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328413(28)

B. E. (Fourth Semester) Examination, 2021

(Old Scheme)

(AEI, EEE, El, ET & T & Mechatronics Engg. Branch)

ANALOG ELECTRONIC CIRCUITS

Time Allowed : Three hours

Maximum Marks : 80

Minimum Pass Marks : 28

Note : *Part (a) of each question is compulsory and attempt any* ***two*** *part from (b) and (c) of each questions.*

Unit-I

1. (a) Which configuration among CB, CE and CC is used as a constant source? 2

(b) With the help of circuit diagram state and prove Miller theorem. 7

(c) Derive the expressions for input resistance (Z_i) output resistance (Z_0) and voltage gain (A_v) for a JFET amplifier with potential Divider bias and self-bias $(R_s$ by passed$)$. 7

(d) Show that the ratio of voltage gains and current gain of a BJT Amplifier with load and source resistance taken into account is independent of h-parameters of the transistor provided the equivalent current and voltage sources have the same resistance. 7

Unit-II

2. (a) How do hybrid-π parameters vary with temperature? 2

(b) Draw the circuit and derive the expression for CE short circuit current gain A_i in terms at any frequency f and f_β of the BJT. 7

(c) Prove that gain bandwidth product : 7

$$|A_{VS} \text{ of } H| = \frac{f_T}{1+2\pi f_T C_c R_L} \frac{R_L}{R_s + rbb'}$$

(d) The following measurements at room temperature are made at $g_m = 50\text{mA/V}$, $r_{b'e} = 1$ K, $C_e = 3$ pF and $C_c = 0{\cdot}2$ pF. Compute f_β and f_t. 7

Unit-III

3. (a) Justify, multistage amplifier reduces Bandwidth. 2

(b) Define noise. What are the various sources of noise? Explain in brief? 7

(c) Justify with derivation "the bandwidth of cascaded amplifier is always less than of the badwidth of single stage amplifier." 7

(d) When n identical (non-interacting) stages of amplifiers are cascaded, derive the expressions for overall gain, lower cut-off frequency and higher cut-off frequency. 7

Unit-IV

4. (a) What type of feedback is used in amplifiers? Mention its advantages. 2

(b) An amplifier consists of three identical stages connected in cascade. The output voltage is sampled and returned to the input in series opposing. If it is specified that the relative change $\frac{dA_F}{A_F}$ in the closed loop voltage gain A_f must not exceed ψf, show that the maximum value of the open loop grain A of the amplifier is given by 7

$$A = 3A_f \left| \frac{\psi_1}{\psi_2} \right| \text{ where } \psi_1 = \frac{dA_1}{A_1}$$

(c) Draw an equivalent circuit of feedback amplifier which given high R_i and high R_0. Also derive the relation for R_i R_0 and R'_{of} in terms of forward and backward gain for the same topology. 7

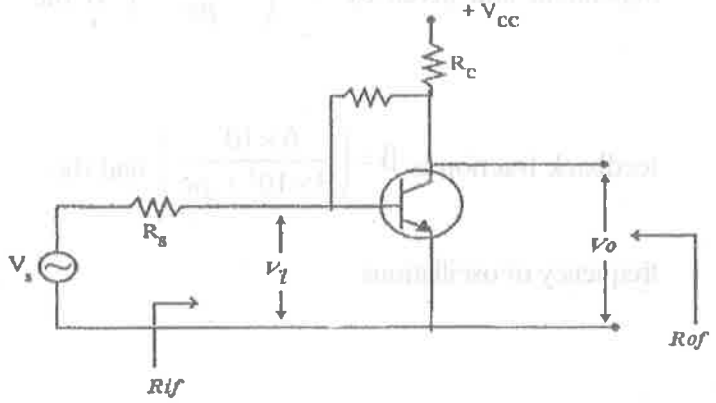
(d) For the circuit shown take R_C = 4 K, R' = 40 K, R_s = 10 K, h_{ie} = 1.1 K, h_{fe} = 50 and h_{re} = h_{oe} = 0. 7

Find :

(i) A_{vf}

(ii) R_{if} and

(iii) R'_{of}



Unit-V

5. (a) Drawe the equivalent circuit of quartz crystal. 2

(b) Draw the circuit and explain the working of Hartely oscillator using BJT. Write expression for frequency of oscillation. 7

(c) What do you mean by frequency stability of an oscillator? State the frequency stability criterion for an oscillator. How you can compare the frequency stability of two oscillators? 7

(d) The gain of a forward amplifier is frequency dependent and given by $A = \left(\frac{-9 \times 10^6}{jw} \right)$. If the feedback fraction is $\beta = \left(\frac{6 \times 10^3}{3 \times 10^3 + jw} \right)$ find the frequency of oscillations. 7

328414 (28)

BE (4th Semester)

Examination, April-May 2021

Branch : AEI, EEE, EI, Et & T

DIGITAL ELECTRONIC CIRCUITS

Time Allowed : Three Hours

Maximum Marks : 80

Minimum Pass Marks : 28

Note : Attempt all questions. Part (a) of all question is compulsory. Attempt any two from part (b), (c) & (d) of all the questions.

UNIT-1

Q. 1. (a) What are unit distance code ? 2

(b) (i) Convert $(1001001.011)_2$ to its equivalent decimal number.

(ii) Find 10's complement of $(935)_{11}$.

(iii) Convert 8686 in BCD.

(iv) Convert $(250.S)_{10}$ into base 3. **7**

(c) Simplify the following Boolean function to a minimum number of literals. **7**

(i) $xy + xy'$

(ii) $(x + y)(x + y')$

(iii) $xyz + x'y + xyz$

(iv) $zx + zx'y$

(v) $(A + B)' (A' + B')'$

(vi) $y(wz' + wz) + xy$

(d) State and explain DeMorgan's Theorem of Boolean algebra. 7

UNIT-2

Q. 2. (a) Why and which code is used for labelling the cell of k-map ? 2

(b) Determine the minimized expression of the logic function given as

$f = \Sigma m\ (2, 3, 5, 7, 9, 11, 12, 13, 14, 15)$

and implement through NAND logic. 7

(c) Draw k-map for the function

$$f_\alpha = AD + BD + \bar{A}\,\bar{B}\,C$$

$$f_\beta = \bar{A}\,B + B\bar{D}$$

and hence derive the k-map for

$f_1 = f_\alpha . f_\beta$ and $f_2 = f_\alpha + f_\beta$

Simplify the maps for f_1 and f_2 and give the resulting expression in SOP form. 7

(d) Simplify the following Boolean function by using the tabulation method : 7

$$f = \Sigma (0, 1, 2, 8, 10, 11, 14, 15)$$

UNIT-3

Q. 3. (a) Explain the term Multiplexing and Demultiplexing. 2

(b) Implement a full subtractor using two half subtractor and OR gate. 7

(c) Describe operation of PLA. 7

(d) Explain the operation of four-bit Carry-Look-Ahead adder circuit. What is the merit of carry-look-ahead adder ? 7

UNIT-4

Q. 4. (a) Write difference between latch and flip-flop. 2

(b) What is race around condition for J-K flip flop ? How it can be avoided in master slave flip-flop ? 7

(c) Design a Asyncronous Decade Counter. 7

(d) Draw and describe the working of parallel-in-serial out (PISO) shift register. Explain how a number can be shifted in and out from such register. 7

UNIT-5

Q. 5. (a) What is tristate logic ? 2

(b) Give comparison among various logic families. 7

(c) Design NAND, NOR gate using CMOS logic. 7

(d) Define the following parameters : 7

(i) Noice Margin

(ii) Propagation delay

(iii) Power dissipation

(iv) Speed power product.

