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T.E. (E &TC/Electronics)(Semester – II) Examination, 2009
INFORMATION THEORY AND CODING TECHNIQUES
(2003 Course)

Time : 3 Hours Max. Marks : 80

Instructions : *1) Answer **any three** questions from **each** Section.*
*2) Black figures to the **right** indicate **full** marks.*
*3) **Use** of electronic pocket calculator is **allowed**.*

SECTION – I

1. a) Find the mutual information for the channel shown in figure below. **8**

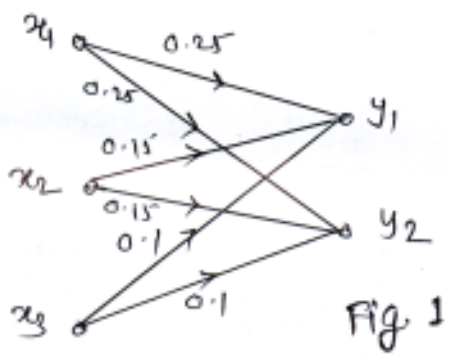

Fig. 1

Also state the type of corresponding channel.

b) State and explain all the three Shannon's theorems of information theory. **8**

OR

2. a) For the given string - 'ZANAPENA', generated by the source (DMS), find codewords using Huffman Algorithm and efficiency of the code. **8**

b) Find the source codes using Lempel-Ziv algorithm for the following bit stream. **8**

10101101101010101111010010101 00

Also, recover the original sequence from the encoded stream.

P.T.O.

3. a) A black and white television picture may be viewed as consisting of approximately 3×10^5 elements, each one of which may occupy one of 10 distinct brightness levels, with equal probability. Assume i) the rate of transmission is 30 picture frames per second, and ii) the signal to noise ratio is 30 dB. **8**

   Using the channel capacity theorem, calculate the minimum bandwidth required to support the transmisson of the resultant video signal.

   b) i) Explain information capacity of coloured noise channel. **8**

   ii) Explain the sphere packing problem.

OR

4. a) For the ideal communication channel, affected by AWGN show that the Shannon's limit is equal to –1.6 dB, in case of information capacity theorem. **8**

   b) Explain the Water - Filling Interpretation of the information capacity theorem. **4**

   c) For the Gaussian random variable having variance σ^2, show that the differential entropy is given by $\left\{\frac{1}{2}\log_2[2\pi e\sigma^2]\right\}$. **4**

5. a) For a systematic Linear Block code the three parity check bits C_4, C_5, C_6 are given by **12**

   $C_4 = m_1 \oplus m_2 \oplus m_3$

   $C_5 = m_1 \oplus m_2$

   $C_6 = m_1 \oplus m_3$

   i) Construct Generator matrix

   ii) Construct all the codes generated by this matrix

   iii) Determine error detecting and correcting capability

   iv) Prepare a suitable decoding table

   v) Decode the received code words 101100 and 000110.

   b) Let C be a binary perfect code of length 'n' with minimum hamming distance 7. For n = 7 or n = 23. Find the order (n, k) for the LBC. **6**

OR

6. a) Obtain generator matrix and parity check matrix for (7,4) systematic cyclic code. **6**

   b) For (7, 4) Linear Cyclic Code with $G(P) = 1+D+D^3$, find out syndrome for the received sequence '1111011' with the help of syndrome calculator using hardware arrangement. **6**

   c) With the help of suitable example, explain "Burst error" and comment on error detection capabilities of CRC codes. **6**

SECTION – II

7. a) A rate $\frac{1}{3}$ convolusion encoder has generating vectors as $g_1 = (110)$, $g_2 = (111)$ and $g_3 = (011)$. **12**

      i) Sketch the encoder

      ii) If input message sequence is 10110, determine the output sequence of the encoder.

      iii) Draw the state diagram and trillis diagram.

   b) What are Unger Bock's TCM design rules ? Explain Asymptotic coding gain. **6**

OR

8. a) For the rate $\frac{1}{2}$ convolutional encoder with constraint length 3 and algebric function generators $g_1 = 111$, $g_2 = 101$. **10**

      i) Decode the received sequence 10101101010111 using Viterbi Algorithm

      ii) Find d_{free} .

   b) Explain turbo code with the help of encoder and decoder. Explain the role of interleaver in the encoder. **8**

9. a) Find the minimal polynomial of $GF[2^3]$ whose transfield is GF(2) with primitive polynomial $x^3 + x + 1$. **8**

b) For the (31, 15) Reed-Solomon code, **8**

i) How many bits are there in a symbol of the code ?

ii) What is the block length in bits ?

iii) What is the minimum distance of the code ?

iv) How many symbols in error can the code correct ?

OR

10. a) Use the prime numbers 3 & 11 to find public key, private key, n & ϕ. Also encrypt plain text m = 4 and decrypt it. **8**

b) With the help of block diagram, explain JPEG compression standards. **8**

11. a) A C band satellite earth station working at 6375/4150 MHz receives signals from geostationary satellite at an elevation angle of 28°. The diameter of the Earth station antenna is 7.5 meters and noise temperature is 100°k. Determine the G/T figure of earth station. If the heavy rain causes the system noise temperature to degrade by 20%, determine the new value of G/T. Assume antenna efficiency to be 60%. **8**

b) Compare TDMA, FDMA, CDMA techniques. State one example of each technique. **8**

OR

12. a) Derive the equanion of $\left[C/No\right]$ for uplink power budget of satellite system. **8**

b) Explain the following terms related to the mobile communication : **8**

i) Cells

ii) Cluster

iii) Frequency reuse

iv) Cell splitting.

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T.E. (E & TC/Electronics) (Sem. – II) Examination, 2009
ELECTROMAGNETIC WAVES AND RADIATING SYSTEMS
(2003 Course)

Time : 3 Hours Max. Marks : 100

Instructions. *: 1) Answer **3** questions from Section **I** and **3** questions from Section **II**.*
*2) Answers to the **two** Sections should be written in **separate** books.*
*3) **Neat** diagrams must be drawn **wherever** necessary.*
*4) Black figures to the **right** indicate **full** marks.*
*5) Your answers will be **valued** as a **whole**.*
*6) **Use** of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is **allowed**.*
*7) Assume **suitable** data, if **necessary**.*
*8) Smith charts are **not allowed**.*

SECTION – I

1. a) Find the electric field intensity due to an infinite line charge at an arbitrary point using Guass Law only. **8**

1. b) Solve the Laplace's equation in cylindrical co-ordinate system for finding the capacitance of a co-axial cable of inner radius 'a', outer radius 'b' and length 'L'. **8**

OR

2. a) Justify that the total flux crossing through a closed surface in a magnetic field must be zero. Write the Maxwell equation which represents this statement. Also write the dual to this equation in electric field and displacement flux. **6**

2. b) Can a scalar magnetic potential be defined similar to the scalar electric potential ? How can we define a potential function which may be found from the current distribution and from which the magnetic fields may be easily determined ? **6**

2. c) Write the continuity equation and explain its physical significance. **4**

P.T.O.

