

13

19/11/18

Sem IV Expt, CBSWS, Dec 18

QP CODE : 22625

(3 Hours)

Marks: 80

- N.B.:
- (1) Question No.1 is compulsory.
 - (2) Solve any three questions from remaining five questions.
 - (3) Figures to the right indicate full marks.
 - (4) Assume suitable data if required and mention the same in the answer sheet.

CL

Q.1 Solve any five of the following: -

20

- (a) What is cross over distortion? How to overcome the same.
- (b) Consider a BJT has parameters $f_T = 500\text{MHz}$ at $I_C = 1\text{mA}$, $\beta = 100$ and $C_{\mu} = 0.3\text{pF}$. Calculate bandwidth of f_{β} and capacitance C_{π} of a BJT.
- (c) Implement $V_o = - (3V_1 + 4V_2 + 2V_3)$ using OpAmp.
- (d) Define the CMRR of Differential Amplifier. Why constant current source biasing is preferred for Differential Amplifier?
- (e) Draw the circuit diagram of widlar current source and derive the relationship between output current and reference current.
- (f) A zener voltage regulator as shown in Fig. 1f has $V_Z = 6.2\text{V}$. The input voltage varies from 10V to 15V and load current is 60mA . To hold output voltage constant under all conditions what should be the range of series resistance ($R_{S\text{min}}$ and $R_{S\text{max}}$) ($I_{Z\text{min}} = 10\text{mA}$, $P_{Z\text{max}} = 2\text{W}$).

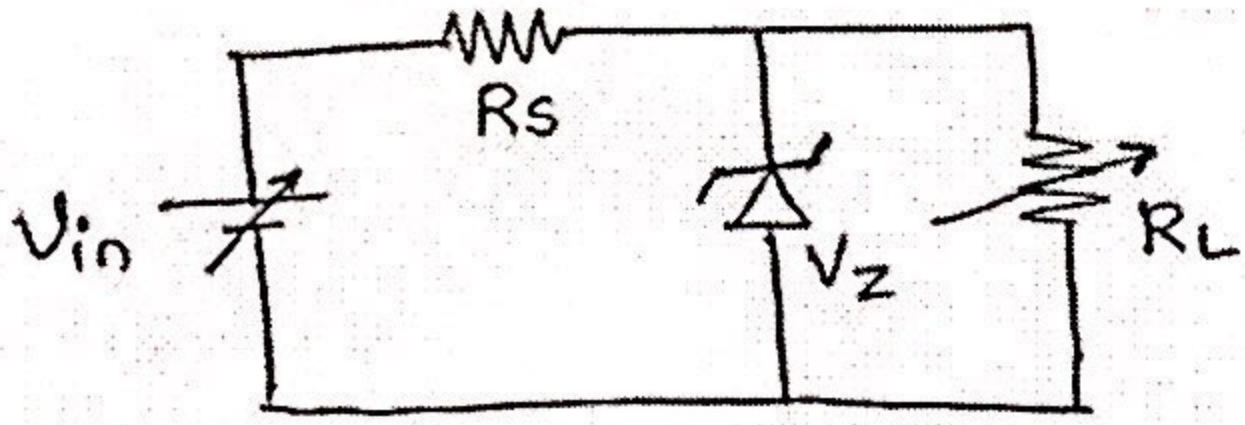


Fig. 1f

Q.2 (a) Determine the corner frequency and maximum gain of a bipolar common-emitter circuit shown in Fig. 2a, with an input coupling capacitor. 10

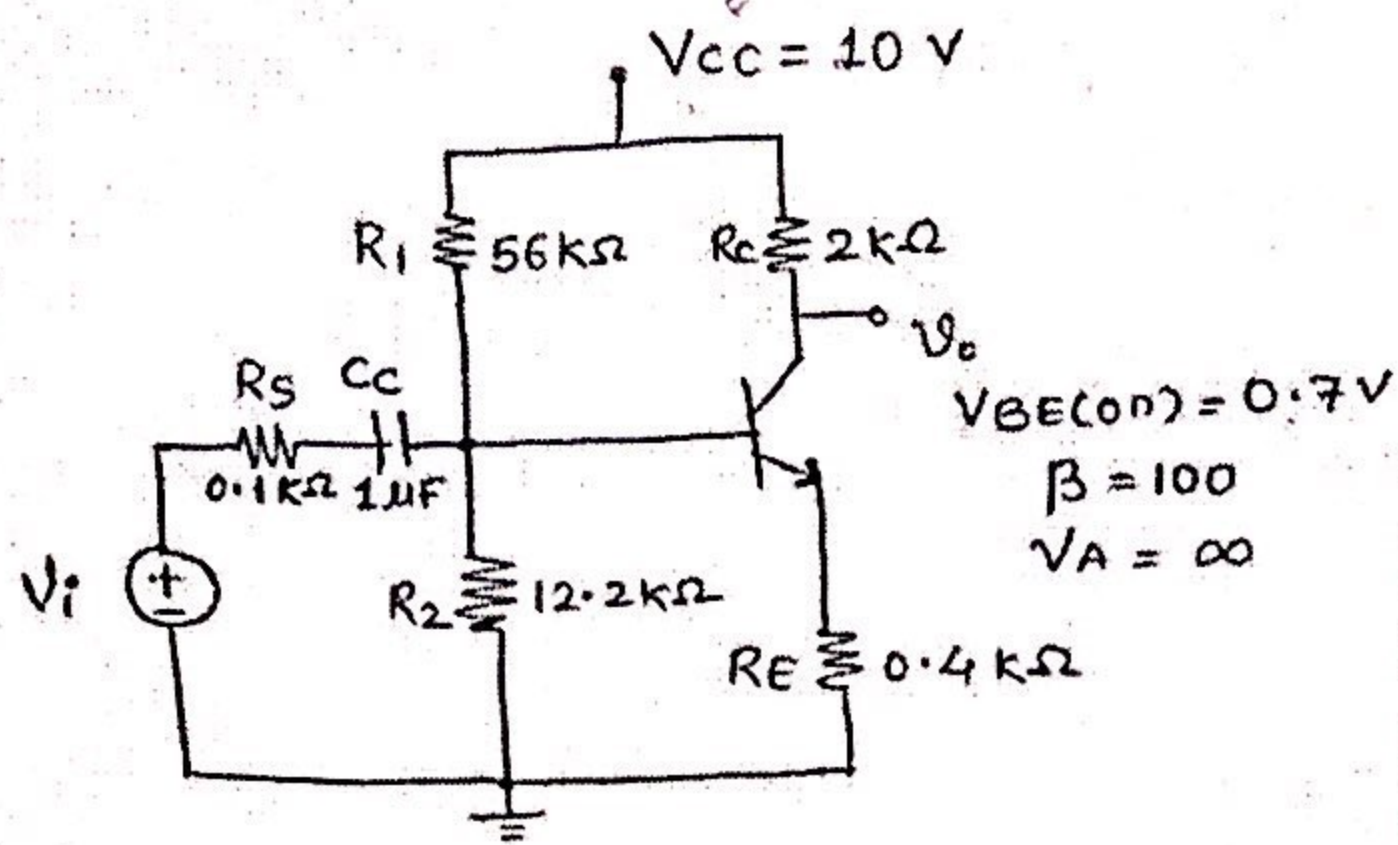


Fig. 2a

(b) Draw the circuits of OpAmp based integrator circuit and derive the expression for output voltage. What are the limitations of integrator circuit and how to overcome the limitations? 10

