3E1147

Roll No. _____ Total No of Pages: 3

3E1147

B. Tech. III - Sem. (Main / Back) Exam., Dec. 2019

PCC Electronics & Communication Engineering

3EC4-04 Digital System Design

Common For EC, EI

Time: 3 Hours **Maximum Marks: 120**

Instructions to Candidates:

Attempt all ten questions from Part A, five questions out of seven questions from Part B and four questions out of five from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used /calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. NIL 2. NIL

PART – A

(Answer should be given up to 25 words only) **[10×2=20]**

All questions are compulsory

Q.1 Find value of x for following equation:

$(135)_x + (531)_x = (666)_x$

Q.2 Convert $(1011)_{\text{gray code}}$ to excess-3 code.

Q.3 Find the sum of $(1.98)_{10} + (4.86)_{16}$.

Q.4 State the difference between flip flop and latch.

Q.5 Write the excitation table of RS flip flop.

Q.6 Define figure of merit for logic family.

Q.7 How many Boolean functions can be made from 3 variables?

Q.8 Write a VHDL code for $y=\overline{A}\overline{B}$ in structural style of modelling.

Q.9 How many flip flops are required to design modules 20 counter?

Q.10 If the present output of 4 – bit twisted ring counter is 1011, then find its output after 6 clock cycles.

PART – B

(Analytical/Problem solving questions) **[5×8=40]**

Attempt any five questions

Q.1 How Ex-OR gate is used in parity bit generation and error detection at transmitter and receiver respectively? Explain using an example of 8-bit data.

Q.2 Convert following canonical form into standard form using tabulation method

$Y=\sum m\ (4,5,6,11,13) + d\sum(0,2)$

Q.3 Explain the procedure for conversion of RS flip flop into JK flip flop.

Q.4 Write the help of neat circuit diagram explain the interfacing of various logic families.

Q.5 Implement the following Boolean functions:

(i) $Y=\overline{AB+CD}$ using CMOS

(ii) $Y = AB+C$ using PMOS

Q.6 Write a VHDL code for full adder in structural style of modelling.

Q.7 What is FSM? State the difference between Mealy and Moore state machines.

PART – C

(Descriptive/Analytical/Problem Solving/Design Questions) **[4×15=60]**

Attempt any four questions

Q.1 (a) What are prime, essential and redundant implicants? Explain with an example.

(b) Signals A, B, C, D and $\overline{A}$ are available. Using only 8:1 mux and no other gate, implement the expression F (A, B, C, D) = BC + AB$\overline{D}$ + $\overline{A}$ $\overline{C}$D

Q.2 The state diagram of a FSM is given below (Fig 1).

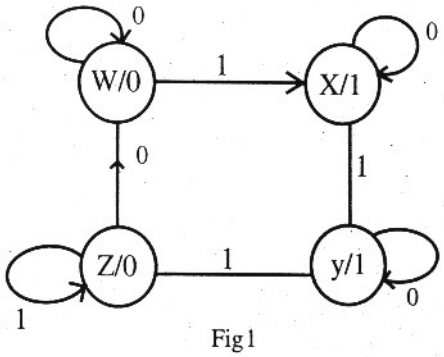

Fig 1

Show its state table, state assignment table and final implemented logic.

Q.3 Design a synchronous counter using JK flip flop to generate following sequence

0,7,5,3,2,1

Also write its state table, state assignment table and final implemented logic.

Q.4 (a) Design the 4-input priority encoder with truth table and draw its logic diagram.

(b) Draw and explain the logic diagram of BCD adder using two 4 bit adders and a correction detection circuit.

Q.5 Write a short note on following :

(i) FPGA

(ii) PLA

(iii) CPLD

(iv) PAL

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B. Tech. III - Sem. (Main / Back) Exam., Dec. 2019
PCC Electronics Instrumentation & Control Engineering
3EI4-05 Signal & Systems
Common For EC, EI

Time: 3 Hours **Maximum Marks: 120**

Instructions to Candidates:

Attempt all ten questions from Part A, five questions out of seven questions from Part B and four questions out of five from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used /calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. NIL 2. NIL

PART – A

(Answer should be given up to 25 words only) **[10×2=20]**

All questions are compulsory

Q.1 What are causal system? Why are non – causal system unrealizable?

Q.2 Cheek whether the following system is BIBO stable or not $y(n) = e^{-x(n)}$.

Q.3 State and prove convolution theorem in relation to Fourier Transform.

Q.4 How is Z– transform obtained from Laplace transform?