3. a) Write the Maxwell equations for static electromagnetic fields. Modify each for time varying fields with proper justification using basic law's of electromagnetics. **8**

3. b) An EM field is said to be non-existent or not Maxwellian's if it fails to satisfy Maxwell equations and the wave equations derived from them. Which of the following fields in free space are not Maxwellian ? **8**

i) $\overline{H} = \cos x \cos 10^6 t \, \hat{a}_X$

ii) $\overline{D} = e^{-10y} \sin (10^5 t - 10y) \, \hat{a}_Z$

iii) $\overline{B} = (1 - p^2) \sin \omega t \, \hat{a}_z$

iv) $\overline{E} = \frac{1}{r \in_o} \sin \theta \sin(\omega t - 5r) \, \hat{a}_\theta$

OR

4. a) Write the following time harmonic fields as phasors.

$\overline{E} = 4 \cos (\omega t - 3x - 10°) \, \hat{a}_y - \sin(\omega t + 3x + 12°) \, \hat{a}_z$ and express the following phasors in their instantaneous form

i) $\overline{B_s} = \frac{20}{\rho} e^{-j2z} \, \hat{a}_\rho$

ii) $\overline{A_s} = (4 - 3j) \, e^{-j\beta x} \, \hat{a}_y$. **6**

4. b) In a non-magnetic material $(\in_r \neq 0, \mu = \mu_0, \sigma = 0)$

i) Find $\overline{E}$ using Maxwell equations

ii) Find Poynting vector

iii) Find the time average power crossing the surface are x = 1 ; 0 < y < 2; 0 < z < 3 m

given $\overline{H} = 30 \cos (2\pi \times 10^8 t - 6x) \, \hat{a}_y$ mA/m. **10**

5. a) Obtain the Helmotz wave equation from the Maxwell equations in phasor form. **4**

5. b) Make all the necessary assumptions for a uniform plane wave propagating in z-direction in TEM mode. **4**

5. c) Solve the Helmotz wave equation for obtaining the expressions for electric field $\overline{E}$, magnetic field $\overline{H}$ intrinsic impedance η, velocity of propagation, attenuation constant α, phase constant β for free space. **10**

OR

6. a) When the wave is propagating in a good conductor, obtain the expression for α, β and what do you understand from skin depth, write the expression and physical significance for skin depth ? **8**

6. b) Define the reflection co-efficient, standing wave ratio. Explain the physical significance. **5**

6. c) A uniform plane wave in air $E^{+}_{x1} = E^{+}_{x10} \cos(10^{10} t - \beta z)$ is normally incident on a copper surface at z =0. What percentage of the incident power is transmitted into the copper ? Find η_c, η_o, reflection co-efficient, transmission coefficient where the conductivity of copper is $\sigma_c = 5.8 \times 10^7$. **5**

SECTION – II

7. a) Show that a lossy transmission line of length *l* has an input impedance $z_{se} = Z_0 \tanh rl$ when shorted and $z_{oe} = z_o \coth rl$ when open. Find the values of z_o, α, β for a given transmission line of 50 mile and has the following measurements at 1200 cycles.

$z_{oe} = 200 \angle -42^\circ \Omega$, $z_{se} = 1890 \angle 22^\circ$. **8**

7. b) A telephone line has the following parameters R = 40 Ω/m; G = 400 μs/m; L = 0.2 μH/m; C= 0.5 n F/m. Find the characteristic impedance and propagation constant and also find the voltage drop in dBs after *l* = 1.06 m. Also find the velocity of propagation for operating frequency of 10 MHz. **10**

OR

8. a) Find attenuation constant α and phase constant β in terms of primary constants (R, L, G,C) of a transmission line. Explain the significance of each. What are the distortions in transmission line and why do they occur ? Find the condition for a distortionless transmission line. **12**

8. b) Draw the typical normalized resistance and reactance circles for 0, 0.5, 1, 2, ∞ without using the Smith chart. Explain the applications of Smith chart. **6**

9. An infinitesimal current element is located at the origin of a coordinate system and it carries a uniform current (constant throughout the element), $I = I_o \cos \omega t$ in a free space.

   i) Find the retarded magnetic vector potential $\overline{A}_s$ at a point P in spherical co-ordinate system i.e. P (r, θ, ϕ).

   ii) Find the magnetic field intensity $\overline{H}_s$ and electric field intensity $\overline{E}_s$ for far field region.

   iii) Find the time average radiated power.

   iv) Find radiation resistance.

   Comment on the each result. **16**

OR

10. a) Define radiation intensity, directive gain, directivity of an antenna and show that the directive gain of Hertzian dipole is $1.5 \sin^2\theta$ and its directivity is 3. **8**

10. b) An electric field strength of $10\,\mu V/m$ is to be measured at an observation point $\theta = \pi/2$, 500 km from a half-wave dipole antenna operating in air at 50 MHz.

   i) What is the length of the dipole ?

   ii) Calculate the current that must be fed to the antenna.

   iii) Find the average power radiated by the antenna. **8**

11. a) What is array factor ? Derive the expression for the array factor of an N-element uniform linear array. **6**

11. b) Sketch the normalized field pattern for a 4-element uniform linear array to have its maximum radiation directed normal to the axis of the array. Assume that the elements are isotropic and spacing to be $\lambda/2$. **10**

OR

12. a) Write the advantages, disadvantages and features of microstrip antenna. Also enlist its applications. **5**

12. b) Draw the structural diagram of Yagi-Ude antenna by giving all the dimensions. Draw its radiation pattern. Discuss its features, applications and merits. **6**

12. c) What is the role of the antenna in communications and how do you choose a particular antenna ? **5**

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T.E. (Electronics/E & TC) (Semester – II) Examination, 2009
DIGITAL SIGNAL PROCESSING
(2003 Course)

Time : 3 Hours | Max. Marks : 100

SECTION – I

1. a) Determine the impulse response h[n] for the system described by difference equation. $y[n] - 3y[n-1] - 4y[n-2] = x[n] + 2x[n-1]$. **4**

   b) Explain the role of digital signal processing in sound recording with necessary equalizers and filters. **6**

   c) Find z transform of :

      i) $x[n] = n^2 u[n]$

      ii) $x[n] = 2^n u[n-2]$. **6**

OR

2. a) Find causal sequence x[n] by using convolution theorem of z transform.

$$x[z] = \frac{1}{\left(1 - \frac{1}{2}z^{-1}\right)\left(1 + \frac{1}{4}z^{-1}\right)}.$$ **8**

   b) State and prove differentiation in z domain theorem of z transform. **4**

   c) Explain the meaning of ROC. How it is important in determining causality and stability of the system ? **4**

3. a) Compute DFT of a sequence $x[n] = \left(\frac{1}{2}\right)^n u[n]$ and N = 8 using DIT FFT algorithm. **8**

   b) Write short notes on : **8**

      i) Relationship of DFT with DTFT and z transform.

      ii) DTMF detection using Goertzel algorithm.

OR

P.T.O.

