AIKTC/KRRC/SoET/ACKN/QUES/2021-22/ **Date:** 02/08/2022

School: SoET-REV. C-SCHEME **Branch:** EXTC **SEM:** IV

To,
Exam Controller,
AIKTC, New Panvel.

Dear Sir/Madam,

Received with thanks the following **Semester/Unit Test-I/Unit Test-II (Reg./ATKT)** question papers from your exam cell:

Sr. No.	Subject Name	Subject Code	Format		No. of Copies
			SC	HC	
1	Engineering Mathematics- IV	ETS401		✓	
2	Microcontroller	ETC402		✓	
3	Linear Integrated Circuits	ETC403		✓	
4	Signals & Systems	ETC404		✓	
5	Principles of Communication Engineering	ETC405		✓	

Note: SC – Softcopy, HC - Hardcopy

(Shaheen Ansari)
Librarian, AIKTC

Math-IV

EXTC - 17/5/202

University of Mumbai

Examinations Summer 2022

Time: 2hour 30 minutes Max. Marks: 80

Evening

Q1.	**Choose the correct option for following questions. All the Questions are compulsory and carry equal marks**
1.	For a matrix $A = \begin{bmatrix} -1 & 2 & 3 \\ 0 & 3 & 5 \\ 0 & 0 & -2 \end{bmatrix}$, Eigen values are
Option A:	1, 2, 3
Option B:	-1, 3, -2
Option C:	1, -3, 2
Option D:	-6,2,3
2.	Any function which satisfies Euler's equation is called
Option A:	Lagrange's function
Option B:	Euler's function
Option C:	extremal
Option D:	Diagonalizable
3.	If $A = \begin{bmatrix} 1 & 0 \\ 0 & 2 \end{bmatrix}$, then e^A is
Option A:	$e^{\begin{bmatrix} 1 & 0 \\ 0 & 2 \end{bmatrix}}$
Option B:	$\begin{bmatrix} e & 0 \\ 0 & e^2 \end{bmatrix}$
Option C:	$\begin{bmatrix} e & 1 \\ 1 & e^2 \end{bmatrix}$
Option D:	$e^{\begin{bmatrix} 1 & 0 \\ 0 & 2 \end{bmatrix}}$
4.	Problems for finding extremal with constraints can be solved by using
Option A:	Rayleigh Ritz method
Option B:	Lagrange's multipliers
Option C:	Runge -Kutta method
Option D:	Cauchy's method
5.	Which is suitable formula to find Extremals $\int_{x1}^{x2} (1 + x^2 y')y'dx$ is given by
Option A:	$\frac{\partial F}{\partial y'} = c$
Option B:	$\frac{\partial F}{\partial y'} - \frac{d}{dx}\left(\frac{\partial F}{\partial y}\right) = 0$
Option C:	$\frac{\partial F}{\partial y} - \frac{d}{dx}\left(\frac{\partial F}{\partial y'}\right) = 0$
Option D:	$\frac{\partial F}{\partial y} = c$
6.	Cauchy-Schwartz inequality is
Option A:	$\|u.v\| \leq \|\|u\|\| \, \|\|v\|\|$

Option B:	$\|u.v\| < \|\|u\|\| \ \|\|v\|\|$
Option C:	$\|u.v\| > \|\|u\|\| \ \|\|v\|\|$
Option D:	$\|u.v\| \geq \|\|u\|\| \ \|\|v\|\|$
7.	The value of $\int \bar{z}dz$, along upper half of the circle |z|=1
Option A:	$2\pi i$
Option B:	πi
Option C:	0
Option D:	$-2\pi i$
8.	Cayley -Hamilton theorem states
Option A:	The degree of minimal polynomial is always the characteristics polynomial
Option B:	Every square matrix is similar to a diagonal matrix
Option C:	For every square matrix Algebraic multiplicity is equal to Geometrical multiplicity
Option D:	Every square matrix satisfies its own characteristic equation
9.	The curve on which the function $\int_{x_1}^{x_2} \sqrt{1+y'^2}\,dx$ is extremal
Option A:	Straight line
Option B:	Parabola
Option C:	Ellipse
Option D:	Hyperbola
10.	Find value of k if U = (2 , 1 , 3) and V = (4 , 7 , k) are orthogonal.
Option A:	K = -4
Option B:	K = 4
Option C:	K = 5
Option D:	K = -5