Q.5 Find Laplace transform of $f(t) = \left[\frac{1-e^t}{t}\right]$

Q.6 Find Z – transform for $x(n) = 2^n u(n-2)$

Q.7 What is Aliasing? Discuss any two corrective measures to combat the effect of Aliasing.

Q.8 Let x(n) be a real and odd periodic signal with period N = 7 and Fourier series coefficients X_K. Given that $X_{15} = j$, $X_{16} = 2j$, $X_{17} = 3j$. Determine values of X_0, X_{-1}, X_{-2}. X_{-3}.

Q.9 Sketch the following signal –

$$x(t) = r(-0.5t + 2)$$

Q.10 Evaluate $\int_{-\infty}^{\infty} e^{-2t^2}\, \delta(t + 5)\, dt$

PART – B

(Analytical/Problem solving questions) **[5×8=40]**

Attempt any five questions

Q.1 Determine Discrete time Fourier transform of –

$$x(n) = \sin(\omega_o n)\, U(n)$$

Q.2 Determine Laplace transform of –

$$x(t) = \cos^3(3t)\, U(t)$$

Q.3 A second order discrete time system is characterized by difference equation $y(n) - 0.1y(n-1) - 0.02\, y(n-2) = 2x(n) - x(n-1)$. Determine y(n) for $n \geq 0$ when $x(n) = U(n)$ and initial condition are $y(-1) = -10$ & $y(-2) = 5$.

Q.4 Consider the continuous time signal $x(t) = \delta(t + 2) - \delta(t - 2)$. Calculate the value of energy signal Ey for the following signal:

$$y(t) = \int_{-\infty}^{t} x(\mathcal{T})\, d\mathcal{T}$$

Q.5 Find inverse Z – transform of $X(z) = e^{1/z}$ with ROC all z – plane except $|z| = 0$.

Q.6 Determine Z – transform of –

(a) $x(n) = -U(-n-1)$

(b) $x(n) = U(-n)$

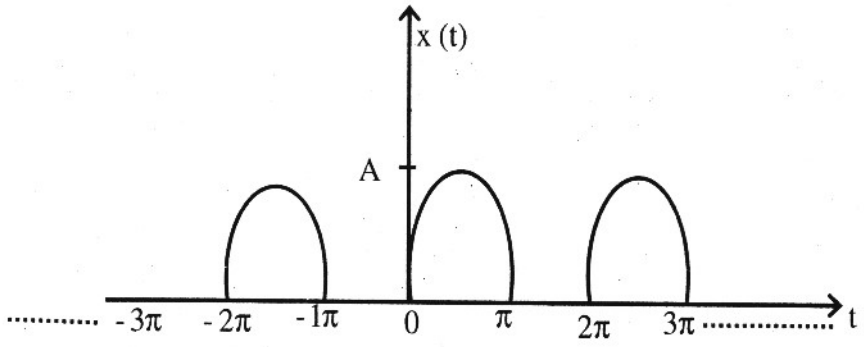
Q.7 Differentiate between real and flat – top Sampling.

PART – C

(Descriptive/Analytical/Problem Solving/Design Questions) **[4×15=60]**

Attempt any four questions

Q.1 Find trigonometric Fourier series for half wave rectified sine wave as shown in Figure, and sketch the line spectrum.

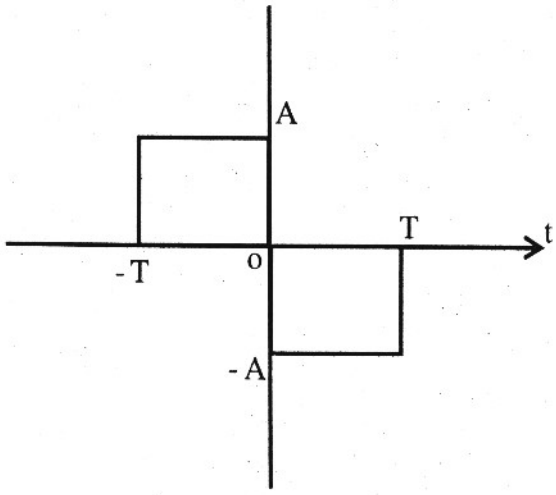


Q.2 Find state equation of a discrete time system described by -

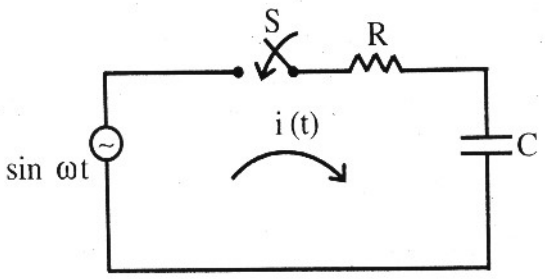
$$y(n) - \frac{3}{4}\,y(n-1) + \frac{1}{8}\,y(n-2) = x(n) + \frac{1}{2}\,x(n-1)$$

Q.3 State and prove any 10 properties of Z – transform.

