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10EC52

Fifth Semester B.E. Degree Examination, June/July 2016
Digital Signal Processing

Time: 3 hrs. Max. Marks:100

Note: *1. Answer any FIVE full questions, selecting atleast TWO questions from each part.*
2. Use of prototype filter tables is not permitted.

PART – A

1 a. Find the N – point DFT of $x(n) = a^n$ for $0 < a < 1$. **(04 Marks)**

b. A discrete time LTI system has impulse response $h(n) = 2\delta(n) - \delta(n-1)$. Determine the output of the system if the input $x(n) = \{\delta(n) + 3\delta(n-1) + 2\delta(n-2) - \delta(n-3) + \delta(n-4)\}$ using circular convolution. **(06 Marks)**

c. Determine 8 – point DFT of the signal $x(n) = \{1, 1, 1, 1, 1, 1, 0, 0\}$. Also sketch its magnitude and phase. **(10 Marks)**

2 a. g(n) and h(n) are the two sequences of length 6 with 6 – point DFT's G(k) and H(k) respectively. The sequence $g(n) = \{4, 3, 1, 5, 2, 6\}$. The DFT's are related by circular frequency shift as $H(k) = G((k-3))_6$. Determine h(n) without computing DFT and IDFT. **(07 Marks)**

b. Given $x(n) = \{1, 2, 3, 4\}$ and $h(n) = \{1, 2, 2\}$ compute i) circular convolution ii) linear convolution iii) linear convolution using circular convolution. **(08 Marks)**

c. Prove Parseval's relation as applied to DFT. **(05 Marks)**

3 a. Explain with necessary diagrams and equations the concept of overlap – save method for linear filtering. **(10 Marks)**

b. Write a note on Goertzel algorithm. **(05 Marks)**

c. What is in–place computation? What is the total number of complex additions and multiplications required for N = 64 point, if DFT is computed directly and if FFT is used? Also find the number of stages required and its memory requirement. **(05 Marks)**

4 a. First five points of the 8 – point DFT of a real valued sequence is given by $x(0) = 0$, $x(1) = 2 + 2j$, $x(2) = -4j$, $x(3) = 2 - 2j$, $x(4) = 0$. Determine the remaining points. Hence find the original sequence x(n) using DIT – FFT algorithm. **(10 Marks)**

b. Find the 4 – pt circular convolution of $x(n) = \{1, 1, 1, 1\}$ and $h(n) = \{1, 0, 1, 0\}$ using radix 2 DIF – FFT algorithm. **(10 Marks)**

PART – B

5 a. Design an analog Chebyshev filter with the following specifications :
Passband ripple : 1 dB for $0 \le \Omega \le 10$ rad/sec
Stopband attenuation : –60 dB for $\Omega \ge 50$ rad/sec. **(12 Marks)**

b. Derive the expressions of order and cutoff frequency of a analog butter worth filter. **(08 Marks)**

6 a. Realize the following difference equation using digital structures in all the forms :
$y(n) - \frac{3}{4}y(n-1) + \frac{1}{8}y(n-2) = x(n) + \frac{1}{3}x(n-1)$. **(16 Marks)**

b. Realize the FIR filter whose transfer function is given by :
$H(z) = 1 + \frac{3}{4}z^{-1} + \frac{17}{8}z^{-2} + \frac{3}{4}z^{-3} + z^{-4}$ in direct form. **(04 Marks)**

7 a. Design a symmetric FIR low pass filter whose desired frequency response is given as :

$$H_d(\omega) = \begin{cases} e^{-j\omega\rho} & \text{for } |\omega| \le \omega_c \\ 0 & \text{otherwise} \end{cases}$$

The length of the filter should be 7 and $\omega_c = 1$ rad/sample. Use rectangular window. **(10 Marks)**

b. Design a normalized linear phase FIR filter having the phase delay of T = 4 and atleast 40 dB attenuation in the stopband. Also obtain the magnitude /frequency response of the filter. **(10 Marks)**

8 a. Let $H_a(S) = \dfrac{b}{(s+a)^2 + b^2}$ be a causal II order analog transfer function. Show that the causal II order digital transfer H(z) obtained from $H_a(s)$ through impulse invariance is given by :

$$H(z) = \frac{e^{-aT} \sin bT z^{-1}}{1 - 2e^{-aT}\omega sbT z^{-1} + e^{-2aT} z^{-2}}.$$ **(10 Marks)**

b. Design an IIR digital butterworth filter that when used in the analog to digital with digital to analog will satisfy the following equivalent specification.

