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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
THIRD SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2017

Course Code: EC207

Course Name: LOGIC CIRCUIT DESIGN (EC, AE)

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any two full questions, each carries 15 marks. Marks

1 a) Convert 326.875_{10} to binary, and Hex form. (3)

b) Represent 478_{10} in BCD and Excess-3 codes. (3)

c) Perform the arithmetic operation on these unsigned binary numbers. Show intermediate steps. (4)
i) 10110.101+101.11 (ii) 100001-1011

d) Simplify using K-map (5)
F(a,b,c,d) = ∑m (4,5,7,8,9,11,12,13,15)

2 a) A function is defined as F(a,b,c,d) = a'b+a'c+c'+a'd+a'b'c'+a'bc' (10)
i) Express the function in standard SOP (canonical) form.
ii) Implement the function using single 8:1 MUX.
iii) Simplify the function using K-map and implement the result using NAND gates only.

b) Design a logic circuit that produces a HIGH output whenever a 3-bit binary number $A_2A_1A_0$ greater than 001 and less than 110 is applied as input (A_2 is MSB). (5)

3 a) A computer system uses 12 bits. What is the counting range of values, in decimal form, if the 12 bits are used to represent i) unsigned numbers only (ii) 2's complement system (iii) 1's complement system. (5)

b) Perform arithmetic operation on the given decimal numbers using 2's complement system. Use 8 bits for each number including sign bit. Express the result in binary form. : 15 - 4 (4)

c) Design the circuit of a 3-line to 8-line decoder using basic gates. (6)

PART B

Answer any two full questions, each carries 15 marks.

4 a) Draw the circuit diagram of a standard 2 input CMOS NOR gate with 5V supply voltage. How does it work as a NOR gate. Write its truth table. (5)

b) What are noise immunity and noise margin? Indicate the logic levels of the 5V CMOS and TTL gates. (5)

c) What is open-collector output gate? State its use. (5)
What is tri-state logic? State its use.

5 a) Design the circuit of a mod-12 asynchronous up counter using JK flip-flop that starts counting at 0. Draw its output waveforms and indicate the sequence. (10)
Design an additional circuit to light an LED when the count is maximum.

b) Consider a 5 bit asynchronousup counter using JK flip-flop. Find its modulus. (5)
What is the lowest output frequency, if the input clock frequency is 160 kHz?
What is the counting range?

6 a) Design a 3-bit synchronous up counter using T Flip-flop with outputs $Q_2Q_1Q_0$ where Q_0 is LSB. Write the complete truth table and excitation table. Derive the expression of T_2, T_1, T_0 in terms of Q_2, Q_1, Q_0. Draw the circuit diagram. (10)

b) What is PLA?Showhowf1= a'bc+ab'+abc', f2= a'b'c'+ac and f3= ab'c+ab can be (5)

implemented in PLA.

PART C

Answer any two full questions, each carries 20 marks.

7 a) Draw the state diagrams of JK flip-flop. Write its state table. (5)

b) Design the logic circuit using JK flip-flop for the given state table where x is the input. Draw the state diagram, transition table, JK flip-flop excitation table, logic diagrams. (15)

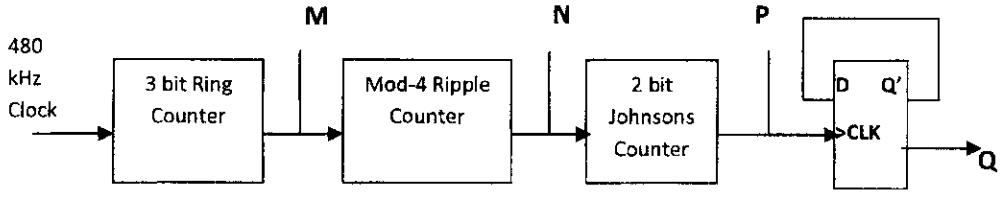
Present state	Next state		Output	
	x=0	x=1	x=0	x=1
A	B	A	0	0
B	B	C	0	0
C	D	A	0	1
D	B	C	0	1

8 a) Find the equivalent states and reduce the given state table using implication chart. x is the input (10)

Present state	Next state		Output	
	x=0	x=1	x=0	x=1
a	e	c	0	0
b	c	a	0	0
c	b	g	0	0
d	g	a	0	0
e	f	b	1	0
f	e	d	0	0
g	d	g	0	0

b) Design a 3-bit up/down synchronous counter using JK Flip-flop that counts up when the control input M=1 and counts down when M=0. Assume that JK flip-flop inputs are $J2K_2$, $J_1 K_1$,$J_0 K_0$ and the corresponding outputs are Q_2 Q_1 Q_0 respectively where Q_0 is LSB. Draw its State table, Excitation Table and Logic diagram (10)