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328415(28)

B. E. (Fourth Semester) Examination, April-May 2021

(Old Scheme)

(AEI, EI & Et&T Engg. Branch)

SIGNALS ~~SINGLES~~ & SYSTEMS

Time Allowed : Three hours

Maximum Marks : 80

Minimum Pass Marks : 28

Note : *Part (a) of each question is compulsory to alternate and attempt any two part from part b, c, d of each question.*

Unit-I

1. (a) Define unit step signal. 2

(b) Sketch the signal $x(t) = e^{-a|t|}$ for a > 0 and determine whether the signal is power signal or an energy signal or neither. 7

(c) (i) Check whether the following systems are time - invariant or time-variant 7

(1) $y(t) = \sin x(t)$

(2) $y(t) = tx(t)$

(ii) Determine if the systems described by the followed input-output equation are linear or non linear.

(1) $y(n) = nx(n)$

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

(d) State and explain the condition for signal is periodic or non periodic and even or odd signal. 7

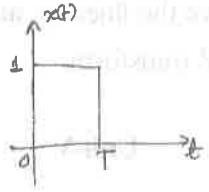
Unit-II

2. (a) Define ROC. 2

(b) State and explain any seven properties of founer transform. 7

(c) State and explain any seven properties of Laplace transform. 7

(d) Find the fourier transform of rectangular pule shown in figure. 7



Unit-III

3. (a) Define transfer function. 2

(b) Find impulse response of system described by the equation $2y'(t) + 3y(t) = x(t)$ 7

(c) Drew direct-I and II structures for the difference equation $\frac{d}{dt}y(t) + y(t) = 5x(t)$ 7

(d) Define state, state variable, state vectors and state space. 7

Unit-IV

4. (a) State the condition for existence of FT. 2

(b) Obtain DTFT of unit step 4 cm. 7

(c) Obtain N-pant DFT of exponential sequence $x(n)a^n u(n)$ for $0 \le n \le n-1$. 7

(d) State and prove the linearty and time stufing properties of Z transform. 7

Unit-V

5. (a) Define FFT. 2

(b) List explain different building blocks are used in block diagram representation for LTI system described by difference equation. 7

(c) Obtain linear convolution of following sequance using graphical method. 7

$x(n) = \{1,2,1,2\}$ and $n(n) = \{1,1,1\}$

(d) Find out zero input response for a second order difference equation. 7

$y(n) - 3y(n-1) - 4y(n-2) = x(n)$

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328451(28)

B. E. (Fourth Semester) Examination, April-May 2021

(New Scheme)

(Et & T Branch)

NUMERICAL ANALYSIS Using C

Time Allowed : Three hours

Maximum Marks : 80

Minimum Pass Marks : 28

Note : *Attempt all questions. Part (a) of each question is compulsory and carries 2 marks. Attempt any* ***two*** *from (b), (c) and (d) which carry 7 marks each.*

Unit-I

1. (a) Define keywords in C language.

(b) (i) Write a C program to find out greatest among three numbers.

(ii) Write a C program to check whether entered number is even or odd.

(c) Write the importance of C language. Also explain else-if ladder with proper example.

(d) Define operators. Explain any four operators of C language.

Unit-II

2. (a) What is the purpose of Break statement?

(b) Differentiate between call by value and call by reference with suitable example.

(c) Write a C program to print following pattern :

```
* * * * *
* * * *
* * *
* *
*
```

(d) How two dimensional array is initialized? Write a program to multiply 3×3 matrices.

Unit-III

3. (a) What are pointers?

(b) Write a program to find the length of the string.

(c) Define structure. Write the difference between Structure and Array.

(d) What is Recursion? Write a program to find out the factorial of a given number using recursion.

Unit-IV

4. (a) Define Transcendental equation.

(b) Find a real root of the equation $x \log_{10} x = 1 \cdot 2$ by regula-falsi method correct to four decimal places.

(c) Using Newton-Raphson method find a root of the equation $x^2 + 4 \sin x = 0$, correct upto 5 decimal places.

(d) Solve by Relaxation method, the equations

$$9x - 2y + z = 50$$

$$x + 5y - 3z = 18$$

$$-2x + 2y + 7z = 19$$

Or

Solve by Jacobi's method, the equations

$$20x + y - 2z = 17$$

$$3x + 20y - z = -18$$

$$2x - 3y + 20z = 25$$

Unit-V

5. (a) Write Newton Cote's quadrature formula.

(b) Solve the following by modified Euler's method,

the equation $\frac{dy}{dx} = \log_e(x+y), y(0) = 2$ at $x = 1 \cdot 2$ and 1·4, 1·6 with $h = 0 \cdot 2$.

(c) Apply Runge-Kutta method of fourth order to solve :

$$10\frac{dy}{dx} = x^2 + y^2, y(0) = 1 \text{ for } x = 0 \cdot 1, 0 \cdot 2$$

(d) Evaluate :

$$\int_0^6 \frac{dx}{1+x^2}$$

by using :

(i) Trapezoidal rule

(ii) Simpson's 1/3 rule

(iii) Simpson's 3/8 rule

(iv) Weddle's rule and compare results with its actual value

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328452(28)

B. E. (Fourth Semester) Examination, April-May 2021

(New Scheme)

(ET&T Engg.)