i) Lowpass filter with –1 dB cutoff 100 πrad/sec
ii) Stopband attenuation of 35 dB at 1000 π rad/sec
iii) Monotonic in stopband and passband
iv) Sampling rate of 2000 rad/sec
v) Use bilinear transformation. **(10 Marks)**

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10EC53

Fifth Semester B.E. Degree Examination, June/July 2016
Analog Communication

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***

PART – A

1 a. Explain mean, correlation and covariance functions of a random process x(t). **(08 Marks)**

b. Explain the properties of auto correlation function and power spectral density. **(12 Marks)**

2 a. Define demodulation and show that a square law device can be used to detect AM waves. **(07 Marks)**

b. Explain the generation of DSB -SC wave using ring modulator. **(08 Marks)**

c. A 250 W carrier of 1000 KHz is simultaneously modulated by sinusoidal signals of 2 KHz, 6 KHz and 8 KHz with modulation indices of 35%, 55% and 75% respectively. What are the frequencies present in the modulated wave and what is the radiated power? **(05 Marks)**

3 a. With the neat diagram, explain the operation of quadrature carrier multiplexing. **(06 Marks)**

b. Describe phase discrimination method of generating SSB waves. **(06 Marks)**

c. Consider a message signal m(t) containing the frequency complents 100, 200 and 400 Hz. This message signal is applied to an SSB modulator together with a carrier at 100 KHz with only USB retained. The coherent detector employed at the receiver uses a local oscillator that gives a sine wave of frequency 100.02 KHz.

i) Determine the frequency component of the detector output

ii) Repeat your analysis assuming only LSB is transmitted. **(08 Marks)**

4 a. Derive the time domain expression of VSB modulated wave s(t) containing a vestige of upper side band. **(07 Marks)**

b. Explain the scheme for generation and demodulation of VSB waves with relevant block diagrams, and mathematical expressions. **(07 Marks)**

c. With a neat block diagram, explain the operation of AM super heterodyne receiver. **(06 Marks)**

PART – B

5 a. Define the terms : i) modulation index ii) band width iii) frequency deviation in the case of frequency modulation. **(06 Marks)**

b. Explain the direct method of generating FM waves. **(08 Marks)**

c. An angle modulated signal is defined by $s(t) = 10 \cos [2\pi \times 10^6 t + 0.2 \sin 2000 \pi t]$ volts find the following :

i) The power in modulated signal

ii) The frequency deviation Δf

iii) Phase deviation $\Delta\theta$

iv) The approximate transmission bandwidth. **(06 Marks)**

6 a. With the help of circuit diagram, explain demodulation of FM wave using balanced frequency discriminator. **(08 Marks)**

b. With relevant block diagram, explain FM stereo multiplexing. **(06 Marks)**

c. Explain non–linearity and its effects in FM system. **(06 Marks)**

7 a. Define : shot noise, thermal noise, white noise. **(06 Marks)**

b. Define noise equivalent band width and derive the expression for the same. **(08 Marks)**

c. Two 2–port devices are connected in cascade. For the first stage, the noise figure and available power gain are 5 dB and 12 dB respectively. For the second stage, the noise figure and available power gain are 15 dB and 10 dB respectively. Determine the overall noise figure in dB. **(06 Marks)**

8 a. Derive the expression for the figure of merit of DSB – SC receiver. **(10 Marks)**

b. Describe the pre – emphasis and de -emphasis in FM. **(06 Marks)**

c. An FM signal with a deviation of 75 KHz is applied to an FM demodulator. When the input SNR is 15 dB, the modulating frequency is 10 KHz, estimate the SNR at the demodulator output. **(04 Marks)**

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10EC54

Fifth Semester B.E. Degree Examination, June/July 2016

Microwaves and Radar

Time: 3 hrs. Max. Marks:100

Note: 1. ***Answer FIVE full questions, selecting at least TWO questions from each part.***
2. Use of Smith Chart is permitted.