Q.4 Determine the magnitude and phase spectrum of the pulse.



Q.5 A sine wave sin ωt is applied to the input of series RC circuit shown in Figure. Find the resultant current i(t) if the switch S is closed at t = 0



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B. Tech. III - Sem. (Main / Back) Exam., Dec. 2019
PCC Electronics & Communication Engineering
3EC4-06 Network Theory
Common For EC, EI

Time: 3 Hours **Maximum Marks: 160**

Instructions to Candidates:

Attempt all ten questions from Part A, fiver questions out of seven questions from Part B and four questions out of five from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used /calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. NIL 2. NIL

PART – A

(Answer should be given up to 25 words only) **[10×3=30]**

All questions are compulsory

Q.1 State the Kirchhoff's voltage law.

Q.2 Define the node, junction, and branch of electric circuits.

Q.3 Write down the statement of superposition theorem.

Q.4 Explain the reciprocity theorem.

Q.5 Represents wave of even, odd, and half symmetry.

Q.6 Explain the shifting of function.

Q.7 Define the Laplace transformation.

Q.8 State the initial and final value theorem.

Q.9 Write down the properties of filter.

Q.10 State the convolution theorem.

PART – B

(Analytical/Problem solving questions) **[5×10=50]**

Attempt any four questions

Q.1 Find current through the 5Ω resistor in figure 1.

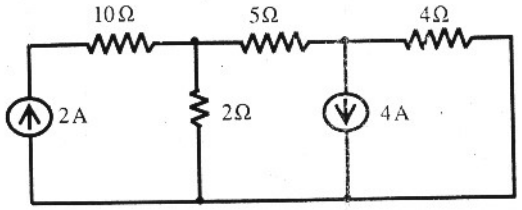

Fig .1.

Q.2 Obtain Thevenin's equivalent circuit across X –Y. (figure 2)

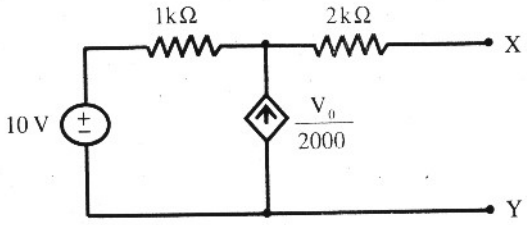

Fig .2.

Q.3 Determine the effective value of f (t) of the waveform shown in figure 3.

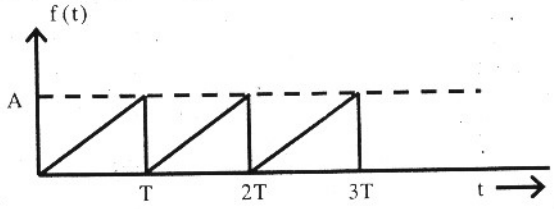

Fig .3.

Q.4 A function in s – domain is given by -

$$F(S) = \frac{50}{S^2 + 2S + 2}$$

Find the inverse Laplace transform.

Q.5 State whether the following function are driving point immittance of LC network or not:

(a) $z(s) = \frac{10(s^2+4)(s^2+6)}{(s^2+1)(s^2+9)}$

(b) $z(s) = \frac{5s(s^2+4)}{(s^2+1)(s^2+3)}$

Q.6 The current I_1 and I_2 at input and output port respectively of a two port network can be expressed as:

$I_1 = 5V_1 - V_2$

$I_2 = -V_1 + V_2$

Find the equivalent π - network.

Q.7 Determine the relationship between the resonance frequency f_0 and the half power frequency f_1 and f_2 in a series resonating circuit.