Q.3 (a) Draw the small signal equivalent circuit of the bipolar differential amplifier. Determine its output voltage in the general form for one sided output $V_o = A_d V_d + A_{cm} V_{cm}$, and hence the expressions for differential mode gain and common mode gain. 10

(b) For the circuit shown in Fig. 3b, Transistors parameters are $K_n = 1\text{mA/V}^2$, $V_{TN} = 0.7\text{V}$, $C_{gs} = 2\text{pF}$, $C_{gd} = 0.2\text{pF}$, $\lambda = 0$. Find the miller capacitance, mid band voltage gain and upper cut off frequency. 10

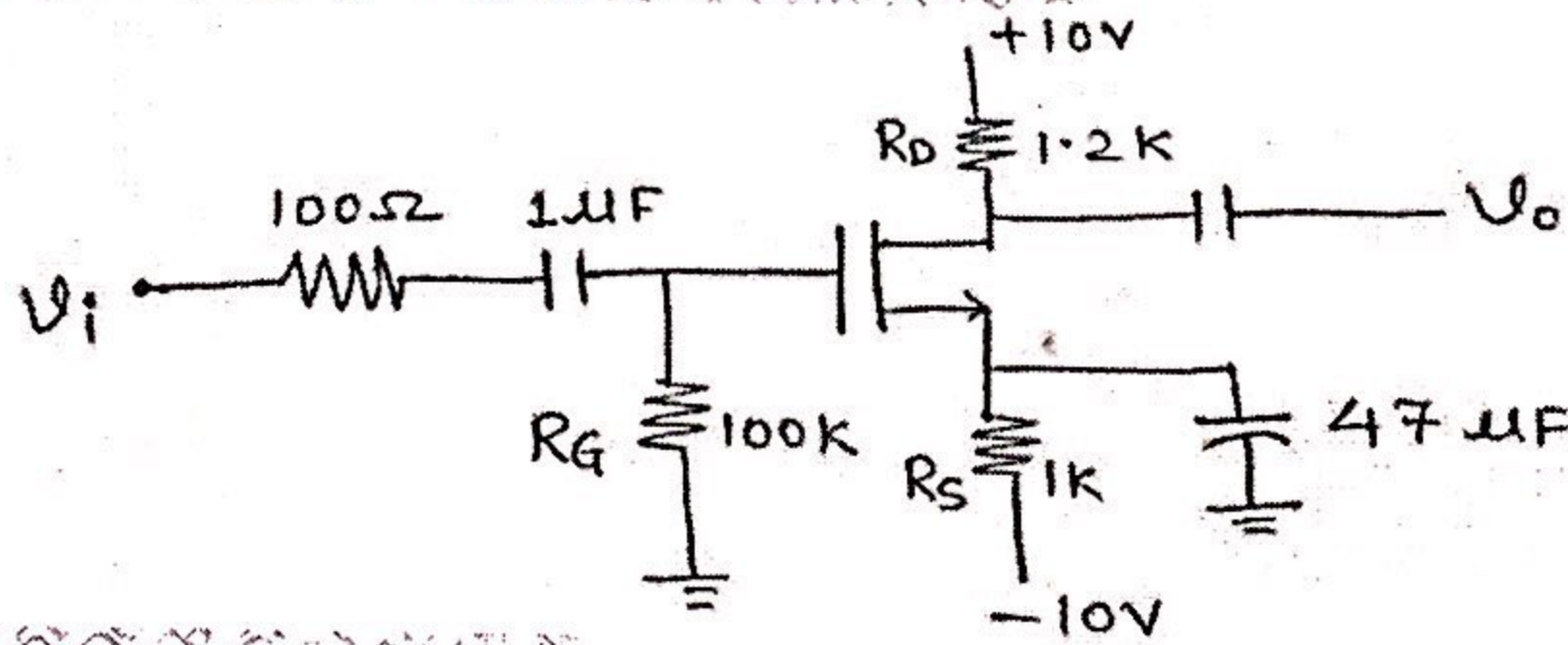


Fig. 3b

Q.4 (a) For the MOSFET differential amplifier shown in Fig. 4a, the transistor parameters are $K_{n1} = K_{n2} = 0.1\text{mA/V}^2$, $K_{n3} = K_{n4} = 0.3\text{mA/V}^2$, $V_{TN} = 1\text{V}$ for all transistors, $\lambda = 0$ for M_1, M_2 and M_3 , $\lambda = 0.01\text{V}^{-1}$ for M_4 . Determine the bias current I_Q , output resistance of current source, differential-mode voltage gain, common-mode voltage gain and CMRR for the differential amplifier. 10