PART – A

1 a. Starting from fundamental, derive the expression for the voltage and current at any point on the transmission line. **(08 Marks)**

b. A transmission line has the following primary constants R = 10.4 Ω/km, L = 0.00367 H/km, G = 0.8×10^{-6} ℧/km, C = 0.00835 μF/km. Find α, β, γ, λ and z_0. **(06 Marks)**

c. Define and derive expression for reflection coefficient and transmission coefficient for a transmission line. **(06 Marks)**

2 a. A load of $Z_R = 115 - j75\Omega$ terminates at a lossless 100 Ω line. Use Smith chart to determine: (i) SWR, (ii) I/P impedance of a 0.2 λ long line, (iii) the distance from load to first voltage maximum. **(08 Marks)**

b. With neat diagram, explain Faraday's rotation isolator. **(05 Marks)**

c. With diagram, explain working of two hole direction coupler and also derive s-matrix for the same. **(07 Marks)**

3 a. Explain with a neat diagram the construction and working of PIN diode and Schottkey barrier diode. **(10 Marks)**

b. An M-Si-M BARITT diode has the following parameter:
i) Relative dielectric constant of silicon $\varepsilon_r = 11.8$
ii) Donor concentration, $N = 2.8 \times 10^{21}/m^3$
iii) Silicon length, L = 6 μm
Determine the breakdown voltage and the breakdown electric field. **(05 Marks)**

c. What is Gunn effect? Explain with constructional details of a Gunn diode. **(05 Marks)**

4 a. Derive the following losses in a microwave network in terms of S-parameter:
i) Insertion loss
ii) Transmission loss
iii) Reflection loss **(06 Marks)**
iv) Return loss **(06 Marks)**

b. State and explain properties of S-parameters.

c. Two transmission lines of characteristic impedance z_1 and z_2 are joined at plane pp^1. Express s-parameter in terms of impedance. **(08 Marks)**

PART – B

5 a. With neat diagram, explain the working of rotary precision phase shifter. **(10 Marks)**

b. Explain H-plane Tee junction and derive the S-matrix also. **(06 Marks)**

c. A 20 MW signal is fed into one of collinear port 1 of a lossless H-plane T-junction. Calculate power delivered through each port when other ports are terminated in matched load. **(04 Marks)**

6 a. Explain the various losses taking place in microstriplines. **(07 Marks)**
b. Explain the construction and field pattern for microstripline. **(08 Marks)**
c. Compare stripline and microstripline. **(05 Marks)**

7 a. Derive Radar range equation in terms of effective aperture, radar cross section of target and minimum detectable signal power of receivers. **(08 Marks)**
b. Discuss various application of Radar. **(06 Marks)**
c. With respect to Radar system, explain:
i) Maximum unambiguous Range
ii) Clutter attenuation
iii) Improvement factor
iv) Doppler shift **(06 Marks)**

8 a. Explain MTI Radar with neat block diagram. **(10 Marks)**
b. Write short notes on any two:
i) Delay line canceller
ii) C.W. Doppler Radar
iii) Pulsed Radar
iv) Blind speed **(10 Marks)**

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10EC55

Fifth Semester B.E. Degree Examination, June/July 2016
Information Theory & Coding

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Define self information, entropy of the long independent messages, information rate, symbol rate and mutual information. **(05 Marks)**

b. The output of an information source consists of 128 symbols, 16 of which occur with a probability of $\frac{1}{32}$ and the remaining occur with a probability of $\frac{1}{224}$. The source emits 1000 symbols per second. Assuming that the symbols are chosen independently, find the average information rate of this source. **(05 Marks)**

c. For the Markov source model shown in Fig. Q1 (c):
i) Compute the state probabilities.
ii) Compute the entropy of each state.
iii) Compute the entropy of the source. **(10 Marks)**

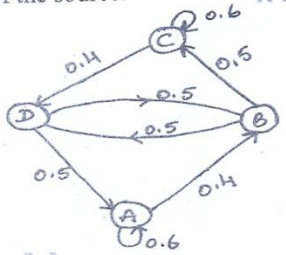

Fig. Q1 (c)