ANALOG COMMUNICATION

Time Allowed : Three hours

Maximum Marks : 80

Minimum Pass Marks : 28

Note : *Part (a) of each question is compulsory. Attempt any* ***two*** *parts from (b), (c) & (d). Attempt all questions. All questions carry equal marks.*

Unit-I

1. (a) Show theat the squaring circuit will not permit the generation of a locak oscillator signal capable of demodulating a SSB-SC signal. 2

(b) Explain the working of a diode-demodulator / envelope detector. Specify the conditions in terms of modulation index so that the message signal can be perfectly recovered from the AM signal using this method. 7

(c) The signal

$$v(t) = \left[1 + 0 \cdot 2 \cos \left(\omega_M / 3 \right) t \right] \cos \omega_c t$$

is demodulated using a square-law demodulator having the characteristics $v_0 = v^2$. The output $v_0(t)$ is then filtered by an ideal low-pass filter having a cut-off frequency at f_M Hz. Sketch the amplitude frequency characteristics of the output waveform in the frequency range $0 <= f <= f_M$. 7

(d) Draw a block diagram of super-heterodyne radio reciever. Explain the function of each block. 7

Unit-II

2. (a) Distinguish beween narrow band FM and wide band FM. 2

(b) Explain the direct method of frequency modulation in detail. 7

(c) Show that $v(t)$ given by

$$v(t) \cos \left(2 \pi 10^6 t \right) + 0 \cdot 02 \cos \left[2 \pi \left(10^6 + 10^3 \right) t \right]$$

represents a carrier which is modulated both in amplitude and frequency by drawing a phasor diagram. Find value of m and β. 7

(d) In an Armostrong modulator the crystal oscillator frequency is 200 kHz. It is desired in order to avoid distortion, to limit the maximum angular deviation to $\phi_m = 0 \cdot 2$. The system is to accommodate modulation frequencies down to 40 Hz. At the output of modu-lator the carrier frequency is to be 108 MHz and the frequency deviation 80 kHz. Select multiplier and mixer oscillator frequencies to accomplish this end. 7

Unit-III

3. (a) Define white noise. 2

(b) A signal (within 4000 Hz) of strength 0·001 W passes through a distorting channel defined as :

$$H(f) = \frac{4000}{j\,4000 + f}$$

The channel is also corrupted with additive white gaussian noise of magnitude 10-8 W/Hz. At the receiver end there is an equalizer which exactly matches the channel within frequency of interest (within 4000 Hz). Find SNR at the output of the equalizer. 7

(c) The auto-correlation function of noise signal is triangular and defined as

$$R_n(\tau) = \begin{cases} 1-|\tau| & \text{for } |\tau|<1 \\ 0 & \text{for } |\tau|>1 \end{cases}$$

Find it's noise spectrum. 7

(d) Find the effect of Linear filtering of White Noise by filtering through a RC low pass filter. 7

Unit-IV

4. (a) Define the figure of merit. What is the figure of merit of DSB-SC system and a SSB-SC system? 2

(b) Determine the output signal to noise ratio for a SSB-SC system. 7

(c) An audio signal of 4 kHz Bandwith is to be transmitted through a channel that introduces 30 dB loss and white noise of PSD 10^{-9} W/Hz. Calculate the minimum required transmitted power if the message is sent by SSB-SC, DSB-SC and DSB-C modulation methods. The received output SNR should be at least 40 dB. For DSB-C energy in the sideband is half of that of the carrier. 7

(d) Determine the signal to noise ratio for an AM systerm using a Square Law demodulator. 7

Unit-V

5. (a) What is an Amplitude limiter? Explain it's significance in demodulation of a FM signal. 2

(b) Explain the need and effect of Pre-emphasis and De-emphasis networks used in commercial FM systems. 7

(c) Find the output SNR of an FM limiter-Demodulator when input signal strength is 0·5 W, maximum frequency deviation 60 kHz, baseband signal cut-off frequency 15 kHz, received white Gaussian noise PSD 10^{-10} W/Hz And average power of the

modulating signal 0·1 W. Find the required transmitted power for above if channel has 20 dB loss and required output SNR is at least 40 dB. 7

(d) Compare the effect of noise in FM and AM in terms of the figure of merits. 7

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328453(28)

B. E. (Fourth Semester) Examination, April-May 2021

(New Scheme)

(Electronics & Telecommunication Engg. Branch)

ANALOG ELECTRONICS

Time Allowed : Three hours

Maximum Marks : 80

Minimum Pass Marks : 28

Note : *Attempt all questions. Part (a) of each unit is compulsory carry 2 marks. Attempt any two parts from (b), (c) and (d) carry 7 marks. Assume suitable data if required.*

Unit-I

1. (a) Which configuration is knows as emitter follower and why?

(b) Draw the hybrid model for all the tree configuration of BJT and give the equations.

(c) A transistor used in CE arrangement has the following set of h parameters when the d.c. operating point is $V_{CE} = 10$ volts and $I_C = 1$ mA : $h_{ie} = 200\ \Omega$; $h_{oe} = 10^{-4}$ mho; $h_{re} = 10^{-3}$; $h_{fe} = 50$.

Determine (i) input impedance (ii) current gain, and (iii) voltage gain.

The a.c. load seen by the transisot if $rL = 600\ \Omega$. What will be approximate values using reasonable approximations?

(d) Draw the h-parameter equivalent circuit for a generalize transistorized amplifier and derive the expression only for A_i, A_v and R_i.

Unit-II

2. (a) What is $r_{b'b}$? How does its respond to temperature?

(b) Prove that :

(i) $h_{fe} = g_m r_{b'e}$

(ii) $h_{ie} = r_{b'b} + r_{b'e}$

(iii) $r_{b'c} = \dfrac{r_{b'e}}{h_{re}}$

(c) The following transistor measurements are made at = 5 mA, $V_{CE} = 10$ V at room temperature, $h_{fe} = 100$, $h_{ie} = 600\ \Omega$.

$|A_{ie}| = 10$ at 10 MHz, $C_c = 3$ pF

Find F_β, F_T, C_e, $r_{b'e}$, $r_{bb'}$.

(d) Derive the equation for g_m, which give the relation between g_m, I_c and temperature.

Unit-III

3. (a) Define rise time of an amplifier. How it is related with upper 3 dB frequency of the amplifier?

(b) Prove that the bandwidth shrinks in cascading of identical non-interacting stages.

(c) It is desired that the voltage gain of the RC coupled amplifier at 60 Hz should not decrease by more than 10% from its midband value. Show that the coupling capacitance C must be at least equal to $5{\cdot}5\ /R'$, where $R' = R'_0 + R'_1$ and is expressed in kiloohms and C in microfarads.

(d) Show that the maximum conversion efficiency of the idealized class B push-pull amplifier circuit is 78·5%.

Unit-IV

4. (a) What do you mean by negative feedback?

   (b) Give step procedure for identifying topology of feedback in amplifiers.

   (c) Derive the derivation of input resistance and output resistance of voltage shunt feedback amplifier.

   (d) Discuss the consequences of introducing negative feedback in small signal amplifier.

Unit-V

5. (a) What is the Barkhausen criterion for the feedback oscillators?

   (b) Explain the operational characteristics of RC phase shift oscillator and prove that $h_{fe\ \min} = 44{\cdot}5$.

   (c) Draw the circuit of Wein bridge oscillator and explain its working principle. Derive the expression for frequency of oscillations.

   (d) Draw the circuit of Colpitts oscillator. How are the feedback requirements met in it? Derive the expression for frequency of oscillations.

