Roll No. | | | | | | | | | | | | Total No. of Pages

Total No. of Questions : 09

B.Tech. (AI & DS / AI & ML / Block Chain / CSE / Cyber Security / IOT / CSD / IT / Robotics & Artificial Intelligence / Internet of Things and Cyber Security including Block Chain Technology) (Sem.–3)

DIGITAL ELECTRONICS

Subject Code : BTES301-18

M.Code : 76435

Date of Examination : 24-12-2024

Time : 3 Hrs. Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.
3. SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.

SECTION-A

1. **Write briefly:**

a) Why l's and 2's complements arc required? Discuss.

b) What do you mean truth table? Write down the truth table of Exclusive-OR gate.

c) Compare combinational circuits with sequential circuits.

d) Discuss the significance of multiplexer.

e) List the advantages of QM method.

f) What is Race around Condition? Discuss.

g) What do you mean by PROM and EPROM? Discuss.

h) What are the advantages of Dual slope A/D converter? Discuss.

i) List the various characteristics of FPGA.

j) Explain the term resolution w.r.t. converters.

SECTION-B

2. Explain the working of a SR flip-flop. Also mention its advantages and disadvantages.

3. What is the need of K-Map? Reduce the following expression to simplest Sum of product form using K-Map.
$F(a,b,c,d) = \sum m(0, 1, 3, 5, 7, 10, 11, 12)$

4. Prove that NAND and NOR are known as universal gates.

5. Draw the logical diagram and explain the working of 4 bit ring counter.

6. Discuss the working of weighted type D/A converter in detail by considering a suitable example.

SECTION-C

7. **Discuss :**

   a) Successive approximation A/D converter

   b) Classification of memory .

8. Discuss in detail the design procedure of binary half adder and binary full adder.

9. **Explain :**

   a) QM method

   b) RAM organization and its comparison with ROM.

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Roll No. | | | | | | | | | | | | |

Total No. of Pages : 02

Total No. of Questions : 09

B.Tech.(AI&ML/CSE/CSD) (Sem.–3)

DIGITAL ELECTRONICS

Subject Code : BTES301/18

M.Code : S76435

Date of Examination: 27-01-2025

Time : 3 Hrs.

Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.
3. SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.

SECTION-A

1. **Write briefly:**

   a. Why digital system is required? Discuss.

   b. Which gate is called an all or nothing gate? Why?

   c. Why are BCD codes required?

   d. Discuss the distributive laws of Boolean algebra.

   e. Why is it required to reduce Boolean expression before realization? Discuss.

   f. What do you mean by sequential circuits? Explain.

   g. What is the drawback of a serial adder? For which application are they preferred?

   h. List the drawbacks of JK flip flop.

   i. Write down the various advantages of PAL.

   j. List the advantages of R–2R type D/A converter.

SECTION-B

2. Convert the 1001010110110.10101 binary number to decimal, hexadecimal and octal.

3. Use the laws of Boolean algebra (Name the laws used at each step), to reduce the following expression to their simplest form and implement that with NAND gate circuit.

$$F = A\,\bar{B} + ABD + AB\,\bar{D} + \bar{A}\,\bar{C}\,\bar{D} + \bar{A}\,B\bar{C}$$

4. Explain the working of a SR flip-flop. Also mention its advantages and disadvantages.

5. Use a multiplexer having three data select inputs to implement the logic for the function given below

$$F = \Sigma m\ (0, 1, 2, 3, 4, 10, 11, 14, 15)$$

Also realize the same using 16:1 MUX.

6. Draw the logic diagram and explain the working of deal slope type A/D converted.

SECTION-C

7. **Explain in detail** :

(i) Successive approximation A/D converter.

(ii) Memories and their classification.

8. Reduce the following expression using K map and verify the result using QM method

$$F = \Sigma m\ (0, 2, 4, 6, 7, 10, 12, 13, 15)$$

9. **Discuss :**

(i) Design of 3-bit synchronous counter.

(ii) BCD Adder.

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B.Tech.(ECE) (Sem.–3)

MATHEMATICS-III

Subject Code : BTAM-303-18

M.Code : 76448

Date of Examination:02-01-2025

Time : 3 Hrs.

Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.
3. SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.