Q2	**Solve any Four out of Six** **5 marks each**
A	Verify Cayley-Hamilton Theorem for the matrix A and hence, find A^{-1} and A^4 where $A = \begin{bmatrix} 1 & 2 & -2 \\ -1 & 3 & 0 \\ 0 & -2 & 1 \end{bmatrix}$.
B	Let $V = R^2$ and define addition and multiplication as $(x_1, y_1) + (x_2, y_2) = (x_1 + x_2, y_1 + y_1)$ $k(x_1, y_1) = (3kx_1, 3ky_1)$ Prove that it is not a vector space
C	Obtain Laurent's series expansion of $f(z) = \frac{1}{z^2+4z+3}$ when (i) $1 < \|z\| < 3$ (ii) $\|z\| > 3$
D	Evaluate $\int_0^{2\pi} \frac{d\theta}{5+3\sin\theta}$
E	Find the extremal of $\int_{x_1}^{x_2} (y^2 + y'^2 + 2ye^x)\, dx$
F	Find the rankcorrelation coefficient from the following data.

X	52	63	45	36	72	65	45	25
Y	62	53	51	25	79	43	60	33

Q3.	**Solve any Four out of Six** **5 marks each**
A	Construct an orthogonal basis of R^2 using Gram-Schmidt process to S={(3,1),(2,2)}
B	Find the possible Laurent's expansions of the function $\frac{z-1}{(z-3)(z+1)}$ about z = 0
C	Find the extremal of $\int_0^{3\pi/2} (y^2 - y'^2)\, dx$ given y(0) = 0 , y(3π/2)=1
D	Using Rayleigh -Ritz method find an approximate solution for extremal of $\int_0^1 (2xy - y^2 - y'^2)\, dx$ with y(0)=0 and y(1)=0
E	Evaluate $\int_0^{2+i} (\bar{z})^2 dz$ along the line x=2y
F	Find the Eigen Values and Eigen vectors of the following matrix $\begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & 2 \\ 2 & 2 & 1 \end{bmatrix}$

Q4.	**Solve any Four out of Six** **5 marks each**
A	Find the Eigen values and Eigen vectors of the following matrix $\begin{bmatrix} 2 & -1 & 1 \\ 1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$

<table>
<tr><td>B</td><td>Find the extremal of $\int_{x_1}^{x_2} y\sqrt{(1+y'^2)}\ dx$</td></tr>
<tr><td>C</td><td>The probability density function of a random variable is given by x. Find the mean & variance for f(x) = $\begin{cases} 0, & x \le 0 \\ kxe^{-x/3}, & x > 0 \end{cases}$.</td></tr>
<tr><td>D</td><td>Find Karl Pearson's coefficient of correlation between X and Y.
<table>
<tr><td>X</td><td>35</td><td>38</td><td>43</td><td>30</td><td>54</td><td>68</td><td>70</td><td>92</td><td>44</td><td>56</td></tr>
<tr><td>Y</td><td>51</td><td>37</td><td>48</td><td>62</td><td>93</td><td>73</td><td>56</td><td>72</td><td>70</td><td>92</td></tr>
</table></td></tr>
<tr><td>E</td><td>Evaluate $\int_0^{3+i} z^2 dz$ along the parabola $x = 3y^2$.</td></tr>
<tr><td>F</td><td>Construct an orthonormal basis of R^3 using Gram-Schmidt process to $S = \{(1,2,0),(0,3,1)\}$.</td></tr>
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EXTC
Evening - 17/5/2022

University of Mumbai **QP-3**

Examinations Summer

Program No : 1T01034

Name of the Examination : S.E.(Electronics and Telecommunication)(SEM-IV)(Choice Base Credit Grading System) (R- 19) (C Scheme)

Subject (Paper Code): 40821 / / Engineering Mathematics-IV

Time: 2 hour 30 minutes Max. Marks: 80

NB:

1. All the questions are COMPULSORY.
2. Write the correct option for multiple choice question (MCQ) in Q. 1
3. Q.2 to Q. 4 have internal choice within question.
4. Figures to the right indicate full marks.
5. Use of scientific calculator is allowed.