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328454(28)

B. E. (Fourth Semester) Examination, April-May 2021

(New Scheme)

(ET&T Engg. Branch)

MICROPROCESSOR and INTERFACES

Time Allowed : Three hours

Maximum Marks : 80

Minimum Pass Marks : 28

Note : *Attempt all questions. Part (a) of each unit is compulsory. Solve any* **two** *parts from (b), (c) and (d) of each unit.*

Unit-I

1. (a) Why accumulator is special type of Register. 2

   (b) Explain generation of Control Signal in 8085. 7

(c) Explain Demultiplexing of bus with diagram in detail. 7

(d) Explain the following : 7

(i) Program Counter

(ii) Stack Pointer

(iii) Flag Register

Unit-II

2. (a) Describe use of H-L Register Pair. 2

(b) Explain various type of addressing mode of 8085 in detail with example. 7

(c) Describe following instruction : 7

(i) MOV A, M

(ii) LDAXB

(iii) LXI H, 2000

(iv) LDA 8000 H

(d) Write a program to convert 2 digit BCD to binary. 7

Unit-III

3. (a) What are different types of memory. 2

(b) Explain different type of data transfer scheme. 7

(c) Compare Memory Mapped I/O and I/O mapped I/O. 7

(d) What is the difference between absolute decoding and linear decoding. 7

Unit-IV

4. (a) What are Hardware Interrupts. 2

(b) Explain Interrupt structure of 8085 in detail. 7

(c) Explain RIM and SIM Instructions. 7

(d) Explain Handshaking signal to interface I/O device and O/P device. 7

Unit-V

5. (a) Define the term control word register. 2

(b) Draw and explain 8255 in detail. 7

(c) Explain 8253/8254 block diagram. 7

(d) Explain USART (8251) block diagram. 7

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328455(28)

B. E. (Fourth Semester) Examination, April-May 2021

(New Scheme)

(ET & T Engg. Branch)

SIGNALS and SYSTEMS

Time Allowed : Three hours

Maximum Marks : 80

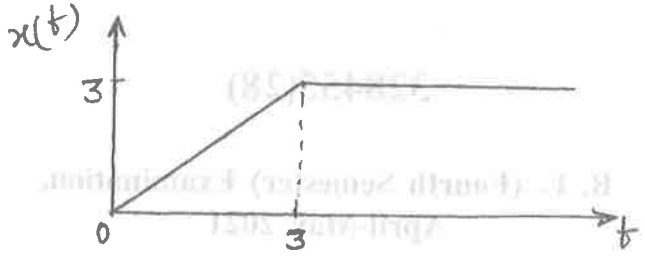
Minimum Pass Marks : 28

Note : *Part (a) of each question is compulsory & carries 2 marks. Solve any two from (b), (c) and (d) and carries 7 marks.*

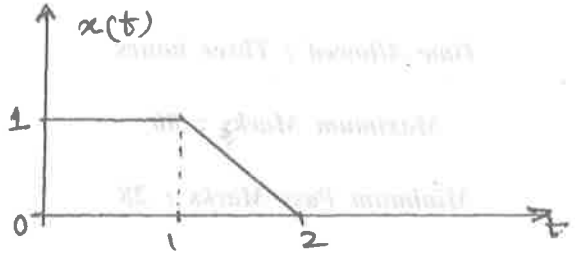
Unit-I

1. (a) Define deterministic and random signals with examples. 2

(b) Determine whether the signal is energy signal or power signal. 7



(c) Sketch the plot $\left(x\frac{3}{2}t+1\right)$ for $x(t)$ given in figure. 7



(d) Determine the properties of the system for 7

$$y[n]=3y^2[n-1]-nx[n]+4x[n-1]-x[n+1]$$

(i) Memoryless/with memory

(ii) Time variant / Invariant

(iii) Linear / Non Linear

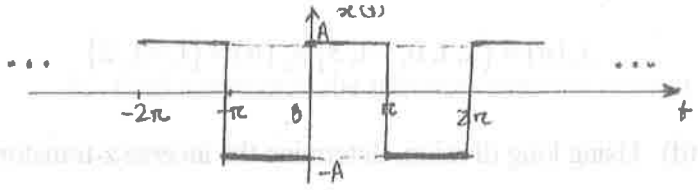
(iv) Anticipative / Non anticipative

(v) Stable / Unstable

Unit-II

2. (a) Define Dirichlet's conditions for the existence of fourier series. 2

(b) Obtain the trigonometric fourier series for the waveform shown. 7



(c) Find the Fourier Transform of $x(t)=1/t$. 7

(d) Find the Inverse Fourier transform of

$$X(w)=\frac{jw}{(2+jw)^2}.$$ 7

Unit-III

3. (a) Explain Region of convergence for Z-transform. 2

(b) Determine the z-transform of the given sequence. Also sketch the ROC and Poles zero location. 7

$$x(n)=\left(\frac{1}{2}\right)^{n}u(-n)-2^{n}u(-n-1)$$

(c) Using z-transform, find the convolution of the sequence. 7

$$x_1(n)=\{2,1,0,-1,3\}\; x_2(n)=\{1,-3,2\}$$

(d) Using long division, determine the inverse z-transform of $X(z)=\dfrac{z^2+2z}{z^3-3z^2+4z+1}$; $ROC|z|>1$. 7

Unit-IV

4. (a) Show that : 2

$$x(t)*\delta(t-t_0)=x(t-t_0)$$

(b) Compute the output $y(t)$ for a continuous time LTI

system whose impulse response $h(t)$ and the input $x(t)$ are given by : 7

$$h(t)=e^{-\alpha t}u(t)$$

$$x(t)=e^{\alpha t}u(-t) \text{ for } \alpha>0$$

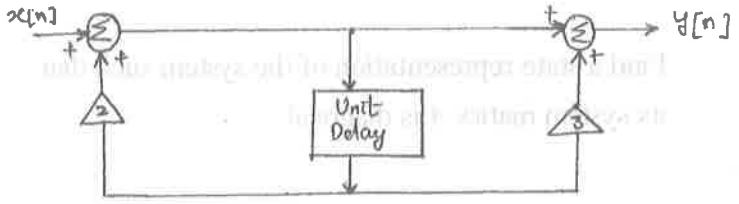
(c) Consider a continuous time LTI system described by : 7

$$y(t)=T\{x(t)\}=\frac{1}{T}\int_{t-T/2}^{t+T/2}x(\tau)\,d\tau$$

(i) Find and sketch the impulse response $h(t)$ at the system

(ii) Is this system causal?

(d) Consider the discrete time system. Write a difference equation that relates the output $y[n]$. 7



Unit-V

5. (a) Define the state of system. 2

(b) Find the state equation of a discrete time system described by 7

$$y[n]-\frac{3}{4}y[n-1]+\frac{1}{8}y[n-2]=x[n]$$

(c) A continuous time LTI system is described by the following euqation, fine the state equation of the system. 7

$$\ddot{y}(t)+3\dot{y}(t)+2y(t)=4\dot{x}(t)+x(t)$$

(d) Consider a discrete time LTI system with system function. 7

$$H(z)=\frac{z}{2z^2-3z+1}=\frac{z}{2(z-1)\left(z-\frac{1}{2}\right)}$$

Find a state representation of the system such that its system matirx A is diagonal.