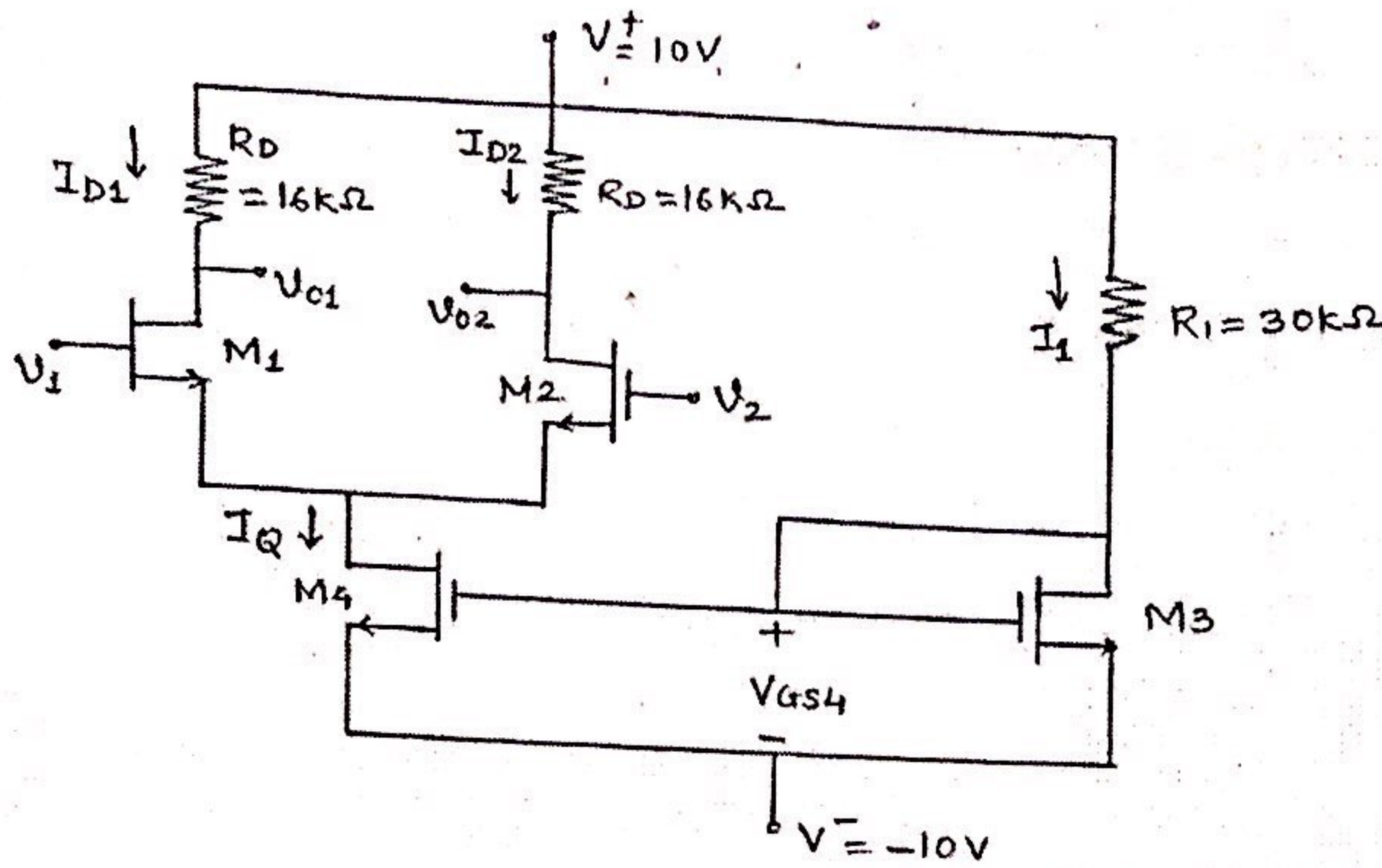


Fig. 4a

(b) Draw circuit diagram of cascode amplifier using BJT and derive expression for voltage gain, input resistance and output resistance. 10

Q.5 a) Draw and explain the working of Class A power amplifier (transformer coupled). Derive the expression for efficiency. 10

(b) For the basic three transistor current source shown in Fig. 5b, the parameters are : 10

$V^+ = 10V$, $V^- = 0V$ and $R_1 = 12K\Omega$, for all transistors $V_{BE(on)} = 0.7V$, $\beta=100$ and $V_A = \infty$. Calculate value of each current shown in Fig. , i.e. I_{REF} , I_{C1} , I_{B1} , I_{B2} , I_{E3} , I_{B3} .

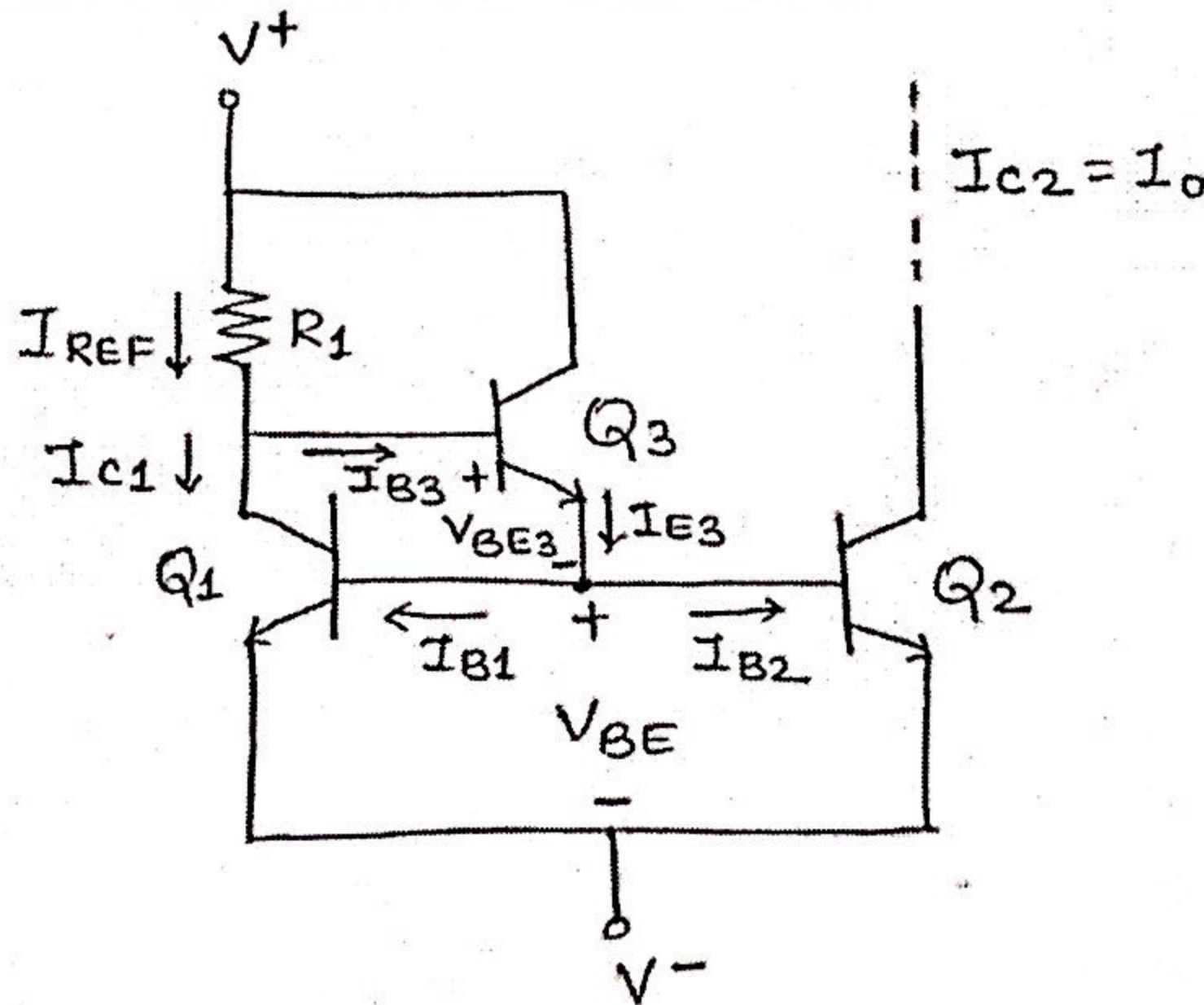


Fig. 5b

(3 hours)

Total Marks: 80

N.B: (1) Question no.1 is compulsory.(2) Attempt any **three** questions from remaining **five** questions.(3) **Figures** to the **right** indicate **full** marks.

(4) Assume suitable data if necessary.

1. (a) Find the extremal of $\int_0^1 (xy + y^2 - 2y^2y') dx$. (5)(b) State Cauchy-Schwartz inequality in R^3 and verify it for $u = (-4, 2, 1)$ and $v = (8, -4, -2)$. (5)(c) If $\lambda_1, \lambda_2, \lambda_3, \dots, \lambda_n$ are eigen values of A, then show that $\frac{1}{\lambda_1}, \frac{1}{\lambda_2}, \frac{1}{\lambda_3}, \dots, \frac{1}{\lambda_n}$ are the eigenvalues of A^{-1} . (5)

(d) A random variable X has the following probability mass distribution;

$X:$	0	1	2	
$P(X = x):$	$3c^3$	$4c - 10c^2$	$5c - 1$, Find c and determine $P(X < 1)$.