SECTION-A

1. **Write briefly:**

   a. State and prove First Shifting Theorem of Laplace Transform.

   b. Find the $L^{-1}\left(\frac{3}{s^2+6s+13}\right)$.

   c. Write a short note on Gibbs Phenomenon.

   d. State how Fourier Transform and Laplace Transform are related to each other?

   e. State final value theorem of Z transform.

   f. If the Z transform of a finite-duration discrete-time signal $x[n]$ is $X(z)$, then what is the Z transform of the signal $y[n] = x[2n]$?

   g. A bag contains 5 red balls, 3 blue balls, and 2 green balls. If one ball is drawn randomly, what is the probability that the ball is either red or blue?

   h. A factory produces light bulbs, and the probability that a randomly selected bulb is defective is 0.02. If 10 bulbs are selected, what is the probability that exactly 2 bulbs are defective?

   i. State the formula for the z-test for comparing a sample mean to a population mean.

   j. The mean of the binomial distribution is 20 and standard deviation is 4. Determine its distribution.

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SECTION-B

2. Apply Convolution Theorem to evaluate inverse Laplace transform of $\frac{s^2}{(s^2+4)(s^2+9)}$.

3. Compute the Fourier Transform of $f(t) = e^{-at}$. $a > 0$.

4. State and prove initial value theorem for Z transform.

5. Fit a second-degree parabola $y = ax^2 + bx + c$ using the least squares method to the data :

X	0	1	2	3	4
Y	1	2	4	7	11

6. A random variable X assumes the values $-3, -2, -1, 0, 1, 2, 3$ such that $P(X = -3)\ P(X = -2) = P(X = -1)$, $P(X = 1) = P(X = 2) = P(X = 3)$, $P(X = 0) = P(X < 0) = P(X > 0)$. Find its distribution function and obtain the probability density function of the random variable Y where $Y = 2X^2 + 3X + 4$.

SECTION-C

7. Solve the partial differential equation

$$\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2},\ u(0, t) = 0,\ u(L, t) = 0,\ u(x, 0) = f(x)$$

using the Laplace Transform.

8. a) Use Final Value Theorem for Z transforms to determine the final value of the sequence $x(n) = 3 + 2^n$.

b) A class of students took a mathematics exam, and their scores are normally distributed with a mean of 75 and a standard deviation of 10. What score corresponds to the 90th percentile of the distribution? (You can use the fact that for a standard normal distribution, the z-score corresponding to the 90th percentile is approximately 1.28.)

9. Perform a t-test for the means of two small samples to determine if they are significantly different. Sample 1 : $n_1 = 8$, $\overline{X}_1 = 10$, $s_1 = 2$ and Sample 2 : $n_2 = 10$, $\overline{X}_2 = 12$,, $s_2 = 3$. Test at the 5% significance level.

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B.Tech. (ECE/ETE) (Sem.–3)

MATHEMATICS-III (INTEGRAL TRANSFROMS, PROBABILITY & STATISTICS)

Subject Code : BTAM-303-23

M.Code : 94631

Date of Examination : 04-01-2025

Time : 3 Hrs.

Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.
3. SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.

SECTION-A

1. Write briefly :

a) Write the Laplace Transform of the Dirac-delta function $\delta(t)$.

b) State the second shifting theorem for Laplace Transforms.

c) Find the first three Fourier coefficients a_0, a_1, and b_1 for the function $f(x) = 2x$ on the interval $[-\pi,\pi]$.

d) Write the expression for the Fourier Transform of a function $f(t) = e^{-t}$.

e) Find the inverse Laplace Transform of $F(s) = \dfrac{3}{s^2 + 4}$

f) What is the initial value theorem for Z transforms? Provide its mathematical expression.

g) Write the Z-transform of a delayed sequence $x[n-k]$ for $k > 0$.

h) The probability that a student passes a statistics exam is 0.8. What is the probability that exactly 3 out of 5 students pass the exam?

i) What are the mean and variance of a binomial distribution with parameters n and p?

j) For the data set 2, 3, 3, 4, 5, 5, 5, 6, 7, determine the mode.

SECTION-B

2. Evaluate the integral $\int_0^{\infty} e^{-5t} \sin(3t)\,dt$ using the properties of the Laplace Transform.

3. A function is defined as

$$f(x) = \begin{cases} 2x & for\ -\pi < x < 0 \\ -2x & for\ 0 < x < \pi \end{cases}$$

Find the Fourier series expansion for $f(x)$ in the interval $(-\pi,\pi)$.

4. Prove the translation theorem for Z transform.

5. A factory manufactures light bulbs with a defect rate of 3%. If a random sample of 10 bulbs is tested, what is the probability that exactly 1 bulb is defective? Use the binomial distribution.

6. Solve the difference equation $y[n] - 0.5y[n-1] = x[n]$ using Z transforms, where $x[n]$ is a given input sequence.

SECTION-C

7. Derive the Z transform of $x[n] = n^2u[n]$, where $u[n]$ is the unit step function, using the differentiation property, and evaluate $X(z)$ at $z = 1$.