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328456(28)

B. E. (Fourth Semester) Examination, April-May 2021

(Electronics & Telecommunication Engg. Branch)

ELECTROMAGNETIC FIELDS AND TRANSMISSION LINES

Time Allowed : Three hours

Maximum Marks : 80

Minimum Pass Marks : 28

Note : *Attempt all questions. Part (a) of each unit is compulsory carry 2 marks. Attempt any two parts from (b), (c) and (d) each carry 7 marks. Assume suitable data if required*

Unit-I

1. (a) Write the differential volume and surfaces in spherical co-ordinates system. 2

(b) Trabnsform the vector 7

$$\vec{A} = \sin^2\theta\cos\phi\, a_r + \cos^2\phi\, a_\theta - \sin\phi\, a_\phi$$

from spherical to cylinderical coordinates and than evaluate it at $P = (2, \pi/2, \pi/2)$

(c) Find the vector component of $\vec{F} = 10a_x - 6a_y + 5a_z$ that is parallel to $\vec{G} = 0.1a_x + 0.2a_y + 0.3a_z$ and find the vector component of $\vec{F}$ that is perpendicular to $\vec{G}$ 7

(d) An infinite uniform line charge $\rho_l = \frac{2nC}{m}$ lies along the x axis in free space, while point charges of 8 nC each are located at (0, 0, 1) and (0, 0, −1). Find $\vec{E}$ at (2, 3, −4). 7

Unit-II

2. (a) Define divergence of a vector and write significance of divergence. 2

(b) Let $\vec{F} = 6xyz^2a_x + 3x^2z^2a_y + 6x^2yza_z\frac{C}{m^2}$. Find the

total charge lying within the region bounded by x = 1 and 3, y = 0 and 1, and z = −1 and 1 by separately evaluating each side of the divergence theorem. 7

(c) In free space, a line charge $\rho_l = 80\frac{nC}{m}$ lies along the entire z axis, while a point charge of 100 nC is located at (1, 0, 0). Find the potential difference V_{PQ} given P (2, 1, 0) and Q (3, 2, 5). 7

(d) Given the potential field $V = \frac{(50\sin\theta)}{r^2}$ in free spcace : 7

(i) determine whether V satisfies Laplace's equation

(ii) find the total charge stored inside the spherical shell $1 < r < 2$.

Unit-III

3. (a) Write Biot Savart's Law. 2

(b) Find $\vec{H}$ in rectanular components at P (2, 3, 4) if there is a current filament located at $x = -1, y = 2$. 7

(c) A current element $I_1\overrightarrow{\Delta L_1} = 10^{-5} a_z$ Am, is located at $P1$ (1, 0, 0), while a second element, $I_2\overrightarrow{\Delta L_2} = 10^{-5}$ $(0.6a_x - 2a_y + 3a_z)$ Am, is located at $P2(-1, 0, 0)$ both in free space. Find the vector force on $I_2\overrightarrow{\Delta L_2}$ by $I_1\overrightarrow{\Delta L_1}$. 7

(d) The magnetic flux density in a magnetic material with $Xm = 9$ is given in a certain region as $\vec{B} = 0.005y^2 a_x T$. At $y = 0.8$ m, find the magnitude of J, $\vec{J}_b$ and $\vec{J}_T$. Note $\begin{cases} x_n = 9 \\ y = 0.8m \end{cases}$ 7

Unit-IV

4. (a) Write Faraday's law. 2

(b) Write Maxwell's equation in integral and differential form and prove that in air EMW moves with velocity of light. 7

(c) Assume a homogeneous material of infinite extent with $\epsilon = 2\times10^{-10}\frac{F}{m}$, $\mu = 1.25\times10^{-5}\frac{H}{m}$, and

$\sigma = 0$. Let $\vec{E} = 400\cos(10^9 t - kz)a_x\frac{V}{m}$. If all the field vary sinusoidally, use Maxwell's equations to find $\vec{D}, \vec{B}, \vec{H}$ and k. 7

(d) State and prove Poynting Theorem. 7

Unit-V

5. (a) Differentiate lossless and distortion less transmission line. 2

(b) Define reflection coefficient and standing wave ratio and derive the relationship between these two for incorrectly terminated two wire transmission line. 7

(c) An open wire transmission line having characteristic impedance of 600Ω is terminated by a resistive load of 900Ω. Calculate the voltage standing wave ratio and design a single with matching to match the load. 7

(d) A lossless transmission line having $Z_0 = 120\Omega$ is operating at $\omega = 5\times10^8$ rad/sec. If the velocity on the line is 2.4×10^5 m/sec. Find (i) L (ii) C (iii) Let Z_L be represented by an inductance 0.6 μH in

series with a 100Ω, them find reflected coefficient and standing wave ratio. 7

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B028411(028)

B.Tech. (Fourth Semester) Examination
April-May 2021

(New Scheme)

(ET & T Engg. Branch)

ANALOG COMMUNICATION

Time Allowed : Three hours

Maximum Marks : 100

Minimum Pass Marks : 35

Note : *Attempt all questions. Part (a) of each question is compulsory & Solve any two parts from (b), (c) and (d) of each questions.*

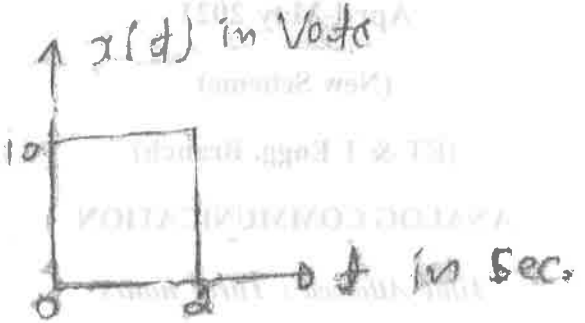
Unit-I

1. (a) What are the basic constituents of a communication system? 4

(b) State and prove parseval's theorem density of a signal. 8

(c) What is convolution? Explain time-convolution and frequency convolution theorems. 8

(d) Obtain the Fourier transform of a rectangular pulse of duration 2 seconds and having a magnitude of 10 volts as shown in figure. 8



Unit-II

2. (a) Define modulation index. 4

(b) Explain square law demodulator for Am signal. 8

(c) Give mathematical proof of vestigial sideband modulation and demodulation alongwith waveform. 8

(d) An Am broadcast radio transfer radiates 10 k Watts of power if modulation percentage is 60 calculate how much of this is the carrier power. 8

Unit-III

3. (a) Define angle modulation. 4

(b) Explain Armstrong parameter variation method for generation of FM signal. 8

(c) A rule of bandwidth for FM signal is sometime used as $BW = (2mf + 1) fm$.

