USN | | | | | | | | | | |

10MAT41

Fourth Semester B.E. Degree Examination, Dec.2013/Jan.2014
Engineering Mathematics – IV

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Employ Taylor's series method to obtain the value of y at x = 0.1 and 0.2 for the differential equation $\frac{dy}{dx} = 2y + 3e^x$, y(0) = 0 considering upto fourth degree term. **(06 Marks)**

b. Determine the value of y when x = 0.1, given that y(0) = 1 and $y'' = x^2 + y^2$ using modified Euler's formula. Take h = 0.05. **(07 Marks)**

c. Apply Adams-Bashforth method to solve the equation $\frac{dy}{dx} = x^2(1+y)$, given y(1) = 1, y(1.1)= 1.233, y(1.2) = 1.548, y(1.3) = 1.979. Evaluate y(1.4). **(07 Marks)**

2 a. Solve $\frac{dy}{dx} = 1 + zx$, $\frac{dz}{dx} = -xy$, y(0) = 0, z(0) = 1 at x = 0.3 by taking h = 0.3. Applying Runge-Kutta method of fourth order. **(06 Marks)**

b. Applying Picard's method to compute y(1.1) from the second approximation to the solution of the differential equation $y'' + y^2y' = x^3$. Given that y(1) = 1, y'(1) = 1. **(07 Marks)**

c. Using the Mitni's method obtain an approximate solution at the point x = 0.8 of the problem $\frac{d^2y}{dx^2} = 1 - 2y\frac{dy}{dx}$, give that y(0) = 0, y'(0) = 0, y(0.2) = 0.02, y'(0.2) = 0.1996, y(0.4) = 0.0795, y'(0.4) = 0.3937, y(0.6) = 0.1762, y'(0.6) = 0.5689. **(07 Marks)**

3 a. Derive Cauchy-Riemann equations in Cartesian form. **(06 Marks)**

b. Give u – v (x – y)(x^2 + 4xy + y^2) find the analytic function f(z) = u + iv. **(07 Marks)**

c. If f(z) = u + iv is an analytic function then prove that $\left(\frac{\partial}{\partial x}|f(z)|\right)^2 + \left(\frac{\partial}{\partial y}|f(z)|\right)^2 = |f'(z)|^2$ **(07 Marks)**

4 a. Find the image of the straight lines parallel to coordinate axes in z-plane under the transformation $w = z^2$. **(06 Marks)**

b. Find the bilinear transformation which maps the points z = 1, i, –1 on to the points w = 0, 1, ∞. **(07 Marks)**

c. Evaluate $\int_c \frac{e^{2z}}{(z+1)(z+2)}$, where c is the circle | z | = 3. **(07 Marks)**

PART – B

5 a. Find the solution of the Laplace equation in cylindrical system leading to Besseis differential equation. **(06 Marks)**

b. If α and β are two distinct roots of $J_n(x) = 0$, then prove that $\int_0^1 x\, J_n(\alpha x)\, J_m(\beta x)\, dx = 0$, $m \neq n$. **(07 Marks)**

c. Express $f(x) = x^4 - 2x^3 + 3x^2 - 4x + 5$ in terms of legendre polynomial. **(07 Marks)**

6 a. A committee consists of 9 students, 2 from first year, 3 from second year and 4 from third year. 3 students are to be removed at random. What is the probability that (i) 3 students belongs to different class (ii) 2 belongs to the same class and third belongs to different class. (iii) All the 3 belongs to the same class. **(06 Marks)**

b. State and prove Baye's theorem. **(07 Marks)**

c. The chance that a doctor will diagnose a disease correctly is 60%. The chance that a patient will die after correct diagnose is 40% and the chance of death after wrong diagnose is 70%. If a patient dies, what is the chance that disease was correctly diagnosed. **(07 Marks)**

7 a. The probability distribution of finite random variable x is given by the following table:

x :	0	1	2	3	4	5	6	7
p(x) :	0	k	2k	2k	3k	k^2	$2k^2$	$7k^2+k$

Find k, $p(x < 6)$, $p(x \geq 6)$, $p(3 < x \leq 6)$ **(06 Marks)**

b. Obtain the mean and variance of Poisson distribution. **(07 Marks)**

c. The life of an electric bulb is normally distributed with average life of 2000 hours and standard deviation of 60 hours. Out of 2500 bulbs, find the number of bulbs that are likely to last between 1900 and 2100 hours. Given that $p(0 < z < 1.67) = 0.4525$. **(07 Marks)**

8 a. Explain the following terms:
i) Null hypothesis (ii) Type I and Type II error (iii) Confidence limits. **(06 Marks)**

b. The weight of workers in a large factory are normally distributed with mean 68 kgs, and standard deviation 3 kgs. If 80 samples consisting of 35 workers each are chosen, how many of 80 samples will have the mean between 67 and 68.25 kgs. Given $p(0 < z < 2) = 0.4772$ and $p(0 \leq z \leq 0.5) = 0.1915$. **(07 Marks)**

c. Eleven students were given a test in statistics. They were provided additional coaching and then a second test of equal difficulty was held at the end of coaching. Marks scored by then in the two tests are given below.

