EXTC | CBSGS | sem IV | AE-II | 19/11/2018

Paper / Subject Code: 39201 / ANALOG ELECTRONICS - II

QP CODE : 22625

(3 Hours) **Marks: 80**

(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.

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 =500MHz at I_C = 1mA, β = 100 and Cμ = 0.3pF. Calculate bandwidth of $f_β$ and capacitance Cπ of a BJT.

(c) Implement Vo = - ($3V_1 + 4V_2 + 2V_3$) 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 = 6.2V. The input voltage varies from 10 V to 15 V and load current is 60 mA. To hold output voltage constant under all conditions what should be the range of series resistance (R_{Smin} and R_{Smax}) (I_{Zmin} = 10 mA, P_{Zmax} = 2W).

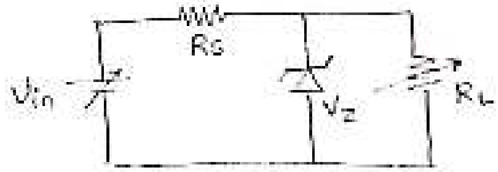

Fig. 1f

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

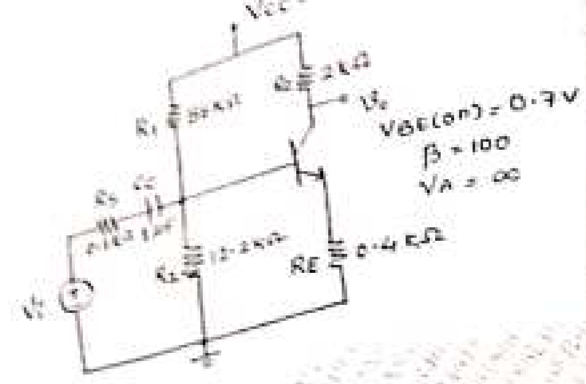

Fig. 2a

(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?

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.

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

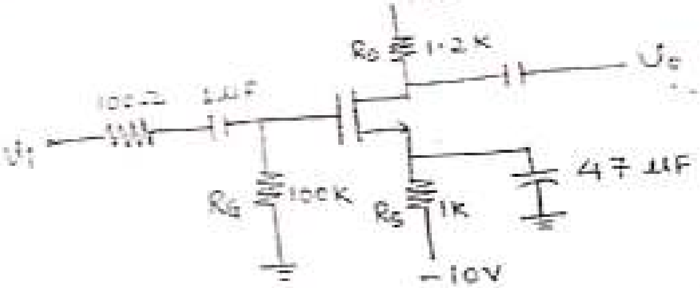

Fig. 3b

Q.4 (a) For the MOSFET differential amplifier shown in **Fig. 4a**, the transistor parameters are $K_{n1} = K_{n2} = 0.1 mA/V^2$, $K_{n3} = K_{n4} = 0.3 mA/V^2$, $V_{TN} = 1V$ for all transistors, $\lambda = 0$ for M_1, M_2 and M_3, $\lambda = 0.01 V^{-1}$ 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.

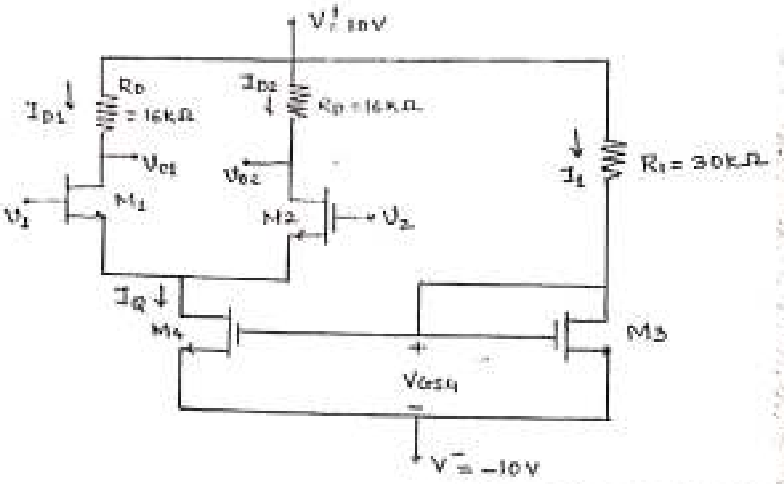

Fig. 4a

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

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 : $V^+ = 10V$, $V^- = 0V$ 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}. 10