9 a) A logic circuit is designed using the following modules. First module is a 3-bit ring counter. A clock signal of 480 kHz is applied at the clock input of this module. The output from its last FF is M. This output is connected to the clock input of the next stage which is a mod-4 ripple counter. The output from its last flip-flop is N. This output is connected to the clock input of the 2-bit Johnsons counter. The output P of its last Flip-flop is applied to the clock input of an edge triggered D flip-flop. The Q' of the D flip-flop is connected to the D input. Find the frequency of the output signals at M, N, P and Q. Justify your answer. What is the overall modulus? (10)



b) Design a 4-bit bi-directional shift register circuit using D flip-flops with shift control input M that shifts right when M=1 and shifts left when M=0. State how it works with examples. (10)

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

THIRD SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2017

Course Code: EC205

Course Name: ELECTRONIC CIRCUITS (EC, AE)

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any two full questions, each carries 15 marks. Marks

1 a) What is the condition for an RC circuit to behave as an integrator? (4)

b) Design a differentiator circuit to differentiate a square wave of 20V peak to peak amplitude and 1.5KHz frequency. (4)

c) Prove that for an emitter follower circuit gain is approximately one. (7)

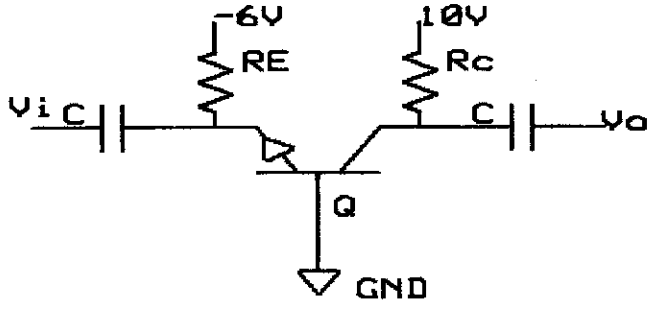
2 a) For a voltage divider network, R_1=36K, R_2 = 9K, R_E =2K, R_C =9K, V_{CC}= 24V, V_{BE}=0.7V. Calculate I_C and V_{CE} for β=100. (5)

b) Derive Input impedance and Voltage gain of a Common Emitter Amplifier with emitter bypassed for the mid frequency range using hybrid π model. (6)

c) For a fixed bias circuit, V_{CC}=10V, R_B = 50K, R_C = 500Ω. Assume silicon transistor with β=50 and V_{BE} = 0.7V. Find the co-ordinates of Q point. (4)

3 a) A square wave of peak to peak amplitude 4V extending ±2V with respect to ground is applied to a low pass RC circuit. The duration of positive section is 0.2sec and that of negative section is 0.1sec. Plot the output waveform. The time constant of the circuit is 0.2sec. (7)

b) For the circuit shown, calculate input impedance, output impedance and voltage gain for the mid frequency range using hybrid π model. R_E=6.8K, R_C=4.7K, α =0.99 (8)



PART B

Answer any two full questions, each carries 15 marks.

4 a) Draw the circuit diagram of a RC phase shift oscillator and explain its working. Derive the expression for frequency of oscillation. (10)

b) Derive expression for short circuit current gain in terms of frequency of operation. (5)

5 a) Calculate the bandwidth f_β and capacitance Cπ of a BJT whose f_T = 500MHz at I_C = 1mA, β = 100 and Cμ = 0.3pF (6)

b) Explain how negative feedback acts on gain, distortion, stability and frequency response of a circuit. (9)

6 a) Explain Miller's theorem. (4)

b) Discuss the variation of input and output resistance on voltage series and current shunt feedback. (6)

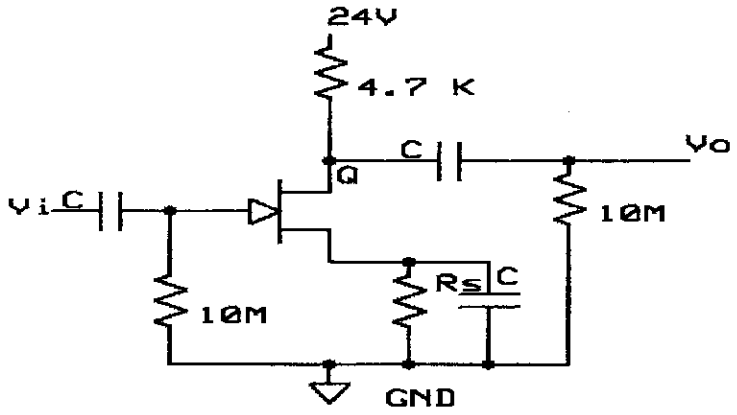
c) Draw the circuit of a cascode amplifier and briefly explain its features. (5)

PART C

Answer any two full questions, each carries 20 marks.

