Seat No.

**S.Y. B.Tech. (Electronics & Telecommunication Engineering)
(Semester - III) (CBCS) Examination, January - 2023
ENGINEERING MATHEMATICS - III
Sub. Code : 73245**

Day and Date : Friday, 20 - 01 - 2023
Time : 10.30 a.m. to 1.00 p.m.

Total Marks : 70

Instructions :
1) All questions are compulsory.
2) Use of non-programmable calculator is allowed.
3) Figures to the right indicate full marks.

Q1) Choose the correct alternative from the following. (2Marks each) **[14]**

a) The complementary function of $(D^3 - 3D^2 + 4) y = e^{3x}$ is _____
   i) $y = c_1 e^{-x} - (c_2 + c_3 x)e^{2x}$
   ii) $y = c_1 e^{-x} + (c_2 - c_3 x)e^{2x}$
   iii) $y = c_1 e^{-x} + (c_2 + c_3 x)e^{-2x}$
   iv) $y = c_1 e^{-x} + (c_2 + c_3 x)e^{2x}$

b) If $\bar{a} = a_1 i + a_2 j + a_3 k$ then div $\bar{a}$ is _____
   i) $2\bar{a}$
   ii) 0
   iii) a^2
   iv) $\bar{a}$

c) The curl of vector field $f(x, y, z) = x^2 i + 2zj - yk$ is _____
   i) $-3j$
   ii) $-3k$
   iii) $-3i$
   iv) 0

d) Value of b_n in a fourier series for the function $f(x) = x$ in the interval $(0, 2\pi)$ is
   i) 2π
   ii) $-2/n$
   iii) $4\pi^2$
   iv) None of these

e) The Laplace transform of $e^{-2t}.\cos4t$ is _____

   i) $\dfrac{s-2}{(s-2)^2 + 16}$
   ii) $\dfrac{s+2}{(s-2)^2 + 16}$

   iii) $\dfrac{s-2}{(s+2)^2 + 16}$
   iv) $\dfrac{s+2}{(s+2)^2 + 16}$

f) Inverse Laplace transform of $\dfrac{1}{(s-1)^2 - 1}$ is _____

   i) $e^t \sinh t$
   ii) $e^{-t} \sin t$
   iii) $e^t \cosh t$
   iv) $e^{-t} \cos t$

P.T.O.

g) Let X = {a, b, c, d, e, f, g, h, i, j} and

$A = \dfrac{0}{a} + \dfrac{0.2}{b} + \dfrac{0.5}{c} + \dfrac{0.2}{d} + \dfrac{0}{e} + \dfrac{1}{f} + \dfrac{0}{g} + \dfrac{0.5}{h} + \dfrac{1}{i} + \dfrac{0.1}{j}$ then |A| is _____

i)   3.5

ii) 3.8

iii) 3.3

iv) 3.6

Q2) Attempt any two.

a) Solve $(D^3 - 3D^2 + 4D - 2)y = e^x + \cos 2x$. [7]

b) Find the constants a and b so that the surface $ax^2 - byz = (a+2)x$ will be orthogonal to the surface $4x^2y + z^3 = 4$ at $(1, -1, 2)$. [7]

c) Find α cuts and strong α cuts of $A(x) = \dfrac{x}{x+1}$ and $B(x) = 1 - \dfrac{x}{10}$,

X = {0, 1, 2, 3, 4, 5} for α = 0.6, 0.7. [7]

Q3) Attempt any two.

a) Solve $(D^2 + D - 2)y = 1 + x$. [7]

b) Show that the vector field

$\bar{F} = (y^2 \cos x + z^3)i + (2y\sin x - 4)j + (3xz^2 + 2)k$

is irrotational and find its scalar potential. [7]

c) If the fuzzy sets A and B are defined by $A = \left\{ \dfrac{0.4}{x_1} + \dfrac{0.2}{x_2} + \dfrac{0.5}{x_3} + \dfrac{0.8}{x_4} + \dfrac{1}{x_5} \right\}$

$B = \left\{ \dfrac{0.2}{x_1} + \dfrac{0.3}{x_2} + \dfrac{0.6}{x_3} + \dfrac{0.1}{x_4} + \dfrac{0.1}{x_5} \right\}$ [7]

Determine

i) $\bar{A}$

ii) $\bar{B}$

iii) $A \cup B$

iv) $\bar{A} \cap \bar{B}$

v) $\overline{A \cap B}$

vi) $\overline{A \cup B} \cap \bar{A}$

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Q4) Attempt any two.

a) Obtain the fourier series expansion of $f(x) = x^2$ in the interval $(-1, 1)$. [7]

b) Find the laplace transform of $\int_0^t \dfrac{e^{-u}\sin u}{u} du$. [7]

c) Six fair coins are tossed simultaneously. If 192 such tosses are made find the expected number of tosses showing [7]

i)   one & only one head

ii) no heads

iii) all heads

Q5) Attempt any two.