(5)
2. (a) Evaluate $\int_0^{1+i} z^2 dz$, along (i) the line $y = x$, (ii) the parabola $x = y^2$, Is the line integral independent of the path? Explain. (6)

(b) A random variable X has the following density function

$$f(x) = \begin{cases} 2e^{-2x}, & x > 0 \\ 0, & x \leq 0 \end{cases}, \text{ Find the m.g.f. and hence, its mean and variance.} \quad (6)$$
(c) Calculate R (Spearman's rank correlation) and r (Karl-Pearson's) from the following data:

$X:$	12	17	22	27	32	
$Y:$	113	119	117	115	121	, Interpret your result.

(8)
3. (a) Let $V = R^3$, Show that W is a subspace of R^3 , where $W = \{(a, b, c) : a + b + c = 0\}$, that is W consists of all vectors where the sum of their components is zero. (6)(b) Evaluate $\oint_C \frac{e^{2z}}{(z+1)^4} dz$, where C is the circle $|z-1| = 3$. (6)

(c) Show that the matrix A is diagonalizable. Also find the transforming matrix and the

diagonal matrix where $A = \begin{bmatrix} 4 & 1 & -1 \\ 2 & 5 & -2 \\ 1 & 1 & 2 \end{bmatrix}$. (8)

4.(a) Find the extremals of $\int_{x_0}^{x_1} (2xy + y^{m^2}) dx$. (6)

(b) A transmission channel has a per-digit error probability $p = 0.01$. Calculate the probability of more than 1 error in 10 received digits using (i) Binomial and (ii) Poisson distribution. (6)

(c) Obtain Taylor's series and two distinct Laurent's series expansion of

$$f(z) = \frac{z-1}{z^2-2z-3}, \text{ indicating the region of convergence.} \quad (8)$$

5.(a) Verify the Cayley-Hamilton Theorem for matrix A and hence find A^{-1} if it exists.

where $A = \begin{bmatrix} 0 & c & -b \\ -c & 0 & a \\ b & -a & 0 \end{bmatrix}$ (6)

(b) Let R^3 have the Euclidean inner product. Use Gram-Schmidt process to transform the

basis $\{u_1, u_2, u_3\}$ in to an orthonormal basis where $u_1 = (1,1,1), u_2 = (-1,1,0), u_3 = (1,2,1)$ (6)

(c) The marks obtained by 1000 students in an examination are found to be normally distributed with mean 70 and standard deviation 5. Estimate the number of students whose marks will be (i) between 60 and 75 (ii) more than 75. (8)

6. (a) Using Rayleigh-Ritz method, solve the boundary value problem using a two degree polynomial as initial solution.

$$I = \int_0^1 (2xy + y^2 - y'^2) dx; \quad 0 \leq X \leq 1, \text{ given } y(0) = y(1) = 0. \quad (6)$$

(b) Show that $A = \begin{bmatrix} 4 & -2 & 2 \\ 6 & -3 & 4 \\ 3 & -2 & 3 \end{bmatrix}$ is derogatory and find its minimal polynomial. (6)

(c) Using Cauchy residue theorem, evaluate the following integrals:

(i) $\int_0^{2\pi} \frac{d\theta}{5 + 3 \sin \theta}$ (4)

(ii) $\int_{-\infty}^{\infty} \frac{x^2}{(x^2 + a^2)(x^2 + b^2)} dx, a > 0, b > 0.$ (4)

Duration: 3 Hours

Total Marks: 80

N.B. : 1) Q.1. is compulsory.

2) Attempt any three from the remaining.

Q.1. a) Show that the set $\{e^x, xe^x, x^2e^x\}$ is linearly independent in $C^2(-\infty, \infty)$. (5)

b) Show that $\int_C \log z dz = 2\pi i$, where C is the unit circle in the z-plane. (5)

c) Find the projection of $u=(3,1,3)$ along and perpendicular to $v=(4,-2,2)$ (5)

d) Find the extremal of $\int_{x_1}^{x_2} (y^2 + y'^2 + 2ye^x) dx$ (5)

Q.2. a) If $A = \begin{bmatrix} 3/2 & 1/2 \\ 1/2 & 3/2 \end{bmatrix}$, find e^A (6)

b) Evaluate $\int_0^\pi \frac{d\theta}{3 + 2\cos\theta}$ (6)

c) Find the singular value decomposition of $\begin{bmatrix} 1 & 2 \\ 1 & 2 \end{bmatrix}$ (8)

Q.3. a) Find the extremal of $\int_0^\pi (y'^2 - y^2) dx$ given $y(0) = 0, y(\pi) = 0$ (6)

b) Verify Cayley Hamilton theorem for $A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & -1 & 4 \\ 3 & 1 & -1 \end{bmatrix}$ and hence find A^{-1} & A^4 (6)

c) Expand $f(z) = \frac{1}{(z-1)(z-2)}$ in the regions (i) $1 < |z-1| < 2$ (ii) $|z| < 1$ (8)

Q.4. a) Construct an orthonormal basis of R^3 using Gram Schmidt process to $S = \{(3,1),(2,3)\}$ (6)

b) Find the extremum of $\int_{x_0}^{x_1} (2xy + y''^2) dx$. (6)

c) Reduce the quadratic form $6x^2 + 3y^2 + 3z^2 - 4xy + 4xz - 2zy$ to canonical form and hence, find its rank, index and signature and value class. (8)

Q.5. a) Using Residue theorem evaluate $\int_C \frac{z^2}{(z-1)^2(z+1)} dz$ where C is $|z|=2$. (6)

b) Find the linear transformation $Y=AX$ which carries $X_1 = (1, 0, 1)'$, $X_2 = (1, -1, 1)'$, $X_3 = (1, 2, -1)'$ onto $Y_1 = (2, 3, -1)'$, $Y_2 = (3, 0, -2)'$, $Y_3 = (-2, 7, 1)'$ (6)

c) Check whether $V = \mathbb{R}^2$ is a vector space with respect to the operations

$$(x_1, 0) + (x_2, 0) = (x_1 + x_2, 0); k(x_1, 0) = (kx_1, 0) \quad (8)$$

Q.6.a) Obtain Taylor's series expansion for $f(x) = \frac{2z^3 + 1}{z(z+1)}$ about $z = i$ (6)

b) Let $W = span \left\{ (0, 1, 0), \left(\frac{-4}{5}, 0, \frac{3}{5} \right) \right\}$, Express $w = (1, 2, 3)$ in the form of $w = w_1 + w_2$ where

$$w_1 \in W \text{ \& } w_2 \in W^\perp \quad (6)$$

c) Using Rayleigh- Ritz method, solve the boundary value problem $I = \int_0^1 (2xy - y^2 - y'^2) dx$;

given $y(0) = y(1) = 0$ (8)

- N.B. (1) Question No. 1 is compulsory.
 (2) Solve any three questions from remaining five questions.
 (3) Figures to the right indicate full marks.
 (4) Assume suitable data if necessary and mention the same in answer sheet.
1. (a) Draw a neat labelled diagram of Enhancement Type MOSFET and explain its operation. **20**
 (b) Explain RC Coupled Amplifier.
 (c) What is an Oscillator? Explain Basic Principle of an Oscillator.
 (d) Differentiate Class A, Class B and Class C Power Amplifiers.