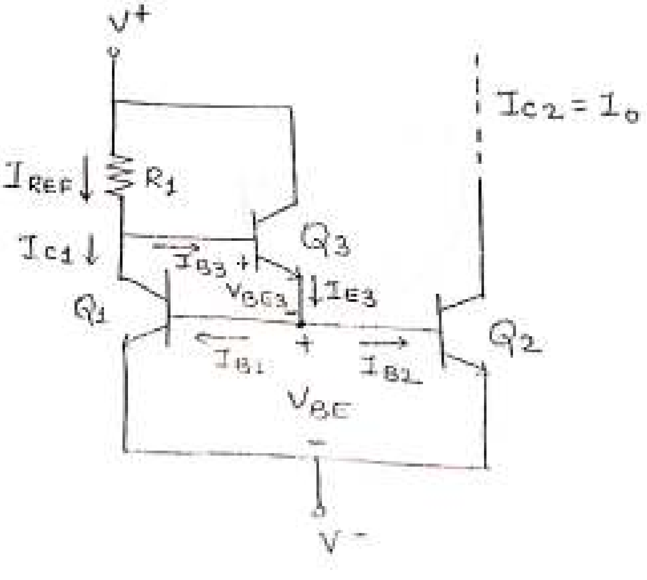

Fig. 5b

Q.6 Write short notes on any **four** of the following :-

(a) Millers Theorem.

(b) Active Filters.

(c) Transistorized series regulator

(d) Wilson current source.

(e) Power MOSFET.

EXTC / CBCGS / sem IV / AM-IV / 15/11/2018

Paper / Subject Code: 40801 / Applied Mathematics-IV

(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) if $A=\begin{pmatrix}2&4\\0&3\end{pmatrix}$, then find the eigen values of $6A^{-1}+A^{3}+2I$. (5)

(b) Find a vector orthogonal to both $u=(-6,4,2), v=(3,1,5)$. (5)

(c) Show that $\oint_C \log z\,dz=2\pi i$, Where C is the unit circle in the Z-plane. (5)

(d) Let X be continuous random variable with probability distribution

$$p(X=x)=\begin{cases}\dfrac{x}{6}+k, & \text{if } 0\le x\le 3\\ 0 & , \text{elsewhere}\end{cases}$$

Evaluate k and find $p(1\le x\le 2)$. (5)

2. (a) Show that the matrix A is diagonalizable. Also find the transforming matrix M and the diagonal matrix D where $A=\begin{bmatrix}-9&4&4\\-8&3&4\\-16&8&7\end{bmatrix}$. (6)

(b) Find the extremals of the function $\int_0^{\frac{\pi}{2}}\left((y')^2-y^2+2xy\right)dx$ with $y(0)=0, y\left(\frac{\pi}{2}\right)=0$. (6)

(c) Let R^4 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 $u_1=(1,0,1,1)$, $u_2=(-1,0,-1,1)$, $u_3=(0,-1,1,1)$. (8)

3. (a) The number of accidents in a year attributed to taxi driver in a city follows poisson distribution with mean 3. Out of 1,000 taxi drivers, find approximately the number of drivers with (i) No accident in a year (ii) more than 3 accident in a year. (*Given* $e^{-1}=0.3679, e^{-2}=0.1353, e^{-3}=0.0498$) (6)

(b) Calculate Rank Correlation co-efficient for the following data: (6)

X:	10	12	18	18	15	40
Y:	12	18	25	25	50	25

(c) Expand $f(z)=\frac{1}{z^2(z-1)(z+2)}$ about $z=0$ for

(i) $|z|\le 1$ (ii) $1\le|z|\le 2$ (iii) $|z|>2$. (8)

