	**10**
Q3a)	With help of neat circuit diagram and voltage transfer characteristics explain the working of a non-inverting Schmitt trigger.	**10**
Q3b)	Design an astable multivibrator having an output frequency of 1 kHz with a duty cycle of 50% using IC 555. Assume C = 0.01µF.	**10**
Q4a)	Design a voltage regulator using 723 to deliver an output voltage of 15 V and load current up to 50 mA.	**10**
Q4b)	Draw the functional block diagram of IC 565 and explain its application as FSK demodulator.	**10**
Q5a)	Draw a neat circuit diagram of an inverting summing amplifier using op-amp to obtain the expression for its output voltage as $V_O = -(V_1+V_2+V_3)$, where V_1, V_2, V_3 are input voltages.	**10**
Q5b)	With the help of a neat diagram explain the working of Wein bridge oscillator using op amp. Derive the expression for its frequency of oscillation. What are the values of R & C if its frequency of oscillation is 5 kHz?	**10**
Q6a)	With the help of a neat diagram and wave forms at appropriate points in the circuit explain the working of square and triangular waveform generator using op amps.	**10**
Q6b)	What is Pulse Width Modulation? With the help of a neat circuit diagram and waveforms at trigger input, control voltage pin, across the timing capacitor and at the output, explain the working of IC 555 as Pulse Width Modulator.	**10**

1T01034 - S.E.(Electronics and Telecommunication)(SEM-IV)(Choice Base Credit Grading System) (R-20-21) (C Scheme) / 40824 - Signals & Systems

QP CODE: 10011849 DATE: 16/12/2022

(Time: 3 Hours) **[Total Marks: 80]**

N.B. : (1) Question No 1 is Compulsory.
(2) Attempt any three questions out of remaining five.
(3) All questions carry equal marks.
(4) Assume Suitable data, if required and state it clearly.

Q1. Answer any 4 questions from the given questions: 20

a. Explain the application of Signals and System in Multimedia Processing.
b. Find the fundamental period of the signal

$$x(t) = \sin\left(\frac{2\pi}{6}t\right) - \cos(\pi t)$$

c. Test the given system for linearity, causality, stability, memory and time variant.

$$y(t) = x(t^2)$$

d. Find x(-2t) and x(3t+2)

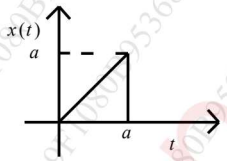

Fig. 1

e. Explain the conditions for the existence of Fourier transform
f. If system matrix $A = \begin{bmatrix} -3 & 1 \\ -2 & 0 \end{bmatrix}$ find the sate transition matrix.

Q2.a. Sketch the following signals for the given signal shown in Fig. 2 10

a) x(-t)
b) x(2t+5)
c) x(2t)
d) x(t/2)
e) -2x(t)

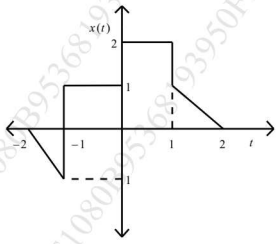

Fig. 2

b. Using unilateral Laplace transform find the output of the system given by 10
$\frac{d^3}{dt^3}y(t) + 6\frac{d^2}{dt^2}y(t) + 11\frac{d}{dt}y(t) + 6y(t) = x(t)$: where $x(t) = e^{-4t}\,u(t)$ and $y(0^-) = 1$,

$$\left.\frac{dy(t)}{dt}\right|_{t=0^-} = 1, \quad \left.\frac{d^2y(t)}{dt^2}\right|_{t=0^-} = 1,$$

Q3.a. Find inverse Z Transform of X(z), 10

$$X(z) = \frac{z^2 + 2Z + 1}{z^2 - \frac{3}{2}z + \frac{1}{2}}$$

b. Given DT sequence: 10

$x(n) = 0.4\delta(n+2) + 0.2\delta(n+1) + 0.1\delta(n) + 0.2\delta(n-1) + 0.4\delta(n-2)$.

Determine the following;

i. $X(e^{j\omega})$

ii. $|X(e^{j\omega})|$

iii. $phase\ \{X(e^{j\omega})\}$

iv. $\int_0^{2\pi} |X(e^{j\omega})|^2$

Q4.a. Determine the state model of the system governed by the equation 10

y[n] = -2y[n-1]+3y[n-2]+0.5y[n-3]+2x[n]+1.5x[n]+1.5x[n-1]+2.5x[n-2]+4x[n-3]

b. Find the Fourier transform of $x(t) = \begin{cases} \cos \pi t\ ; & -\frac{1}{2} \le t \le \frac{1}{2} \\ 0; & otherwise \end{cases}$ 10

i. From the definition of Fourier transform

ii. Using the convolution theorem of Fourier transform

Q5.a Determine DTFS for the sequence x(n)= $\cos^2((\pi/8)n)$ 8

b. i. Find Laplace transform of $\frac{d}{dt} sin(t)\, u(t)$. 4

ii. Find the Z Transform of signal *cos(ω_0 n) u[n]* 4

c. Find the canonic (direct form II) realization of $H(z) = \frac{1-\left(\frac{7}{4}\right)z^{-1}-\left(\frac{1}{2}\right)z^{-2}}{1+\left(\frac{1}{4}\right)z^{-1}-\left(\frac{1}{8}\right)z^{-2}}$ 4

Q6. Answer the following:

a. Find the autocorrelation function $R_{xx}(\tau)$ of sine wave signal 8

$$x(t) = A\sin(\omega_0 t + \varphi)\,, \omega_0 = \frac{2\pi}{T}$$

b. Explain the concept ROC in Z-Transform and Laplace Transform. 6

c. Discuss application of signals in Control system 6

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Duration: 3hrs **[Max Marks:80]**

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(2) Attempt any three questions out of the remaining five.
(3) All questions carry equal marks.
(4) Assume suitable data, if required and state it clearly.

1		Attempt any **FOUR**	**[20]**
	a	Explain the necessity of de-emphasis and pre-emphasis	
	b	Compare AM and FM.	
	c	What is aliasing? How it can be avoided?	
	d	A transmitter radiates 9kW of power with carrier unmodulated and 10.125 kW when modulated. Calculate the depth of modulation.	
	e	List the advantages of pulse modulation over continuous modulation schemes.	
2	a	Explain indirect FM transmitter.	**[10]**
	b	Draw a neat block diagram of a superheterodyne radio receiver and explain each block in detail.	**[10]**
3	a	What are the different methods for SSB generation? Explain any one in detail.	**[10]**
	b	Explain the balanced slope detector with the help of a schematic diagram.	**[10]**
4	a	State and prove sampling theorem for low pass bandlimited signal.	**[10]**
	b	With the help of suitable waveforms explain the generation and detection of PPM	**[10]**
5	a	Draw and explain the FDM transmitter & receiver block diagram along with its applications.	**[10]**
	b	With the help of a block diagram explain the concept of PCM.	**[10]**
6	a	Explain in detail the balanced modulator with suitable expressions and waveforms.	**[10]**
	b	i) Write a note on Delta and adaptive delta modulation ii) Explain VSB in broadcast television.	**[10]**

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