DECEMBER- 2019

EXAMINATION TIME TABLE

PROGRAMME -S.E. (Electronics & Telecommunication)
(REV. -2012)(CBSGS)

SEMESTER – IV

Days and Dates	Time	Paper Code	Paper
Wednesday, December 04, 2019	02:30 p.m. to 05:30 p.m.	39201	ANALOG ELECTRONICS - II
Monday, December 09, 2019	02:30 p.m. to 05:30 p.m.	39202	APPLIED MATHEMATICS - IV
Wednesday, December 11, 2019	02:30 p.m. to 05:30 p.m.	39203	MICROPROCESSORES AND PERIPHERALS
Friday, December 13, 2019	02:30 p.m. to 05:30 p.m.	39204	WAVE THEORY AND PROPAGATION
Tuesday, December 17, 2019	02:30 p.m. to 05:30 p.m.	39205	SIGNALS AND SYSTEMS
Thursday, December 19, 2019	02:30 p.m. to 05:30 p.m.	39206	CONTROL SYSTEMS

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(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 5 questions [20]

a) What is the major limitation of class B power amplifier and how to overcome the same?
b) Compare series and shunt voltage regulators.
c) Draw high frequency hybrid pi equivalent circuit of FET and define various components in the model.
d) Draw the circuit diagram of Widlar current source and derive the relationship between output current and reference current.
e) Compare ideal and practical OP-AMP.
f) Define differential and common mode gain and differential and common mode input impedance of the differential amplifier.

Q.2 a) Determine the corner frequency and maximum gain of MOSFET amplifier. For the circuit shown in fig 2a) the parameters are Rs=3.2KΩ, R_D=10KΩ, R_L=20KΩ and C_L=10pF. The transistor parameters are V_{TP}=-2V, Kp=0.25mA/V^2 and λ=0 Consider I_{DQ}=0.5mA and V_{SGQ}=3.41V [10]

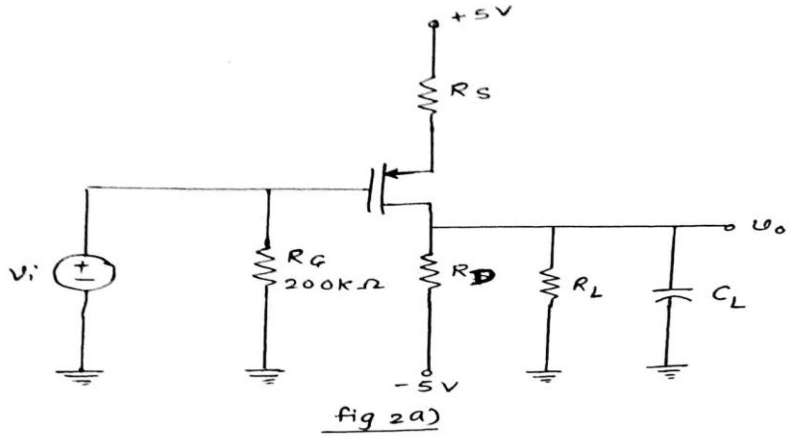

Fig.2a

b) Determine unity gain bandwidth of N channel MOSFET with parameters Kn= 0.25mA/V^2 , V_{TN} =1V, λ=0, Cgd=0.04pF and Cgs=0.2pF. Assume the transistor is biased at V_{GS} =3V. Calculate Miller capacitance and 3dB frequency of the circuit when 10KΩ load is connected to the output. [10]

Q.3 a) Draw circuit diagram of two stage common emitter amplifier (CE-CE) and derive overall voltage gain, current gain, input resistance and output resistance using hybrid pi equivalent circuit. [10]

b) Draw the circuit diagram of MOSFET based differential amplifier and derive expression for differential voltage gain, common mode gain and CMRR. [10]

Q.4 a) 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]

b) Draw the circuit diagram of Darlington pair amplifier using BJT and derive the expression for Av, Ai, Zi and Zo [10]

Q.5 a) Draw and explain the working of class B power amplifier. Explain its working with the help of waveforms and derive expression for power conversion efficiency. [10]

b) Draw circuit diagram of Adder using OP-AMP and derive expression for its output voltage. [10]

Q.6 Short notes on: (Attempt any four) [20]

a) Wilson Current sources
b) Power MOSFET
c) Cascode Amplifier
d) Differentiator using Op-AMP
e) Class C power Amplifier

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(3 Hours) **(Total Marks : 80)**

N.B.: 1) **Question No. 1** is **Compulsory**.
2) Attempt **any three** from the **remaining**.