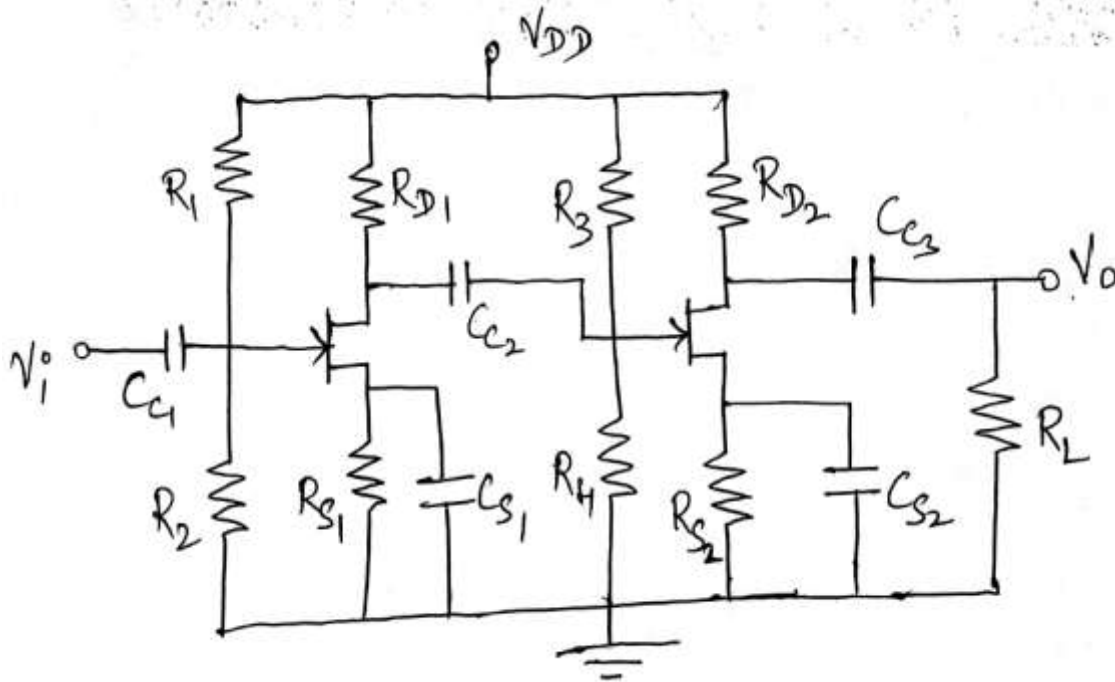
 2. (a) Design a two stage RC coupled CS – CE Amplifier to meet following specifications: **15**
 $A_v \geq 500$, $S \leq 8$, $R_i \geq 1 \text{ M}\Omega$, $V_{cc} = 6 \text{ V}$.
 Assume the following data: $\beta_{typ} = 290$, $h_{ie} = 4.5 \text{ k}\Omega$, $g_{mo} = 5000 \mu\text{S}$, $I_{DSS} = 7 \text{ mA}$,
 $r_d = 50 \text{ k}\Omega$, $V_p = -4 \text{ V}$.
 (b) For a 'n' stage cascaded amplifier, show that overall lower 3 dB cut – off frequency is **05**

$$f_{LT} = \frac{f_L}{\sqrt{2^{1/n} - 1}}$$

 3. (a) With the help of neat block diagram, derive expression for R_{IF} , R_{OF} , G_{mF} for Voltage **10**
 Series Negative Feedback Amplifier. Give significance of the above mentioned parameters.
 (b) Write Short Note on: Darlington Pair Amplifier. **10**

 4. (a) Find the necessary condition for oscillations to occur and frequency of oscillations of **10**
 Colpitts Oscillator. Also, explain its working.
 (b) Draw a neat diagram of Direct Coupled Class A Amplifier and explain its working. **10**
 Hence, find its efficiency.

5. (a) Determine input impedance, output impedance, voltage gain and current gain for the given cascaded amplifier as shown in the figure below: **10**



- (b) Draw circuit diagram of Cascode Amplifier and explain in detail. **10**
6. (a) State and Explain different types of Biasing techniques for Depletion Type MOSFET. **08**
- (b) Explain the concept of Heat Sink in detail required for Power Amplifiers. **07**
 A Silicon Power Transistor is operated with a heat sink with $Q_{SA} = 1.2^\circ \text{C/W}$. The transistor is rated for 120 W at 25°C and has $Q_{JC} = 0.5^\circ \text{C/W}$. The mounting insulation has $Q_{CS} = 0.5^\circ \text{C/W}$. What maximum power can be dissipated if the ambient temperature is 40°C and $T_{J(\text{max})} = 200^\circ \text{C}$
- (c) Calculate frequency of Oscillation for Hartley Oscillator if $L_1 = L_2 = 1\text{mH}$ and $C = 0.2 \mu\text{F}$. **05**

(Time: 3 Hours)

[Total Marks: 80]

- N.B.:** (1) Question No. 1 is compulsory.
 (2) Solve any three questions from the remaining five.
 (3) Figures to the right indicate full marks.
 (4) Assume suitable data if necessary and mention the same in answer sheet.

- Q.1** Attempt any 4 questions:
- (a) With neat circuit explain the working of comparator circuit. [05]
 (b) Write short note on: Bi FET and Bi MOS differential amplifier circuit. [05]
 (c) Design a circuit with Op Amp, resistors and a capacitor that simulates an inductor of 1 H. [05]
 (d) For a regulated dc power supply the output voltage varies from 12 V to 11.6 V when the load current is varied from 0 to 100 mA which is the maximum value of I_L . If the ac line voltage and temperature are constant, calculate the load regulation, % load regulation and output resistance of the power supply. [05]
 (e) How can the true RMS value of voltage signal to measured using analog multipliers. [05]
- Q.2** (a) Design an adjustable output voltage regulator circuits using IC 317 to give 5 to 12 volts at $I_L=1$ Amp. Given; $I_{ADJ}=100 \mu A$ and let $R_1=240 \Omega$. [10]
 (b) Explain the operation of single slope integrating ADC and state its advantages, disadvantages. [10]
- Q.3** (a) Draw a neat circuit diagram of a RC phase shift oscillator using op-amp. Derive its frequency of oscillation. What are the values of R and C for frequency of oscillation to be 1 kHz? [10]
 (b) Explain the working principle of successive approximation type ADC. [10]
- Q.4** (a) With the help of a neat diagram, input and output waveforms and voltage transfer characteristics explain the working of non-inverting Schmitt trigger. Derive the expressions for its threshold levels. Explain how these levels can be varied? [10]
 (b) Design a differentiator to differentiate an input signal that varies in frequency from 10 Hz to about 500 Hz. Draw its frequency response. If a sine wave of 2 V peak at 500 Hz is applied to the differentiator, write expression for its output and draw output waveform. [10]
- Q.5** (a) Draw the circuit diagram of a square and triangular waveform generator using op-amp. With the help of waveforms at suitable points in the circuit explain its working. Explain how duty cycle can be varied? [10]