Test I	23	20	19	21	18	20	18	17	23	16	19
Test II	24	19	22	18	20	22	20	20	23	20	17

Do the marks give evidence that the student have benefited by extra coaching? Given $t_{0.05}(10) = 2.228$. Test the hypothesis at 5% level of significance. **(07 Marks)**

* * * * *

USN | | | | | | | | | | |

MATDIP401

Fourth Semester B.E. Degree Examination, Dec.2013/Jan.2014

Advanced Mathematics – II

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions.***

1 a. Prove that $\sin^2\alpha + \sin^2\beta + \sin^2\gamma = 2$. **(06 Marks)**

b. If l_1, m_1, n_1 and l_2, m_2, n_2 are direction cosines of two lines then prove that the angle between them is $\cos\theta = l_1l_2 + m_1m_2 + n_1n_2$. **(07 Marks)**

c. Find the equation of the plane through the interaction of the planes $2x + 3y - z = 5$ and $x - 2y - 3z = -8$, also perpendicular to the plane $x + y - z = 2$. **(07 Marks)**

2 a. Prove that the equation of the plane in the intercept form is $\frac{x}{a}+\frac{y}{b}+\frac{z}{c}=1$. **(06 Marks)**

b. Find the equation of the plane through the points (1, -2, 2) (-3, 1, -2) and perpendicular to the plane $2x - y - z + 6 = 0$. **(07 Marks)**

c. Find the angle between the following lines:

$$\frac{x-2}{3}=\frac{y-1}{1}=\frac{z-3}{2} \quad \text{and} \quad \frac{x+1}{2}=\frac{y-3}{-1}=\frac{z-1}{0}$$ **(07 Marks)**

3 a. Find the sine of the angle between $\vec{a} = 2\vec{i} - 2\vec{j} + \vec{k}$ and $\vec{b} = \vec{i} - 2\vec{j} + 2\vec{k}$. **(06 Marks)**

b. Find the value of λ if the vectors $\vec{a} = 4\vec{i} + 6\vec{j} + 2\vec{k}$, $\vec{b} = 3\vec{i} + 10\vec{j} + 5\vec{k}$ and $\vec{c} = -4\vec{i} + 5\vec{j} + \lambda\vec{k}$ are coplanar. **(07 Marks)**

c. Prove the following:

i) $(3\vec{a} - 2\vec{b}) \times (4\vec{a} + 2\vec{b}) = 14(\vec{a} + \vec{b})$

ii) $(2\vec{a} + 3\vec{b}) \times (\vec{a} + 4\vec{b}) = 5(\vec{a} + \vec{b})$ **(07 Marks)**

4 a. A particle moves along the curve $\vec{r} = (t^3 - 4t)\vec{i} + (t^2 + 4t)\vec{j} + (8t^2 - 3t^3)\vec{k}$. Find the velocity and acceleration at t = 1 and also find their magnitude. **(06 Marks)**

b. Find the unit normal vector to the surface $xy^3z^2 = 4$ at the point (-1, -1, 2). **(07 Marks)**

c. Find the directional derivative of x^2yz^3 at (1, 1, 1) in the direction of $\vec{i} + \vec{j} + 2\vec{k}$. **(07 Marks)**

5 a. Find div $\vec{F}$ and curl $\vec{F}$, where $\vec{F} = x^3\vec{i} + y^3\vec{j} + z^3\vec{k}$. **(06 Marks)**

b. Prove that curl grad $\phi = 0$. **(07 Marks)**

c. Find the constants a, b, c such that the vector $\vec{F} = (x + y + az)\vec{i} + (x + cy + 2z)\vec{k} + (bx + 2y - z)\vec{j}$ is irrotational. **(07 Marks)**

6 Find the Laplace transform of the following:

a. $\sin 4t \cos 3t$

b. cos hat

c. $te^{-t}\sin t$

d. $\frac{1-\cos t}{t}$ **(20 Marks)**

7 Find the inverse Laplace transform of

a. $\log\left(\frac{s+1}{s-1}\right)$ **(06 Marks)**

b. $\frac{s+1}{s^2+2s+2}$ **(07 Marks)**

c. $\frac{s}{(s+1)(s+2)(s-3)}$ **(07 Marks)**

8 a. By applying Laplce transforms, solve the differential equation $\frac{d^5y}{dt^2}+5\frac{dy}{dt}+6y=5e^{2t}$ subjected to the conditions $y(0) = y'(0) = 0$. **(10 Marks)**

b. Solve the simultaneous equations $\frac{dx}{dt}+y=\sin t$, $\frac{dy}{dt}+x=\cos t$ using Laplace transforms. Given that $x = 1$, $y = 0$ when $t = 0$. **(10 Marks)**