Q1. (20 Marks)	**Choose the correct option for following questions. All the Questions are compulsory and carry equal marks** **2marks each**
1.	The function $f(z) = \frac{2}{(z+5)^3(z-2)^4}$ has poles at z=-5 of order …. and z=2 of order …
Option A:	3, 2
Option B:	3, 4
Option C:	2, 4
Option D:	4, 5
2.	If f(z) is analytic function and f'(z) is continuous at all points inside and on simple closed curve 'C' , then
Option A:	$\oint_C f(z)dz = 0$
Option B:	$\oint_C f(z)dz \neq 0$

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Option C:	$\oint_C f(z)dz = 2\pi i f(a)$
Option D:	$\oint_C f(z)dz = 1$
3.	The rank of the matrix A is the
Option A:	Dimension of the row space A
Option B:	Dimension of the column space A
Option C:	Both option A and B
Option D:	Dimension of the null space of A and B
4.	Let $Q(X) = X^T AX$, be a quadratic form in 'n' variables then which of the following statement is wrong
Option A:	The total number of non-zero terms in the canonical form of quadratic form is called as rank of quadratic form
Option B:	The number of positive square terms in the canonical form is called as Index of the quadratic form
Option C:	The difference between number of positive and negative terms in the canonical form is called as signature of the quadratic form
Option D:	Signature of the quadratic form is greater than rank of quadratic form
5.	The necessary condition for $\int_{x_1}^{x_2} f(x, y, y')\,dx$ to be maximum or minimum is
Option A:	$\frac{\partial f}{\partial y} - \frac{d}{dx}\left(\frac{\partial f}{\partial y'}\right) = 0$
Option B:	$\frac{\partial f}{\partial y} + \frac{d}{dx}\left(\frac{\partial f}{\partial y'}\right) = 0$
Option C:	$\frac{\partial f}{\partial y'} - \frac{d}{dx}\left(\frac{\partial f}{\partial y}\right) = 0$
Option D:	$\frac{\partial f}{\partial y'} + \frac{d}{dx}\left(\frac{\partial f}{\partial y'}\right) = 0$
6.	If the vectors [k, k, -2] and [k, -2, 12] are orthogonal vectors, then the values of 'k' are

Option A:	$k = 6$ or $k = -4$
Option B:	$k = 6$ or $k = 4$
Option C:	$k = 3$ or $k = -4$
Option D:	$k = 2$ or $k = -2$
7.	The value of coefficient of correlation lies between
Option A:	0 to 1
Option B:	$-\infty$ to 1
Option C:	0 to ∞
Option D:	-1 to 1
8.	The rank correlation coefficients of the following data is

X	23	25	27	29	31	33
Y	43	45	47	49	51	53

Option A:	0
Option B:	-1
Option C:	1
Option D:	0.99
9.	If 'X' and 'Y' are two normal variables with mean 40 and 50 with standard deviation 4 and 3 respectively, what is the distribution of X+Y
Option A:	N(90, 7)
Option B:	N(90 , 3)
Option C:	N(90, 5)
Option D:	N(90,4)
10.	What would be the expectation of the number of failures preceding the first success in an infinite series of independent trials with the constant probability of success p and failure q
Option A:	$\frac{p}{q}$
Option B:	$\frac{q}{p}$
Option C:	$\frac{p+1}{q}$
Option D:	$\frac{p^2}{q^2}$

Q2 (20 Marks)	**Solve any Four out of Six** **5 marks each**
A	Find the extremals of the functional $\int_0^1 \{y'^2 + 12xy\}\,dx$ subject to $y(0) = 0$ and $y(1) = 1$
B	For real values of a, b and θ, using Cauchy- Schwarz inequality, show that $(a\cos\theta + b\sin\theta)^2 \leq a^2 + b^2$
C	Evaluate $\oint_C \frac{\sin^6 z}{\left(z-\frac{\pi}{6}\right)^3} dz$ where C is the circle |z|=1
D	Find the probability that at most 4 defective bulbs will be found in a box of 200 bulbs, if it is known that 25 of the bulbs are defective.
E	Ten students got the following percentage of marks in mathematics and statistics 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.
F	A bolt is manufactured by three machines A, B, and C. A turns out twice as many times as B, and machines B and C produce equal number of items. 3% of bolts produced by A and B are defective and 5% of bolts produced by C are defective. All bolts are put into one stock pile and one is chosen from this pile. What is the probability that it is defective?
Q. 3 (20 Marks)	**Solve any Four out of Six** **5 marks each**
A	Test for an extremal of the functional $\int_0^1 \{xy + y^2 - 2y^2y'\}\,dx$ with y(0)=0, y(1)=2
B	Show that the set $W = \{[x, y, z] \mid y = x + z\}$ is a subspace of R^3 under usual addition and scalar multiplication.
C	Evaluate the complex line Integral $\int_0^{1+i} (x - y + ix^2)dz$ along (a)the straight line from z=0 to z=1+i (b)the real axis from z=0 to z=1 & then along a line parallel to the