- (b) Analyze the circuit given in Fig. 5(b). Draw the waveforms at output terminal v_O and across the capacitor C . Comment on the duty cycle of output waveform. Take diode D as an ideal diode and assume R_A is equal to R_B . [10]

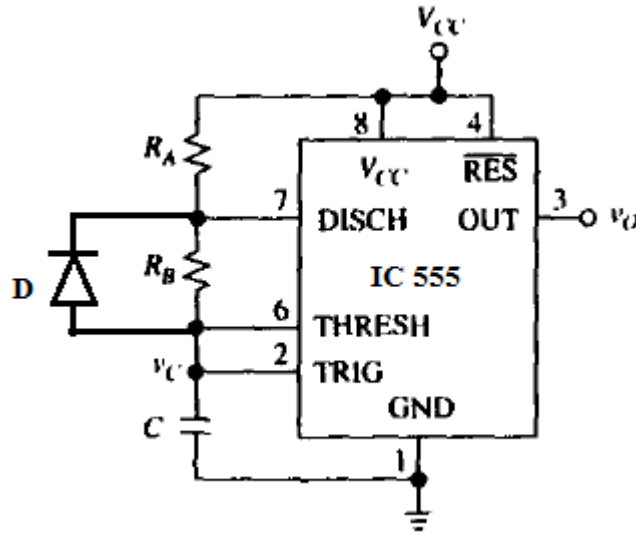


Fig. 5(b)

Q.6

Short notes on: (Attempt any four)

- | | |
|--|------|
| (a) Wilson current source. | [05] |
| (b) Temperature compensated log amplifier. | [05] |
| (c) Wein bridge oscillator. | [05] |
| (d) XR2206 waveform generator. | [05] |
| (e) Switch mode power supply. | [05] |

13
Sem IV CBGS, Dec 18, M & P
(E.T.C.)

Q.P.Code: 24738

(3 Hours)

Max Marks: 80

CL

- Note:
1. Question No. 1 is compulsory.
 2. Out of remaining questions, attempt any three questions.
 3. Assume suitable additional data if required.
 4. Figures in brackets on the right hand side indicate full marks.

1. (A) Explain interrupt pins of 8085. (05)
(B) Explain string addressing mode of 8086 (05)
(C) Explain memory segmentation of 8086. (05)
(D) Write control word of 8255 to initialize port A as input port, port B and C as output port, Group A and B in mode 0. (05)
2. (A) Draw and explain timing diagram for read operation of 8086 in minimum mode. (10)
(B) Write a program to set up 8253 as square wave generator with 1 ms period if input frequency of 8253 is 1 MHz. (10)
3. (A) Draw and explain interfacing of ADC 0808 with 8086 microprocessor using 8255. (10)
(B) Explain 8086 interrupt structure. (10)
4. (A) Describe in brief architecture of 80286 microprocessor (10)
(B) Explain Modes of 8254 Timer/Counter peripheral IC with the help of timing diagram. (10)
5. (A) Draw and Explain interfacing of Math co-processor with 8086. (10)
(B) Explain interfacing of 8086-8259 (10)
6. (A) Explain interfacing of 8086 with 8257 DMA controller. (10)
(B) Explain how 64 KB EPROM can be interfaced with 8086 that operates at frequency of 10 MHz using 8 KB device. (10)

Semester Exam in CBCRS, Dec 18

Q.P.Code: 39182

(3 Hours)

Total Marks : 80

KC

N.B. (1) Question No. 1 is compulsory.**(2) Attempt any three questions out of remaining five.****(3) Figures to the right indicate full marks.****(4) Assume suitable data if required and mention the same in answer sheet****1. Solve any four**

- Modulation Index for AM should be less than one. Justify/Contradict. **20**
- What is aliasing? How it can be prevented?
- Why AGC is required in radio receivers?
- Justify, why FM is more immune to noise?
- Define noise figure and noise factor.

2. (a) State and prove sampling theorem for low pass bandlimited signals. 10

(b) One input to AM modulation is 800 KHz carries with an amplitude of 10 Vp. The second input is 10KHz modulating signal that is of sufficient amplitude to cause a change in o/p wave of $\pm 5.5V_p$. Determine. 10

- Upper and lower side frequency
- Modulation co-efficient and percent modulation
- Draw o/p frequency spectrum
- Draw modulated wave showing maxima and minima of waveforms

3. (a) Explain the operation of Foster seeley discriminator with the help of circuit diagram and phasor diagram. 10

(b) Explain the working of stabilized reactance modulator with suitable diagram. 10

4. (a) With help of neat diagram and waveforms explain generation and demodulation of PWM. 10

(b) Explain phase shift method for suppression of unwanted carrier with neat block diagram. 10

5. (a) Explain the following with reference to AM receiver

- (i) Double spotting
- (ii) Three point tracking
- (iii) Image frequency rejection ratio
- (iv) Fidelity

(b) Explain Indirect FM transmitter with suitable diagram.

6. Write short note on (any four)

- (a) Vestigial side band transmission (VSB) and its application.
- (b) μ -law and A-law companding
- (c) Frequency division Multiplexing (FDM)
- (d) Amplitude limiting and thresholding
- (e) Pre emphasis and de-emphasis circuits and its need

Sem IV Exp. CBWS, - Dec-18

Q.P. Code :11967

LC

[Time: 3 Hours]

[Marks:80]

Please check whether you have got the right question paper.

- N.B:**
1. Question No.1 is compulsory.
 2. Attempt any three questions out of remaining five.
 3. Assume suitable data if required.

Q.1 Answer the following

20

a) Determine whether the following signals are energy signals or power signals and calculate their energy or power.

(1) $x(t) = e^{-2t} u(t)$

(2) $x[n] = (\frac{1}{2})^n u[n]$

b) Determine if following system is memoryless, casual, linear, time invariant.
 $y(t)=10 x (t) + 5$

c) Determine Fourier transform of $x(t)$ using time shifting property
 $x(t) = e^{-3|t-t_0|} + e^{3|t+t_0|}$

d) Find out even and odd components of the following signals:

