Course Code : ECT 354 EZFY/RW – 22 / 1152

Fifth Semester B. Tech. (Electronics and Communication Engineering) Examination

DIGITAL SIGNAL PROCESSING

Time : 3 Hours] [Max. Marks : 60

Instructions to Candidates :—

(1) All questions are compulsory.
(2) Use of non – programmable calculator is allowed.
(3) Assume suitable data wherever necessary.

1. (a) Compute the circular convolution of two sequences using DFT-IDFT approach $x(n) = n$ for $0 \leq n \leq 3$ and $h(n) = \cos\left(\frac{n\pi}{2}\right)$ for $0 \leq n \leq 3$. 5(CO1,2)

(b) Compute 8-Point DFT of sequence $x(n) = \{1, 0, 0, 0, 1\}$. Use Radix-2, DIT-FFT Algorithm. 5(CO1,2)

2. (a) Realize the system given by difference equation

$y(n) = -0.1\ y(n-1) + 0.2\ y(n-2) + 3x(n) + 3.6\ x(n-1) + 0.6\ x(n-2)$ in

(1) Direction form - II

(2) Cascade form. 6(CO1,3)

(b) Realize the given system function using minimum number of multipliers

$H(z) = 1 + 0.5\ z^{-1} + 0.25\ z^{-2} + 0.75\ z^{-3} + 0.25\ z^{-4} + 0.5\ z^{-5} + z^{-6}$ 4(CO1,3)

3. Design digital IIR Butterworth LPF filter using bilinear transformation with following Specifications :
Pass band ripple 3dB up to 2π rad/Sec
Stop band attenuation 20 dB beyond $8\ \pi$ rad/Sec
Sampling frequency 200 Hz. 10(CO1,3)

4 (a) Design a linear phase FIR filter for the following specifications

$H_a(f) = 1, \quad 0 <= f <= 1000 \text{ Hz}$

$= 0, \quad f > 1000 \text{ Hz}$

Sampling frequency f_s = 10 KHz. Impulse duration of the filter = 1msec. Compute the impulse response of the filter using Hamming Window given by

$W_H(n) = 0.54 - 0.46 \cos(2 \pi n/(N-1)), \quad 0 <= n <= N-1$

8(CO1,3)

(b) Distinguish between FIR and IIR filters. 2(CO1,3)

5. (a) Implement a two stage decimetor for the following specifications.

Sampling rate of the input signal = 20000Hz
M = 100, Passband = 10 to 40Hz
Transition band = 40 to 50 Hz
Passband ripple = 0.01
Stopband ripple = 0.002 6(CO1,4)

(b) What are Quadrature mirror filter banks ? Give input output analysis for a two channel QMF filter bank. 4(CO1,4)

6. (a) Explain with functional block diagram the architecture of DSP Processor. 6(CO1,5)

(b) State the advantages and applications of DSP processors. 4(CO1,5)

Course Code : ECT 355-5 EZFY/RW – 22 / 1156

Fifth Semester B. Tech. (Electronics and Communication Engineering) Examination

DATABASE MANAGEMENT SYSTEMS

Time : 3 Hours] [Max. Marks : 60

Instructions to Candidates :—

(1) All questions are compulsory.
(2) Draw a neat diagram wherever necessary.

1. (a) Explain various architectures of DBMS. 3(CO1)

(b) Explain ACID property of DBMS. 4(CO1)

(c) DBMS is a better choice over File system. Justify giving any three real life scenarios. 3(CO1)

2. (a) Develop an ER Diagram for Car Insurance company whose customers own one or many cars each. Each car is associated with it zero or any number of recorded accidents. 3(CO4,5)

(b) Consider the universal relation R = {A, B, C, D, E, F, G, H, I, J} and the set of functional dependencies —

FD : {{A, B} ⟶ {C}, {A} ⟶ {D, E}, {B} ⟶ {F}, {F} ⟶ {G, H}, {D} ⟶ {I, J}}.

Decompose R into 2NF and then 3NF relations. 7(CO4)

3. Design a database considering the following database schema —

Student (Roll No, S_name, Address)

Teacher (T_ID, T_name, T_course)

College (C_ID, C_address)

Write SQL queries or Relational algebra expression for the following :—

(a) Insert a tuple into relation Student.