	imaginary axis from z=1 to z=1+i
D	Reduce the matrix of the quadratic form $6x_1^2 + 3x_2^2 + 3x_3^2 - 4x_1x_2 + 4x_1x_3 - 2x_2x_3$ to canonical form by congruent transformation and find rank, signature, value class.
E	Obtain the equations of the lines of regression for the following data.

X	65	66	67	67	68	69	70	72
Y	67	68	65	68	72	72	69	71

F — A random variable X has the following probability distribution

X	-2	-1	0	1	2	3
P	0.1	K	0.1	2K	0.2	3K

(i) Find the constant K. (ii) Find the mean and variance of X.

Q. 4 (20 Marks)	**Solve any Four out of Six** — **5 marks each**
A	Using Rayleigh-Ritz method, find an approximate solution for the extremal of the functional $\int_0^1 \left\{xy + \frac{1}{2}y'^2\right\} dx$ subject to y(0)=y(1)=0
B	Using Gram-Schmidt process, construct an orthonormal basis for the plane x+y+z=0
C	Obtain Taylor's and Laurent's series expansions of $f(z) = \frac{2}{(z-1)(z-2)}$ When 1. |z|<1 2. 1<|z|<2 3. |z|>2
D	Find Singular value decomposition of $\begin{bmatrix} 2 & 2 \\ -1 & 1 \end{bmatrix}$
E	Fit a straight line of the form y=a+bx to the following data

X	1	3	5	7	8	10
Y	8	12	15	17	18	20

F — A random variable x has probability density function

$$f(x) = \begin{cases} kx^2e^{-x} & x > 0, \quad k > 0 \\ 0 & Otherwise \end{cases}$$

Find 'k' and hence find mean and variance.

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ET
Sem IV
20/05/2022

University of Mumbai
Examination First Half 2022
Program: Electronics & Telecommunication Engineering
Curriculum Scheme: C-Scheme Rev-2019
Examination: SE Semester IV
Course Code: ECC 402_ and Course Name: Microcontrollers
Time: 2:30 hours Max. Marks: 80

Q1.	**Choose the correct option for following questions. All the Questions are compulsory and carry equal marks**
1.	Program Counter is a register that?
Option A:	keeps the address of instruction byte to be fetched
Option B:	is use to hold one of the operand for arithmetic operation
Option C:	keeps address of most recent entry in the stack
Option D:	none of the above
2.	Subroutine is-
Option A:	a separately written program that can be Call in main program whenever it is required.
Option B:	used to reduce the size of the program
Option C:	mostly implementation using CALL and RET type of instruction
Option D:	All of the above
3.	Microcontroller is
Option A:	CPU of a Computer
Option B:	ALU
Option C:	Single Chip Computer
Option D:	Act like a memory
4.	If R0 and RS1 both bits in PSW register are 1, and R5 register is being used by the 8051, then R5 belongs to
Option A:	Bank 0
Option B:	Bank 1
Option C:	Bank 2
Option D:	Bank 3
5.	Which of the following instruction needs stack memory?
Option A:	LJMP
Option B:	LCALL
Option C:	MOVX
Option D:	DAA
6	One NOP instruction can be used to generate delay of_____microsecond. if 8051 is operating on 12MHz.
Option A:	1
Option B:	2
Option C:	12
Option D:	None of the above