4.(a) Evaluate $\oint_C \frac{\sin^6 z}{\left(z-\frac{\pi}{6}\right)^3}dz$, where C is the circle $|z|=1$. (6)

(b) Find the m.g.f. of a random variable whose probability density function is

$$p(X=x)=\begin{cases}\left(\frac{1}{2}\right)^x, & x=1,2,3\ldots\ldots\\ 0 & , elsewhere\end{cases}$$

Hence, find the mean and variance. (6)

(c) Verify the Cayley-Hamilton Theorem for matrix A and hence find A^{-1} for:
$A=\begin{pmatrix}1 & 4\\ 2 & 3\end{pmatrix}$. Hence, find $A^5-4A^4-7A^3+11A^2-A-10I$ in terms of A. (8)

5.(a) Express $p(x)=7+8x+9x^2$ as a linear combination of $p_1(x)=2+x+4x^2$, $p_2(x)=1-x+3x^2$, $p_3(x)=2+x+5x^2$. (6)

(b) Using Cauchy residue theorem, evaluate $\int_0^{2\pi}\frac{\cos 2\theta}{5+4\cos\theta}d\theta$ (6)

(c) In an examination marks obtained by students in mathematics, physics and chemistry are normally distributed with mean 51, 53, 46 and with standard deviation 15, 12, 16 respectively, find the probability of securing total marks (i) 180 or above (ii) 90 or below. (8)

6. (a) If $A=\begin{bmatrix}1 & 0 & 0\\ 1 & 0 & 1\\ 0 & 1 & 0\end{bmatrix}$, Find A^{50}. (6)

(b) Using Cauchy residue theorem, evaluate $\oint_C \frac{e^z}{\left(z^2+\pi^2\right)^2}dz$, where C is the circle $|z|=4$ (6)

(c) Using Rayleigh-Ritz method, solve the boundary value problem
$I=\int_0^1\left(xy+\frac{1}{2}y'^2\right)dx$; $0\le x\le 1$, given $y(0)=y(1)=0$ where $\bar{y}(x)=c_0+c_1x+c_2x^2$. (8)

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Comp / CBSGS | sem IV | AM - IV | 19/11/2018

Paper / Subject Code: 38901 / APPLIED MATHEMATICS - IV

Q. P. Code: 37067

Total Marks:80

(3 hours)

N.B:

1. Question No .1 is compulsory.
2. Answer any three questions from Q. 2 to Q. 6
3. Use of statistical tables permitted.
4. Figures to the right indicate full marks.

1) (a) A continous random variable x has the pdf $f(x) = kx^2e^{-x}$ where $x \geq 0$. Find k ,its mean and variance. 5

(b)State true or false with reasoning: 2x+y=3 and x=2y+3 cannot be the lines of regression. 5

(c)Find the relative maximum or minimum of the function $z=x_1^2+x_2^2+x_3^2-6x_1-8x_2-10x_3$. 5

(d)Find the eigen values of adj.A and A^2-2A+I where $A=\begin{bmatrix}2 & 3 & 4\\ 0 & 4 & 2\\ 0 & 0 & 3\end{bmatrix}$. 5

2) (a) Obtain the rank correlation coefficient from the following data. 6

X:	10	12	18	18	15	40
Y:	12	18	25	25	50	25

(b) The marks obtained by the students in Maths ,Physics & Chemistry in an examination are normally distributed with the means 52,50 & 48 and with standard deviations 10 ,8 & 6 respectively. Find the probability that a student selected at random has secured a total of i) 180 or above ii) 135 or less. 6

(c) Is the matrix $A=\begin{bmatrix}8 & -6 & 2\\ -6 & 7 & -4\\ 2 & -4 & 3\end{bmatrix}$ diagonalisable? If so, find the diagonal form and the transformation matrix. 8

3) (a) If $A=\begin{bmatrix}1 & 0 & 0\\ 1 & 0 & 1\\ 0 & 1 & 0\end{bmatrix}$,find A^{50}. 6

(b) A die was thrown 132 times and the following frequencies were observed 6

No: obtained :	1	2	3	4	5	6
Frequencies :	15	20	25	15	29	28

Test the hypothesis that the die is unbiased.