* * * * *

USN | | | | | | | | | | |

10ES42

Fourth Semester B.E. Degree Examination, Dec.2013/Jan.2014
Microcontrollers

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Define microcontroller. Differentiate between microprocessor and microcontroller. **(05 Marks)**

b. With the neat diagram, explain the 8051 architecture. **(10 Marks)**

c. Briefly explain the dual functions of port-3 pins of 8051. **(05 Marks)**

2 a. What is addressing mode? Put the number OFAH in registers R_3, R_4 and R_5 in four different addressing modes. **(06 Marks)**

b. Explain the following in brief:
i) The pin that connects external memory.
ii) The port that has open-drain output.
iii) The register that sequences the program execution.
iv) PSW. **(08 Marks)**

c. Show the stack contents, sp contents and contents of any register affected after each step of the following sequences of operation:

```
MOV SP, #70H
MOV R5, #30H
MOV A, #44H
Add A, R5
MOV R4, A
PUSH 4
PUSH 5
POP 4
```

(06 Marks)

3 a. Explain the different types of conditional and unconditional jump instructions of 8051. Specify the different ranges associated with jump instructions. **(08 Marks)**

b. Find the address of first two internal RAM locations between 20H and 40H, which contains consecutive numbers. If so, set the carry flag to one, else clear the carry flag. **(06 Marks)**

c. Write an 8051 assembly time delay subroutine to generate a time delay of 100 μsec when called. Assume crystal frequency as 12 MHz. Show delay calculations. Do not use timers. **(06 Marks)**

4 a. Give bit size and data range details for the widely used seven 'C' data types of 8051. **(04 Marks)**

b. Write an 8051 ALP to convert packed BCD number 48 to ASCII and display the result on port-2 and port-3. **(06 Marks)**

c. Write an ALP 8051 program to find the checksum byte of data stream 30H, 4AH, 65H and 10H. Convert the binary value of checksum into decimal and display the value of the BCD digits on ports P_0, P_1 and P_2. **(10 Marks)**

PART – B

5 a. With regard to timers of 8051:
   i) Explain briefly the difference between the timer and counter operation.
   ii) Indicate how to start/stop the timer if GATE control is also used.
   iii) Explain mode-2 operation. **(06 Marks)**

   b. Write an ALP to generate a square wave continuously of 2 kHz with a duty cycle of 66%. **(06 Marks)**

   c. A switch is connected to the pin P1.2. Write a 'C' program to monitor the switch and create the following frequencies on pin P1.7:
   i) When SW = 0; 500Hz
   ii) When SW = 1; 750Hz
   Use timer 0, mode 1 for both of them. **(08 Marks)**

6 a. What is serial communication? How serial communication is carried out with RS232 in 8051? **(06 Marks)**

   b. Explain the bit pattern of SCON register. **(06 Marks)**

   c. Write:
   i) ALP to transfer serially letter 'A' continuously.
   ii) C program to receive bytes of data and put them in P1. Use 9600 baud rate, 8-bits and one stop bit, for both transmission and reception. Use timer 1, mode-2. **(08 Marks)**

7 a. Explain briefly the MSP430 RISC CPU architecture. **(10 Marks)**

   b. Give details of register of MSP430. **(10 Marks)**

8 Write short notes on:
   a. RTC
   b. DMA
   c. DAS
   d. RF interfaces. **(20 Marks)**

* * * * *

USN | | | | | | | | | | |

10ES43

Fourth Semester B.E. Degree Examination, Dec. 2013/Jan. 2014
Control Systems

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Define control system? what are the requirements of a good control system. **(04 Marks)**

b. Show that the two systems shown in Fig. Q1(b)(i) and (ii) are analogous systems by comparing their transfer functions. **(08 Marks)**

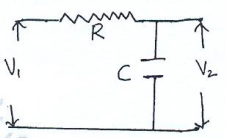

Fig. Q1(b)(i)

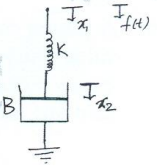

Fig. Q1(b)(ii)

c. For the electromechanical system show in Fig. Q1(c). Find the transfer function $\frac{X(S)}{E(S)}$ **(08 Marks)**

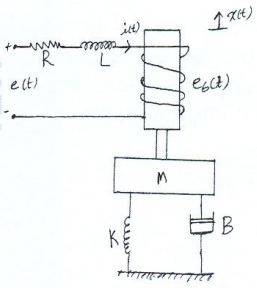

Fig. Q1(c)