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7	Primary memory is
Option A:	a memory which is directly access by the CPU
Option B:	a Random-Access Memory (RAM)
Option C:	a Read Only Memory (ROM)
Option D:	a Hard Disc Drive in a computer
8	Which feature of an operating system enables a computer to compensate shortages of physical memory by transferring pages of data from random access memory to disk storage?
Option A:	Cache Memory
Option B:	Virtual memory
Option C:	Flash memory
Option D:	Shared memory
9	Which Chip has 11 channels 10 bit ADC
Option A:	8051
Option B:	NXP 89v51RD2
Option C:	Atmega328P
Option D:	PIC16F886
10.	Watch Dog Timer (WDT) is Used to -
Option A:	Resets the system if applied voltage increased above threshold value
Option B:	Resets the system if the software fails to operate properly
Option C:	Resets the system if applied voltage decreases below threshold value
Option D:	Resets the system if Power failure is detected

Q2.	Solve any Four out of Six	5 marks each
A	Describe the features of ARM processor. Also explain Which features are accepted and which are rejected from basic RISC machine.	
B	What is significance of CPSR register of ARM? Draw and explain each bit position.	
C	Explain with the help of neat diagram interfacing of single push button key to 8051 microcontroller. How you will solve key bouncing issue?	
D	Compare main features of 89v51RD2, PIC16F886 & Atmega 328P	
E	What is need of Cache memory? Explain in brief Cache organization	
F	What is addressing modes? Explain 8051 addressing modes with an examples.	

Q3.	Solve any Two Questions out of Three	10 marks each
A	Explain Interrupt Structure of 8051 microcontroller in detail. What is the role of IE, IP TCON, SCON registers in interrupt process.	
B	What are the factors that needs to be considered for selecting a microcontroller for an application?	
C	Generate square wave of frequency 1KHz at Pin 1.0 of 8051 microcontroller using delay subroutine. Assume 8051 is operating on 6MHz.	

Q4.	Solve any Two Questions out of Three	10 marks each
A	Draw and explain memory organization of 8051 in detail	
B	With the help of diagram, list the sequence of operation carried out by the microprocessor after reset to execute a program stored in a memory. Assume suitable RESET vector address.	
C	Explain following instruction of ARM – ➢ ADD R0,R2,R3,LSL#1 ➢ CMP R0,R1,LSR#7 ➢ MLA R4,R3,R7,R8 ➢ MVN R0,#4 ➢ STR r0,[r1]	

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B.P. Code : 91564

23/05/2022

Branch ET

University of Mumbai

Examinations Commencing from 17th May 2022

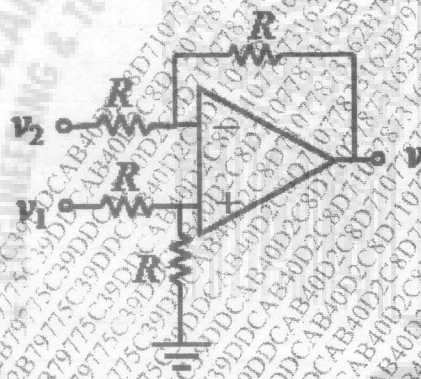
Program: SEM IV C Scheme

Curriculum Scheme: C Scheme R-2019

Examination: SE Semester IV

Course Code: ECC403 and Course Name: Linear Integrated Circuits

Time: 2-hour 30 minutes | Max. Marks: 80

Q1. (2 Marks Each)	**Choose the correct option for following questions. All the Questions are compulsory and carry equal marks**
1.	The input stage of operational amplifier is
Option A:	Common Emitter Amplifier
Option B:	Dual Input Balanced output Differential Amplifier
Option C:	Common Base Amplifier
Option D:	Common Collector Amplifier
2.	For the difference amplifier shown below, the output voltage is given by 
Option A:	$v_o = v_1 + v_2$
Option B:	$v_o = v_1 - v_2$
Option C:	$v_o = -v_1 + v_2$
Option D:	$v_o = -(v_1 + v_2)$
3.	A current to voltage converter converts
Option A:	Input current to proportional output voltage.
Option B:	Input current to proportional output current.
Option C:	Input voltage to proportional output voltage.
Option D:	Input voltage to proportional output current.
4.	For a Wein Bridge oscillator, the RC networks in the feedback circuit have values of their resistances R = 3.3 kΩ and capacitances C = 0.047 μF,
Option A:	Its frequency of oscillation is ≈ 1 kHz
Option B:	Its frequency of oscillation is ≈ 3.030 kHz
Option C:	Its frequency of oscillation is ≈ 3.3 kHz
Option D:	Its frequency of oscillation is ≈ 480 Hz
5.	An Inverting Schmitt trigger employs