(c) Use duality to solve the following linear programming problem. 8

Minimise $Z = 4x_1+3x_2+6x_3$ subject to

$x_1+x_3 \geq 2$,

$x_2+x_3 \geq 5$, $x_1,x_2,x_3 \geq 0$.

Q. P. Code: 3

4) (a)A sample of 100 students is taken from a large population. The mean height of the students in this sample is 160 cm. Can it be reasonably regarded that, in the population, the mean height is 165cm and the SD is 10cm?

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

(c) Evaluate $\int_0^{2\pi} \frac{1}{3+2\cos\theta} d\theta$.

5 .(a) Evaluate $\int \frac{1}{z^3(z+4)} dz$ where C is the circle $|z|=2$.

(b) show that the matrix $A=\begin{bmatrix} 5 & -6 & -6 \\ -1 & 4 & 2 \\ 3 & -6 & -4 \end{bmatrix}$ is derogatory.

(c) Samples of 2 types of electric bulbs were tested for length of life and the following data were obtained

	Size	Mean	SD
Sample 1	8	1234h	36h
Sample 2	7	1036h	40h

Is the difference in the means sufficient to warrant that type 1 bulbs are superior to type 2 bulbs?

6 (a). Using the Big-M penalty method ,solve the following L.P.P

Minimise $Z=10x_1+3x_2$

subject to $x_1+2x_2\geq 3$

$x_1+4x_2\geq 4$ $x_1 , x_2\geq 0$.

(b)Use the Kuhn-Tucker conditions to solve the following N.L.P.P

Maximise $Z=2x_1^2 - 7x_2^2 + 12x_1x_2$

Subject to $2x_1 +5x_2\leq 98$ $x_1 ,x_2\geq 0$

(c)Obtain Taylor's and Laurent's expansion for $f(z)=\frac{z-1}{(z-3)(z+1)}$ indicating the regions of convergence.

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EXTC / CBSGS / IV / AM - IV / 27/11/2018

e: 37

Paper / Subject Code: 39202 / APPLIED MATHEMATICS - IV

Q. P. Code: 24492

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 $\int_{x_1}^{x_2} \left(y^2 - y'^2 - 2ye^x\right) dx$ (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 $\begin{bmatrix} 1 & 2 \\ 2 & 1 \end{bmatrix}$ (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^2 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 $|z|=2$.

b) Find the linear transformation Y=AX which carries $X_1 = (1,0,1)', X_2 = (1,-1,1)', X_3 = (1,1,$

onto $Y_1 = (2,3,-1)', Y_2 = (3,0,-2)', Y_3 = (-2,7,1)'$

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

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

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

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 $w_1 \in W$ & $w_2 \in W^{\perp}$

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

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

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EXTC / CBCGS | IV | EDC-II | 27/11/18

Paper / Subject Code: 40802 / Electronics Devices and Circuits-II

(Time: 3 Hours) **[Total Marks: 80]**

(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.

(a) Draw a neat labelled diagram of Enhancement Type MOSFET and explain its operation. **20**
(b) Explain RC Coupled Amplifier.
(c) What is a Oscillator? Explain Basic Principle of an Oscillator.
(d) Differentiate Class A, Class B and Class C Power Amplifiers.

(a) Design a two stage RC coupled CS – CE Amplifier to meet following specifications: **15**
$A_v \geq 500,\ S \leq 8,\ R_i \geq 1\ M\Omega,\ V_{cc} = 6\ V.$
Assume the following data: $\beta_{typ} = 290,\ h_{ie} = 4.5k\Omega,\ g_{mo} = 5000\mu℧,\ I_{DSS} = 7mA,$
$r_d = 50k\Omega,\ V_P = -4V.$

(b) For a 'n' stage cascaded amplifier, show that overall lower 3 dB cut – off frequency is **05**
$f_{LT} = \frac{f_L}{\sqrt{2^{1/n}-1}}$

