University of Mumbai

Examinations Summer 2022

S.E.(Electronics and Telecommunication)(SEM-III)
(Choice Base Credit Grading System) (R- 19) (C Scheme)
Paper Code 51221 / / Engineering Mathematics-III

Time: 2 hour 30 minutes Max. Marks: 80

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Q1.	**Choose the correct option for following questions. All the Questions are compulsory and carry equal marks**
1.	If $L\{f(t)\} = \frac{2}{s^3}e^{-s}$ then $L\{f(2t)\}$
Option A:	$\frac{8}{s^3}e^{-\frac{s}{2}}$
Option B:	$\frac{6}{s^3}e^{-\frac{s}{2}}$
Option C:	$\frac{8}{s^3}e^{-s}$
Option D:	$\frac{8}{s^3}e^{-1}$
2.	The Fourier Coefficient b_n of $f(x) = 4 - x^2$ in (0,2) is
Option A:	$\frac{2}{n\pi}$
Option B:	$\frac{4}{n\pi}$
Option C:	$\frac{8}{n^2\pi^2}$
Option D:	$\frac{16}{n^2\pi}$
3.	The directional derivative of $\Phi = x^2 + 3y^2 + 2z^2$ in the direction of the vector $2\hat{\imath} - \hat{\jmath} - 2\hat{k}$ at the point$(1, -3, 2)$ is given
Option A:	2
Option B:	4
Option C:	-2
Option D:	-4
4.	The Maximum direction derivative of $\Phi = (4x - y + 2z)^2$ at (1,2,1) is
Option A:	$8\sqrt{11}$
Option B:	$\sqrt{7}$
Option C:	5
Option D:	$8\sqrt{21}$

5.	If the matrix $A = \begin{bmatrix} a & 1 \\ 2 & 3 \end{bmatrix}$ has 1 as an eigen value, then trace A is
Option A:	4
Option B:	5
Option C:	6
Option D:	7
6.	The characteristic polynomial of matrix $A = \begin{bmatrix} 0 & 0 & -c \\ 1 & 0 & -b \\ 0 & 1 & -a \end{bmatrix}$ is
Option A:	$x^3 + ax^2 + bx + c$
Option B:	$(x-a)(x-b)$
Option C:	$(x-1)(x-abc)^2$
Option D:	$(x-1)^2(x-abc)$
7.	If $v = \tan^{-1}\left(\frac{y}{x}\right)$ is the imaginary part of the analytic function $f(z)$, then
Option A:	$f(z) = \log(z) + c$
Option B:	$f(z) = \frac{1}{2}\log(z) + c$
Option C:	$f(z) = \log(z - \sin(z)) + c$
Option D:	$f(z) = i\log(z) + z^2\tan(z) + c$
8.	If $\bar{r} = x\,\hat{\imath} + y\hat{\jmath} + z\hat{k}$ then $div(\bar{r}) =$ ____
Option A:	2
Option B:	3
Option C:	5
Option D:	6
9.	If $f(x) = \begin{cases} 0 & , -\frac{\pi}{\omega} < x < 0 \\ E\sin(\omega x) & , 0 < x < \frac{\pi}{\omega} \end{cases}$ .with period $\frac{2\pi}{\omega}$, where E and ω are non zero constants, then the value of a_1 in Fourier Series expansion of $f(x)$ is
Option A:	0
Option B:	1
Option C:	-1
Option D:	2
10.	Let $\bar{F} = (x-y-z)\hat{\imath} + (y-z-x)\hat{\jmath} + (z-x-y)\hat{k}$ and S is a paraboloid $x^2 + y^2 = 4 - z \;\; , z \geq 0$. Then by Stoke's Theorem the value of $I = \int_C \bar{F} \cdot dr$
Option A:	1
Option B:	2
Option C:	0
Option D:	3