Option A:	Only Negative feedback
Option B:	Only Positive feedback
Option C:	Both Negative and Positive feedback
Option D:	No feedback
6.	A square waveform having ON time equal to its OFF time is fed as input to an integrator. The resulting output of the integrator is called
Option A:	Triangular waveform
Option B:	Sawtooth waveform
Option C:	Inverted Square waveform
Option D:	Sine waveform
7.	The output pulse width of a monostable multivibrator using IC 555 where R and C are the external components is
Option A:	RC
Option B:	1.1 RC
Option C:	(2/3) RC
Option D:	(1/3) RC
8.	Role of Pin-7 of IC 555
Option A:	Control Voltage
Option B:	Reset
Option C:	Output
Option D:	Discharge
9.	For High voltage-High current type of voltage regulator using IC 723, output voltage and output currents respectively have the following correct values.
Option A:	Less than 7 V, greater than 150 mA
Option B:	Less than 7 V, less than 150 mA
Option C:	7 to 37 V, greater than 150 mA
Option D:	7 to 37 V, less than 150 mA
10.	For a Phase Locked Loop which of the following is true?
Option A:	Lock in range > Capture range
Option B:	Lock in range < Capture range
Option C:	Lock in range = Capture range
Option D:	Lock in range = half of Capture range

Q2 (10 Marks Each)	Solve any Two Questions out of Three	10 marks each
A	Design a second order high pass Butterworth filter for cut off frequency of 1 kHz.	
B	With the help of a neat diagram explain the working of R C phase shift oscillator using op amp. Derive the expression for its frequency of oscillation.	
C	With help of neat circuit diagram, input and output waveforms, and voltage transfer characteristics explain the working of a non- inverting Schmitt trigger.	

N/3

Q3 (10 Marks Each)	Solve any Two Questions out of Three 10 marks each
A	With the help of functional block diagram explain the working of PLL IC 565.
B	Design an astable multivibrator using IC 555 for frequency 1 kHz & duty cycle 50%. Assume C = 0.1μF.
C	Draw a neat circuit of an instrumentation Amplifier using 3-Op-Amps & Derive its output equation.

Q4 (10 Marks Each)	Solve any Two Questions out of Three 10 marks each
A	With the help of a neat circuit diagram and waveforms at relevant points in the circuit, explain the working of a square and triangular waveform generator. Derive the frequency of oscillation of the generator.
B	Design a circuit using op-amp to perform $Vo = 2V_2 - 3V_1$, where V_1 and V_2 are inputs.
C	Design a voltage regulator using IC 723 to deliver an output voltage of 15 V and load current upto 1.5 A.

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Q.P. Code: 90531

26/05/2022

University of Mumbai
Examination Summer 2022

Program: **EXTC**
Curriculum Scheme: Rev 2019
Examination: SE Semester IV
Paper Code: 40824 Course Code: ECC404 and Course Name: Signals and Systems
Time: 2 hours and 30 minutes Max. Marks: 80

Q1(20 Marks)	**Choose the correct option for the following questions. All the Questions are compulsory and carry equal marks**
1.	A system is described by differential equation $\frac{d^2y}{dt^2} + 3\frac{dy}{dt} + 2y(t) = x(t)$ is initially at rest. For input x(t) = 2u(t) the output y(t) is
Option A:	$(1 - 2e^{-t} - e^{-2t})u(t)$
Option B:	$(1 - 2e^{-t} - 2e^{-2t})u(t)$
Option C:	$(0.5 + e^{-t} + 1.5e^{-2t})u(t)$
Option D:	$(0.5 + 2e^{-t} + 2e^{-2t})u(t)$
2.	The power in the signal (t) = 8cos (20πt – (π/2)) + 4sin (15πt) is equal to
Option A:	40
Option B:	42
Option C:	41
Option D:	82
3.	Find the Z-transform of y(n) = x(n+2)u(n)
Option A:	z^2 X(z) – z^2 x(0) – zx(1)
Option B:	z^2 X(z) + z^2 x(0) – zx(1)
Option C:	z^2 X(z) – z^2 x(0) + zx(1)
Option D:	z^2 X(z) + z^2 x(0) + zx(1)
4.	Find the Z-transform of x(n) = n[a^n u(n)].
Option A:	1 / (z (z-a))
Option B:	az / (z(z-a))
Option C:	az / (z(z+a))
Option D:	a / (z $(z-a)^2$)
5.	If two LTI systems with impulse response h1(t) and h2(t) and are connected in parallel then output is given by _____
Option A:	y(t) = x(t) *(h1(t) + h2(t))
Option B:	y(t) = x(t) + (h1(t) + h2(t))
Option C:	y(t) = x(t) * (h1(t) h2(t))
Option D:	y(t) = (x(t) * h1(t)) + h2(t)
6.	Laplace transform of e^{-2t} u(t)
Option A:	1 / (S+2)
Option B:	S / (S+2)
Option C:	1 / (S-2)