4. a) Convolve the following sequences using :

(i) Overlap add and (ii) Overlap save method

$x[n] = [1, -1, 2, 1, 2, -1, 1, 3, 1]$

$h[n] = [1, 2, 1]$. **8**

b) For the 8-sample sequence $x[n] = [1, 2, 3, 5, 5, 3, 2, 1]$, the first five DFT coefficients are

$[22, -7.5355 - j3.1213, 1 + j, -0.4645 - j\ 1.1213, 0]$. Determine the remaining three DFT coefficients. **8**

5. a) Explain Gibb's phenomenon. **4**

b) The desired frequency response of a LPF is

$$H_d[e^{j\omega}] = 1 \quad -\pi/2 \le \omega \le \frac{\pi}{2}$$

$$= 0 \quad \frac{\pi}{2} \le |\omega| \le \pi$$

Determine $h_d[n]$. Also determine h[n] using symmetrical Bartlet window with length 7. **8**

c) Realize the system function

$$H[z] = \frac{1 - z^{-3}}{\left(1 + z^{-1}\right)\left(1 + 3z^{-1} + z^{-2}\right)}$$ in cascade canonic form. **6**

OR

6. a) What is linear phase filter ? What are the necessary conditions for linear phase filters ? How FIR filter $y[n] = x[n] - x[n-2]$ gives linear phase response ? **9**

b) Design a normalized linear phase FIR filter having phase delay of $\tau = 4$ and at least 50 dB attenuation in sideband. Also obtain magnitude-frequency response of the filter. **9**

SECTION – II

7. a) Design a digital Butterworth filter to meet the constraints.

$$0.9 \le |H[e^{j\omega}]| \le 1 \quad 0 \le \omega \le 0.25\pi$$

$$|H[e^{j\omega}]| \le 0.2 \qquad 0.6\pi \le \omega \le \pi$$

Using bilinear transformation with $T_s = 0.1$ sec. **8**

b) Compare Butterworth and Chebyshev approximations. **4**

c) Realise $H[z] = \dfrac{(1 - z^{-1})^3}{\left(1 - \frac{1}{2}z^{-1}\right)\left(1 - \frac{1}{3}z^{-1}\right)}$ in parallel form. **4**

OR

8. a) Determine H[z] using impulse invariance technique for analog system function

$$H[s] = \frac{1}{(s + 0.5)(s^2 + 0.5s + 2)}$$ with $f_s = 20$Hz. **8**

b) Compare the features of digital Butterworth, Chebyshev type I and type – II in terms of :

i) the distribution of their poles and zeros

ii) filter order

iii) transition width

iv) phase and group delay responses. **8**

9. a) A four stage decimator is used to reduce the sampling rate from 96 KHz to 1 KHz. Assume decimation factors 4, 3, 4, 2 pass band ripple $\delta_p = 0.01$ and passband deviation $\delta_s = 0.001$. Design an efficient decimator. Calculate MPS and TSR for the design. **10**

b) Explain the method of sampling rate reduction and increase. **6**

OR

10. a) What is STFT ? Write its mathematical expression and explain its significance with suitable example. **6**

b) Design two stage decimator with sampling rate to be reduced from 10 KHz to 500 Hz. Passband edge 150 Hz, stopband edge 180 Hz, Passband ripple 0.002 and stopband ripple 0.001. **10**

11. a) The input to the system $y[n] = 0.999\ y[n-1] + x[n]$ is applied to an ADC. What is the power produced by the qualitization noise at the output of filter if input is quantized to (i) 8 bits (ii) 16 bits. **8**

b) Write short notes on : **10**

i) Finite word length effects in FFT

ii) Effect of coefficient quantization in FIR filters.

OR

12. a) With the help of architecture of DSP processor explain :

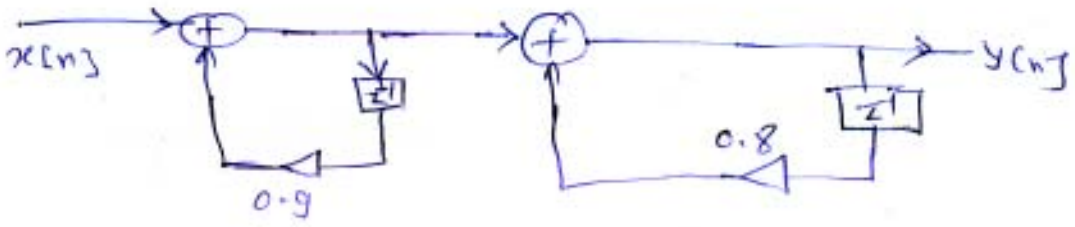
i) Barrel shifter

ii) Cache memory

iii) DAG

iv) MAC/Program sequence. **10**

b) A cascaded realization of two first order digital filters is shown below :



The system functions of the individual sections are

$H_1[z] = \frac{1}{1-0.9z^{-1}}$ and $H_2[z] = \frac{1}{1-0.8z^{-1}}$. Draw the product quantization noise model of system and determine the overall o/p noise power. **8**

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T.E. (E&TC/Electronics) (Sem. – II) Examination, 2009
POWER ELECTRONICS
(2003 Course)

Time : 3 Hours Max. Marks : 100

Instructions *: 1) Answer* ***any three*** *questions from* ***each*** *Section.*
2) Answer ***three*** *questions form Section* ***I*** *and three questions from Section* ***II****.*
3) Answers to the ***two*** *Sections should be written in* ***separate*** *books.*
4) ***Neat*** *diagrams must be drawn* ***wherever*** *necessary.*
5) ***Black*** *figures to the* ***right*** *indicate* ***full*** *marks.*
6) ***Use*** *of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is* ***allowed****.*
7) Assume ***suitable*** *data,* ***if necessary****.*

SECTION – I

1. a) Draw the vertical cross section and VI characteristics of IGBI. Also explain latchup in IGBT and how to avoid it ? **8**

   b) A UJT trigger circuit is used to fire a PNPN device. It is supplied from a source across the SCR to be triggered through 10 V zener. The valley and peak point voltages are found to be 1V and 7 V respectively. Calculate the intrinsic stand-off ratio of UJT and frequency of relaxation oscillator if $R = 1k\,\Omega$ and $C = 1\mu F$. **8**

OR

2. a) Draw the internal structure of SCR. Also explain the advantages and disadvantages of SCR over Diode. **8**

   b) Describe following ratings as applicable to SCR. **8**

      i) Surge current rating

      ii) i^2t rating

      iii) $\frac{di}{dt}$ rating

      iv) $\frac{dv}{dt}$ rating.

P.T.O.

3. a) A single phase half controlled bridge rectifier operates from the 115V, 60Hz mains and supplies a resister load of $250\,\Omega$. For firing angles $45° \& 135°$, Calculate : **16**

   i) Average output voltage

   ii) rms output voltage

   iii) rms supply current

   iv) Peak supply current.

OR

4. a) Draw the circuit diagram for 3ϕ full converter for resistive load. Draw and explain the waveform of output voltage and current for $\alpha = 30°$ and $\alpha = 60°$. **10**

   b) Discuss the advantages of 3ϕ supply over the 1ϕ supply. **6**

5. a) Draw the circuit diagram of a single phase transistorised bridge inverter and explain how quasi-square wave operation is possible with the help of following waveform for RL Load.

   i) Base current waveforms for transistors T_1 and T_4

   ii) Output voltage waveforms

   ii) Load current waveforms.

   Clearly indicate when power flows from source to load, load to source and the free-wheeling intervals. **12**

   b) Calculate the following for a single-phase transistorised half bridge inverter. **6**

   i) RMS output voltage at fundamental frequency.

   ii) Output power.

   Assume DC supply of 24V and load resistance of 2 ohm.

OR

6. a) Explain $180°$ conduction scheme for 3ϕ VSI bridge inverter having balanced star 'R' load.

   Draw the circuit and waveforms.