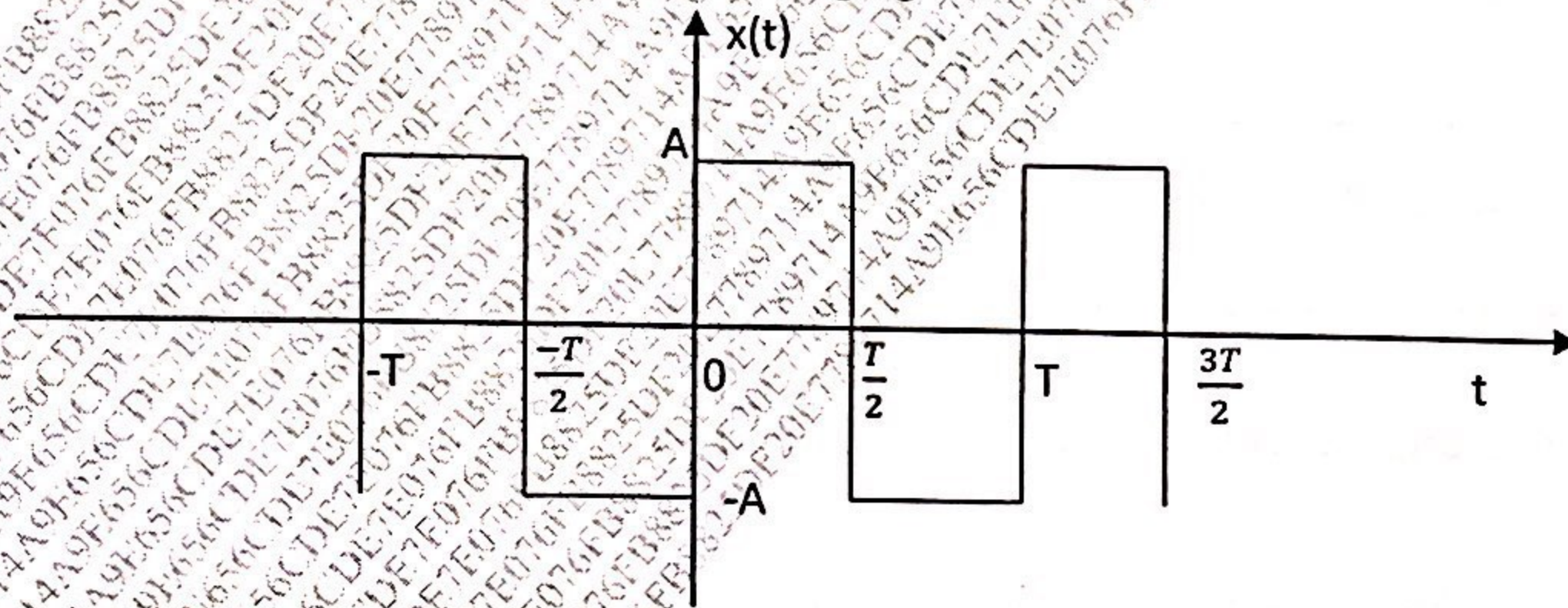
(i) $x[n] = u[n] - u[n-5]$

(ii) $x(t) = 3+2t+5t^2$

e) Determine relation between continuous time Fourier Transform and Laplace Transform.

Q.2 a) Determine Fourier Series representation of the following signal:

10



Q.2 b) Find impulse response of continuous time systems governed by following transfer function.

10

(i) $H(s) = \frac{1}{s^2(s-2)}$

(ii) $H(s) = \frac{1}{s(s+1)(s-2)}$

Q.3 a) A continuous time signals is defined as,

10

$x(t) = t; 0 \leq t \leq 3$

$x(t) = 0; t > 3$

Sketch waveforms of following signals:

- (i) $x(-t)$ (ii) $x(2-t)$ (iii) $x(3t)$ (iv) $x(0.5t+1)$

Q.3 b) Determine inverse z-transform of the following function:

$$X[Z] = \log(1+az^{-1}); |z| > |a|$$

05

Q.3 c) Compute DTFT of sequence $x[n] = \{0, 1, 2, 3\}$. Also Sketch magnitude and phase spectrum.

05

Q.4 a) Using Laplace Transform determine complete response of system described by following equation.

10

$$\frac{d^2y(t)}{dt^2} + 5 \frac{dy(t)}{dt} + 4y(t) = \frac{dx(t)}{dt} \text{ where } y(0) = 0; \left. \frac{dy(t)}{dt} \right|_{t=0} = 1, \text{ for input } x(t) = e^{-2t} u(t)$$

Q.4 b) Find impulse response of system described by following difference equation

10

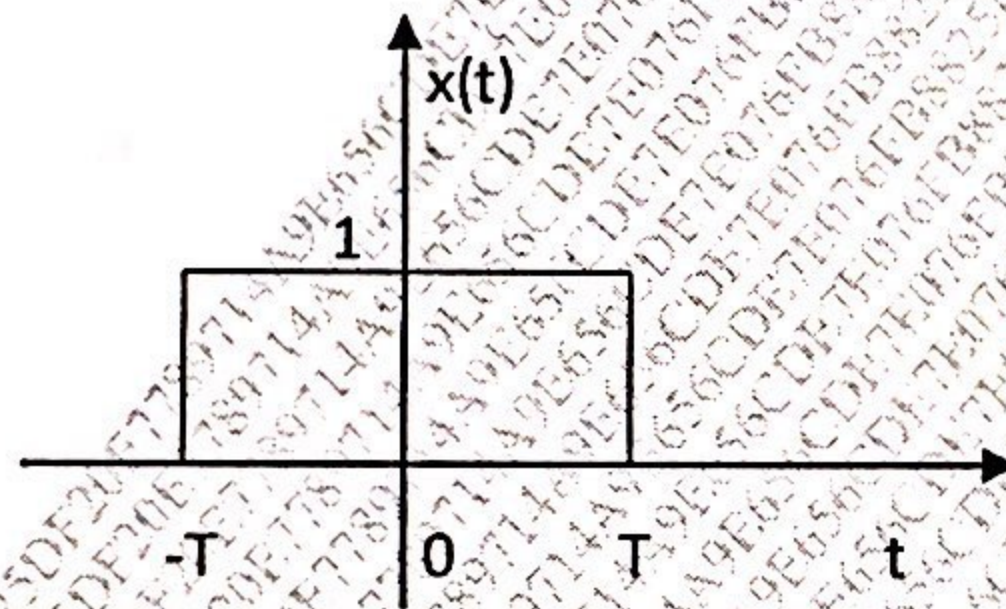
$$y[n] - 3y[n-1] - 4y[n-2] = x[n] + 2x[n-1] \text{ where all initial conditions are zero.}$$

Q.5 a) For the following continuous time signals, determine Fourier Transform.