8. a) Solve the initial value problem $y'' + 4y = 0$, $y(0) = 1$, $y'(0) = 0$ using Laplace Transforms.

   b) Using the convolution theorem for Fourier, find the convolution of $f(t) = e^{-t}u(t)$ and $g(t) = u(f)$, where $u(t)$ is the unit step function.

9. Given the following data points, fit a parabola using principle of least squares.

x	–1	0	1	2	3
y	1	0	1	4	9

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Total No. of Pages : 02

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B.Tech.(ECE) (Sem.–3)

ELECTRONIC DEVICES

Subject Code : BTEC/301/18

M.Code : 76444

Date of Examination: 07-01-2025

Time : 3 Hrs.

Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.
3. SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.

SECTION-A

1. **Write briefly:**

a) What is N-type and P-type semiconductor?

b) Distinguish between majority and minority carriers.

c) What is the atomic structure of germanium?

d) Why is varactor diode?

e) What is the difference between CB and CE configuration?

f) What is LED?

g) What are the uses of diodes?

h) What do you mean by Avalanche breakdown?

i) What are the applications of solar cell?

j) Define dynamic resistance of a PN junction diode in forward biasing

SECTION-B

2. Explain the construction and V-I characteristics of Zener Diode. What is Zener impedance?

3. Distinguish between Semiconductors, Conductors and Insulators?

4. What is construction process of Enhancement-type MOS?

5. What is the process of Chemical Vapour Deposition (CVD)?

6. Elaborate Poisson and continuity equation.

SECTION-C

7. Explain the working of an Emitter follower and show how it performs the function of impedance transformation.

8. Explain with diagram the construction and working of MOSFET.

9. **Write short note on:**

   a) Schottky Diode

   b) Varactor Diode

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Total No. of Pages : 03

Total No. of Questions : 09

B.Tech.(ECE) (Sem.–3)

NETWORK THEORY

Subject Code : BTEC-304-18

M.Code : 76447

Date of Examination : 08-01-2025

Time : 3 Hrs.

Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.
3. SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.

SECTION-A

1. Write briefly:

a. What are poles and zeroes?

b. What are Transmission parameters? Why these are called so?

c. Find whether the polynomial $P(s) = s^2 + 2s + 5$ is Hurwitz or not?

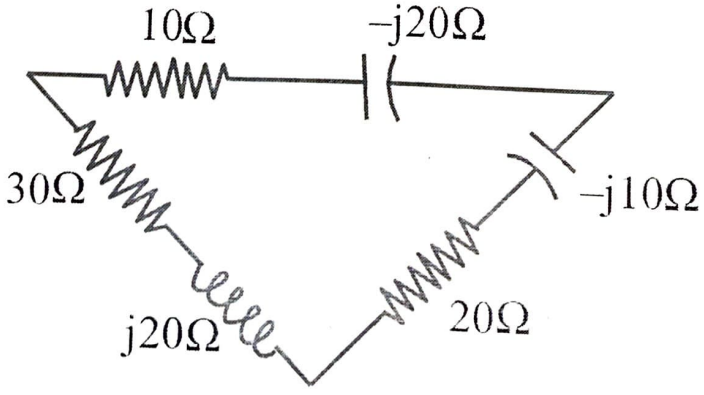
d. What are the properties for a polynomial to be Hurwitz?

e. What is the difference between network synthesis and network analysis?

f. A series RC circuit has R=10Ω, C = 1μF. Find i(t) when V=10V.

g. Find f(t) if $F(s) = \frac{2}{s(s^2+1)}$

h. Convert to an equivalent star network.



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i. What do you mean by active and reactive power?

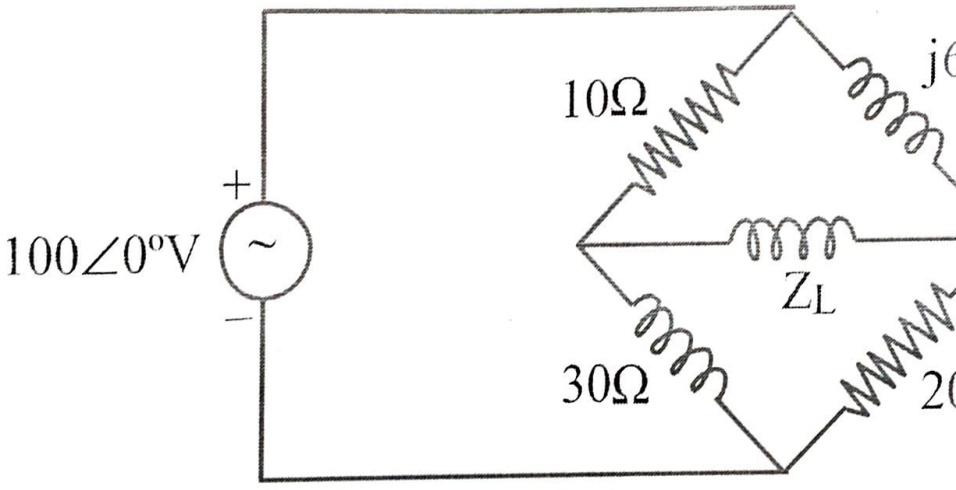
j. What is the difference between balanced and unbalanced 3-phase l