   Compare it with other technique. **12**

   b) Write a short note on PWM ICs for inverter control. Draw the circuit diagram. **6**

SECTION – II

7. a) Explain the control techniques used in chopper circuits. **6**

   b) For step down type A chopper, input voltage is 600V DC. It supplies a load of 10Ω at 25% duty cycle. Find average output voltage, average output current, RMS value of output voltage and ripple factor. **10**

OR

8. a) Give the advantages and disadvantages of SMPS over linear power supply. **8**

   b) Explain the operation of flyback converter used in SMPS with the help of circuit diagram and necessary waveforms. **8**

9. a) Explain methods of AC voltage regulation in detail. Draw the necessary waveforms and circuit diagram. Also derive the equation for rms value of outjoint voltage in each case. **12**

   b) Draw the input voltage waveform, output voltage waveform and device voltage waveform for the circuit shown in Fig. I. **4**

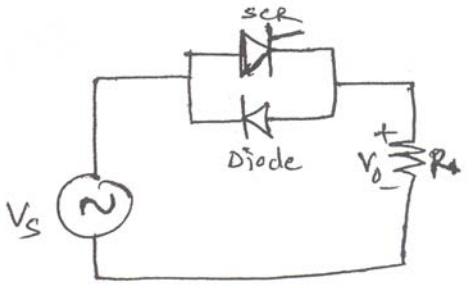

Fig. I

OR

10. a) Draw the circuit diagram of AC phase control using triac with diac as a triggering device. Sketch the output voltage waveforms. Derive the equation for RMS output voltage. **6**

   b) With the help of circuit diagram and waveforms explain the operation of three phase full wave AC/AC controller with balanced 'R' load. **10**

11. a) With the help of respective block diagrams, explain the difference between online and offline UPS. What are the advantages of online UPS over offline UPS ? **10**

b) Explain the operation of electronic ballast for fluorescent lamps with the block diagram and mention its advantages and disadvantages. **8**

OR

12. Write short note on **(any three)** : **18**

i) Induction heating

ii) HVDC transmission

iii) Electric welding

iv) Separately excited DC motor using controlled rectifier.

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T.E. (E and T.C./Electronics) (Sem. – II) Examination, 2009
ADVANCED MICROPROCESSORS
(2003 Course)

Time : 3 Hours Max. Marks : 100

Instructions : *1) Answer **any 3** questions from **each** Section.*
*2) Answers to the **two** Sections should be written in **separate** books.*
*3) **Neat** diagrams must be drawn **wherever** necessary.*
*4) Black figures to the **right** indicate **full** marks.*
*5) **Use** of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is **allowed**.*
*6) Assume suitable data, **if necessary**.*

SECTION – I

1. a) Explain interrupt response sequence of 8086. What are the interrupt vector addressed of following interrupts in 8086 INT ?

   i) INTO ii) NMI iii) INT 20H iv) INT 55H **4**

   b) Explain segmentation concept in detail and list its advantages. **4**

   c) Compute physical address for specified operand in each of following instructions. Register contents and variables are as follows

   (CS) = 0A00H, (DS) = 0B00H, (SI) = 0100H

   (DI) = 0200H, (BX) = 0300H

   i) MOV [DI], AX

   ii) MOV [BX] 0400H, CX

   iii) MOV AH, [SI] [BX]

   iv) MOV AX, [00FFH]. **8**

   d) How large is the 8086 memory and I/O address space ? **2**

OR

2. a) Explain flag register of 8086 in detail. Can the state of flags be modified through software ? Justify. **6**

   b) What are the different instructions types of 8086 ? Explain machine control instructions in detail. **6**

   c) Write Assembly language program to find out numbers of even and odd numbers from given series of 16 bit hexadecimal numbers. **6**

   Numbers are 2367 H, 0F579H, 0C300H, 0963H, 0B000H.

3. a) What is segment selector ? Explain selector format in detail. **3**

   b) Explain in detail control registers of 80386. List all the registers used in protected mode of 80386. **8**

   c) What is GDT ? How GDTR is used to calculate maximum size of GDT ? One GDT contains how many descriptors ? **5**

   OR

4. a) Explain in detail linear to physical address translation. Provide details of page frame, page table and page directory. **6**

   b) What are the ways to change privilege levels in 80386 ? What is call gate ? Explain call gate descriptor format. **6**

   c) How much physical memory 80386 can access in protected mode ? List the main features of virtual mode of 80386. **4**

5. a) Explain with suitable diagram memory organisation in personal computer. **6**

   b) What is key debouncing ? How key board encoder performs key scanning in simple 4×4 matrix keyboard ? Explain with suitable diagram. **8**

   c) Write all pins of keyboard connector. **2**

   OR

6. a) Write short note on Video Adapter. **8**

   b) Explain following mouse interface types

      i) Serial mouse interface

      ii) PS/2 mouse interface. **6**

   c) List various modes in which mouse can operate. **2**

SECTION – II

7. a) List the features of PCI BUS and EISA BUS. **8**

   b) Explain in detail Hardware blocks for USB device. **6**

   c) What basic operations USB device generally perform ? **2**

OR

8. a) Draw interfacing diagram of standard parallel port with printer. Also explain pins and signals functionality of standard parallel port. **8**

   b) List the various registers used in UART of serial port. Explain LCR in detail. **4**

   c) To configure COM 1 port for 9600 baud rate, 8 bit data, no parity, 1 stop bit, which valves should be loaded in registers DLL, DLM and LCR registers.

   Assume clock frequency = 1.84332 MHz. **4**

9. a) Write short note on swapping. **8**

   b) Compare .com and .exe programs. **2**

   c) What do you mean by resident programs ? Explain various DOS INT 21 H services used for T.S.R programming. List any two applications of T.S.R. **6**

OR

10. a) Explain with respect to file system
    i) File naming ii) File access iii) File structure. **6**

    b) What is process ? Explain process states in detail. **6**

    c) What is installable device driver ? Explain its types. **4**

11. a) List various modes of operations of ARM processor. Explain ARM register set in various modes of operations. **8**

    b) Explain ARM core data flow model in detail. **6**

    c) List applications of ARM processor. **4**

OR

12. a) Compare ARM and Thumb instruction set features. **4**

    b) Explain various exceptions and interrupts in ARM processor. Mention their vector addresses. **7**

    c) What is Role of CPSR in ARM processor. **3**

    d) Explain following instructions in ARM
    i) MLA R0, R1, R2, R3
    ii) MOV R6, R4, LSR#3. **4**

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T.E. (E&TC/Electronics) (Semester – I) Examination, 2009
MECHATRONICS
(2003 Course)

Time : 3 Hours Max. Marks : 100

Instructions *: 1) Answer* ***3*** *questions from Section –* ***I*** *and* ***3*** *questions from Section –* ***II****. Answer from Section – I Q.* ***1*** *or Q.* ***2****, Q.* ***3*** *or Q.* ***4****, Q.* ***5*** *or Q.* ***6****, Section – II Q.* ***7*** *or Q.* ***8****, Q.* ***9*** *or Q.* ***10****, Q.* ***11*** *or Q.* ***12****.*

2) Answers to the ***two*** *Sections should be written in* ***separate*** *books.*

3) ***Neat*** *diagrams must be drawn* ***wherever*** *necessary.*

4) Black figures to the ***right*** *indicate* ***full*** *marks.*

5) Assume suitable ***data****, if* ***necessary****.*

SECTION – I

1. a) Define mechatronics and state primary disciplines involved. Explain in detail with help of basic block diagram of mechatronics and its system components. **8**

   b) Define Robot and explain different components of Robot with schematic. **8**

OR

2. a) Explain following characteristics of measurement system
   1) Accuracy, 2) Resolution, 3) Repeatibility, 4) Sensitivity ; also compare static and dynamic characteristics. **8**

   b) Explain in detail the role of mechatronics in the design of Automation of Printer with various functional and controls. **8**