1. a) Find the extremal of $\int_{x_0}^{x_1} \frac{1+y^2}{y'^2} dx$. **(05)**

b) Is the following set of vectors in P_2 linearly independent? $2 - x + 4x^2$, $3 + 6x + 2x^2$, $2 + 10x - 4x^2$? **(05)**

c) Show that Eigen values of Hermitian matrix are real. **(05)**

d) Evaluate $\int (z^2 - 2\bar{z} + 1)\, dz$ over a closed circle $x^2 + y^2 = 2$. **(05)**

2. a) Find the extremal $\int_0^{\pi} (y^2 - y'^2 - 2y\cos x) dx$, $y(0) = 0$, $y(\pi/2) = 0$. **(06)**

b) Find the Eigen Values and Eigen Vectors of the matrix $A^3 + 3I$, where **(06)**

$$A = \begin{bmatrix} 2 & -2 & 3 \\ 1 & 1 & 1 \\ 1 & 3 & -1 \end{bmatrix}$$

c) Obtain all possible expansion of $f(z) = \frac{z}{(z-1)(z-2)}$ about $z = -2$ indicating region of convergence. **(08)**

3. a) Verify Cayley - Hamilton Theorem for $A = \begin{bmatrix} 1 & -1 & 0 \\ 2 & 3 & -2 \\ -2 & 0 & 1 \end{bmatrix}$ and find A^{-1}. **(06)**

b) Using Cauchy's Residue Theorem evaluate $\int_C \frac{e^z}{z^2 + \pi^2} dz$ where C is |z|=4. **(06)**

c) Show that a closed curve 'C' of a given fixed length (perimeter) which encloses maximum area is a circle. **(08)**

4. a) Find an orthonormal basis for the subspace of R^3 by applying Gram-Schmidt process, where $u_1 = (1,0,1,1), u_2 = (-1,0,1,1), u_3 = (0,-1,1,1)$. **(06)**

b) Find A^{20} for the matrix $A = \begin{bmatrix} 2 & 3 \\ -3 & -4 \end{bmatrix}$. **(06)**

c) Reduce the Quadratic Form $2xy + 2yz + 2zx$ to diagonal form by orthogonal reduction method. **(08)**

5. a) Using Rayleigh-Ritz Method, find an approximate solution to the extremal problem $\int_0^1 (y'^2 - y^2 - 2yx) dx$, $y(0) = 0$, $y(1) = 0$. **(06)**

b) Let V be a vector space containing 2×2 matrices and $W \subseteq V$ such that $W = \begin{bmatrix} a & 0 \\ 0 & b \end{bmatrix}$. Is W a subspace of V? Justify. **(06)**

c) Show that the matrix $A = \begin{bmatrix} 8 & -8 & -2 \\ 4 & -3 & -2 \\ 3 & -4 & 1 \end{bmatrix}$ is diogonable.Also find the transforming matrix and diagonal matrix. **(08)**

6. a) Using Cauchy's Residue Theorem, evaluate $\int_0^{2\pi} \frac{d\theta}{13+5\sin\theta}$. **(06)**

b) Evaluate $\int_{1-i}^{2+i} (2x + 1 + iy) dz$ along the curve $x = t + 1, y = 2t^2 - 1$. **(06)**

c) Find the singular value decomposition of the matrix A= $\begin{bmatrix} 2 & 3 \\ 0 & 2 \end{bmatrix}$ **(08)**

Q.P. CODE: 37022

(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 address pins of 8085. **(04)**

(B) Explain addressing modes of 8086 **(08)**

(C) Explain memory segmentation of 8086. **(08)**

2. **(A)** Draw and explain operation of 8086 in maximum 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 interfacing of 8086 with DMA 8237 **(10)**

4. **(A)** Describe pipeline architecture of 80286 microprocessor **(10)**

(B) Explain programmable interrupt controller 8259 in brief **(10)**

5. **(A)** Draw and Explain interfacing of Math co-processor with 8086. **(10)**

(B) Explain interfacing of 8255 with 8086 microprocessor in minimum mode **(10)**

6. **(A)** Explain how 64 KB EPROM can be interfaced with 8086 that operates at frequency of 10 MHz using 8 KB device. **(10)**

(B) Explain in brief HOLD, HLDA, TRAP, RESET IN, RD, WR, SID, SOD pins of 8085 **(10)**

(3 Hours) **(Total Marks : 80)**

N. B. : 1. Question No. 1 is compulsory.
2. Attempt **any three** out of the remaining **five**.
3. Draw **neat diagrams** wherever **necessary**.
4. Assume **data**, if missing, with **justification**.
5. **Figures** to the **right** indicate **full marks**.