(b) Find the name of all the students who live in Nagpur.

(c) Find the name of the teacher who teaches DBMS course.

(d) Find the name of the teacher who teaches DSP course to student named 'XXX'.

(e) Find the name of the students who took the course taught by the teacher named 'YYY'.

(f) Find the name of the students who enrolled in the college having ID 12345.

(g) Delete record of students whose address in Mumbai. 10(CO3,5)

4. (a) Determine canonical set of functional dependencies for the relation R = (V, W, X, Y, Z) with the following functional dependencies :

FD : $V \longrightarrow W$, $VW \longrightarrow X$, $Y \longrightarrow VYZ$ 5(CO4)

(b) Analyze the storage structure of indexed sequential files and their access method. 5(CO2)

5. (a) What do you mean by linear hashing ? Apply linear hashing technique to generate a hash structure for given sequence of search keys. The number of Initial buckets M = 2. Each bucket has 2 keys. One extra key for overflow :

8, 13, 10, 15, 19, 22, 29, 12, 17, 23, 11, 16 5(CO2)

(b) How does a query tree represent a relational algebra expression ? Discuss any three rules for query optimization, giving example as to when should each rule be applied. 5(CO2)

6. (a) Differentiate between wait-die and wound-wait approaches for deadlock prevention. 5(CO1)

(b) Explain recovery process after system failure using checkpoint. 5(CO1)

Course Code : ECT 351 EZFY/RW–22/1149

Fifth Semester B. Tech. (Electronics and Communication Engineering) Examination

ELECTROMAGNETIC WAVES

Time : 3 Hours] [Max. Marks : 60

Instructions to Candidates :—

(1) All questions are compulsory.
(2) All questions carry marks as indicated.
(3) Illustrate your answers with neat sketches.
(4) Assume suitable data wherever necessary.

1. (a) Derive the expression for the input impedance of transmission lines in terms of load impedance and characteristic impedance. 5(CO1)

(b) An impedance of $75 - j\,30\ \Omega$ is connected to $100\ \Omega$ line. Find the complex reflection coefficient at the load, the complex reflection coefficient and impedance at a distance of $0.35\ \lambda$ from the load. What is the VSWR measured on the line ? 5(CO1)

2. (a) Derive relationship between E and H fields for uniform plane waves. 5(CO2)

(b) A uniform plane wave at frequency of 300 MHz travels in vacuum along +y direction. The electric field of the wave at some instant is given as $\mathbf{E} = 3\ \mathbf{ax} + 5\ \mathbf{az}$. Find the phase constant of the wave and also the vector magnetic field. 5(CO2)

3. (a) Explain the behavior of plain waves at dielectric interface. 5(CO4)

(b) A light beam is incident from air to a medium with a dielectric constant 4 and relative permeability 100. If the angle of incidence is 60^0, find the angle of reflection and angle of refraction. 5(CO4)

4. (a) Prove that attenuation factor in parallel plane wave guide is α = Power lost per unit length / 2 x Power Transmitted. 5(CO5)

(b) A parallel plane waveguide is formed using two parallel sheets of copper spaced 4 cm apart in free space. The conductivity and permeability of copper given by $\sigma = 5.8 \times 10^7$ W/m, $\mu = 4\pi \times 10^{-7}$ H/m resp. If the frequency of the wave is 10 GHz, find the attenuation coefficient due to conductor losses for $TE_{1,0}$ mode TEM mode. 5(CO5)

5. (a) Explain the impossibility of TEM waves in rectangular wave guides. 5(CO5)

(b) A rectangular wave guide of cross sectional dimension 2.3 cm x 1 cm is used to transmit a signal of 9 GHz.
Determine :

(i) Cutoff frequency for the dominant mode.

(ii) Phase and group velocities of dominant mode.

(iii) Guide wavelength. 5(CO5)

6. (a) Explain the following terms related to antenna :

(i) Front to back ratio.

(ii) Antenna Beam width.

(iii) Directivity. $P_{rad} = U_{max} \int\int P_{in}(\theta, \phi) d\Omega$

(iv) Antenna Gain.