2 a. State the properties of entropy. **(04 Marks)**

b. A source emits one of the 5 symbols A, B, C, D & E with probabilities $\frac{1}{4}, \frac{1}{8}, \frac{1}{8}, \frac{3}{16}$ and $\frac{5}{16}$ respectively in an independent sequence of symbols. Using Shannon's binary encoding algorithm, find all the code words for the each symbol. Also find coding efficiency and redundancy. **(08 Marks)**

c. Construct a Shannon-Fano ternary code for the following ensemble and find code efficiency and redundancy. Also draw the corresponding code – tree.
$S = \{S_1, S_2, S_3, S_4, S_5, S_6, S_7\}$; $P = \{0.3, 0.3, 0.12, 0.12, 0.06, 0.06, 0.04\}$ with $X = \{0, 1, 2\}$ **(08 Marks)**

3 a. Show that $H(X,Y) = H(Y) + H\left(\frac{X}{Y}\right)$. **(05 Marks)**

b. The noise characteristics of a non-symmetric binary channel is given in Fig. Q3 (b). **(10 Marks)**

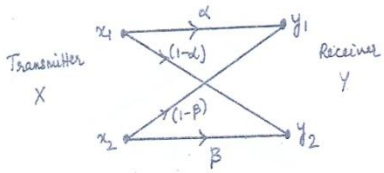

Fig. Q3 (b)

i) Find H(X), H(Y), $H\left(\frac{X}{Y}\right)$ and $H\left(\frac{Y}{X}\right)$. Given $P(x_1) = \frac{1}{4}$, $P(x_2) = \frac{3}{4}$, $\alpha = 0.75$, $\beta = 0.9$

ii) Also find the capacity of the channel with $r_s = 1000$ symbols/sec.

c. A source has an alphabet consisting of seven symbols A, B, C, D, E, F & G with probabilities of $\frac{1}{4}, \frac{1}{4}, \frac{1}{8}, \frac{1}{8}, \frac{1}{8}, \frac{1}{16}$ and $\frac{1}{16}$ respectively. Construct Huffman Quarternery code. Find coding efficiency. **(05 Marks)**

4 a. State Shannon-Hartley theorem and explain its implications. **(08 Marks)**

b. A Gaussian channel has a bandwidth of 4 kHz and a two-side noise power spectral density $\frac{\eta}{2}$ of 10^{-14} watts/Hz. The signal power at the receiver has to be maintained at a level less than or equal to $\frac{1}{10}^{th}$ of milliwatt. Calculate the capacity of this channel. **(06 Marks)**

c. Explain the properties of mutual information. **(06 Marks)**

PART – B

5 a. What are the types of errors and types of codes in error control coding? **(04 Marks)**

b. Consider a (6, 3) linear code whose generator matrix is, $G = \begin{bmatrix} 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 \end{bmatrix}$

i) Find all code vectors.
ii) Find all the Hamming weights.
iii) Find minimum weight parity check matrix.
iv) Draw the encoder circuit for the above codes. **(10 Marks)**

c. The parity check bits of a (7, 4) Hamming code are generated by,
$C_5 = d_1 + d_3 + d_4$; $C_6 = d_1 + d_2 + d_3$; $C_7 = d_2 + d_3 + d_4$
where d_1, d_2, d_3 & d_4 are the message bits.
i) Find generator matrix and parity check matrix.
ii) Prove that $GH^T = 0$. **(06 Marks)**

6 a. Define Binary cyclic codes. Explain the properties of cyclic codes.

b. A (15, 5) linear cyclic code has a generator polynomial,
$g(x) = 1 + x + x^2 + x^4 + x^5 + x^8 + x^{10}$ **(08 Marks)**
i) Draw the block diagram of an encoder for this code $g(x) = 1 + x + x^2 + x^4 + x^5 + x^8 + x^{10}$
ii) Find the code vector for the message polynomial $D(x) = 1 + x^2 + x^4$ in systematic form.
iii) Is $V(x) = 1 + x^4 + x^6 + x^8 + x^{14}$ a code polynomial? **(12 Marks)**

7 Write short notes on:
a. BCH codes.
b. RS codes.
c. Golay codes.
d. Brust error correcting codes. **(20 Marks)**

8 a. What are convolutional codes? Explain encoding of convolutional codes using transform domain approach. **(08 Marks)**

b. Consider the (3, 1, 2) convolutional code with $g^{(1)} = (1\ 1\ 0)$, $g^{(2)} = (1\ 0\ 1)$ and $g^{(3)} = (1\ 1\ 1)$
i) Draw the encoder block diagram.
ii) Find the generator matrix.
iii) Find the code word corresponding to the information sequence (1 1 1 0 1) using time domain approach. **(12 Marks)**