Find the fraction of the signal power that is included in that frequency band. Assume the $mf = 1$. 8

(d) Explain the difference between narrow band FM and Wideband FM. 8

Unit-IV

4. (a) Define selectivity for a recover. 4

(b) Draw the block diagram of a superheterodyne receiver and explain the function of each block. 8

(c) Distinguish between simple AGC and delayed AGC. 8

(d) Write the advantages of a R. f. amplifier. 8

Unit-V

5. (a) Define figure of merits. 4

(b) Discuss the noise in DSBSC receiver prove that the figure of merit is unity. 8

(c) Derive expression to calculate figure of merit in SSB-SC. 8

(d) Find the overall noise figure of a three stage cascaded amplifier each stage having a power gain of 10 dB and figure of 6 dB. 8

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B028412(028)

B. Tech. (Fourth Semester) Examination, April-May 2021

(AICTE Scheme)

(Electronics & Telecommunication Engineering Branch)

ANALOG CIRCUITS

Time Allowed : Three hours

Maximum Marks : 100

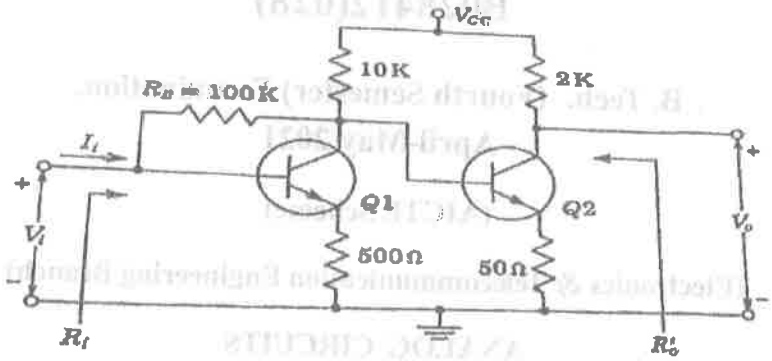
Minimum Pass Marks : 35

***Note** : All questions are compulsory. Part (a) of each question is compulsory and carries 4 marks. Attempt any **two** parts from (b), (c) and (d) from each question which carry 8 marks each. Assume any data if required or if found missing or misprint it with proper justification.*

Unit-I

1. (a) State Miller's theorem and Dual of Miller's theorem.

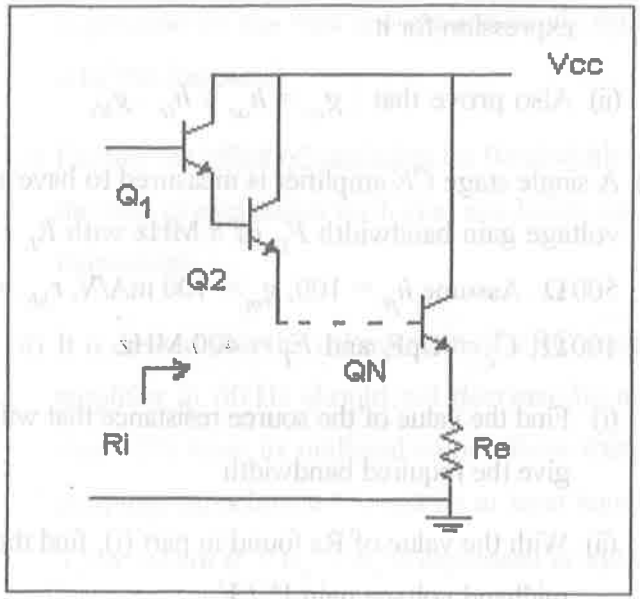
(b) For the two stage cascade shown find A_i, A_v, R_i and R_o'.



(c) (i) Show that the exact expression for h_{fb} in terms of CE hybrid parameters is :

$$h_{fb} = -\frac{h_{fe}\cdot(1-h_{re})+h_{ie}\cdot h_{oe}}{(1+h_{fe})\cdot(1-h_{re})+h_{ie}\cdot h_{oe}}$$

(ii) The cascade configuration shown is the tendem emitter follower. Find the input resistance R_i if $h_{ie} = h_{re} = h_{oe} = 0$ and h_{fe} is the same for each transistors Q_1 to Q_N.



(d) What is Darlington Pair Circuit? Why and where is it used? Derive expression for A_i and R_i for such a pair?

Unit-II

2. (a) What is the physical origin of the two capacitors in the hybrid $-\pi$ model? which one is having a greater magnitude and why? What is the order magnitude of each capacitance?

(b) (i) Define Transconductance g_m and derive the expression for it.

(ii) Also prove that : $g_{ce} = h_{oe} - h_{fe} \cdot g_{b'c}$

(c) A single stage *CE* amplifier is measured to have a voltage gain bandwidth F_H of 5 MHz with R_L = 500 Ω. Assume h_{fe} = 100, g_m = 100 mA/V, $r_{bb'}$ = 100 Ω, C_c = 1 pF, and F_T = 400 MHz.

(i) Find the value of the source resistance that will give the required bandwidth.

(ii) With the value of Rs found in part (i), find the midband voltage gain V_o / V_s.

(d) Analyse common emitter transistor amplifier at high frequencies for short circuit current gain. Also prove that $F_T = h_{fe} \cdot F_B$.

Unit-III

3. (a) Define the following types of distortion :

(i) Non-Linear Distortion

(ii) Frequency Distortion

(b) Explain the step response of an amplifier. Derive the expression for rise time and sag and briefly explain why this happens?

(c) Explain the effect of cascading on Bandwidth with the help of expression for higher and lower cut-off frequencies.

(d) It is desired that the voltage gain of a RC coupled amplifier at 60 Hz should not decrease by more than 10% from its midband value. Show that the coupling capacitance *C* must be at least equal to $5.5/R'$ where $R' = R_o' + R_l'$ is expressed in kΩ and *C* in microfarad.

Unit-IV

4. (a) Draw a feedback amplifier in one-line block diagram form. What is the relation between transfer gain with feedback A_f and that without feedback *A* for a negative feedback amplifier.

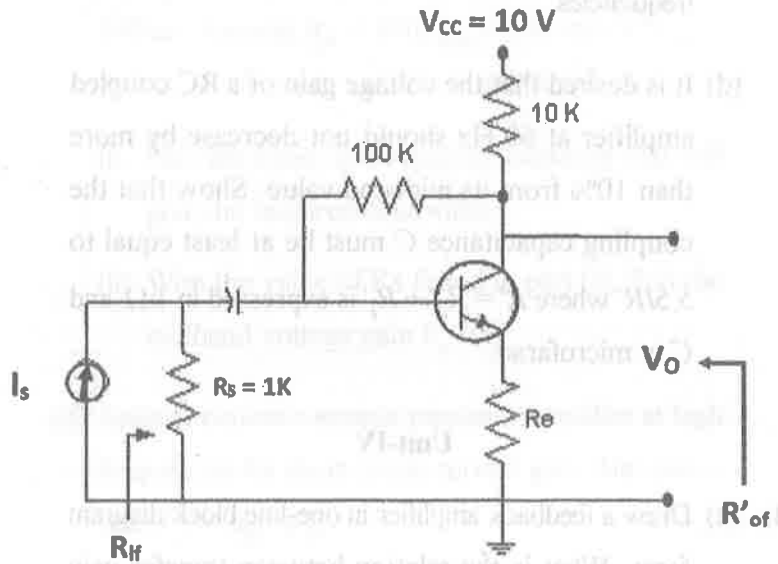
(b) For the transistor feedback amplifier stage shown, h_{fe} = 100, h_{ie} = 1 kΩ while h_{re} and h_{oe} are negligible. Determine with R_e = 0.