7 a) Explain the working of an astable multivibrator circuit with a neat circuit diagram and waveforms. Derive an expression for period of oscillation. (10)

b) For the circuit shown, I_{DSS}= 5mA, gmo = 2500μS. If Rs = 820Ω, what is I_D, V_{GS} and V_{DS}. (10)



8 a) For a series fed class A amplifier, R_B =1K, R_C =20Ω and V_{CC} = 20V. β for BJT is 25. Calculate the input power, output power and conversion efficiency for an input voltage resulting in a base current of 10mA peak. (6)

b) Derive expressions for voltage gain and output resistance for a common source amplifier with source bypassed using small signal model in mid frequency. (8)

c) Compare Class A, Class B and Class AB power amplifiers. (6)

9 a) Explain the working of bootstrap circuit with a neat circuit diagram and waveforms. (7)

b) Prove that the conversion efficiency of Class B amplifier is 78.5%. (5)

c) With a neat circuit diagram, explain how output voltage can be regulated by using series feedback voltage regulator. How short circuit protection can be implemented in this? (8)

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

THIRD SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2017

Course Code: EC203

Course Name: SOLID STATE DEVICES (EC, AE)

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any two full questions, each carries 15 marks. Marks

1 a) Derive the expression for electron, hole and intrinsic concentrations at equilibrium in terms of effective density of states. Formulate the relation between these concentrations at equilibrium. (8)

b) A Silicon sample is doped with 10^{17} boron atoms/cm^3. What is the equilibrium electron and hole concentrations at 300K? Where is E_F relative to E_i. Draw the energy band diagram. Intrinsic carrier concentration of Silicon is 1.5 x 10^{10} at 300K. (7)

2 a) A Silicon bar of 100 cm long and 1 cm^2 cross sectional area is doped with 10^{17}Arsenic atoms/cm^3. Calculate electron and hole concentrations at 300K. Also find the conductivity and the current with 10V applied. Electron mobility at this doping is 700 cm^2/V-sec. (7)

b) What is Hall effect? Derive the expression for carrier concentration and mobility in terms of Hall voltage. (8)

3 a) Describe diffusion process. Derive the expression for diffusion current density. (7)

b) Prove that under steady state carrier injection, the injected excess carrier concentration is an exponentially decreasing function of distance. (8)

PART B

Answer any two full questions, each carries 15 marks.

4 a) Draw the energy band diagram of a PN junction (6)
i) at equilibrium, ii) under forward bias and iii) under reverse bias.

b) A Silicon sample having circular cross section with diameter 10μm is doped with 10^{18} cm^{-3} acceptor impurities on one side and 5x10^{15} cm^{-3} donor impurities on the other side. If the sample is at equilibrium, calculate contact potential, width of depletion region, penetration of depletion region on both N side and P side, and total charge on both N side and P side at 300K. (9)

5 a) An abrupt Silicon PN junction has the following parameters at 300K. (10)
P side:- Na=10^{17} cm^{-3}, τ_n=0.145, μ_n= 700 cm^2/V-sec.
N side:-N_d=10^{15} cm^{-3}, τ_p=1045, μ_p= 450 cm^2/V-sec.
The junction is forward biased by 0.5V. What is the forward current. What is the current at reverse bias of (-0.5V).

b) Differentiate between ohmic and rectifying contacts. (5)

6 a) Derive the expression for depletion and diffusion capacitance of a PN junction. (7)

b) With the help of necessary diagrams, explain the working of a tunnel diode. (8)

PART C

Answer any two full questions, each carries 20 marks.