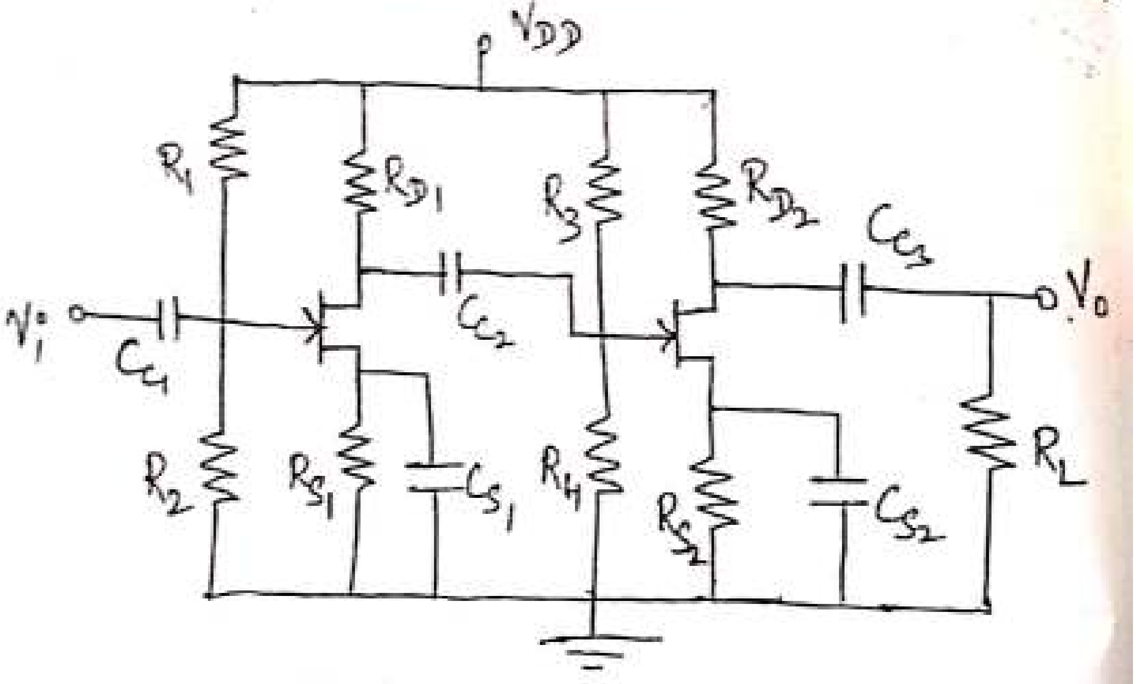
(a) With the help of neat block diagram, derive expression for R_{IF}, R_{OF}, G_{mF} for Voltage Series Negative Feedback Amplifier. Give significance of the above mentioned parameters. **10**

(b) Write Short Note on: Darlington Pair Amplifier. **10**

(a) Find the necessary condition for oscillations to occur and frequency of oscillations of Colpitts Oscillator. Also, explain its working. **10**

(b) Draw a neat diagram of Direct Coupled Class A Amplifier and explain its working. Hence, find its efficiency. **10**

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



(b) Draw circuit diagram of Cascode Amplifier and explain in detail.

6. (a) State and Explain different types of Biasing techniques for Depletion Type MOSFET.

(b) Explain the concept of Heat Sink in detail required for Power Amplifiers. A Silicon Power Transistor is operated with a heat sink with Q_{SA} = 1.2° C/W. The transistor is rated for 120 W at 25° C and has Q_{JC} = 0.5° C/W. The mounting insulation has Q_{CS} = 0.5° C/W. What maximum power can be dissipated if the ambient temperature is 40° C and $T_{J(max)}$ = 200° C

(c) Calculate frequency of Oscillation for Hartley Oscillator if $L_1 = L_2$ = 1mH and C = 0.2 µF.