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10EC56

Fifth Semester B.E. Degree Examination, June/July 2016
Fundamentals of CMOS VLSI

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Discuss latch-up in a p-well CMOS structure and its remedies. With neat figure explain twin tub CMOS process steps. **(10 Marks)**

b. For an NMOSFET, the following details are available $\mu n = 500 cm^2/V\text{-se}$, $(V_a - V_{tn}) = 2.6V$ $t_{ox} = 100$ Å . Calculate Rn of the device if w = 100μm L = 0.5μm. **(05 Marks)**

c. Deduce an equation for figure of merit of MOS transistor. Fnd the operating frequency f_o in the following condition $\mu n = 125 cm^2/v\text{-sec}$, L =2 μm, $V_{gs} = 2V$ and $\mu_{tn} = 1V$. **(05 Marks)**

2 a. What are the uses of stick diagram? Give the table of color and monochrome stick encoding for simple single metal NMOS process. **(07 Marks)**

b. Draw the CMOS circuit diagram, stick diagram and symbolic diagram of Boolean function $F = \overline{wx + yz}$. **(06 Marks)**

c. What do you mean by λ based design rule? Explain λ based design rules applicable to MOS layers and transistors. **(07 Marks)**

3 a. With neat circuit diagram explain the following : (i) A simple BiCMOS inverter and (ii) An improved BiCMOS inverter with no static current flow and better output logic levels. **(10 Marks)**

b. Draw and explain the basic structure of dynamic CMOS logic and discuss the charging sharing problem in this structure. **(10 Marks)**

4 a. What are the most commonly used scaling models? Provide scaling factors for (i) power dissipation per gate (ii) Gate delay (iii) current density and (iv) speed power product. **(10 Marks)**

b. For the given multilayer structure shown in Fig. Q4(b) calculate the total capacitance. **(10 Marks)**

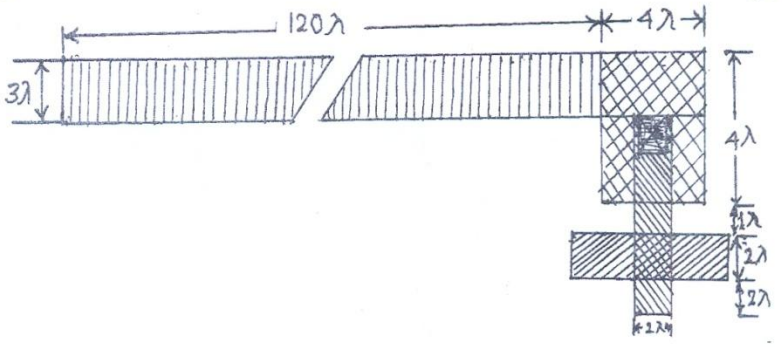

Fig. Q4(b)

PART – B

5 a. Obtain switch logic arrangements for (i) $V_{out} = V_1A + V_2B + V_3C$ using 3 way selector switch and (ii) 3 input nMOS OR gate. **(10 Marks)**

b. Draw and explain 4 : 1 MUX using transmission gate. **(05 Marks)**

c. Explain with neat figure, non – inverting dynamic storage cells using CMOS transmission gate switch. **(05 Marks)**

6 a. With the help of logic expressions explain how to implement arithmetic logic operations with a standard adder. **(10 Marks)**

b. Explain with neat diagram the 4×4 cross bar switch. **(10 Marks)**

7 a. With neat figure explain transistor dynamic RAM cell. **(06 Marks)**

b. Describe the CMOS pseudo static memory cell with neat figure. **(06 Marks)**

c. Explain read and write operations in dynamic memory cell. **(08 Marks)**

8 Write short notes on :

a. Input/output pads **(05 Marks)**

b. Test and Testability. **(05 Marks)**

c. Level sensitive scan design and **(05 Marks)**

d. Built in self test (BIST). **(05 Marks)**

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10TE52

Fifth Semester B.E. Degree Examination, June/July 2016
Digital Signal Processing

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***

PART – A

1 a. Derive the expression for DFT and IDFT. **(10 Marks)**

b. Find the 6 point DFT of the sequence x(n) = {1, 1, 2, 2, 3, 3}. Compute the corresponding magnitude and phase angle. **(10 Marks)**