Q1. Attempt ANY FOUR out of the FIVE

(a) What is the importance of Maxwell's equations in Electromagnetism? Name and state the laws that form Maxwell's equations. **[5]**

(b) Explain Coulomb's law in vector form. **[5]**

(c) "Ground Wave propagation supports vertical polarization" Comment on the statement, whether true or false with justification. **[5]**

(d) Explain the terms : i) Ray Path and ii) Critical Frequency **[5]**

(e) Explain Super Refraction. **[5]**

Q2. (a) State and prove Poynting theorem. Explain its physical significance **[10]**

(b) State and explain Gauss' Law. List the applications of Gauss' law. Prove that the electric field intensity of a long positively charged wire does not depend on length of the wire but on the radial distance r of points from the wire. **[10]**

Q3 (a) What is the significance of numerical techniques? Compare FDM, FEM and MOM with respect to the significant points. **[10]**

(b) For normal incidence, determine the amplitudes of reflected and transmitted E and H at interface of two regions at z = 0. Given: Incident $E_i = 1.5\text{x}10^{-3}$, $\varepsilon_{r1} = 8.5$, $\mu_{r1} = 1$, $\sigma_1 = 0$. Region 2 is a free space. **[10]**

Q 4 (a) Define loss tangent. How does it classify lossless dielectrics, lossy dielectrics and good conductors? **[5]**

(b) A 10 GHz plane wave travelling in free space has an amplitude of Ex = 10 V/m. Find v, λ, β, η and the amplitude and direction of H. **[5]**

(c) Define a uniform Plane Wave. Derive the Helmholtz equation for the wave. **[10]**

Q 5 (a) State the boundary conditions for Electric and Magnetic fields. Explain their significance in electromagnetism **[10]**

(b) Describe space wave propagation and derive relation for maximum distance between transmitting and receiving antenna. Assume the earth to be flat. **[5]**

(c) Explain the working of an ink jet printer. **[5]**

Q 6 (a) Obtain reflection and transmission coefficient of perpendicularly polarized wave incident on a dielectric-dielectric boundary with oblique incidence. **[10]**

(b) Explain the phenomenon of duct propagation **[5]**

(c) Find the depth of penetration if for copper μr = 1, σ = 58 Mmho/m at frequencies f = 60 Hz, 1 MHz and 30 GHz. **[5]**

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

N.B.:

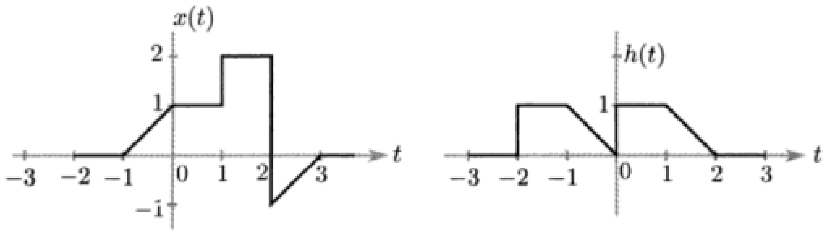
1. Question No.1 is compulsory.

2. Attempt any three questions out of the remaining five.

3. Assume suitable data wherever necessary.

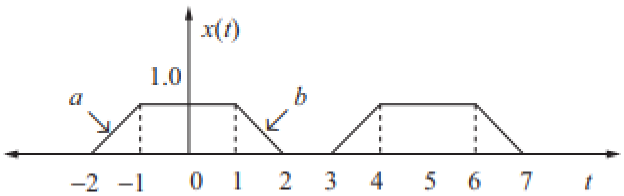
Q1].Answer the following [20]

a) Sketch even and odd parts of $e^{-t} u(t)$
b) State and prove time shifting property of Continuous Time Fourier Transform.
c) Explain properties of ROC in Laplace Transform.
d) Consider the following signal $x(t)$ and $h(t)$
find $x(t)h(t+1)$, $x(t)h(-t)$, $x(t-1)h(1-t)$ and $x(1-t)h(t-1)$.



e) Describe Gibbs Phenomenon in signal generation.

Q2] (a) Compute the exponential Fourier Series of $x(t)$ [10]



Q2b) Determine Laplace transform and ROC of [10]

$e^{2t} u(t) + e^{-2t} u(-t)$,

Q3a) Sketch following signals [10]

(i) $x(n) = u(n+2)u(-n+3)$
(ii) $x(n) = u(n+4) - u(n-2)$

Q3b) Find the transfer function and unit sample response of the second order difference equation with zero initial condition y (n) = x(n) - 0.25y(n-2) . [10]

Q4a) Find the transfer function of the systems governed by following impulse response [10]

$h(t) = (2+t)\, e^{-3t}\, u(t)$

Q4b) Find Fourier transform of following signals

(a) $e^{at}u(-t)$ [5]