Q2, (20 Marks)	**Solve any Four out of Six** **5 marks each**
A	Find the Fourier Series of $f(x) = x^3$ in the interval$(-\pi, \pi)$
B	Find the values of a, b, c if $\bar{F} = (axy + bz^3)i + (3x^2 - cz)j + (3xz^2 - y)k$ is irrotational.
C	Find the value of α if $\int_0^\infty e^{-2t} \sin(t+\alpha)\cos(t-\alpha)\, dt = \frac{1}{4}$
D	Find $L^{-1}\left\{s \log\left(\frac{s+1}{s-1}\right)\right\}$
E	Find the Eigen values and Eigen vectors of $A = \begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$
F	Show that $v = e^x(x \sin y + y \cos y)$ is harmonic and also find its corresponding analytic fuction.

Q3. (20 Marks)	**Solve any Four out of Six** **5 marks each**
A	Find $L\left\{\frac{sin^2 2t}{t}\right\}$
B	Find $L^{-1}\left\{\frac{s}{(s^2+4)(s^2+1)}\right\}$
C	Find the half range cosine series $f(x) = lx - x^2$, on $0 < x < l$.
D	Show that $\bar{F} = (ye^{xy}\cos z)\hat{\imath} + (xe^{xy}\cos z)\hat{\jmath} - (e^{xy}\sin z)\hat{k}$ is irrotational and also find the scalar potential Φ such that $\bar{F} = \nabla\Phi$
E	If $A = \begin{bmatrix} -1 & 4 \\ 2 & 1 \end{bmatrix}$, then prove that $3tanA = Atan3$.
F	Find the orthogonal trajectories of the family of curves given by $e^{-x}\cos y + xy = \alpha$.

Q4. (20 Marks)	**Solve any Four out of Six** **5 marks each**
A	Find the analytic function $f(z) = u + iv$ in terms of z if $u + v = \frac{\sin(2x)}{\cosh(2y) - \cos(2x)}$
B	Evaluate using Laplace transform, $\int_0^\infty e^{-t}\left(\int_0^t \frac{sinu}{u} du\right) dt$
C	Find the Fourier Series expansion $f(x) = x^2$ in $(0,2\pi)$
D	Using Cayley Hamilton theorem for matrix $A = \begin{bmatrix} 3 & 1 \\ -1 & 2 \end{bmatrix}$, express $2A^5 - 3A^4 + A^2 - 4I$ as a linear polynomial in A.
E	Using Green's theorem evaluate $\oint_C x^2(1-y)dx + (2y+1)dy$ Where C is the circle $x^2 + y^2 = a^2$
F	Find $L^{-1}\left\{\frac{5s^2+8s-1}{(s+3)(s^2+1)}\right\}$

University of Mumbai

Examination 2022 under cluster __May 2022 (Lead College: _____)

Program: Instrumentation Engineering
Curriculum Scheme: Rev-2019-C
Examination: SE Semester- III
Course Code: ISC302 and Course Name: Transducers-I

Time: 2 ½ hour Max. Marks: 80

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Q1.	**Choose the correct option for following questions. All the Questions are compulsory and carry equal marks**
1.	Which among the following is not a dynamic characteristic?
Option A:	Precision
Option B:	Measuring lag
Option C:	Dynamic error
Option D:	Fidelity
2.	Which of the following is not a characteristic of ideal transducer?
Option A:	High dynamic range
Option B:	Low linearity
Option C:	Low noise
Option D:	High repeatability
3	Which of the following uses displacement to pressure conversion?
Option A:	Flapper nozzle system
Option B:	Gyroscope
Option C:	Viscometer
Option D:	Hygrometer
4	The displacement measuring instruments is
Option A:	Thermistor
Option B:	LDR
Option C:	RTD
Option D:	LVDT
5	Temperature transducers make use of _____
Option A:	change in resistivity
Option B:	change in length
Option C:	change in area
Option D:	change in capacitance
6	Thermocouple connected in series is called as
Option A:	Thermopile
Option B:	Thermostat
Option C:	Equal thermocouples
Option D:	Unequal thermocouples