2 a. State and prove the following DFT properties :
i) Time shift property
ii) Periodicity property
iii) Multiplication of 2 sequences in time domain. **(10 Marks)**

b. Find the response of an FIR filter with impulse response h(n) = {1, 2, 4} to the input/output sequence x(n) = {1, 2]. Mention the property used. Use DFT and IDFT method for computation. **(10 Marks)**

3 a. Use overlap add method to find y(n) = x(n)*h(n) for the sequences x(n) = {1, 2, –1, 2, 3, –2, –3, –1, 1, 1, 2, –1} and h(n) = {1, 2}. **(10 Marks)**

b. Derive the (decimation in time)DFT- FFT algorithm. **(07 Marks)**

c. What is the speed improvement factor in calculating 64 point DFT of a sequence using direct computation and FFT algorithm? **(03 Marks)**

4 a. Find the 8 point DFT of a continuous time signal x(t) = sin (2πft) ; with f = 50 Hz. Use DIT – FFT algorithm. **(10 Marks)**

b. Find the inverse DFT of the sequence using (decimation in frequency DIF radix – 2 algorithm for x(k) = {4, 1 –j2.414, 0, 1 – j0.414, 0, 1 + j0.414, 0, 1 + j2.414}. **(10 Marks)**

PART – B

5 a. For the given specification, design an analog Butterworth filter :
$0.9 \le |H(j\Omega)| \le 1$ for $0 \le \Omega \le 0.2\pi$
$|H(j\Omega)| \le 0.2$ for $0.4\pi \le \Omega \le \pi$. **(08 Marks)**

b. Design a Chebyshev filter with maximum passband attenuation of 2.5 dB at $\Omega_p = 20$ mad/sec and the stopband attenuation of 30 dB at $\Omega_s = 50$ rad/sec. **(12 Marks)**

6 a. Obtain the cascaded and parallel realization of :

$$H(z) = \frac{1 + \frac{1}{4}z^{-1}}{(1 + \frac{1}{2}z^{-1})(1 + \frac{1}{2}z^{-1} + \frac{1}{4}z^{-2})}.$$ **(08 Marks)**

b. Convert the following pole zero IIR filter into a lattice ladder structure :

$$H(z) = \frac{1 + 2z^{-1} + 2z^{-2} + z^{-3}}{1 + \frac{13}{24}z^{-1} + \frac{5}{8}z^{-2} + \frac{1}{3}z^{-3}}.$$ **(12 Marks)**

7 a. Design an ideal highpass filter with the frequency response

$$H_d(e^{j\omega}) = 1 \quad \frac{\pi}{4} \leq |\omega| \leq \pi$$

$$= 0 \quad |\omega\} < \frac{\pi}{4}$$

Use a Hamming window with N = 11. **(15 Marks)**

b. What is the need for employing window technique for FIR filter design? Draw the frequency response of N – point rectangular window. **(05 Marks)**

8 a. For the analog transfer function $H(s) = \frac{2}{(s+1)(s+2)}$ determine H(z) using : i) impulse invariance method ii) Bilinear transformation method. Assume T = 1 sec. **(10 Marks)**

b. Explain the approximation of derivative method for digitizing the analog filter to digital filter. **(10 Marks)**

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10TE54

Fifth Semester B.E. Degree Examination, June/July 2016

Transmission Lines and Waveguides

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Derive the expression for general solution of a transmission line at any point along the line of any length with uniformly distributed constants. **(12 Marks)**

b. Derive equations for filter elements of a low pass constant K filter with symmetrical T-section. **(08 Marks)**

2 a. A generator of 1V, 1 kHz supplies power to a 100 km line terminated by Z_0 and has R = 10.4 Ω/km, L = 0.00367 H/km, G = 0.8×10^{-6} mho/km and C = 0.00835 μF/km. Calculate Z_0, attenuation constant α, phase constant β, wavelength λ, velocity ν, received current, voltage and power. **(06 Marks)**

b. Explain the various distortions that occur when a wave propagates through transmission line. **(04 Marks)**

c. Derive the equation for voltage and current for a high frequency dissipationless line. Draw the voltage and current waveforms for open and short circuit conditions. **(10 Marks)**

3 a. Derive the relationship between standing wave ratio and reflection coefficient. **(06 Marks)**

b. Derive the equations for length and location of single stub matching device in terms of reflection coefficient. **(10 Marks)**

c. What is Smith chart? Discuss the applications and properties of Smith chart. **(04 Marks)**