(v) Half power beamwidth. 5(CO3)

(b) Transmitting and receiving antennas operating at 2 GHz with gains of 25 dB and 20 dB respectively are separated by a distance of 2 km. Assume that both antennas are identical in polarization. Estimate the received power if the transmitted power is 150 W. 5(CO3)

$G = \frac{4\pi U(\theta, \phi)}{P_{in}}$

$P_{rad} = k P_{in}$

Course Code : ECT 353 EZFY/RW–22/1151

Fifth Semester B. Tech. (Electronics and Communication) Examination

MICROCONTROLLER AND INTERFACING

Time : 3 Hours] [Max. Marks : 60

Instructions to Candidates :—

(1) All questions carry marks as indicated.
(2) Assume suitable data wherever necessary.

1. Classify Boolean operators as in the equation below. Also demonstrate with embedded c program that solves the result of the equation and passes the result to PORT 1.

   A = ~((B&C) | (D^0x01))

   Where A, B, C and D are 8 bit data. Assume the initial data to be utilized is in code memory as an array {0xA8, 0xB4, 0x6F} ? 6(CO1,2)

2. Recognize the flag structure of 8051 microcontroller with a neat diagram and implement an embedded c program to arrange 20 bytes of data present in data memory 30h onwards in descending order. 8(CO1,2)

3. Structuring the use of timer, please write an assembly language program to demonstrate serial transmission of a string "HELLO EC STUDENTS" at 4800 baud rate. Please outline the question with details of calculation and description in regards to baud rate and mode selection of timer. Also illustrate what is the maximum baud rate generation possible with 8051 and how one can double the baud rate with the use of a special register along with its format. 8(CO3,4)

4. Select and draw a display circuit comprising of a single 7 Segment Common Anode interfaced with 8051 at port 1. Write a program to display 0 to F continuously with a delay of 1 second. Show the look up table of HEX values as well as the delay calculations considering a crystal of 24 MHz. 8(CO4,5)

5. Recall ARM Modes of operations in detail. 6(CO1)

6. Describe ARM7TDMI with LPC2148 microcontroller architecture with diagram. Also differentiate the interrupt handling capacity of ARM7TDMI over 8051 microcontroller. 8(CO1)

7. Implement and draw a circuit comprising of 8 led's connected at PORT 0 and a single switch is connected at PORT1. Write a program to display the amount of times switch is pressed across the led. 8(CO3,4)

8. Create a FIFO (first in first out) algorithm for 4 tasks considering the input data given below in the table. Also Explain what do you understand by threads and how they differ from tasks.

TASK NO.	Arrival Time	Execution Time
1	1	3
2	7	5
3	10	9
4	15	2

8(CO5)

Course Code : ECT 352

EZFY/RW–22/1150

Fifth Semester B. Tech. (Electronics and Communication Engineering) Examination

CONTROL SYSTEMS

Time : 3 Hours]

[Max. Marks : 60

Instructions to Candidates :—

(1) All questions are compulsory.
(2) All questions carry marks as indicated against them.
(3) Use graph paper wherever necessary.
(4) Assume suitable data and illustrate answers with neat sketches wherever necessary.

1. (a) Using the block reduction technique, determine the transfer function C(s)/R(s) of a system represented by the block shown in Fig. 1.

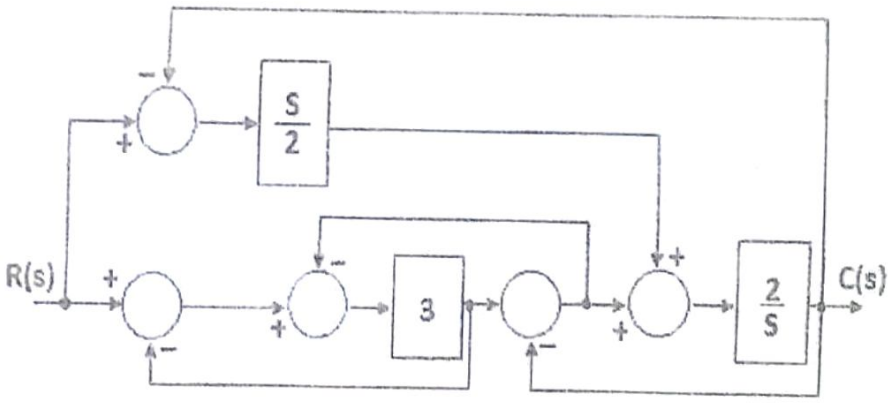

Fig. 1

6(CO2)

(b) For the block diagram shown in Fig. 2, draw a signal-flow graph and determine the overall transmittance using Mason's gain formula.