SECTION-B

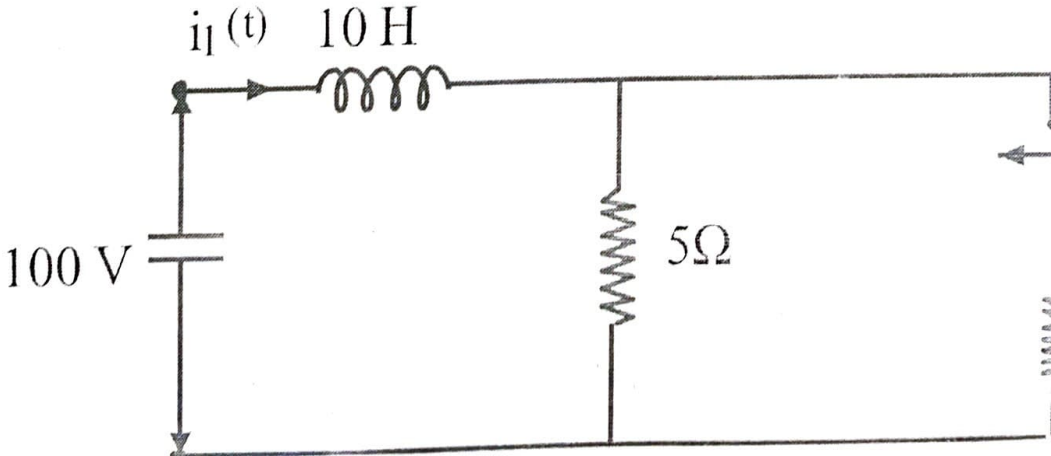
2. What are positive real functions? Discuss the necessary and sufficie functions. Check if the function is PR?

$$z(s) = \frac{(s^3 + 7s^2 + 14s + 7)}{(s^3 + 6s^2 + 11s + 1)}$$

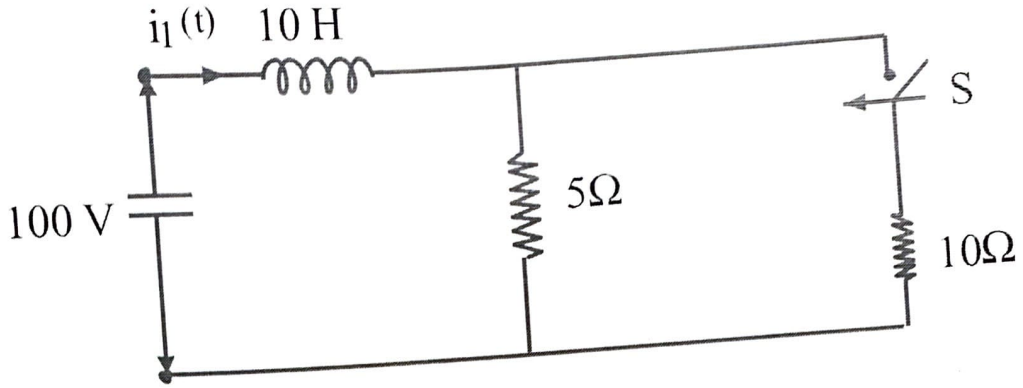
3. Find the value of ZL so that maximum power is transferred to it.



4. Obtain the impedance parameters of the following network:



6. In the given Fig, Switch S is open and steady state has been reached. S is closed at t=0. Find current through inductor, $i_L(t)$.