3. a) Enlist the important steps in selection of transducer. Explain with the help of important specifications a Piezoelectric Pressure Transducer for measuring fast changing pressure. **8**

   b) A parallel plate capacitor transducer uses plates of area 400 mm^2 which are separated by a distance of 0.3 mm with $\varepsilon_0 = 8.85 \times 10^{-12}$ f/m. Calculate i) Value of capacitance ii) new value of capacitance if plate is displaced to 0.15 mm iii) ratio of per unit change of capacitance to per unit change of displacement iv) dielectric material having constant 4 and a thickness of 0.01 mm is inserted between plates separated by 0.05 mm and same area as above. Find new capacitance value. **8**

OR

4. a) Explain how ultrasonic transducer can be used for measurement of flow through pipe ? **8**

   b) A load cell of solid cylinder of steel with 30 mm diameter and having two strain gauges placed in axial direction and two placed in transverse direction, each having a resistance of 120 ohms and gauge factor of 2.15 are used to measure force of 70 kN, the Young's modulus is 210 GN/sqm. The poissons ratio is 0.31. Calculate i) output voltage ii) sensitivity iii) change in resistance with V_s=10 V. **8**

5. a) Explain the role of instrumentation amplifier in signal conditioning. What is the use of Wheatstone's bridge ? Justify with proof. **9**

   b) Enlist the features of PIC microcontroller ? Draw an interfacing of keyboard (4×3) with PIC 16F84 also make provision of displaying the key pressed. **9**

OR

6. a) Give performance parameters for selection of DAC. Draw an interfacing to interface temp. level and displacement (mechanical) sensors with 89C51 processor. **9**

   b) Draw and explain in depth PLC architecture with different functions ? Draw the Ladder diagram to implement AND and X-OR gates. **9**

SECTION – II

7. a) Enlist different types of display recoders ? Explain any one in detail. **9**

   b) Explain role of HART protocol in communication system along with its modes of operation. **9**

OR

8. a) Draw and explain block diagram of compact DATA logger system in detail. **9**

   b) Enlist the objectives of DAS ? Explain operation of multichannel DAS with block schematic. **9**

9. a) What is an actuator ? Explain working of single and double acting cylinders with control actions. **8**

   b) Mention advantages of Hydraulic system over pneumatic ? Explain different types of Hydraulic valves with appropriate diagram for one type. **8**

OR

10. a) Explain principle of operation of stepper motor with equation. State important selection criteria. **8**

    b) Explain role of relays and solenoid valves with any one application. **8**

11. a) Explain with mechanical assembly and placement/use of different sensors required for design of coin counter. **8**

    b) Design a skip control system of CD player using tilt sensors and actuators. **8**

OR

12. a) Explain the design aspect of Rotary optical encoder with the help of incremental and absolute positioning. **8**

    b) Explain with design support how LVDJ can be effectively used for measurement of pressure in co-ordination with bourdon tubes. **8**

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T.E. (E &TC) (Semester – I) Examination, 2009
MICROPROCESSOR, MICROCONTROLLER AND APPLICATIONS
(2003 Course)

Time : 3 Hours Max. Marks : 100

Instructions *: 1) Answers to the* ***two*** *Sections should be written in* ***separate*** *books.*
2) ***Neat*** *diagrams must be drawn* ***wherever*** *necessary.*
3) ***Black*** *Figures to the* ***right*** *indicate* ***full*** *marks.*
4) ***Assume*** *suitable data,* ***if necessary****.*

SECTION – I

1. a) Give general architecture of a microprocessor and explain various flags for it in detail. **8**

   b) Explain Dynamic RAM (DRAM) and static RAM (SRAM) and compare the same. **8**

OR

2. a) With the help of timing diagram explain the functioning of 8255 in model, input mode and format of BSR mode. **8**

   b) Write a note on 8051 simulator. **8**

3. a) Explain the interrupt structure for 8051 microcontroller along with priorities. **10**

   b) Explain single stepping in MCS-51 family. **6**

OR

4. a) Explain memory organization of 8051 in details. **8**

   b) Write an assembly language program to transfer the message "WELCOME" serially at 4800 baud rate, 9 bit data and 1 stop bit for 8051. **8**

5. a) Explain following instructions in detail : **10**

      i) XCH

      ii) SWAP

      iii) LCALL

      iv) AJMP

      v) XRL

   b) Write a program for checking the parity of number is even or odd with a neat flow-chart. **8**

OR

6. a) Write a program to generate a sawtooth waveform for 8051 and draw flow-chart. **10**

   b) Write a program to transfer a block of N bytes from source to destination in External memory (Non overlapped block transfer). **8**

SECTION – II

7. a) Interface ADC 0808 and DAC 0808 to 8051 microcontroller with timing diagram. **10**

   b) Explain different types of stepper motors in brief. **8**

OR

8. a) Explain successive Approximation ADC. **8**

   b) Interface 4×4 matrix keyboard to 8051. **10**

9. a) Explain details of RS485. Give the detailed specifications and versions of RS485. **10**

b) Write a note on CAN protocol. **6**

OR

10. a) Explain Enhanced I 2C (Fast mode). **8**

b) Write a short note on MODBUS. **8**

11. a) Explain instruction pipelining in PIC microcontroller. **8**

b) Explain microprocessor supervisorycontrol. **8**

OR

12. a) Explain Addressing modes of PIC microcontroller. **8**

b) Explain details of OTP. **8**

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T.E. (E&TC/Electronics) (Semester – I) Examination, 2009
DIGITAL COMMUNICATION
(2003 Course)

Time : 3 Hours Max. Marks : 100

Instructions : *1) Answer **any three** questions from **each** Section.*
*2) Answer to the **two** Sections should be written in **separate** books.*
*3) **Neat** diagrams must be drawn **wherever** necessary.*
*4) Figures to the **right** indicate **full** marks.*
*5) **Assume** suitable data, **if necessary**.*

SECTION – I

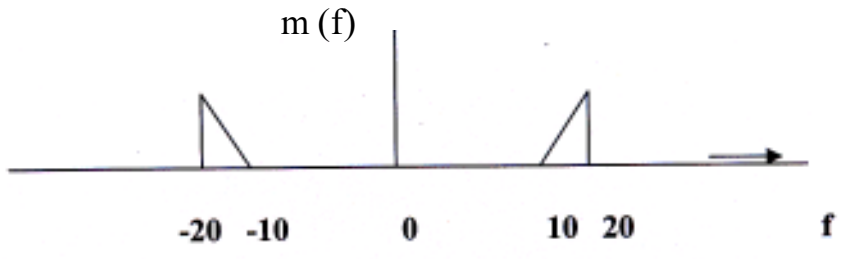
1. a) Explain stationary random processes, non-stationary random processes, and wide sense stationary processes and Ergodic processes, with help of mathematical expression. **8**

   b) Show that if a wide sense stationary process X (t) is passed through a LTI filter with impulse response h (t) then its output has constant mean square value. **8**

OR

2. a) Represent and discuss on the time domain and frequency domain approach of sampling theorem. **8**

   b) A band pass signal m (t) with a spectrum shown in figure. Check the band pass sampling theorem by sketching the spectrum of the ideally sampled signal m_s (t) when f_s = 25, 45 and 50 kHz. Indicate if and how the signal can be recovered. **8**



P.T.O.