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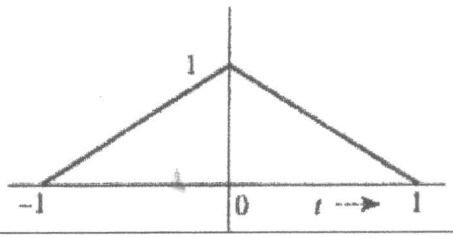
Option D:	S / (S-2)
7.	Inverse Laplace transform of a constant 5
Option A:	5
Option B:	5 δ (t)
Option C:	5 e^{t}
Option D:	5 e^{-t}
8.	RoC of finite duration left sided DT signal
Option A:	Right side of imaginary axis
Option B:	Left side of imaginary axis
Option C:	Entire Z-plane except Z = 0
Option D:	Entire Z-plane except Z = ∞
9.	The discrete time Fourier Transform of x[n] = {2, 1, 2}
Option A:	$1/(1+4\cos\omega)\, e^{-j\omega}$
Option B:	$(2+4\cos\omega)\, e^{-j\omega}$
Option C:	$(1+4\cos\omega)\, e^{-j\omega}$
Option D:	$(e^{-j\omega}+4\cos\omega)\, e^{-j\omega}$
10.	The ROC of the signal $x[n]= a^n$ for $-5 < n < 5$
Option A:	Entire z-plane
Option B:	Entire z-plane except z=0 and z=∞
Option C:	Entire z-plane except z=0
Option D:	Entire z-plane except z=∞

Q2 (20 Marks)	
A	**Solve any Two** **5 marks each**
i.	Find the Laplace transform of $x(t) = 5\sin\omega_0 t\, u(t)$ and sketch the RoC
ii.	If x[n] = [4 2 1 3], Sketch x[n], x[-n], -x[-n], x[-2n] and x[n/2]
iii.	Verify the given signals are periodic or not. If periodic, determine the period and frequency of each signal $x_1(t) = \cos 50\pi t$, $x_2(t) = \cos 100\pi t$, $x_3(t) = x_1(t) + x_2(t)$ and $x_4(t) = x_1(t)\ x_2(t)$
B	**Solve any One** **10 marks each**
i.	Perform convolution of the causal signals, using Laplace transform. **$x_1(t) = \cos t\, u(t)$, $x_2(t) = t\, u(t)$**
ii.	Find the Fourier transform of following signal and plot magnitude and phase spectrum 

Q3 (20 Marks)	
A	**Solve any Two** **5 marks each**
i.	Input to a continuous time system is x(t) = 3, 0 < t < 3 and zero

	elsewhere. Sketch x(t+3), x(-t+3), x(-t-3), x(3t) and x(t/3)
ii.	Find the IZT of $X[z] = 3+2z^{-1}+z^{-2} / 1-3z^{-1}+2z^{-2}$ using partial fraction method
iii.	Determine the even and odd parts of the signals. x[n] = {4, -4, 2, -2} (Please note - the arrow is under -4) ⇑
B	**Solve any One** **10 marks each**
i.	Find inverse Fourier transform of $X(j\omega) = \frac{(j\omega+3)}{(j\omega+4)(j\omega+2)^2}$
ii.	Using the differentiation in frequency property, find the Fourier transform of $y(t)=t\,x(t)$ where $x(t)= e^{-bt}\,u(t)$.