10

(i) $x(t) = e^{-at} \sin \omega_0 t u(t)$

(ii)



Q.5 b) Determine Fourier series representation of $x[n] = 4 \cos \left[\frac{\pi n}{2} \right]$

05

Q.5 c) Determine cross correlation of sequence $x[n] = \{1, 1, 2, 2\}$ and $y[n] = \{1, 3, 1\}$

05

Q.6 a) The input signal $x(t)$ and impulse response $h(t)$ of a continuous-time system are described as follows

10

$$x(t) = e^{-3t} u(t) \text{ and } h(t) = u(t-1). \text{ Find output of system using convolution integral.}$$

b) Determine Z Transform and ROC of

(i) $x[n] = a^n u[n-1]$

05

(ii) $x[n] = a^n \cos \omega_0 n u[n]$

05

3 Hours**Total marks: 80**

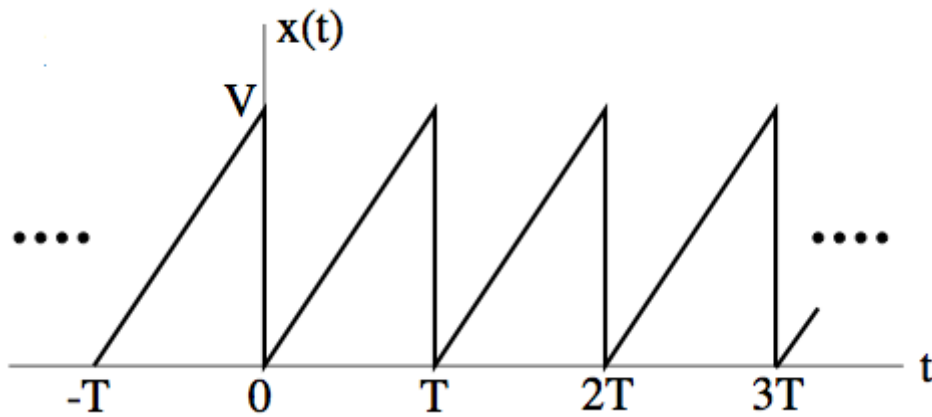
- **Question no. 1 is compulsory**
- **Attempt any Three questions from remaining**

- Q1. Answer any 4 questions from the given questions: 20
- Find even and odd part of following continuous time signals
 - $X(t) = 3 + 2t + 5t^2$.
 - $x_2(t) = \sin 2t + \cos t + \sin t \cos 2t$
 - Determine energy and power of the unit step signal
 - Explain the application of Signals and System in Multimedia Processing.
 - Construct the block diagram of discrete time systems whose input output relations are described by following difference equations
 - $Y_1(n) = 0.5x(n) + 0.5x(n-1)$
 - $Y_2(n) = 0.25y_1(n-1) + 0.5x(n) + 0.75x(n-1)$
 - Test the given system for linearity, causality, stability, memory and time variant.

$$y(t) = x(t^2)$$
 - Give advantages of state space analysis for system analysis
- Q2. Perform convolution of $x_1(t) = e^{-3t}u(t)$ and $x_2(t) = tu(t)$ using mathematical method and also by graphical method. 20
- Q3.a. Determine the sequence $x[n]$ associated with Z-Transform 10
- $$X(z) = \frac{1}{1 - 1.5z^{-1} + 0.5z^{-2}}$$
- Find the impulse response $h(n)$ of the system if the spectrum is given by 10
- $$H(e^{j\omega}) = \frac{1}{3} (1 + \cos \omega)$$
- Q4.a. Explain the procedure to obtain transfer function of system from state model of the system. 10

b. Find exponential Fourier series for $x(t)$

10



Q5.a Determine Fourier transform of gate function given by $x(t) = A$ for $|t| \leq \frac{T}{2}$ 8

b. Find Laplace transform of $x(t) = u(t) - u(t - a)$. 4

c. Find Initial and final value using Laplace transform 8

$$X(s) = \frac{7s + 6}{s(3s + 5)}$$

Q6. Write short note on **any two**: 20

a. Relation of ESD, PSD with auto-correlation

b. ROC in Z-Transform and Laplace Transform

c. Feedforward Control system

NOTE :

1. Question No.1. is **compulsory**. Attempt any **four** out of **five** in it.
2. Attempt any **three** out of remaining **five**.
3. Assume suitable data, wherever **necessary** and **justify** the same.
4. Figures to the right indicate marks.

1. A) Compare MOM, FEM and FDM. (5)
 B) Given the potential $V = 2x^2y - 5z$ (V) and a point P (-4, 3, 6), find (2+2+1)
 a) Electric field intensity at P
 b) Electric flux density at P
 c) Volume charge density at P
 C) State the Maxwell's equations for good dielectric in integral and point form. (5)
 Also state their significance.
 D) With the help of neat schematic diagram, explain the working of an (5)
 Electromagnetic Pump.
 E) Explain Super refraction. (5)
2. A) Two extensive homogeneous isotropic dielectrics meet on plane $z = 0$. (5+5)
 For $z > 0$, $\epsilon_{r1} = 4$ and for $z < 0$, $\epsilon_{r2} = 3$.
 A uniform electric field $\vec{E}_1 = 5\hat{a}_x - 2\hat{a}_y + 3\hat{a}_z$ (kV/m) exists for $z \geq 0$. Find,
 a) \vec{E}_2 for $z \leq 0$.
 b) The angles E_1 and E_2 make with the interface.
 B) State Poynting theorem. Derive its final expression and explain the meaning of (2+5+3)
 each term.
3. A) What is ionosphere? Describe its various layers. Which layers are present (10)
 during day and night time? Where maximum attenuation of electromagnetic
 waves takes place inside the ionosphere?
 B) State and derive FRISS transmission equation. (10)
4. A) Determine the potential at the free nodes in the potential system of Fig.1. using (10)
 Finite Difference Method (Band Matrix Method).

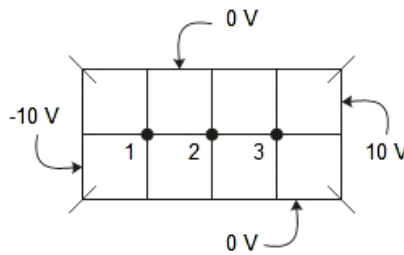


Fig.1.

- B) Derive Helmholtz equations for Magnetic field in free space. (5)
- C) For the normal incidence, determine the amplitudes of reflected and transmitted (5)
 \vec{E} and \vec{H} at interface of two regions at $z = 0$.
 Given: Incident $E_i = 1.5 \times 10^{-3}$ (V/m); $\epsilon_{r1} = 8.5$; $\mu_{r1} = 1$; $\sigma_1 = 0$.
 Second region is free space.

5. A) Explain formation of duct and condition for duct propagation. (10)
 B) Obtain an expression for MUF in terms of d , H and f_c . (5+5)
 If a high frequency communication link is to be established between two points on the Earth 2000 km away, and the reflection region of ionosphere is at height of 200 km and has critical frequency of 5 MHz, then calculate the MUF for the given path.

6. A) Explain the formation of inversion layer in troposphere. (5)
 B) Define critical frequency as a measure of ionospheric propagation and determine critical frequency for reflection at vertical incidence if the maximum value of electron density is 1.24×10^6 per CC. (2+3)
 C) Consider a two element mesh as shown in Fig.2. Using FEM determine the potentials at free nodes. (10)

Node	(x, y)
1	(0.8, 1.8)
2	(1.4, 1.4)
3	(2.1, 2.1)
4	(1.2, 2.7)

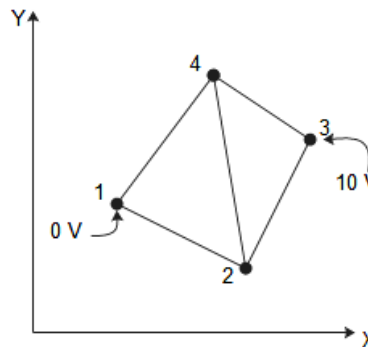


Fig.2.