3. a) A Television signal with a band width of 4.2 MHz is transmitted using binary PCM. The number of quantization levels is 512. Calculate the following :

   i) Code word length ii) Transmission bandwidth

   iii) Final bit rate iv) $(SNR)_0$. **8**

   b) Explain with the help of block diagram the CD audio playback system. How the error detection is taken care of ? **8**

OR

4. a) If a sinusoidal signal m (t) = A cos $\omega_m t$ is applied to delta modulator with step size δ, Show that slope overload distortion will occur if

   $A > \delta / \omega_m T_s$ where fs = 1 / T_s is the sampling frequency. **8**

   b) Explain the need for non uniform quantization. **2**

   c) What is delta sigma modulation ? Explain the transmitter and receiver schemes of a delta sigma system. **6**

5. a) Diagram a digital multiplexing system that accommodates both analog and digital signals in a standard multiplexing hierarchy including the North American and CCIT. **10**

   b) What is a synchronizer ? Explain any one type of bit synchronizer. **8**

OR

6. a) What are desirable properties of line codes ? Compare RZ and NRZ line coding formats on the basis of above properties along with their merits and demerits. **6**

   b) Define Scrambling and its importance in digital communication. **4**

   c) Write the functions performed by a multiplexer. What are three main categories of multiplexers ? **8**

SECTION – II

7. a) Derive the expression for frequency spectrum of binary FSK signal and Plot it. **6**

   b) Write a note on :

      i) Integrator and dump circuit.

      ii) Signal space representation.

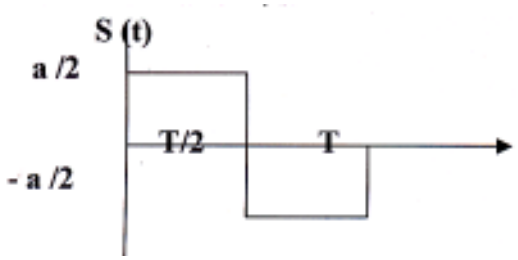
      iii) Phase continuity in MSK. **12**

OR

8. a) Describe with the help of block diagram 16-point QAM system transmitter and receiver. Explain the working with the help of mathematical expressions. Also express the bandwidth requirement. **10**

   b) Compare QPSK and MSK. Explain phase continuity of MSK. **8**

9. a) Consider the signal S (t) shown in fig.



Determine the impulse response of a filter matched to this signal and sketch it as a function of time Plot the matched filter output as a function of time. **8**

   b) Derive the expression of error probability for BPSK and BFSK. **8**

OR

10. a) Show that the impulse response of a matched filter is a time reversed and delayed version of the input signal. **8**

b) Binary data is transmitted at rate of 10 Mbps over a channel whose bandwidth is 8 MHz. Find signal energy per bit at the receiver input for coherent BPSK and DPSK to achieve probability error Pe $\leq 10^{-4}$. Assume $N_o/2 = 10^{-10}$ WATT/Hz. **8**

11. a) A fast FH / MFSK has the following parameters

No. of bits/MFSK symbol = 4

No. of MFSK symbols/hop = 4

Calculate the processing gain of the system. **4**

b) A slow FH / MFSK has the following parameters

No. of bits/MFSK symbol = 4

No. of MFSK symbols / hop = 5

Calculate the processing gain of the system. **4**

c) Explain the working of direct sequence spread spectrum transmitter and receiver. **8**

OR

12. a) A PN sequence is generated using a feedback shift register of length m = 4, the chip rate is 10^7 chips per second. Find the following parameters :

i) PN sequence length.

ii) Chip duration of the PN sequence.

iii) PN sequence period. **8**

b) What is difference between multiplexing and multiple accesses technique ? What is multiple accesses technique ? Compare it with help of relevant diagram. **8**

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T.E. (E&TC/Electronics, Indl. Elex.) (Semester – I) Examination, 2009
(2003 Course)
ANALOG INTEGRATED CIRCUITS – DESIGN AND APPLICATIONS

Time : 3 Hours Max. Marks : 100

Instructions: *1) Answer **any three** questions from **each** Section.*
*2) Answers to the **two** Sections should be written in **separate** books.*
*3) Neat diagrams must be drawn **wherever** necessary.*
*4) Black figures to the **right** indicate **full** marks.*
*5) Use of electronic pocket calculator is **allowed**.*
*6) Assume suitable data, if **necessary**.*

SECTION – I

1. A) State the different methods to improve CMRR of a differential amplifier. Explain the widely used method with the help of neat circuit diagram. **8**

   B) What is the need of frequency compensation in an op-amp ? With the help of neat diagram explain the dominant pole compensation technique. **8**

   OR

2. A) What are the requirements of output stage in an op-amp ? Explain the o/p stage of IC 741 C. **8**

   B) State the reasons for limiting the value of slew rate. **4**

   C) An op-amp has slew rate of 5V/μs, find the rise time for an o/p voltage of 10V amplitude resulting from a rectangular pulse input if the op-amp is slew-rate limited. **4**

3. A) Discuss the effect of cable capacitance on the performance of instrumentation amplifier. **8**

   B) Design a practical integrator using op-amp IC 741 C to satisfy the following specifications : **8**

   i) 3-dB cut-off frequency = 1.5 kHz

   ii) DC gain = 10

   Assume the $\pm V_{cc} = \pm 15V$.

   Sketch the frequency response of the circuit.

   OR

P.T.O.

4. A) Explain the effect of offset and bias parameters on practical integrator cct. Also explain the other sources of error in practical integrator circuit. **8**

   B) State the different applications of instrumentation amplifier and explain any one in detail. **8**

5. A) What are the limitations of an op-amp as comparator ? State the important features of any one comparator IC. **8**

   B) A Schmitt trigger circuit with the upper threshold voltage $V_{ut} = 0V$ and hysteresis width $V_H = 0.2V$ converts a 1 kHz sine wave of $4V_{PP}$ amplitude into a square wave. Calculate the time duration of the positive and negative portion of the o/p waveform. **5**

   C) Explain operation of positive clamper circuit using op-amp. Sketch the i/p and o/p waveforms. **5**

OR

6. A) Explain the following parameters of S/H cct
   1) Acquisition time
   2) Aperture time
   3) Hold set up
   4) Voltage droop. **8**

   B) Using neat circuit diagram and waveforms explain operation of following circuits using op-amp
   1) Negative peak clipper
   2) Window detector. **10**

SECTION – II

7. A) Draw a neat circuit diagram of voltage-to-frequency convector and explain its operation. **8**

   B) Design astable multivibrator using op-amp to satisfy the following specifications
   i) o/p frequency = 10 kHz
   ii) variable duty cycle = 10% to 90%

   Assume $\pm V_{cc} = \pm 15V$. **8**

OR

8. A) Explain operation of Wien bridge oscillator using op-amp. How Barkhausen's criteria gets satisfied in this cct ? **8**

   B) Design FSK circuit using NE 555 and transistor for switching between two frequencies namely 1070Hz and 1270Hz at the rate of 180 Hz. **8**

9. A) Discuss the various advantages and drawbacks of active filters over the passive filters. Also state the different approximation techniques of active filter design. **8**

   B) Design a second order wide bandpass filter for passing frequencies between 100Hz to 1.8 kHz. Draw neat labelled diagram indicating the practical values of all components. **8**