7	_____ consists of two different metals connected at two points.
Option A:	Thermistor
Option B:	Resistance Thermometer
Option C:	Thermocouple
Option D:	Semiconductor based sensor
8	Which of the following conversions take place in float element?
Option A:	Level to force
Option B:	Level to voltage
Option C:	Level to displacement
Option D:	Voltage to level
9	In radiation methods, the detector system is located at
Option A:	The top of the liquid filled tank
Option B:	The bottom of liquid filled tank
Option C:	Middle of the liquid filled tank
Option D:	Outside a liquid filled tank
10	An average speed is equal to the total distance which is travelled divided by the
Option A:	Taken time
Option B:	Speed limit
Option C:	Direction
Option D:	Area

Q2	**Solve any Two Questions out of Three. (10 marks each)**
A	Explain block diagram of instrumentation system.
B	Explain construction and working of thermistor with neat diagram.
C	Draw & explain working of LVDT. What causes residual voltage to occur?

Q3	**Solve any Two Questions out of Three. (10 marks each)**
A	Write note on radiation pyrometer in detail.
B	Explain ultrasonic type level detector with neat diagram. Also list advantages and disadvantages.
C	Explain any one speed and vibration measurement technique.

Q4	**Solve any Two Questions out of Three. (10 marks each)**
A	Explain classification of transducers with examples.
B	Explain flapper nozzle system with neat labelled diagram. Also list advantages and disadvantages.
C	Compare RTD, Thermistor and Thermocouple.

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Summer 2022

Curriculum Scheme: Rev2019

Examination: SE Semester III

Course Code: ISC303and Course Name: Analog electronics

Time: 2 hour 30 minutes Max. Marks: 80

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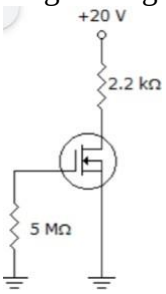
Q1.	**Choose the correct option for following questions. All the Questions are compulsory and carry equal marks**
1.	KVL in input loop of BJT circuit determines
Option A:	equation for collector current, Ic
Option B:	equation for emitter current, Ie
Option C:	equation for base current, I_b
Option D:	saturation current
2.	In a Common-Emitter r_e model, r_e is given by,
Option A:	$0.26V/i_e$. where i_e is emitter current
Option B:	$26V/i_e$. where i_e is emitter current
Option C:	$2.6V/i_e$. where i_e is emitter current
Option D:	$26mV/i_e$. where i_e is emitter current
3.	In a FET, gate voltage controls
Option A:	gate current
Option B:	drain current
Option C:	source current
Option D:	power supply voltage
4.	For the JFET, the relationship between input and output quantities is nonlinear due to_____term in_____equation.
Option A:	Shockley's, Squared
Option B:	Squared, Squared
Option C:	Shockley's, Shockley's
Option D:	Squared, Shockley's
5.	In class A power amplifier
Option A:	bias point is chosen to be at cutoff region.
Option B:	bias point is chosen to be at saturation region.
Option C:	bias point is chosen to be at center of load line.
Option D:	bias point is chosen depending on device temperature.
6.	Collector-feedback bias is
Option A:	based on the principle of positive feedback
Option B:	based on beta multiplication
Option C:	based on the principle of negative feedback
Option D:	not very stable

7.	In a certain voltage-divider biased npn transistor, VB is 3.05 V. The dc emitter voltage is approximately
Option A:	0.7 V
Option B:	2.56 V
Option C:	2.35 V
Option D:	2.45 V
8.	Refer to the given figure. I_D = 6 mA. Calculate the value of V_{DS}. 
Option A:	13.2 V
Option B:	6.8 V
Option C:	10 V
Option D:	0 V
9.	The efficiency of a power amplifier is the ratio of the power delivered to the load to the _____
Option A:	input signal power
Option B:	power dissipated in the last stage
Option C:	power from the dc power supply
Option D:	Fixed value
10.	A differential amplifier
Option A:	reject or nullify the part of input signals which is greater among both applied inputs
Option B:	reject or nullify the part of input signals which is smaller among both applied inputs
Option C:	reject or nullify the part of input signals which is not same as power supply value
Option D:	reject or nullify the part of input signals which is common to both inputs