PART – C

(Descriptive/Analytical/Problem Solving/Design Questions) **[4×20=80]**

Attempt any two questions

Q.1 (a) Determine the node voltage and the current through the resistors using mesh method for the network shown in figure. 1(a)

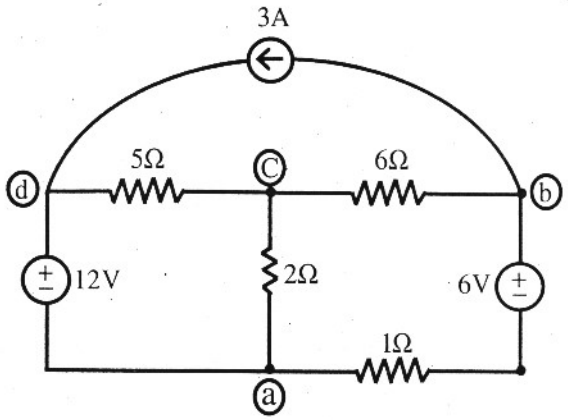

Fig.1.(a)

(b) Form the nodal equations for the network shown in figure 1(b)

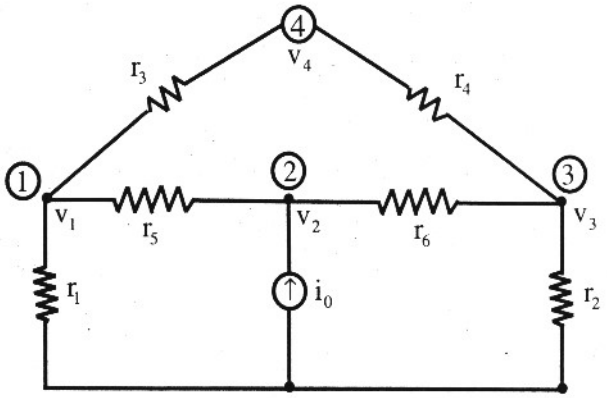

Fig.1.(b)

Q.2 Figure 2 represents a mixed circuit. Find the magnitude of V_0 by superposition theorem and find the power produced by each of the sources.

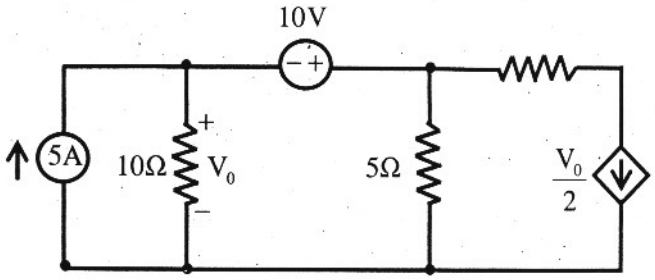

Fig.2.

Q.3 (a) Obtain the Fourier series of the waveform shown in Figure 3. (a)

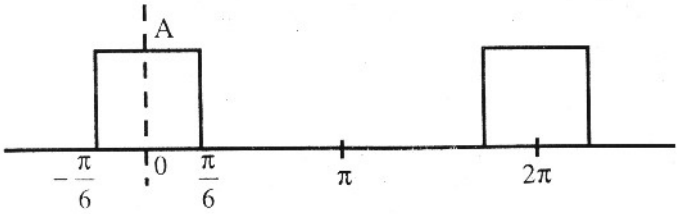

Fig. 3 (a)

(b) The phase currents in a star connected unbalanced load are $I_a = (44 - j33)$ Amps, $I_b = (-32 - j24)$ Amps, $I_c = (-40 + j25)$ Amps.
Find the values of sequence currents.

Q.4 (a) A differential equation is represented by

$$\frac{d^2x}{dt^2} - x = e^{-t}$$

Assuming zero initial condition, find x (t) at $t > 0$.

(b) Find the final value of the following functions:

(i) $1 + e^{-2t}\cos 5t$

(ii) $2 - 2\,e^{-t}$

Q.5 (a) Design an m – derived low pass filter to match a line having characteristics impedance of 500Ω and to pass signals up to 1 kHz with infinite alternatives occurring at 1.2 kHz.

(b) Find an expression for the driving point impedance in s – domain for the reactive network shown in Figure 5(b).

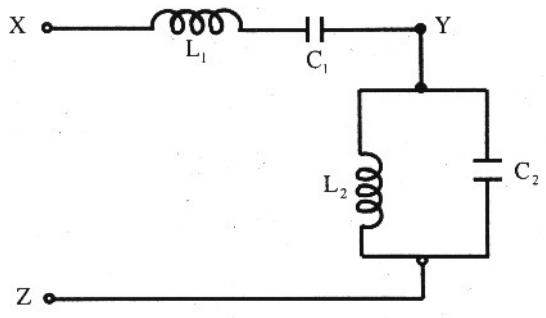

Fig. 5 (b)

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B. Tech. III - Sem. (Main /Back) Exam., Dec. 2019
PCC Electronics & Communication Engineering
3EC4-07 Electronics Devices
EC, EI

Time: 3 Hours **Maximum Marks: 160**

Instructions to Candidates:

Attempt all ten questions from Part A, fiver questions out of seven questions from Part B and four questions out of five from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used /calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. NIL 2. NIL