OR

10. A) Design equal component KRC second order low pass filter with fo = 1kHz and Q = 5. **8**

    B) Design 4th order low pass filter with cut-off frequency 5 kHz using sallen key configuration. Find V_{out} for $V_{in} = 2V_{PP}$ sine wave signal is applied. **8**

11. A) Using internal block diagram of IC 565 explain the operation of PLL. **8**

    B) Explain following applications of analog multiplier
    1) Voltage multiplication
    2) Phase angle detection
    3) Voltage divider. **10**

OR

12. A) Define different parameters of PLL. **4**

    B) Explain operation of AM demodulator using PLL with neat diagram. State its advantages over the conventional AM demodulator. **8**

    C) Input to PLL is having 2Hz rate of variation. Design PLL with free running frequency fo = 10 kHz. Find out capture range considering the frequency deviation rate as given above i.e. 2 Hz. Also calculate lock-in-range. Assume $\pm V_{cc} = \pm 10V$ for PLL IC 565. **6**

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T.E. (E & TC/Electronics) (Sem. – I) Examination, 2009
DIGITAL DESIGN AND COMPUTER ORGANISATION
(2003 Course)

Time : 3 Hours Max. Marks : 100

Instructions *: 1) In Section I : Attempt Q.* ***1*** *or Q.* ***2****, Q.* ***3*** *or Q.* ***4****, Q.* ***5*** *or Q.* ***6****.*
2) In Section II : Attempt Q. ***7*** *or* ***8****, Q.* ***9*** *or Q.* ***10****, Q.* ***11*** *or Q.* ***12****.*
3) Answers to the ***two*** *Sections should be written in* ***separate*** *books.*
4) ***Neat*** *diagrams must be drawn* ***wherever*** *necessary.*
5) Black figures to the ***right*** *indicate* ***full*** *marks.*
6) Assume ***suitable*** *data, if* ***necessary****.*

SECTION – I

1. a) Design a sequential circuit using Melay machine to detect an overlapping sequence as follows :.....1010..... Design the circuit using JK flip flops. **8**

   b) Explain the fundamental and pulse mode asynchronous sequential circuits. **6**

   c) Explain Hazards and its different types. **2**

OR

2. a) Draw an ASM chart for the synchronous circuit having the following description. The circuit has control input C, clock and outputs x, y and z.

      i) If C = 1, on every rising edge of the clock code on output x, y and z changes from 000 $\rightarrow$ 010 $\rightarrow$ 100 $\rightarrow$ 110 $\rightarrow$ 000 and repeats.

      ii) If C = 0, the circuit holds the present state. **6**

   b) What is the difference between Melay and Moore sequential circuits ? Discuss their advantages and disadvantages. **6**

   c) Compare ASM chart and state diagrams. **4**

P.T.O.

3. a) Explain following statements used in VHDL with suitable example.
   i) Process
   ii) If
   iii) With select
   iv) Wait. **8**

   b) What is difference between sequential and concurrent execution of VHDL statements ? **4**

   c) What is the use of library clause and use clause ? Give example. **4**

OR

4. a) Write VHDL code for latch with synchronous set and reset. **8**

   b) Explain the difference between signal and variable. **6**

   c) Explain Entity and Architecture. **2**

5. a) Perform non-restoring division for the following :

   Dividend = 1010

   Divisor = 0011

   Also compare non-restoring division with restoring division. State merits and demerits. **12**

   b) Explain and draw the flow chart for floating point substraction. **6**

OR

6. a) Draw a flow chart and explain the Booth's Algorithm used for signed number multiplication. **6**

   b) Briefly explain the operation of look ahead carry generator. **6**

   c) Describe the IEEE standard for single precision and double precision floating point numbers. **6**

SECTION – II

7. a) Describe the following addressing modes along with suitable examples.
   i) Absolute mode
   ii) Register mode
   iii) Index mode. **6**

   b) Explain the execution of a complete instruction with the help of example. **6**

   c) What do you mean by branching ? **4**

OR

8. a) Draw and explain the multiple bus organisation of the CPU. Explain its advantages. **6**

   b) State and explain what happens after a subroutine is called from a program ? **6**

   c) Explain various assembler directives used in the assembly language programming. **4**

9. a) Discuss with suitable example programmed I/O and Interrupt driven I/O. **8**

   b) Explain the synchronous bus in an output operation with timing diagram. **8**

OR

10. a) Explain interface between printer and processor. Also explain communication between them. **8**

    b) What is BUS Arbitration ? Explain and compare Daisy chaining and polling methods of BUS Arbitration. **8**

11. a) What are different cache mapping techniques ? Explain any one with neat diagram. **8**

    b) Explain with suitable diagram interleaving of memory. **6**

    c) Explain SRAM with diagram. **4**

OR

12. a) Explain virtual memory address translation with neat block diagram and elaborate use of TLB in the virtual memory. **8**

    b) Explain DVD and Magnetic Disk. **6**

    c) Write advantages and disadvantages of CD-ROM. **4**

[3563] – 11A

T.E. (E. & TC/Electronics) (Semester – II) Examination, 2009
COMMUNICATION SYSTEMS – I (Old)
(1990 Course)

Time : 3 Hours Max. Marks : 100

Instructions *: 1) Answer* ***any three*** *questions from* ***each*** *Section.*
2) Answer to the ***two*** *Sections should be written in* ***separate*** *books.*
3) ***Neat*** *diagrams must be drawn* ***wherever*** *necessary.*
4) Figures to the ***right*** *indicate* ***full*** *marks.*
5) ***Assume*** *suitable data,* ***if necessary****.*

SECTION – I

1. a) State and explain the properties of Fourier transform. **8**

   b) Find the Fourier transform of

      i) $\sin(2\pi f_0 t)e^{-\alpha|t|}$

      ii) $\sin(2\pi f_0 t) * e^{-\alpha|t|}$ **8**

2. a) Write a note on different types of Noise in communication systems. **8**

   b) Obtain a relationship between the noise figure and noise temperature of a two-port network (like an amplifier). **8**

3. a) The efficiency η for ordinary AM is defined as the percentage of the total power carried by the sidebands, that is, $\eta = P_s/P_t \times 100\%$. Where P_s is the power carried by the sidebands and P_t is the total power of the AM signal.

      i) Find η for μ=0.5 (50 percent modulation).

      ii) Show that for a single-tone AM, η_{max} is 33.3 percent at μ=1. **10**

   b) Describe any one method of generation of AM signals. **6**

P.T.O.

4. a) Draw and explain fully the block diagram of a typical FM receiver. **8**

   b) An angle-modulated signal is described by

$$x_c(t)=10\cos[2\pi(10^6)t+0.1\sin(10^3)\pi t]$$

   i) Considering x_c (t) as a phase modulated signal with k_p (phase deviation constant) = 10, find m (t).

   ii) Considering x_c (t) as a frequency modulated signal with k_f (frequency deviation constant) = 10π, find m (t). **8**

5. Write a short notes on **any three** : **18**

   i) Envelope detector.

   ii) Single Sideband Modulation.

   iii) Modulation index of AM and FM.

   iv) Pre-emphasis and De-emphasis.