EXTC | Sem-IV | CBSGS | MPP | 3/12/18

Paper / Subject Code: 39203 / MICROPROCESSORS AND PERIPHERALS

Q.P.Code: 24738

(3 Hours)

Max Marks: 80

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 80386 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 8237 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)

EXTC / CBCGS | Sem-IV | LIC | 3/12/18

Paper / Subject Code: 40803 / Linear Integrated Circuits

(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 µA and let R_1=240 Ω. [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 and across the capacitor *C*. Comment on the duty cycle of output waveform. diode D as an ideal diode and assume R_A is equal to R_B.

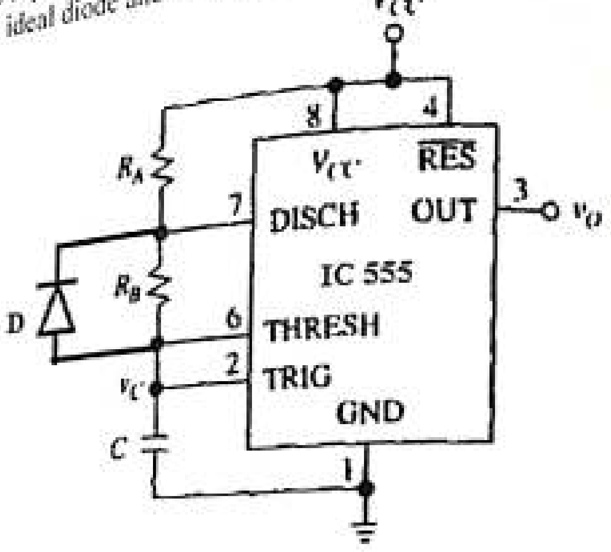


Fig. 5(b)

Q.6 Short notes on: (Attempt any four)

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

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NOTE
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2.
3.
4.

1.
2.
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EXTC/ semIV/ CBSGS/ WTP/ 10/12/18

Paper / Subject Code: 39204 / WAVE THEORY AND PROPAGATION

Q.P. CODE: 36048

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. Also state their significance. **(5)**

D) With the help of neat schematic diagram, explain the working of an Electromagnetic Pump. **(5)**

E) Explain Super refraction. **(5)**

2. A) Two extensive homogeneous isotropic dielectrics meet on plane $z = 0$. **(5+5)**

For $z > 0$, $\varepsilon_{r1} = 4$ and for $z < 0$, $\varepsilon_{r2} = 3$.

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 each term. **(2+5+3)**

3. A) What is ionosphere? Describe its various layers. Which layers are present during day and night time? Where maximum attenuation of electromagnetic waves takes place inside the ionosphere? **(10)**

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 Finite Difference Method (Band Matrix Method). **(10)**

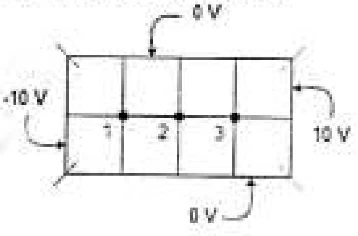


Fig.1.

B) Derive Helmholtz equations for Magnetic field in free space. **(5)**

C) For the normal incidence, determine the amplitudes of reflected and transmitted $\vec{E}$ and $\vec{H}$ at interface of two regions at $z = 0$. **(5)**

Given: Incident $E_i = 1.5 \times 10^{-3}$ (V/m); $\varepsilon_{r1} = 8.5$; $\mu_{r1} = 1$; $\sigma_1 = 0$.
Second region is free space.

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

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

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

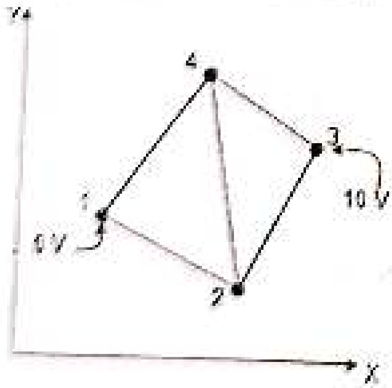


Fig.2.