PART – A

(Answer should be given up to 25 words only) **[10×3=30]**

All questions are compulsory

Q.1 Define Intrinsic and Exterinsic Semiconductor with examples. [3]

Q.2 How does pure semiconductor behave like a absolute zero temperature and why? [3]

Q.3 Define drift and diffusion current with equation of net hole current. [3]

Q.4 Explain role of depletion layer in semiconductor diode with knee voltage. [3]

Q.5 Give the differences between Silicon [Si] and Gallium Arsenide [GaAs]. [3]

Q.6 What is avalanche breakdown for P – N Junction diode? [3]

Q.7 Explain working of transistor as a switch. [3]

Q.8 Define stability factor (s) for a transistor. [3]

Q.9 Write the short note on twin – tub fabrication process. [3]

Q.10 Define the steps of Photolithography process. [3]

PART – B

(Analytical/Problem solving questions) **[5×10=50]**

Attempt any four questions

Q.1 (a) A sample of Si at a given temperature "T" in intrinsic condition has a resistivity of $25 \times 10^4\ \Omega$ - cm. The sample is now doped to the extent of 4×10^{10} donor atoms 1 cm^3 and 10^{10} acceptor atom/cm^3, find the total conduction current density if an electric field of 4V/cm is applied across the sample. Given that μ_n=1250 cm^2/V–s, μ_p = 475 cm^2/V – s at the given temperature. [6]

(b) Explain band gap theory for semiconductor materials. [4]

Q.2 (a) Difference between breakdown condition for P–N junction diode and Zener diode. [5]

(b) Derive the relation for continuity equation in P –N Junction. [5]

Q.3 (a) Explain the process P – type and N – type semiconductor formation with doping. [5]

(b) Discuss for C-V characteristics of MOS capacitor. [5]

Q.4 Write the Ebers-Moll equation sketch the circuit model, which satisfies these equations. [10]

Q.5 Write short note on –

(a) Light Emitting Diode [3]

(b) Photo diode [3]

(c) P-V plate [4]

Q.6 (a) Explain in detail the ion-implantation process. [5]

(b) Define the steps of fabrication with flow chart for CMOS. [5]

Q.7 Discuss the types of oxidation process involve in CMOS fabrication. [10]

PART – C

(Descriptive/Analytical/Problem Solving/Design Questions) **[4×20=80]**

Attempt any two questions

Q.1 In reference to semiconductor write short note on –

(a) Mobility [5]

(b) Conductivity [5]

(c) Degenerate and Non – degenerate [10]

Q.2 (a) Explain the motion of Electrons in periodic lattices. [4]

(b) Differentiate direct and indirect band gap in context of E – R diagram. [12]

(c) Describe the theory of sheet resistance. [4]

Q.3 (a) Explain the working of NPN transistor with characteristics. [6]

(b) Which configuration of transistor is used generally and why? [8]

(c) Why small signal model analysis used for MOS transistor? [6]

Q.4 (a) Derive relation for P-N Junction's Poisson equation. [6]

(b) Design I-V characteristics for Schottky diode and give application of Zener diode. [8]

(c) Define transconductance for small signal Model of MOS. [6]

Q.5 (a) Explain process of fabrication of CMOS in detail with neat and clean sketch for each step. [10]

(b) Design CMOS circuit for NAND gate. [10]

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3E1614

B. Tech. III - Sem. (Back) Exam., Dec. 2019
Applied Elect. & Inst. Engineering
3EX2A Circuit Analysis & Synthesis
EC, EI, EX, AI, BM

Time: 3 Hours **Maximum Marks: 80**

Instructions to Candidates:

*Attempt any **five questions,** selecting **one question** from **each unit.** All questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly.*

Units of quantities used/calculated must be stated clearly.

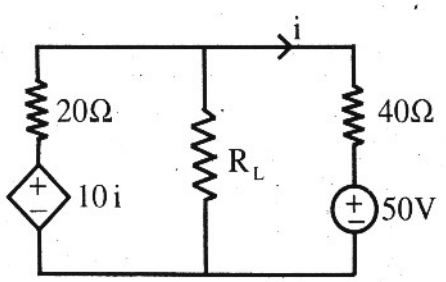
Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. NIL 2. NIL

UNIT- I

Q.1 (a) State and explain Thevenin's theorem with the help of suitable example. [8]

(b) In the Network shown in figure, find the value of R_L to which the maximum power gain can be delivered. Hence find the voltage across R_L. [8]