(i) $R_{Mf} = V_o / I_s$

(ii) $A_{Vf} = V_0 / V_s$

(iii) R_{if}

(iv) R_{of}



(c) What is the effect of negative feedback on input impedance of voltage shunt and current shunt amplifier?

(d) Enumerate the effects of negative Feedback on the various characteristics of the amplifier.

Unit-V

5. (a) Give the two Barkhausen conditions required in order for sinusoidal oscillations to be sustained.

(b) Draw the circuit and explain the working of Hartley oscillator using BJT. Write expression for frequency of oscillation.

(c) What is Weign bridge oscillator? Show that for such an oscillator gain of amplifier should be $A > 3$ to produce oscillations.

(d) What is piezoelectric effect? Draw and explain ac equivalent circuit of a crystal oscillator.

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B028414(028)

B. Tech. (Fourth Semester) Examination, April-May 2021

(Electronics & Tele. Communication Engg. Branch)

SIGNALS & SYSTEMS

Time Allowed : Three hours

Maximum Marks : 100

Minimum Pass Marks : 35

Note : *Attempt all questions. Part (a) from each question is compulsory. Attempt any* ***two*** *parts from part (b), (c) and (d) of each question.*

Unit-I

1. (a) (i) Define the term signal. 2

(ii) Define continuous time and discrete time signal. 2

(b) find the even and odd components of signal 8

$$x(t) = \cos t + 2\sin t + 3\cos t \cdot \sin t$$

(c) Describe energy and power signals. 8

(d) Sketch and calculate their energies. 8

(i) $e^{-10t}u(t)$

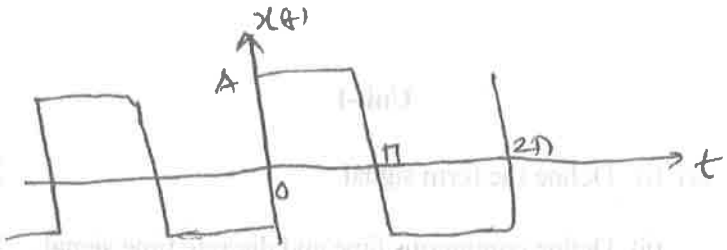
(ii) $u(t) - u(t-15)$

Unit-II

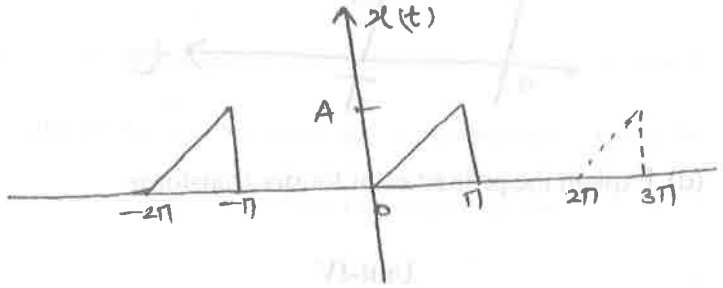
2. (a) Define fourier series and give the Dirichlet's conditions. 4

(b) State and explain any five properties of fourier series. 8

(c) Obtain the exponential fourier series for waveform shown in figure. 8



(d) Obtain the trigonometric fourier series for following waveform. 8



Unit-III

3. (a) State and prove following properties of fourier transform : 4

(i) Time scaling

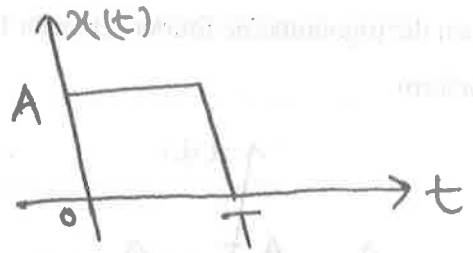
(ii) Time shifting

(b) Find the fourier transform for : 8

(i) $\cos w_0 t\, u(t)$

(ii) $\sin w_0 t\, u(t)$

(c) Find the fourier transform of the rectangular pulse shown in figure. 8



(d) Explain the properties of fourier transform. 8

Unit-IV

4. (a) Explain any two property of z-transform. 4

(b) Find z-transform for : 8

(i) $x(n)=2^n u(n-2)$

(ii) $x(n)=n^2 u(n)$

(c) Find z-transform and ROC of 8

$$x(n)=(2/3)^n u(n)+\left(\frac{-1}{2}\right)^2 u(n)$$

(d) Find z-transform of following sequences : 8

(i) $a^{-n}u(-n-1)$

(ii) $a^{n+1}u(n+1)$

Unit-V

5. (a) Write the properties of continuous time LTI system. 4

(b) If the impulse response of any system is given by $e^{-at}u(t)$. Determine the step response. 8

(c) Obtain the convolution of $x(t)=e^{-3t}u(t)$ and $h(t)=u(t-1)$. 8

(d) For an LTI system with unit impulse response $h(t)=e^{-2t}u(t)$ determine output to the input $x(t)=e^{-t}u(t)$. 8

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B028415(028)

B. Tech. (Fourth Semester) Examination, April-May 2021

(AICTE Scheme)

(ETC Branch)

PROBABILITY THEORY and STOCHASTIC PROCESSES

Time Allowed : Three hours

Maximum Marks : 100

Minimum Pass Marks : 35

Note : *Attempt all questions. Every question has four parts. Part (a) is compulsory. Attempt any* ***two*** *parts from (b), (c) and (d).*

Unit-I

1. (a) State and explain Baye's theorem. 4

(b) In a communication system the signal sent. From point 'a' to point 'b' arrives by two path in parallel. Over each path the signal passes through two repeaters (in series). Each repeater in one path has a probability of Failiny (becoming an open circuit) of 0·006. This probability is 0·008 for each repeater on the other path. All repeaters Rail independently of each other. Find the probability that the signal will not arrive at point 'b'. 8

(c) A student is known to arrive late for a class 40% of the time. If the class meets five time each week find (i) the probability the student is late for at least three classes in a given week and (ii) the probability the student will not be late at all during a given week. 8

(d) Explain with application the Bernaulli trials. 8

Unit-II

2. (a) Define random variable and give one example of random variable. 4

(b) Define commulative probability distribution function and explain its properties. 8

(c) Find a constant $b > 0$ so that the function

$$f_X(x) = \begin{cases} e^{3x/4} & 0 \le x \le b \\ 0 & \text{otherwise} \end{cases}$$

is valid probability density. 8

(d) A random variable X has the distribution function

$$F_X(x) = \sum_{n=1}^{12} \frac{n^2}{650} u(x-n)$$

Find the probabilities : 8

(i) $P\{-\infty < x \le 6-b$

(ii) $P\{X > 4\}$

(iii) $P\{6 < X \le 9\}$

Unit-III

3. (a) Define co-relation between random variable. 4

(b) Let z be a random variable with pdf $f(z) = \frac{1}{2}$ in

the range $-| \leq z \leq |$ and the random variable $x = z$ and the random variable $y = z^2$. Find out the co-relation between x and y. 8