EXTC / sem IV / CBCGS / S&S / 10/12/18

Paper / Subject Code: 40804 / Signals & Systems

Total marks: 80

Hours

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

Answer any 4 questions from the given questions: 20

Find even and odd part of following continuous time signals

i) $X(t) = 3 + 2t + 5t^2$, ii) $x_2(t) = \sin 2t + \cos t + \sin t \cos 2t$

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

i. $Y_1(n) = 0.5x(n) + 0.5x(n-1)$
ii. $Y_2(n) = 0.25y_2(n-1) + 0.5x(n) + 0.75x(n-1)$

e. Test the given system for linearity, causality, stability, memory and time variant.

$$y(t) = x(t^2)$$

f. Give advantages of state space analysis for system analysis

2. Perform convolution of $x_1(t) = e^{-2t}u(t)$ and $x_2(t) = tu(t)$ using mathematical method and also by graphical method. 20

a. Determine the sequence x[n] associated with Z-Transform 10

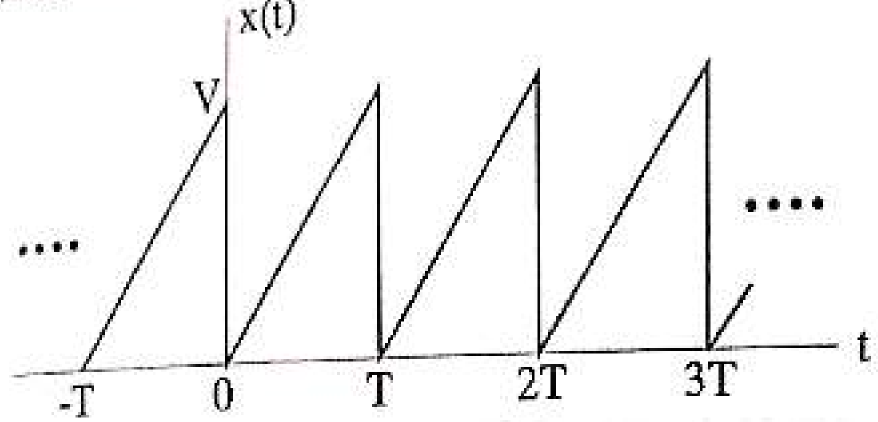
$$X(z) = \frac{1}{1-1.5z^{-1}+0.5z^{-2}}$$

b. Find the impulse response h(n) of the system if the spectrum is given by 10

$$H(e^{jw}) = \frac{1}{3}(1 + \cos w).$$

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)



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

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

c. Find Initial and final value using Laplace transform

$$X(s) = {}^{7s+6}/_{s(3s+5)}$$

Q6. Write short note on any two:

a. Relation of ESD, PSD with auto-correlation

b. ROC in Z-Transform and Laplace Transform

c. Feedforward Control system

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EXTC/semIV/CBSGS/S&S/

Paper / Subject Code: 39205 / SIGNALS AND SYSTEMS

Q.P. Code :11967

[Marks:80]

[Time: 3 Hours]

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.

20

Answer the following

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

Determine if following system is memoryless, casual, linear, time invariant.

$y(t)=10\,x(t)+5$

Determine Fourier transform of x(t) using time shifting property

$x(t) = e^{-3|t-t_0|} + e^{3|t+t_0|}$

Find out even and odd components of the following signals:

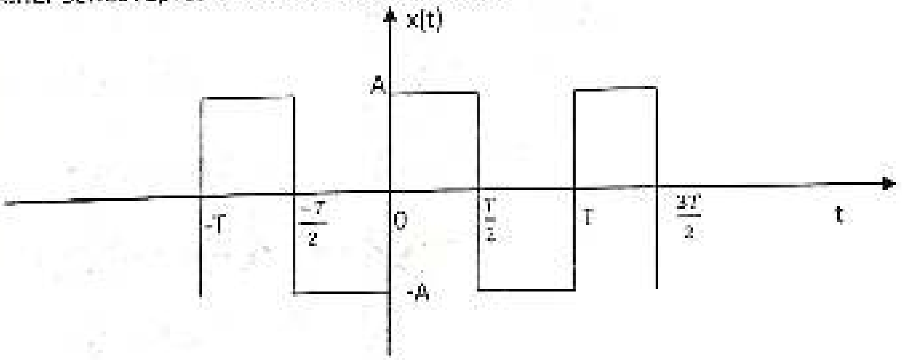
(i) $x[n] = u[n] - u[n-5]$

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

Determine relation between continuous time Fourier Transform and Laplace Transform.