OR

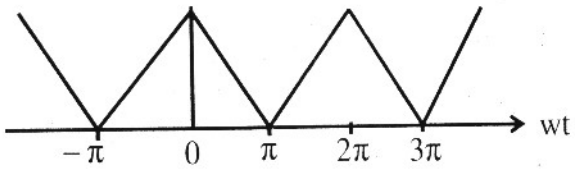
Q.1 (a) State and Prove maximum power transfer theorem. [8]

(b) Derive the expression for coefficient of coupling for a mutually coupled circuit. [8]

UNIT- II

Q.2 (a) Explain different types of functions used in transient analysis. [8]

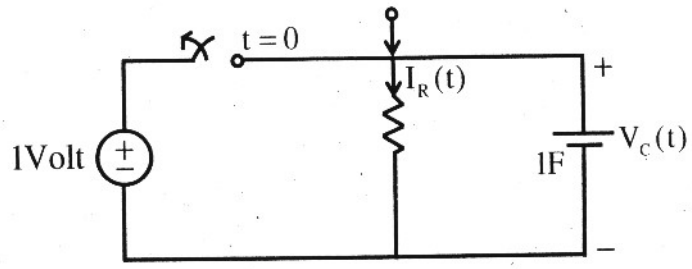
(b) Find the trigonometric Fourier series for the given waveform. [8]



OR

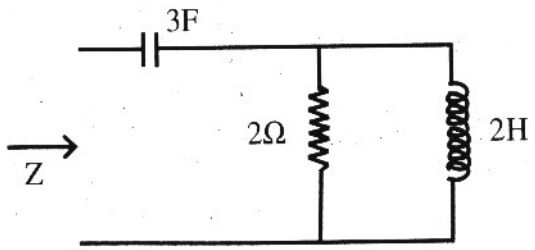
Q.2 (a) Describe Initial value and final value theorem in detail. [8]

(b) Calculate the voltage $V_C(t)$ and current $I_R(t)$ for $t \geq 0$ for the circuit shown in figure. Assume that switch S was closed for a long time before being opened at $t = 0$. [8]



UNIT- III

Q.3 (a) Find Z(s) for the following Network. [8]



(b) Find the relationship between pole position and stability. [8]

OR

Q.3 (a) Check whether the following polynomial $P(s) = 3s^4 + 2s^3 + s^2 + 2s + 3$ is stable or not. Explain it. [8]

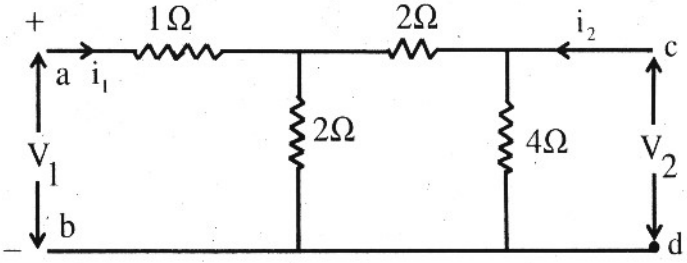
(b) Check the positive realness of the function: [8]

$$z(s) = \frac{2s^2 + 2s + 1}{s^3 + 2s^2 + s + 2}$$

UNIT- IV

Q.4 (a) Derive Y parameter in terms of Z parameters. [8]

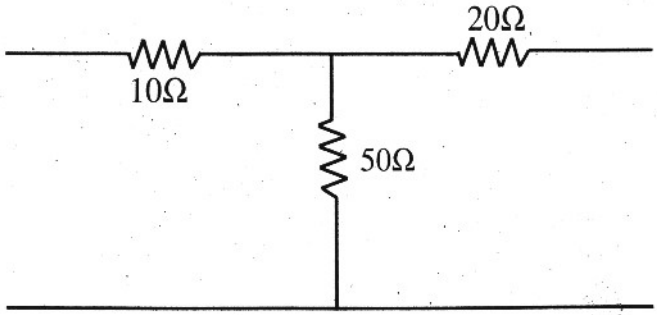
(b) Find the ABCD parameter of the Network shown. Also obtain image parameters for the network. [8]



OR

Q.4 (a) Derive the condition for reciprocity and symmetry in case of ABCD parameters. [8]

(b) Determine the image parameter of the T – Network given below [8]



UNIT- V

Q.5 (a) The driving point impendence of an LC network is given by: [8]

$$z(s) = \frac{10(s^2+4)(s^2+16)}{s(s^2+9)}$$

Obtain the first form of Cauer Network.

(b) Show that the function given below represents either an RL impendence or an RC admittance: [8]

$$F(s) = \frac{3s^3+18s^2+24s}{s^3+9s^2+23s+15}$$

Synthesize the function and obtain foster – I and foster – II form realization network.