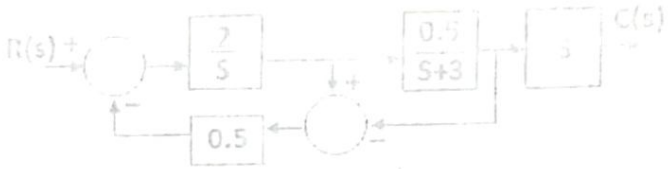

Fig. 2

6(CO2)

2. (a) A control system is shown in Fig. 3 Determine the transfer function and derive an expression relating the output time if the input is a step having a magnitude of 2 unit.

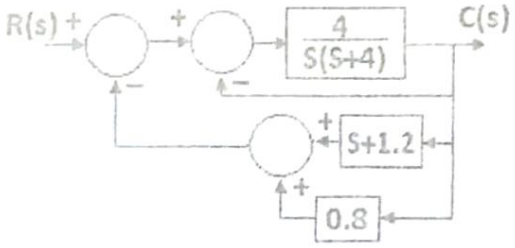

Fig. 3 6(CO4)

(b) The block diagram of a unity feedback control system is shown in Fig. 4 below. Determine ω_n, ζ, ω_d, t_p, M_p, the time at which the first undershoot occurs, the time period of oscillations and the number of cycles completed before reaching the steady state.

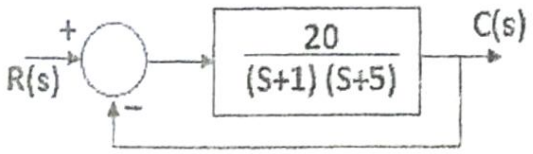

Fig. 4

6(CO4)

3. (a) The closed-loop transfer function of a feedback system is,

$$\frac{C(s)}{R(s)} = \frac{As + 36}{s^4 + As^3 + (A + 6)s^2 + Bs + 36}$$

Evaluate one value of A and B so that the system response is oscillatory. Determine the frequency of oscillation at the chosen value of A and B. 6(CO3)

(b) Construct the root locus for a system with open-loop transfer function,

$$G(s)\ H(s) = \frac{K}{s(S + 1)\ (S + 3)}$$

Determine (i) gain margin and (ii) phase margin, for K = 6. 7(CO3)

4. (a) For unity feedback system, the open-loop transfer function is

$$G(s) = \frac{0.25(1 + 0.5s)}{s(1 + 2s)\ (1 + 4s)}$$

Sketch the log-magnitude plot and the phase plot and determine the gain crossover frequency, the phase crossover frequency, the phase margin and the gain margin. 8(CO4)

(b) The log-magnitude (LM) plot of a transfer function T(s) is shown in Fig. 5. Determine the transfer function.

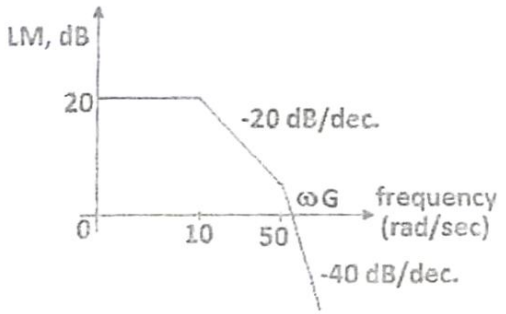

Fig. 5 6(CO4)

5. (a) Express the electrical network shown in Fig. 6 in a state model in physical variable form.

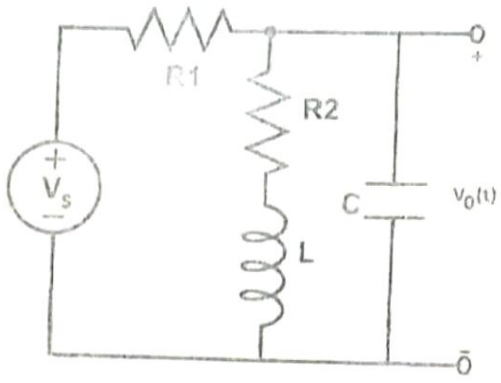

Fig. 6

6(CO5)

(b) Differentiate linear and non-linear control system. 3(CO1)