7 a) Derive the expression for minority carrier distribution and terminal currents in a transistor. (12)

b) Describe early effect in a transistor. (5)

c) What are the factors which cause base current in a transistor? (3)

8 a) With the help of necessary band diagrams, explain equilibrium, accumulation, depletion and inversion stages of a MOS capacitor. (12)

b) What are the effect of real surfaces of a MOS capacitor. (4)

c) Draw and explain the structure of FINFET. (4)

9 a) Derive the expression for drain current of a MOSFET. (10)

b) Draw and explain the transfer characteristics of an n-channel MOSFET. (5)

c) A Silicon n-channel MOSFET has μ_n= 600 cm^2/V-sec, C_{ox}= 1.2x10^{17} F/cm^2, z=50 μm, L=10 μm and V_{TH}= 0.8V. Find he drain current when (5)

i) V_{GS}=2V and V_{DS}=1V ii) V_{GS}=3V and V_{DS}=5V

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

THIRD SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2017

Course Code: EC201

Course Name: NETWORK THEORY (EC, AE)

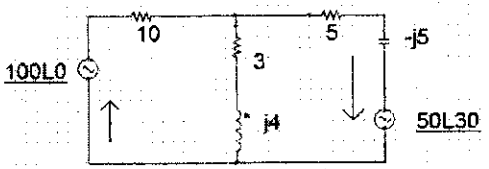
Max. Marks: 100 Duration: 3 Hours

PART A

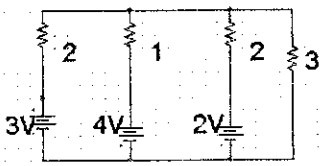
Answer any two full questions, each carries 15 marks. Marks

1 a) State and prove final value theorem and initial value theorems. (7)

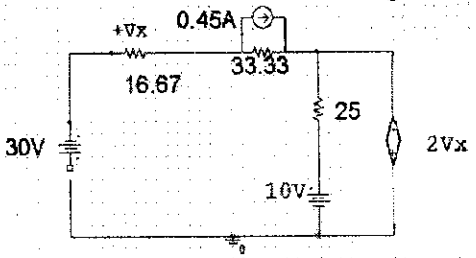
b) Find the current in each resistor using the superposition theorem. (8)



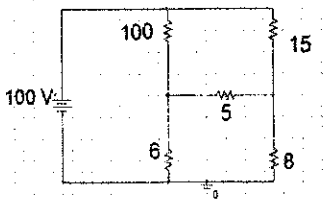
2 a) For the circuit shown in figure, find the current through 3 Ω using Millmann's theorem (5)



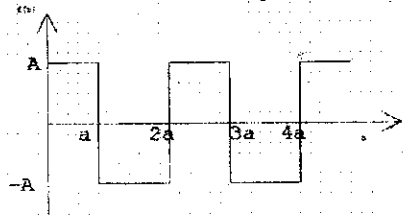
b) Use mesh analysis to find Vx in the circuit shown in figure (10)



3 a) Use Thevenin's theorem to find the current through 5Ω resistor (10)



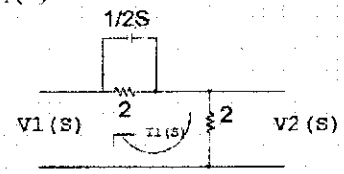
b) Find the Laplace transform of the square wave shown in figure (5)



PART B

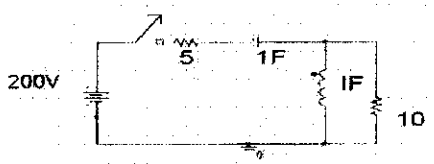
Answer any two full questions, each carries 15 marks.

4 a) For the network shown in fig obtain the transfer functions $G_{21}(S)$, $Z_{21}(S)$ and driving point impedance $Z_{11}(S)$. (10)



b) Determine the transform impedance and admittance across capacitor (5)

5 a) For the circuit shown in figure , the switch was closed at time t=0, find the drop across 10Ω (8)



b) Derive the response of a series RLC circuit with step input. (7)

6 a) For the given network function, draw the pole zero diagram and hence obtain the time domain response i(t). (10)

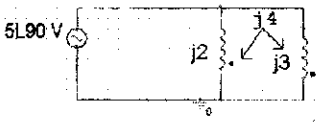
$$I(S) = \frac{5s}{(s+1)(s^2+4s+8)}$$

b) Find the inverse Laplace transform of $F(s)= \frac{15s^2-15s-11}{(s+1)(s-2)^3}$ (5)

PART C

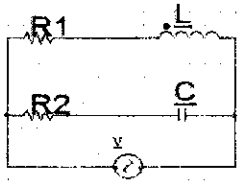
Answer any two full questions, each carries 20 marks.