OR

Q.5 (a) Realize the R - C admittance in foster – II form: [8]

$$y(s) = \frac{s^3+9s+7}{s+4}$$

(b) $z(s) = \frac{8(s^2+1)(s^2+3)}{s(s^2+4)(s^2+2)}$ [4×2=8]

Realize the Network in :

(i) Foster – I Form

(ii) Cauer – II Form

3E1615

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3E1615

B. Tech. III - Sem. (Back) Exam., Dec. 2019
Electronic Ins. & Control Engineering
3EI5A Electromagnetic Properties of Materials
EC,EI

Time: 3 Hours **Maximum Marks: 80**

Instructions to Candidates:

*Attempt any **five questions,** selecting **one question** from **each unit.** All questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly.*

Units of quantities used/calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. NIL 2. NIL

UNIT- I

Q.1 (a) Describe the polarization. What mechanism contribute to the polarization of a dielectric material under an electric field? [04]

(b) A field strength E is applied to dielectric, show that the stored energy per unit volume in the medium due to polarization P is $\frac{1}{2}$ PE. [04]

(c) Distinguish clearly the phenomena of Ferroelectricity, Piezoelectricity and pyro electricity, name their specific application also. [08]

OR

Q.1 (a) Explain the different applications of dielectrics. [06]

(b) Discuss about the temperature dependence of dielectric constant. [04]

(c) A parallel plate capacitor has an area of $20cm^2$ & separation between the plates is 0.2mm. The space between the plates is filled with dielectric having the real part of the dielectric constant $\varepsilon_r = 2.5$ when subjected to a 2.0 volt alternating voltage at 1MHz. The loss tangent at this frequency is 4×10^{-4}. Find the elements of parallel R-C circuit. [06]

UNIT- II

Q.2 (a) Give the classification of magnetic material and explain their applications. [08]

(b) Explain the Curie Weiss law and its uses. [08]

OR

Q.2 (a) Draw the B-H curve for a ferromagnetic material and identify the retentivity and coercive field on the curve. What is the energy loss per cycle? [08]

(b) A solenoid of 500 turns per meter is carrying a current of 3Amp. Its core is made of iron which has a relative permeability of 5000. Determine following: [3+2.5+2.5=8]

(i) Magnitudes of magnetic intensity

(ii) Magnetizations

(iii) Magnetic field inside the core

UNIT- III

Q.3 (a) Draw the energy band diagram showing donor or acceptor level for the following: - [4+4=8]

(i) N-type silicon with phosphorous impurity atom.

(ii) P- type silicon with aluminum impurity atom.

(b) Describe the Czochralski method of crystal growth with necessary diagram. [8]

OR

Q.3 (a) Explain the electronic properties and application of following semiconductors : - [4×2=8]

(i) Silicon (Si)

(ii) Germanium (Ge) -

(iii) Gallium Arsenide (GaAs) –

(iv) Silicon carbide (SiC) –

(b) A semi-conductor is said to be degenerate when the Fermi level is located at an energy of 3kT or less from the conduction band. In the case of a donor doped semi-conductor, calculate the minimum doping density for silicon at 300K to become degenerate if n_i is $1.4\times10^{16}/m^3$ .Take Boltzmann's constant (K) = 1.38×10^{-23} J/K. [08]

UNIT- IV

Q.4 (a) Find the relationship in between current density, drift velocity, conductivity and electric field? [08]

(b) What is the effect of temperature and impurities on the electrical conductivity of metals? Explain the Matthiessen's rule. [08]

OR

Q.4 (a) Classify the resistive materials on different parameters. Write important properties and applications of following materials: - [08]

(i) Tungsten

(ii) Manganin

(iii) Constantan

(b) What is the Meissner effect? Describe the type I and type II super conductors and their applications. [08]

UNIT- V

Q.5 Write short notes on - [08]

(i) Quantum dots

(ii) Carbon NanoTube (CNT) [08]

OR

Q.5 Write short notes on:

(i) Mano wires [08]

(ii) Mechanical Grinding [08]

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B. Tech. III Sem. (Back) Exam., Dec. 2019
Electronics & Communication Engineering
3EC6A Advanced Engineering Mathematics-I
EC,EIC,BM,AI,CR,PE,PC

Time: 3 Hours **Maximum Marks: 80**

Instructions to Candidates:

*Attempt any **five questions,** selecting **one question** from **each unit.** All questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly.*

Units of quantities used/calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. NIL 2. NIL

UNIT- I

Q.1 (a) Find the Laplace transforms of the following: [8]

(i) $f(t) = \frac{\cos at}{\sqrt{t}}$,

(ii) f(t) = [t], Where [t] denotes the greatest integer ≤ t.