SECTION – II

6. a) Sketch the block diagram of the Armstrong frequency-modulation system. **8**

   b) A carrier is frequency-modulated with a sinusoidal signal of 2 kHz, resulting in a maximum frequency deviation of 5 kHz.

   i) Find the bandwidth of the modulated signal.

   ii) The amplitude of the modulating sinusoid is increased by a factor of 3, and its frequency is lowered to 1 kHz. Find the maximum frequency deviation and the bandwidth of the new modulated signal. **8**

7. a) Discuss the merits of delayed AGC as compared with simple AGC. Show AGC curves to illustrate the comparison and explain how delayed AGC may be obtained and applied. **6**

b) Draw the block diagram of a superheterodyne AM receiver. The broadcast band frequencies range from 540 to 1600 kHz.

i) Determine the range of tuning that must be provided in the local oscillator when f_{LO} is higher than fc (superheterodyne receiver) and when f_{LO} is lower than fc.

ii) Explain why the usual AM radio receiver uses a superheterodyne system. **10**

8. a) Describe ground-wave propagation. What is angle of tilt ? How does it affect field strength at a distance from the transmitter ? **8**

b) What is three-point tracking ? How does tracking error arise in the first place ? What is the name given to the element that helps to achieve three-point tracking ? **8**

9. a) Electromagnetic waves are said to be *transverse*; what does this mean ? In what way are transverse waves different from *longitudinal* waves ? Illustrate each type with sketch. **10**

b) Briefly describe the following terms connected with sky-wave propagation : virtual height, critical frequency, maximum usable frequency, skip distance and fading. **6**

10. Write a short notes on **any three** : **18**

i) Demodulation of angle modulated signals.

ii) Frequency division multiplexing.

iii) Coherent detection.

iv) Independent sideband system (ISB)

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[3563] – 7

T.E. (E. and TC/Electronics) (Semester – II) Examination, 2009
NETWORK ANALYSIS AND SYNTHESIS (Old)
(1997 Course)

Time : 3 Hours Max. Marks : 100

Instructions *: 1) Answer* ***any three*** *questions from* ***each*** *Section.*
2) Answers to the ***two*** *Sections should be written in* ***separate*** *books.*
3) ***Black*** *figures to the* ***right*** *indicate* ***full*** *marks.*
4) ***Use*** *of electronic pocket calculator is* ***allowed****.*

SECTION – I

1. a) Define the following terms associated with graph theory with the help of suitable example : **8**

   i) Tree and co-tree

   ii) Fundamental cutset

   iii) Fundamental circuit

   iv) Planar graph.

   b) Resolve the waveforms into its even and odd components. **8**

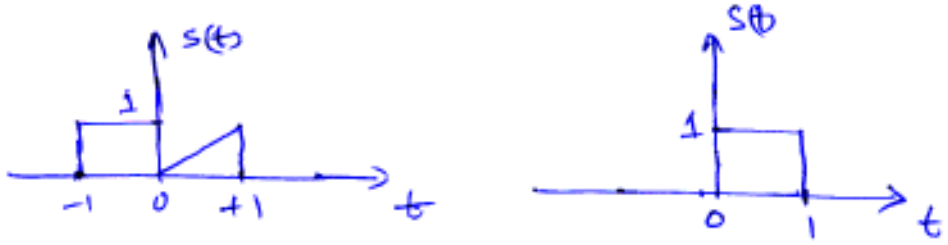

Fig. 1

P.T.O.

2. a) A rectangular pulse of unit strength and duration 1 second is applied to a series R-C combination with R = 1 ohm and C = 1 Farad. Assume capacitor initially uncharged and find current flowing through RC circuit. Also plot waveform of current. **10**

b) Find inverse laplace transform for **8**

i) $F(s)=\frac{2s+9}{(s+3)(s+4)}$

ii) $F(s)=\frac{s+1}{s^2+2s+2}$

3. a) Find driving point impedance function of the one port network shown in Fig 2. Also plot poles and zeros of this driving point function. **8**

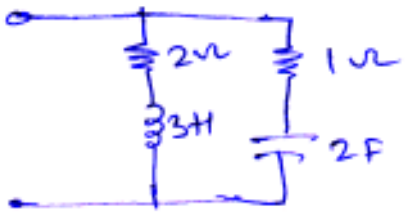

Fig. 2

b) For a ladder network shown in Fig. 3 determine $G_{12}(s)=\frac{V_2(s)}{V_1(s)}$ **8**

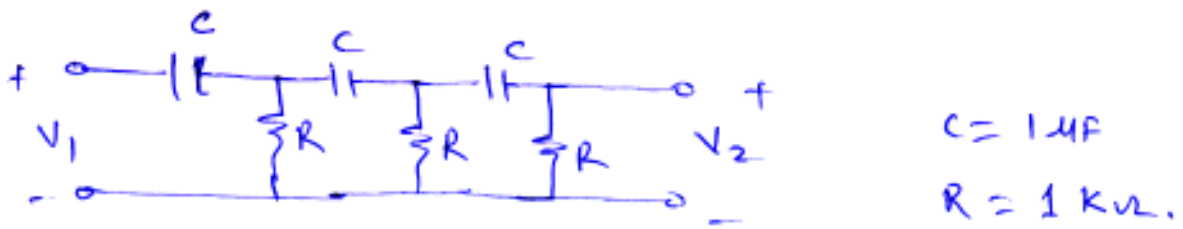

Fig. 3

4. a) Test whether following functions are positive real : **8**

i) $\frac{s^5+5s^3+4s}{s^4+8s^2+15}$ ii) $\frac{s^3+4s^2+3s+5}{s^2+6s+8}$

b) The fundamental circuit matrix of a particular graph is given as,

Chord/Branch	3	4	5	1	2	6
3	1	0	0	0	–1	1
4	0	1	0	–1	0	–1
5	0	0	1	–1	–1	0

Form a corresponding graph. **8**

5. a) Find first and second foster forms of network for the impedance, **8**

$$z(s)=\frac{s(s^2+3)}{(s^2+1)(s^2+4)}$$

b) Find first and second cauer networks for the function, **8**

$$y(s)=\frac{s^2+7s+10}{s^2+4s+3}$$

SECTION – II

6. a) Realize the following function as a symmetrical lattice network with 1 Ω termination. **8**

$$\frac{v_0}{v_s}=\frac{1}{2}\cdot\frac{s^2-3s+1}{s^2+3s+1}$$

b) Sythesize the following function as LC ladder network terminated in a 1 Ω resistor. **8**

$$z(s) = \frac{s^3}{s^3 + 2s^2 + 2s + 2}$$

7. a) List properties of LC driving point admittance function. **4**

b) Design Butterworth low pass filter with specifications,

i) Pass band attenuation 0.7dB or less at $\omega \leq 0.5 \frac{rad}{sec}$

ii) Stop band attenuation $\geq$ 26 dB at ω = 5 rad/sec.

Assume $R_L = R_S = 1\ \Omega$. **12**

8. a) Design second order Butterworth active low pass filter with cut-off frequency 1.8 KHz. Use Sallen key configuration. **8**

b) Explain the terms related to active filter : **8**

i) Frequency scaling

ii) Impedance scaling.

9. a) Compare Butterworth and Chebyshev approximations. **4**

b) Explain step by step procedure of active filter design using cascade approach assuming suitable specifications. **8**

c) Explain the elementary synthesis operation : removal of a constant. **4**

10. Write short notes on **any four** : **18**

i) Significance of complex frequencies in analysis

ii) Zeros of transmission.

iii) Incidental dissipation.

iv) Initial and final value theorem of L.T.

v) All pass filter.

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