4 a. Derive the equations for short circuit and open circuit impedances for quarter wave lines and half wave lines of small dissipation. **(10 Marks)**

b. A load of admittance $\frac{Y_R}{G_O} = 1.25 + j0.25$ is connected to the transmission line. Find the length and location of single stub tuner short circuited connected to line. **(10 Marks)**

PART – B

5 a. Explain S-matrix representation of multiport network. **(04 Marks)**

b. State and explain the properties of S-matrix. **(06 Marks)**

c. Two transmission lines of characteristic impedances Z_1 and Z_2 are joined at plane PP^1. Express s-parameters in terms of impedances. **(10 Marks)**

6 a. Describe the properties and characteristics of wave guides. **(06 Marks)**

b. What are microwave cavities? Also show that cavity resonator has only one frequency of resonance for a given mode. **(10 Marks)**

c. Define the following terms with necessary equations:
   i) Cutoff frequency of waveguide
   ii) Cutoff wavelength of waveguide
   iii) Group velocity
   iv) Guide wavelength **(04 Marks)**

7 a. Starting from Maxwell's equation derive expression for various field components inside circular waveguide for TE_{mn} wave propagation. **(10 Marks)**

b. A rectangular air filled copper waveguide has dimensions of 4 cm × 2.2 cm and length 8 cm. It operates at 8 GHz with dominant TE_{10} mode. Determine:

i) Cut off frequency ii) Guide wavelength

iii) Phase velocity iv) characteristic wave impedance

v) Total attenuation in dB.

Assume $\sigma = 8.57 \times 10^7$ mho/m for copper. **(10 Marks)**

8 a. With neat sketches, explain working of Gunn diode and its modes of operation. **(10 Marks)**

b. With relevant diagrams, explain IMPATT diode operation and mechanism of oscillation. **(10 Marks)**

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10TE55

Fifth Semester B.E. Degree Examination, June/July 2016
Digital Switching Systems

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***

PART – A

1 a. Explain time division multiplexing with suitable block diagram. **(06 Marks)**
b. With a neat diagram, explain hierarchy of national public switched telecommunication network. **(06 Marks)**
c. Describe SDH frame structure with diagram. **(08 Marks)**

2 a. Describe the functions of electronic switching. **(06 Marks)**
b. With block diagram, explain subscriber's line interface circuit for a digital exchange. **(06 Marks)**
c. What are the facilities provided by central office, explain with diagram. **(08 Marks)**

3 a. Define the following terms : i) traffic ii) congestion iii) busy hour. **(06 Marks)**
b. Derive the expression for second Erlangs distribution starting from basic principles. **(08 Marks)**
c. A group of five trunks is offered 2E of traffic. Calculate :
i) Grade of service ii) probability that only one trunk is busy iii) probability that only one trunk is free iv) probability that at least one trunk is free. **(06 Marks)**

4 a. What is grading? Explain types of grading. **(06 Marks)**
b. Differentiate single stage and multistage networks. **(06 Marks)**
c. Design three stage network for 100 incoming trunks and 400 outgoing trunks. **(08 Marks)**

PART – B

5 a. With neat diagram, explain T–S–T switching network. **(06 Marks)**
b. Explain the need for frame alignment in time division switching. **(06 Marks)**
c. A T–S–T network has 20 incoming and 20 outgoing PCM highway, each conveys 30 channels. The required GOS is 0.01, 0.02, 0.001, 0.005. Find traffic capacity of network in mode 1 and mode 2. **(08 Marks)**

6 a. With diagram, explain software linkages during a call. **(08 Marks)**
b. Explain digital switch software classification with block diagram. **(06 Marks)**
c. Explain the concept of call models in the design of telephone systems. **(06 Marks)**

7 a. Explain organizational interfaces of central office. **(08 Marks)**
b. Draw a typical problem reporting system for digital switching environment. Briefly explain the same. **(06 Marks)**
c. Explain with a neat diagram, a strategy for improving software quality. **(06 Marks)**

8 a. With neat diagram, explain generic switch software architecture. **(06 Marks)**
b. Explain common characteristics of digital switching systems. **(08 Marks)**
c. List the steps to complete simple call. **(06 Marks)**

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