(b) Use Laplace transform to solve the equation [8]

$(D^3 - 3D^2 + 3D - 1)y = t^2e^t; \quad y(0) = 1, \quad y'(0) = 0,$

$y''(0) = -2, \; D \equiv \frac{d}{dt}$

OR

Q.1 (a) Find the inverse Laplace transforms of the following: [8]

(i) $\cot^{-1}(s/k)$

(ii) $\frac{e^{-1/s}}{\sqrt{s}}$

(b) Use Laplace transformation to solve the equation- [8]

$\frac{\partial u}{\partial t} = 5\frac{\partial^2 u}{\partial x^2}$, $u(x,0) = \cos 5x$, $u_x(0,t) = 0$, $u\left(\frac{\pi}{2}, t\right) = 0$

UNIT- II

Q.2 (a) Find the Fourier series for $f(x) = \begin{cases} 0, & -\pi \le x \le 0 \\ \sin x, & 0 \le x \le \pi \end{cases}$ [8]

Hence show that $\frac{1}{1.3} + \frac{1}{3.5} + \frac{1}{5.7} + \cdots = \frac{1}{2}$

(b) If $z(u_n) = \frac{2z^2+3z+4}{(z-3)^3}, |z| > 3$, show that $u_1 = 2$, $u_2 = 21$, $u_3 = 139$. [8]

OR

Q.2 (a) The following table gives the variations of a periodic current over a period-

t(secs):	0	T/6	T/3	T/2	2T/3	5T/6	T
A (amps):	1.98	1.30	1.05	1.30	-0.88	-0.25	1.98

Show by Harmonic analysis that there is a direct current part of 0.75 amp in the variable current and obtain the amplitude of the first harmonic. [8]

(b) Verify convolution theorem for Z-transformation, when $f_n = \{n\}$ and

$g_n = \{n^2\}$. [8]

UNIT- III

Q.3 (a) Find the Fourier cosine and sine transform of $f(t) = e^{-at}$, $t \geq 0$, $a > 0$. [8]

(b) Use Fourier transform to solve the Heat equation

$$\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}, t > 0$$

Subject to the initial condition $u(x, 0) = f(x)$, $-\infty < x < \infty$ [8]

OR

Q.3 (a) Using convolution find the inverse Fourier transform of $\frac{1}{12+7i\omega-\omega^2}$ [8]

(b) Use Fourier transform to solve the Heat equation [8]

$$\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}$$

Subject to the conditions-

(i) $u(x, 0) = 0$, $x \geq 0$

(ii) $u_x(0, t) = -\mu$, $t > 0$.

Assume that $u(x, t)$ and $u_x(x, t)$ both tend to zero as $x \to \infty$.

UNIT- IV

Q.4 (a) Show that the function $v(x, y) = e^x \sin y$ is harmonic. Find its conjugate harmonic. [8]

(b) Evaluate the following integral using Cauchy's integral formula

$$\int_c \frac{e^{2z}}{(z-1)^2(z+2)^2} dz,$$

Where c is the circle: (i) $|z| = 1$, (ii) $|z|=3$ [8]

OR

Q.4 (a) Determine the analytic function $f(z) = u + iv$, if [5]

$u = e^x [(x^2-y^2) \cos y - 2xy \sin y]$

(b) Find the bilinear transformation which maps the points z=1, i,-1 into the points w= i, 0,-i. [5]

(c) Let $f(z_0) = \int_c \frac{4z^2+z+5}{z-z_0} dz$, where C is the ellipse $9x^2 + 4y^2 = 36$,

Find $f'(-1)$ and $f''(-i)$. [6]

UNIT- V

Q.5 (a) Expand the following function in Laurent's series: [8]

$f(z) \frac{1}{z(z-1)(z-2)}$

For (i) $|z-1| < 1$, (ii) $1 < |z| < 2$.

(b) Evaluate the following integral using Cauchy's Residue theorem: [8]

$\int_c \frac{z^2}{(z-2)(z-1)^2} dz$,

Where C : $|z| = 2.5$

OR

Q.5 (a) State Taylor's and Laurent's theorems for an analytic function. [4]

(b) Determine the poles of the function [4]

$f(z) = \frac{z^2}{(z+2)(z-1)^2}$

And the residue at each pole.

(c) Show that $\int_0^{2\pi} \frac{d\theta}{(5-3\sin\theta)^2} = \frac{5\pi}{32}$. [8]