Q4 (20 Marks)	
A	**Solve any Two** **5 marks each**
i.	Using canonical structure, realize the following IIR system with I/O relation y[n] = x[n] +2x[n-1] +3y[n-1]
ii.	Realize the following FIR system with h[n] = [4,0,2,-3,-4]
iii.	Find x(t) * h(t) using LT and ILT where x(t) = u(t) and h(t) = δ (t-3)
B	**Solve any One** **10 marks each**
i.	Impulse response of a LTI system is given as $h(t) = e^{-4t}\,u(t)$. Find H(s), sketch the RoC and verify the stability of the system
ii.	A causal DT LTI system is described by $y(n)-(5/6)y(n-1)+(1/6)y(n-2)=x(n)$, where $x(n)$ and $y(n)$ are the input and output of the system. Find the response $y(n)$ for the input $x(n)=(1/4)^n\,u(n)$.

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30/05/2022

University of Mumbai

Examination Summer 2022

Program: Electronics and Telecommunication Engineering

Curriculum Scheme: Rev2019

Examination: **SE** Semester: **IV**

Course Code: **ECC405** and Course Name: **Principles of Communication Engineering**

Time: 2 hour 30 minutes | Max. Marks: 80

Q1.	**Choose the correct option for the following questions. All the questions are compulsory and carry equal marks**
1.	Medium which sends information from source to receiver is called
Option A:	Channel
Option B:	Transmitter
Option C:	Loudspeaker
Option D:	Transducer
2.	What is modulation?
Option A:	Process of separating a carrier signal and analog signal
Option B:	Recovering information from a modulated signal
Option C:	Process of varying one or more properties of a modulating signal
Option D:	Involvement of noise
3.	The ability of receivers to select the wanted signals among various incoming signals is called
Option A:	Fidelity
Option B:	Selectivity
Option C:	Sensitivity
Option D:	Modulation
4.	For low level amplitude modulation, amplifier must be
Option A:	Class C amplifier
Option B:	Class B amplifier
Option C:	Class D amplifier
Option D:	Class A amplifier
5.	In a radio receiver, noise is generally developed at
Option A:	IF stage
Option B:	Receiving antenna
Option C:	Audio stage
Option D:	RF stage
6.	A superheterodyne receiver with an IF of 450 kHz is tuned to a signal at 1250 kHz. The image frequency is
Option A:	1700 kHz
Option B:	2150 kHz
Option C:	1650 kHz
Option D:	2100 kHz

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7.	Standard intermediate frequency used for AM receiver is
Option A:	455 MHz
Option B:	455 KHz
Option C:	455 Hz
Option D:	20 KHz
8.	Pre-Emphasis Circuit is used to amplify what kind of frequencies?
Option A:	Low
Option B:	High
Option C:	Moderate
Option D:	Oscillator
9.	Natural and flat top sampling are the types of
Option A:	PWM
Option B:	PPM
Option C:	PCM
Option D:	PAM
10.	Which is a circuit used to generate a double sideband suppressed carrier signal?
Option A:	Sideband suppressor
Option B:	Anti-modulator
Option C:	Balanced modulator
Option D:	Carrier suppressor

Q2.	**Solve any four Questions out of Six, (5 marks each)**
A	Explain the use of VSB in broadcast television
B	A transmitter radiates 9kW of power with carrier unmodulated and 10.125 kW when modulated. Calculate the depth of modulation.
C	Explain types of AGC.
D	Define and explain SNR, Noise Figure, Noise factor, Noise Temperature, and Friss Formula.
E	Explain how PPM is generated from PWM?
F	Explain FDM and TDM applications

Q3.	**Solve any Two Questions out of Three (10 marks each)**
A	Draw a neat block diagram of a superheterodyne radio receiver and explain each block in detail.
B	What are different methods for SSB generation? Explain any one method in detail.
C	With the help of a block diagram explain the concept of PCM. What is DPCM?

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Q4.	**Solve any Two Questions out of Three (10 marks each)**
A	What are different methods for FM demodulation? Explain any one method in detail.
B	State and prove sampling theorem for low pass band-limited signal.
C	Explain Frequency Division Multiplexing (FDM) transmitter & receiver with a neat block diagram.