7 a) For the circuit shown below find the input impedance and also find the loop currents. (8)

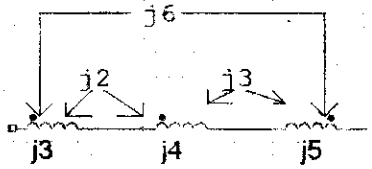


b) Define the terms Characteristic impedance, Image impedance and propagation constant (5)

c) Find the expression for resonant frequency for the circuit shown below. (7)

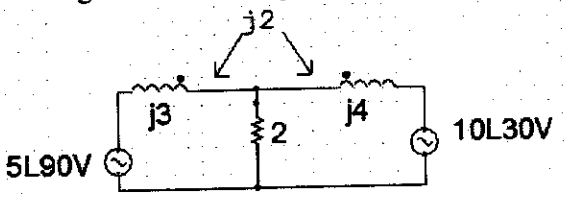


8 a) For the circuit shown below determine the equivalent reactance (5)



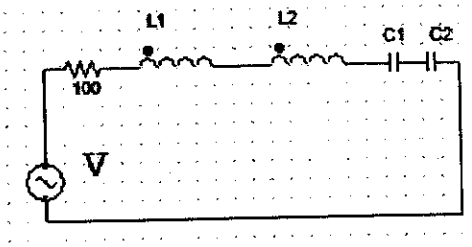
b) Prove that AD-BC=1 for a two port bilateral network (7)

c) For the circuit shown in figure find the drop across the two inductor coils. (8)



9 a) A capacitor of 30μF and a resistance of 40Ω are connected in series with a coil having resistance 5 and inductance L. The circuit resonates at 1.5Khz frequency. Find the value of L. Also find the current at resonance, Q factor, half power frequencies and bandwidth. (10)

b) For the circuit shown in figure find the expression for frequency at resonance. (10)



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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

THIRD SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2017

Course Code: HS200

Course Name: BUSINESS ECONOMICS

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any three questions, each carries 10 marks.

1 a) What is a PPC? Explain opportunity cost concept using Production Possibility Curve. (6)

b) What is Price Elasticity of demand? (4)

2 a) Explain the market equilibrium concept using a schedule and diagram. (6)

b) Calculate marginal utility from the following data. (4)

X	1	2	3	4	5	6	7	6
TU	10	18	25	30	33	35	35	30

3 a) Give examples of any three business decisions which can be taken effectively using the concepts in business economics. (6)

b) Comment on the nature of elasticity from the following data (4)

i) Ep =1 ii) Ep=0 iii) Ep=2 iv) Ep=.85

4 a) Given below are the production function of Firm A (4)

$Q = 100\ K^{0.3}L^{0.7}$,

The firm use 20 units of Labour (L) and 10 units of Capital (K).

Calculate the output

b) State and explain the Law of variable proportions (6)

PART B

Answer any three questions, each carries 10 marks.

5 a) Elucidate the features of a perfect market structure 6)

b) What will happen if a firm cut price in an oligopoly market (4)

6 a) (i)Calculate Break Even Quantity from the following data (6)

Fixed Cost:Rs. 25,000 ; Average Variable Cost : Rs. 12; Selling Price Rs. 17

(ii) What will be the Break-Even Quantity, if selling price increases by Rs.3?

b) What are the limitations of Break-even analysis? (4)

7 a) Describe the Circular Flow Concept using a three-sector model. (6)

b) Differentiate between GDP and GNP. (4)

8 a) What is inflation? What adjustments can be made in CRR and SLR to bring down the level of inflation? (5)

b) Describe the different phases of Trade Cycle (5)

PART C

Answer any four questions, each carries 10 marks.

9 a) What are the advantages of NPV method (4)

b) Mr. Keynes, an investor is evaluating two projects with an objective of selecting (6)

one among these for making an investment. From the following data, recommend which project to be selected using Pay Back Period Method

Project	Initial Outlay	Year1	Year 2	Year3	Year4
A	90,000	20,000	30,000	50,000	50,000
B	90,000	30,000	40,000	50,000	20,000

10 a) What is GST? (5)

b) Distinguish between a money market and capital market. (5)

11 a) Elucidate the four main cannons of taxation. (6)

b) What are the uses of demand forcasting? (4)

12 a) Prepare a balance sheet and arrange the following items in it (6)
Cash, Interest Payable, Machinery, Wages Payable, Goodwill, Sundry Creditors, Inventories

b) Why is it important to preparea balance sheet? (4)