a) Obtain half range cosine series for $f(x) = x - x^2$ for $0 \le x \le 1$. [7]

b) Find the inverse laplace transform by using Convolution theorem

$\dfrac{1}{(s-2)(s+2)^2}$. [7]

c) The life time of certain type of battery has mean life of 400 hours and a standard deviation of 50 hours. Assuming the distribution of life time to be normal, find [7]

i)   The percentage of batteries which have life time of more than 350 hours.

ii) The percentage of batteries which have life time between 300 & 500 hours

[Given : For S.N.V.z area between z = 0 & z = 1 is 0.3413 and z = 0 & z = 2 is 0.4772]

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Q5) Solve the following (15 marks)

a) Draw and explain high frequency model for transistor. Derive expression for f_B consider short circuit load. [7]

b) Design single stage R-C coupled C_E amplifier Vcc = 12V, hfe = 150, AV = 60, hie = 2.2K'Ω, frequency range 20Hz to 20 kHz, S = 10 [8]

OR

Find Av, Ai, Ri, Ro, Avg, Aig for following parameter. Rg = 500Ω, R_L = 2KΩ, hie = 1000Ω, hre = 3×10^{-4}, hoe = 3×10^{-6} ℧, hfe = 250. [8]

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Seat No.

S.Y.B.Tech.(ETC)(Part-II) (Semester- IIII) Examination, January - 2023

PCC- ETC-301: ELECTRONIC CIRCUIT DESIGN- I (CBCS)

Sub. Code : 73247
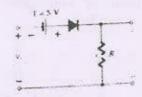
Day and Date : Wednesday, 25 - 01 - 2023   Total Marks :70
Time : 10.30 a.m. to 1.00 p.m.

Instructions :
1) All questions are compulsory.
2) Figures to the right indicate full marks.
3) Assume suitable data, if necessary.
4) Use of standard datasheet is allowed.

Q1) Choose one correct answer and rewrite the complete statement. [10]

a) For the given circuit for a 20 V$_{peak}$ sinusoidal input v_i, what is the value of v_i at which the clipping begins?

i) 5   ii) 0

iii) -5   iv) None of the above

b) Find the cut off frequency for an RC low pass filter of R = 200Ω and C = 0.01μF?

i) 500KHz   ii) 100Hz

iii) 200KHz   iv) 79.57KHz

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c) A sinusoidal voltage with a peak-to-peak value of 30 V is applied to an RC low-pass filter. If the reactance at the input frequency is zero, the output voltage is_____

   i) Zero   ii) 12.74 V(p-p)

   iii) 18 V(p-p)   iv) 1 V(p-p)

d) PIV of BWR is_____

   i) Vm   ii) 2Vm

   iii) 0.7   iv) None of the above

e) In simple transistor shunt regulator if Zener voltage is 7Volt, VBE = 0.7Volt then output voltage (Vo)is Volt

   i) 7.7   ii) 8

   iii) 8.3   iv) 0

f) Which of the following is the best biasing method for transistor bias?

   i) Emitter bias   ii) Voltage divider bias

   iii) Fixed bias   iv) Collector feedback bias

g) There are_____*h* parameters of a transistor.

   i) Four   ii) Two

   iii) Three   iv) None of the above

h) For a fixed bias circuit, the drain current was 1 mA, what is the value of source current?

   i) 0 mA   ii) 1 mA

   iii) 2 mA   iv) 3 mA

i) In CE arrangement, the value of input impedance is approximately equal to_____

   i) hie   ii) hoe

   iii) hre   iv) None of the above

j) If the value of collector current IC increases, then the value of VCE____

   i) Remains the same   ii) Decreases

   iii) Increases   iv) None of the above

Q2) Solve the following (15 marks)   **[7]**

  a) Design zener regulator with zener voltage Vz = 12V to a load for which IL(max) = 150mA, Vin varies between 20 to 25V.

OR

Draw and explain the operation of Voltage Tripler.   **[7]**

  b) Design FWR power supply using capacitor filter for following specifications Vo = 15V, Io = 70mA, r = 2%.   **[8]**

Q3) Solve the following (15 marks)

  a) Explain Half wave rectifier with neat diagram and waveform.   **[7]**

  b) Design emitter follower regulator Vo = 4.4V, Io = 40mA and vin = 8-15V, (use SL100)   **[8]**

OR

Derive gain equation for High pass filter also design high pass filter with cut-off frequency 5 KHz and draw the frequency response.   **[8]**

Q4) Solve the following (15 marks)

  a) Derive expression for lower 3dB frequency of CE amplifier by considering coupling capacitor [Cc]. Calculate Cc for R_1 = 12 K′Ω, R_2 = 6.8 K′Ω, hie = 4.5K′Ω, hfe = 320, Rs = 400′Ω.   **[8]**

  b) Draw and explain hybrid equivalent circuit for CC configuration of transistor.   **[7]**

OR

Derive the expression for lower cut off frequency of R-C coupled amplifier considering square wave.   **[7]**