(b) $te^{-at}u(t)$ [5]

Q5a) Find DTFT of $x(n) = (\frac{1}{4})^n u(n+1)$ [5]

Q5b) Determine discrete time Fourier series of $x(n) = 2\sin\sqrt{3}\ \pi n$ [5]

Q5c) Determine cross correlation of sequence x (n) = {1, 1, 2, 2} and y (n) = {1, 3, 1} [10]

Q6a) Perform convolution of $x_1(t) = \cos t\ u(t)$; $x_2(t) = u(t)$ using convolution integral. [10]

Q6b) Using long division, determine the inverse Z-transform of [10]

$X(z) = \frac{z^2+z+2}{z^3-2z^2+3z+4}$; ROC; $|Z| < 1$

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(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 the transient and steady – state response. Draw these responses for first and second – order systems. **(05)**

(B) State the principle of optimality. Give list of various performance measures. **(05)**

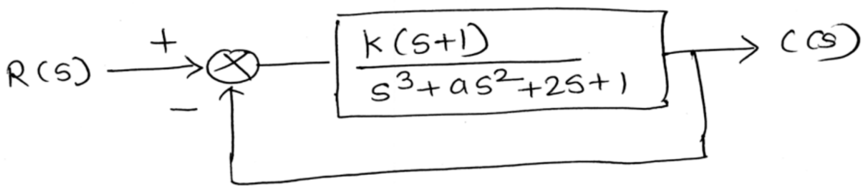
(C) Define gain and phase margin. Explain how to find gain and phase margins using polar plot. **(05)**

(D) Explain the concept of relative stability. **(05)**

2. **(A)** The open-loop transfer function of a servo system with unity feedback is $G(s) = \frac{10}{s(0.1s+1)}$ **(10)**

Evaluate the dynamic error using dynamic error coefficients.

(B) Determine the value of k > 0 and a > 0 so that the system shown oscillates at frequency 2 rad/sec . **(10)**



3. **(A)** A unity feedback control system has G(s) = $\frac{c}{s(s+c)}$ **(10)**

(i) Determine value of c so that maximum overshoot is 40%.

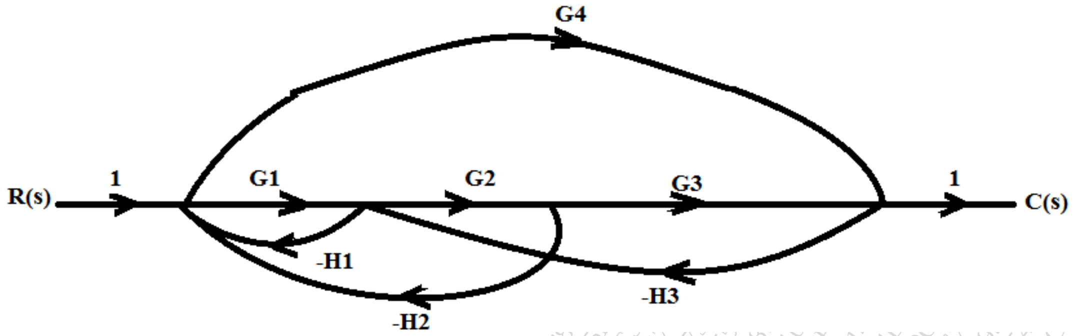
(ii) For this value of c, determine resonant peak value and resonant frequency.

(B) Sketch the root locus diagram of control system having, for the below given System. **(10)**

$$G(S)H(S) = \frac{k(s+4)}{s(s^2+6s+13)}$$

Also find the value of k for a system having damping ratio 0.707.

4. (A) (b) Determine the C(s)/R(s) of the following signal flow graph. **(10)**



(B) Using Nyquist criterion, investigate closed loop stability of the system whose open loop transfer function is given by **(10)**

$$G(s)H(s) = \frac{50}{(s+1)(s+2)}$$

5. (A) Explain error compensation methods and their effects on system performance. **(10)**

(B) Explain the concept of Neuro-Fuzzy adaptive control system. **(05)**

(C) Explain Mason's Gain Formula. **(05)**

6. (A) Determine the value of k for a unity feedback control system having open loop transfer function $G(s)H(s) = \dfrac{k}{s(s+2)(s+4)}$ **(10)**

such that (i) gain margin = 20 dB (ii) phase margin = 60^0

(B) (a) Compute the state-transient-matrix and response of the following system – **(10)**

$$\dot{x} = \begin{bmatrix} 0 & 0 & -2 \\ 0 & 1 & 0 \\ 1 & 0 & 3 \end{bmatrix} x \; ; x(0) = \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix}$$

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