13 a) What is Cost Benefit Analysis? (6)

b) Discuss Delphi Technique of demand forecasting? (4)

14 a) "Business always operate in an environment of uncertainty". Do you agree? (5)
Give three reasons.

b) What are the benefits of FDI? (5)

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

THIRD SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2017

Course Code: MA201

Course Name: LINEAR ALGEBRA AND COMPLEX ANALYSIS

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any two full questions, each carries 15 marks. Marks

1 a) Find the points where Cauchy-Riemann equations are satisfied for the function $f(z) = xy^2 + i\,x^2 y$. Where does $f'(z)$ exist? Is the function f(z) analytic at those points? (7)

b) If $v = e^x(x \sin y + y \cos y)$, find an analytic function f(z)=u+iv. (8)

2 a) Show that $u = x^2-y^2-y$ is harmonic. Also find the corresponding conjugate harmonic function. (7)

b) (i) Find a bilinear transformation which maps $(-i, 0, i)$ onto $(0, -1, \infty)$. (8)

(ii) Test the continuity at z = 0, if $f(z) = \frac{Im\, z}{|z|}, z \neq 0$

$= 0, z = 0$

3 a) Find the image of the lines x=1, y=2 and x>0, y<0 under the mapping $W= z^2$ (8)

b) Find the image of the semi-infinite strip $x > 0, 0< y < 2$ under the transformation w=iz+1. Draw the regions. (7)

PART B

Answer any two full questions, each carries 15 marks.

4 a) Evaluate $\oint Re\, z^2 dz$ over the boundary C of the square with vertices 0, i, 1+ i,1 clockwise (8)

b) Evaluate $\int \frac{4-3z}{z(z-1)} dz$ over the circle $|z|=\frac{3}{2}$ (4)

c) Evaluate $\int \frac{3z^2+7z+1}{z+1} dz$ over the circle |z+ i |=1 (3)

5 a) Expand $\frac{z}{(z-1)(z-2)}$ in (1) $0<|z-2|<1$, (2) $|z-1|>1$ (8)

b) Evaluate $\int_0^{2\pi} \frac{1}{2+\cos\theta} d\theta$ (7)

6 a) Using Residue theorem evaluate $\int \frac{z^2}{(z-1)^2(z+2)} dz$ over the circle |z|=3 (7)

b) Find the Taylor series of $\frac{\sin z}{z-\pi}$ about the point $z= \pi$ (4)

c) Evaluate $\int \frac{\sin z}{z^6} dz$ over the circle |z|=2 using Cauchy's Residue theorem. (4)

PART C

Answer any two full questions, each carries 20 marks.

7 a) Solve by Gauss-Elimination method x + y + z = 6, x+ 2y- 3z = -4, -x-4y+9z =18. (7)

b) Find the values of 'a' and 'b' for which the system of equations x + y + 2z =2, 2x-y+3z=10,5x-y+az=b has: (7)

(i) no solution (ii) unique solution (iii) infinite number of solutions.

c) Verify whether the vectors (1,2,1,2), (3,1,-2,1),(4,-3,-1,3) and (2,4,2,4) are linearly independent in R^4. (6)

8 a) Write down the matrix associated with the quadratic form $8x_1^2+7x_2^2+3x_3^2-12x_1x_2 -8x_2x_3+4x_3x_1$. By finding eigen values, determine nature of the quadratic form. (7)

b) Diagonalise the matrix $A = \begin{bmatrix} 1 & -2 & 0 \\ -2 & 0 & 2 \\ 0 & 2 & -1 \end{bmatrix}$ (7)

c) If A is a symmetric matrix, verify whether AA^T and A^TA are symmetric? (6)

9 a) Find the eigen vectors of $A = \begin{bmatrix} 3 & 0 & 0 \\ 5 & 4 & 0 \\ 3 & 6 & 1 \end{bmatrix}$ (8)

b) Find the null space of AX=0 if $A=\begin{bmatrix} 1 & 1 & 0 & 2 \\ -2 & -2 & 1 & -5 \\ 1 & 1 & -1 & 3 \\ 4 & 4 & -1 & 9 \end{bmatrix}$ (6)

c) Verify whether $A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos\theta & -\sin\theta \\ 0 & \sin\theta & \cos\theta \end{bmatrix}$ is orthogonal. (6)

What can you say about determinant of an orthogonal matrix? Prove or disprove the result.

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