(c) Let X and Y are independent random variable and $Z = X + Y$ than show that 8

$$\text{var}(Z) = \text{var}(X) + \text{var}(Y)$$

(d) Define Average value, Variance and Moment of random variable. 8

Unit-IV

4. (a) Define random process with one example. 4

(b) State and explain the properties of random processes Auto correlation function. 8

(c) Given auto correlation function, for a stationary ergodic process with no periodic components is :

$$R_{XX}(Z) = 25 + \frac{4}{1+6Z^2}$$

find the mean value and variance of the process $X(t)$. 8

(d) Explain the Poisson random process. 8

Unit-V

5. (a) Define the power density spectrum for the random process. 4

(b) Consider the random process

$$X(t) = A_0 \cos(w_0 t + \theta)$$

where A_0 and w_0 are real constants and θ is a random variable uniformly distributed on the interval $(0, z_1/2)$. Find the average power P_{XX} in $X(t)$. 8

(c) Derive the relationship between power spectrum and Auto correlation function. 8

(d) State and explain the properties of power density spectrum of random processes. 8

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B067413(067)

B. Tech. (Fourth Semester) Examination
April-May 2021

(AICTE Scheme)

MODERN CONTROL SYSTEMS

Time Allowed : Three hours

Maximum Marks : 100

Minimum Pass Marks : 35

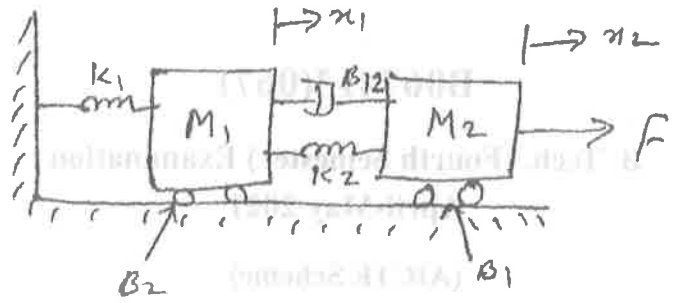
Note : *Attempt all questions. Part (a) of each question is compulsory and carries 4 marks each. Attempt any* ***two*** *from parts from (b), (c) and (d) and carries 8 marks each.*

Unit-I

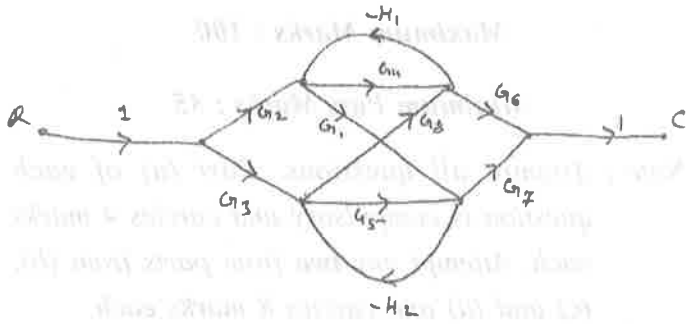
1. (a) Define transfer function. 4

(b) Comparison between open loop and closed loop system. 8

(c) Draw the analogous electrical circuit of the system show in figure. Use force-voltage analog. 8



(d) Obtain the transfer function C/R from the signal flow group show in figure. 8



Unit-II

2. (a) Define transient repsonse. 4

(b) A feedback system is described by the following transfer function

$$G(s) = \frac{1^2}{s^2 + 4s + 16}, \quad H(s) = KS$$

The damping factor of the system is 0·8./ Determine the overshoot of the system, and the value of K. 8

(c) For a unity feedback control system the forward path transfer function is

$$G(s) = \frac{20}{s(s+2)(s^2 + 2s + 20)}$$

Determine the steady state error of the system. When the inputs are

(i) 5

(ii) $5t$

(iii) $\frac{3t^2}{2}$ 8

(d) The characteristics equation of feedback control system is $s^4 + 20s^3 + 15s^2 + 2s + k = 0$.

(i) Determine the range of K for the system to be stable

(ii) Can the system be marginally stable? If so, find the required value of K and the frequency of sustained oscillation. 8

Unit-III

3. (a) Define all pass and minimum phase system. 4

(b) Consider a unity feedback control system with the following feedback transfer function

$$G(s) = \frac{K}{s\left(s^2 + 4S + 8\right)}$$

plot the root locii for the system. 8

(c) Sketch the polar plot of

$$G(s) = \frac{K}{(1+5T_1)(1+5T_2)} \cdot$$ 8

(d) Draw the Bode plot for the transfer function

$$G(s) = \frac{50}{s\,(1+0\cdot 25\,s)\,(1+0\cdot 1\,s)}$$

from the graph determine

(i) Gain crossover frequency

(ii) Phase crossover frequency

(iii) G. M. & P. M.

(iv) Stability of the system 8

Unit-IV

4. (a) Define stability. 4

(b) Using Nquist criterion investigate the stability of a closed long control system where open loop transfer function is given below

$$G(s)\cdot H(s) = \frac{K}{S\,(1+5T_1)(1+5T_2)}$$ 8

(c) Write short notes on different type of compensations. 8

(d) Write short notes on load-log compensation. 8

Unit-V

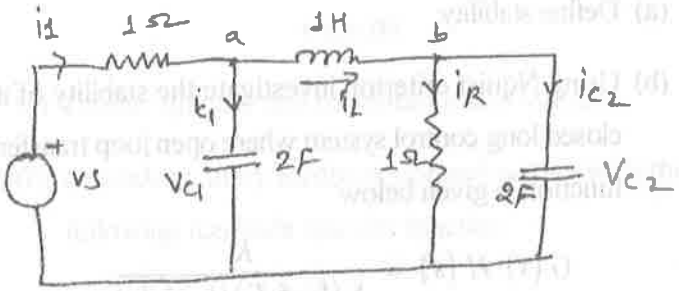
5. (a) Define state equation with Mathematical. 4

(b) A single input single output system is given as

$$\dot{x}\,|\,t\,| = \begin{bmatrix} -1 & 0 & 0 \\ 0 & -2 & 0 \\ 0 & 0 & -3 \end{bmatrix} x(t) + \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix} u$$

$$y = \begin{bmatrix} 1 & 0 & 2 \end{bmatrix} x(t).$$ 8

(c) Write the state equation for the circuit shown in figure 8



(d) Construct the state model of a system characteristics by the differential equation.

$$\frac{d^3y}{dt^3} + 6\frac{d^2y}{dt^2} + 11\,dy/dt + 6\,y = u$$

Give the block diagram representation of the state mode. 8