Q2	**Solve any Four out of Six** **5 marks each**
A	A 2N2222A BJT is connected in voltage divider biasing circuit with R_1 = 6.8 kΩ, R_2 = 1 kΩ, R_C = 3.3 kΩ, R_E = 1 kΩ and V_{CC} = 40V. Assume, V_{BE} = 0.7V & β = 100. Compute V_{CEQ} and I_{CQ}
B	Explain working of pnp transistor.
C	Explain BJT as a transistor and switch.
D	Explain output characteristics of BJT. Identify regions for BJT operation as switch and as amplifier.
E	Explain negative series clipper.
F	Explain DIBO differential amplifier.

Q3	Solve any Two Questions out of Three 10 marks each
A	Explain operation of series fed Class-A amplifier with neat sketch.
B	Explain fixed bias and voltage divider bias in BJT.
C	Explain the working of enhancement type MOSFET with diagram.

Q4	Solve any two questions out of three 10 marks each
i.	Explain frequency response of CS amplifier.
ii.	Explain block diagram of SMPS with advantages and disadvantages.
iii.	Explain r_e transistor model and hybrid equivalent model for CE configuration in BJT.

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Q1.	On multiplication of $(10.10)_2$ with $(1.01)_2$ we get
Option A:	101.0010
Option B:	0010.101
Option C:	011.0010
Option D:	110.0011
Q2.	An OR gate has 4 inputs. One input is high and the other three are low. The output is …….
Option A:	Low
Option B:	High
Option C:	alternately high and low
Option D:	may be high or low depending on relative magnitude of inputs
Q3.	A device which converts BCD to seven segments is called ……..
Option A:	Encoder
Option B:	Decoder
Option C:	Multiplexer
Option D:	None of these
Q4.	In 2's complement representation the number 11100101 represents the decimal number ……
Option A:	+37
Option B:	-31
Option C:	+27
Option D:	-27
Q5.	A counter with 5 flip flops will have ……. states.
Option A:	5
Option B:	10
Option C:	32
Option D:	Infinite
Q6.	In the expression A + BC, the total number of minterms will be ……
Option A:	2
Option B:	3
Option C:	4
Option D:	5
Q7.	Which of the following is non-saturating?
Option A:	TTL
Option B:	CMOS

Option C:	ECL
Option D:	Both 1 and 2
Q8.	The expression Y = πM (0, 1, 3, 4) is
Option A:	POS
Option B:	SOP
Option C:	Hybrid
Option D:	none of these
Q9.	The basic storage element in a digital system is …….
Option A:	flipflop
Option B:	counter
Option C:	multiplexer
Option D:	encoder
Q10.	A full adder can be made out of …….
Option A:	two half adders
Option B:	two half adders and a OR gate
Option C:	two half adders and a NOT gate
Option D:	three half adders

Q2	**Solve any Four out of Six** **5 marks each**
A	Explain the working of Johnson counter.
B	Convert T type flip flop into D type flip flop.
C	Compare PAL with PLA.
D	Compare PROM with EPROM.
E	Compare FPGAs with CPLDs.
F	Compare combinational circuit with sequential circuit.

Q3.	**Solve any Two Questions out of Three** **10 marks each**
A	What is shift register? Explain any one type of shift register. Give its application.
B	Compare Logic Families (CMOS ,TTL,ECL)
C	Design Full adder circuit.

Q4.	**Solve any Two Questions out of Three** **10 marks each**
A	Implement the following Boolean equations single 8:1 MUX and few logic gates: F(A,B,C,D,E)=Σm(0,1,3,4,8,9,15)
B	State and prove De Morgan's theorem

C	Design a synchronous counter using D type flip flop for getting the following sequence : 0-2-4-6-0. take care of lockout condition.