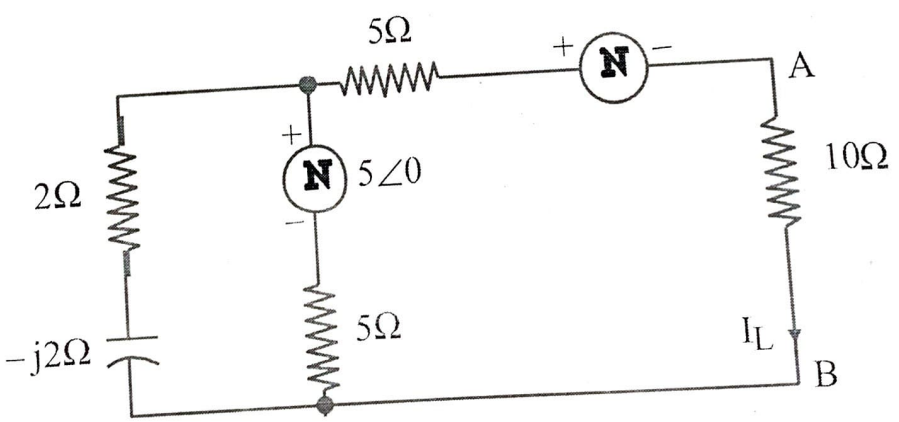
SECTION-C

7. If an m-derived high pass filter has design impedance of 500Ω and cut off frequency of 3.5 KHz and infinite attenuation at 2.6 KHz, design the filter.

8. Realize the following function using all four canonical forms:

$$z(s) = \frac{(s+2)(s+4)}{s(s+3)}$$

9. Determine Thevenin's equivalent circuit and find IL. Verify answer using Norton's theorem.



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Total No. of Pages : 02

Total No. of Questions : 09

B.Tech.(ECE/ETE) (Sem.–3)

ELECTROMAGNETIC WAVES

Subject Code : BTEC-303-18

M.Code : 76446

Date of Examination : 14-01-2025

Time : 3 Hrs.

Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.
3. SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.

SECTION-A

1. Write briefly :

a) Define the concept of distributed elements in transmission lines.

b) Write the voltage equation for a transmission line.

c) What is the difference between lossless and low-loss transmission lines?

d) Describe the purpose of a Smith chart in transmission line calculations.

e) State Gauss's law and its significance in electromagnetics.

f) Explain the role of surface charge in Maxwell's equations.

g) What is the Poynting vector and what does it represent?

h) Define wave polarization.

i) Define Electromagnetic Waves.

j) Describe Poincare's sphere.

SECTION-B

2. Explain impedance matching using transmission lines and its applications.

3. Derive Maxwell's equation for Ampere's Circuital law and discuss its implications.

4. Describe the concept of phase velocity and power flow in a uniform plane wave.

5. Explain the phenomenon of total internal reflection and provide an example of its application.

6. Discuss the function and importance of rectangular waveguides in electromagnetic wave propagation.

SECTION-C

7. Analyze the equations of voltage and current on a transmission line with the help of distributed parameters and discuss the role of standing waves in impedance transformation.

8. Using Maxwell's equations, derive the boundary conditions at a media interface and explain their significance in electromagnetic theory.

9. Explain the process of wave propagation in a conducting medium, discussing factors that affect phase velocity, power flow, and how the Poynting vector can be used to analyze energy distribution?

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Total No. of Pages : 02

Total No. of Questions : 09

B.Tech.(ECE) (Sem.–3)

DIGITAL SYSTEM DESIGN

Subject Code : BTEC-302-18

M.Code : 76445

Date of Examination:24-12-2024

Max. Marks : 60

Time : 3 Hrs.

INSTRUCTIONS TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.
3. SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.

SECTION-A

1. **Write briefly:**

a) Implement 2:4 decoder using 1:2 decoders.

b) Design Half adder circuit.

c) Minimize the following expression

AB'C + A'BCD' + ABC'D'+AB + C

d) Write De-Morgan's theorem.

e) Discuss dataflow style of modelling in VHDL.

f) Convert $(11110)_{Gray}$ to Binary code.

g) Discuss PAL and PLA circuits.

h) Why priority encoders are preferred?

i) Discuss the working of BCD adder circuit.

j) Convert $(1000\ 1001)_{BCD}$ to Excess-3 code.

SECTION-B

2. What is shift register and discuss its applications?

3. What is Race Around condition, how it can be removed?

4. Write short note on TTL logic family.

5. Write a program in VHDL for designing full adder circuit.

6. Implement the following function using Multiplexer

   $F(A,B,C,D) = \Sigma m\ (0, 1, 2, 3, 6, 7, 8, 12)$

SECTION-C

7. Minimize using K Map technique $F(w,x,y,z) = \Sigma m\ (0,2,3,6,7,8,12,13,14) + d(4,11,15)$

8. Describe various characteristics of A/D convertor. Also explain the working of successive approximation A/D convertor.

9. Design 2bit magnitude comparator circuit.

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