10

Determine Fourier Series representation of the following signal:



Find impulse response of continuous time systems governed by following transfer function. 10

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

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

A continuous time signals is defined as, 10

$x(t) = t; \quad 0 \le t \ge 3$

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

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:

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

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

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

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

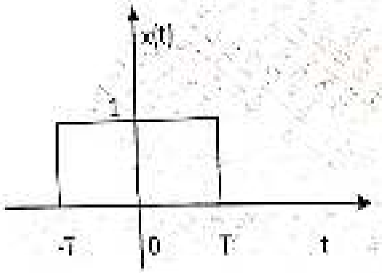
Q.4 b) Find impulse response of system described by following difference equation

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

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

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

(ii)



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

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

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

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

b) Determine Z Transform and ROC of

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

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

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Paper / Subject Code: 89206 / CONTROL SYSTEMS

Ex. Sem VI / CBSGS / CS / ... Q.P. Code: 27187

[Time: Three Hours] [Marks:80]

N.B.: (1) Question No.1 is compulsory.
(2) Attempt any three out of remaining questions.
(3) Assume suitable data wherever required.

Q.1. Attempt the following (20)

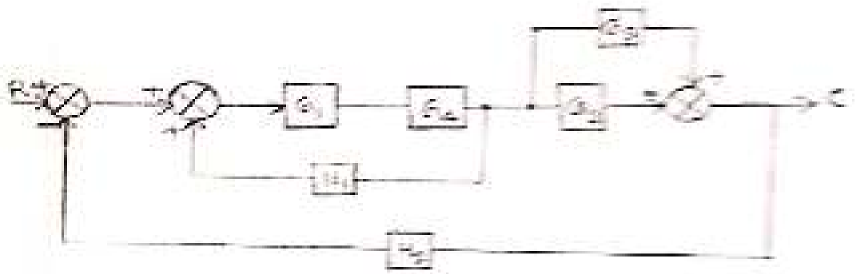
a) Differentiate between Open Loop and Closed Loop Control System.

b) Define the terms (i) Zero input response (ii) Zero state response.

c) Define Absolute, Relative and Robust Stability of the System.

d) What are the drawbacks of transfer function model?

Q.2 a. Find the transfer function C(S)/R(S) of the system Shown in the figure below. (10)



b. Sketch the root locus for the below given System. (10)

$$G(S)H(S) = \frac{K}{s(s+3)(s+5)}$$

Q.3 a. Obtain the State Variable model of the transfer function given below. (10)

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

b. Explain Controllability and Observability analysis of LTI System using Suitable example. (10)

Q.4 a. Use the Routh Stability Criteria to determine the range of 'K' for stability of unity feedback system whose Open Loop transfer function is given below. (10)

$$G(s) = \frac{K}{s(s+1)(s+2)}$$

[TURN OVER]

b. If

$$G(s)H(s) = \frac{K(s+1)}{s^2(s+2)(s+4)}$$

Using Polar Plot determine the range of 'K' for stability. Verify [illegible] Rouths Criteria.

Q.5 a. Draw the Bode diagram for the transfer function

$$G(s) = \frac{64(s+2)}{s(s+0.5)(s^2+3.2s+64)}$$

Determine G_m, P_m, W_{gc} and W_{pc}. Comment on the Stability.

b. For the given transfer function find Tp, % MP, Ts, and Tr.

$$G(s) = \frac{100}{(s^2+15s+100)}$$

Q.6 a. Explain the concept of Neuro-Fuzzy adaptive control system. Explain [illegible] method of adaptive control.

b. Derive the expression for solution of homogeneous equation.

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