2 a. Illustrate how to perform the following, in connection, with block diagram reduction rules :

i) Shifting take –off point after a summing point

ii) Shifting take –off point before a summing point. **(04 Marks)**

b. Find the closed loop transfer function of the system shown in Fig. Q2(b), using block diagram reduction rules. **(08 Marks)**

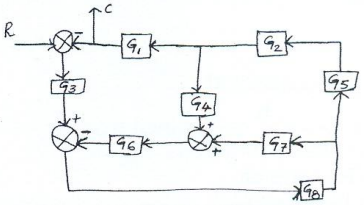

Fig. Q2(b)

c. For the network shown in Fig. Q2(c), construct the signal flow graph and determine the transfer function using Mason's gain formula. **(08 Marks)**

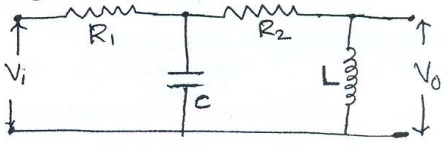

Fig. Q2(c)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

3 a. Define the following terms : i) Transient response ii) Steady state response. **(04 Marks)**

b. The system given in Fig.Q3(b) is a unity feed back system with minor feed back loop.

i) In the absence of derivative feedback (a = 0), determine the damping ratio and undamped natural frequency

ii) Determine the constant 'a' which will increase damping ratio to 0.7

iii) Find the overshoot in both the case. **(08 Marks)**

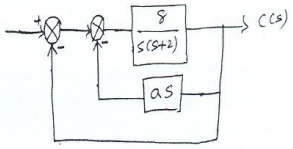

Fig. Q3(b)

c. A plotter may be represented by the block diagram shown in Fig. Q3(c). i) Determine the value of gain 'K' that gives a peak over shoot of 4.32% ii) For this value of K, determine the steady state error for a unit ramp input iii) For what range of K is the 2% of settling time less than one, sec. **(08 Marks)**

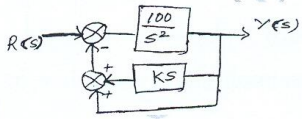

Fig. Q3(c)

4 a. $s^6 + 4s^5 + 3s^4 - 16s^2 - 64s - 48 = 0$. Find the number of roots of this equation with positive real part, zero real part and negative real part. **(06 Marks)**

b. The block diagram of a feedback control system is shown in Fig. Q4(b). applying RH criterion to determine the range of K for stability if

$$G(s) = \frac{K}{(s+4)(s+5)}.$$ **(06 Marks)**

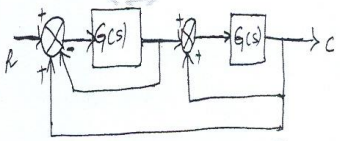

Fig. Q4(b)

c. Determine the value of 'K' and 'b' so that the system whose open loop transfer function is

$$G(s) = \frac{K(s+1)}{s^3 + 6s^2 + 3s + 1}$$

Oscillates at a frequency of oscillations of 2 rad/sec. [assume unity feedback]. **(08 Marks)**

PART – B

5 a. Consider the system with

$$G(s)H(s) = \frac{K}{s(s+2)(s+4)}.$$ Find whether s = -0.75 and s = - 1 + j4 is on the root locus or not using angle condition. **(04 Marks)**

b. The open loop transfer function of a control system is given by

$$G(s)H(s) = \frac{K(s+1)}{s(s-1)(s^2+5s+20)}$$

Determine the valid break away points. **(08 Marks)**

c. Show that the part of root locus of a system with

$$G(S)H(s) = \frac{K(s+3)}{S(s+2)}$$ is a circle having center (-3, 0) and radius at $\sqrt{3}$. **(08 Marks)**

6 a. For a closed loop control system $G(s)=\frac{100}{s(s+8)}$ H(s) = 1. Determine resonant peak and resonant frequency. **(04 Marks)**

b. List the limitations of lag and lead compensation. **(08 Marks)**

c. Find the open loop transfer function of a single loop unity feedback system whose asymptotic bode magnitude plot is shown in Fig. Q6(c). **(08 Marks)**

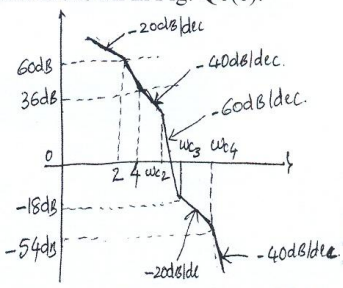

Fig. Q6(c)

7 a. Determine the number of encirclements about the origin in Fig. Q7(a). **(04 Marks)**

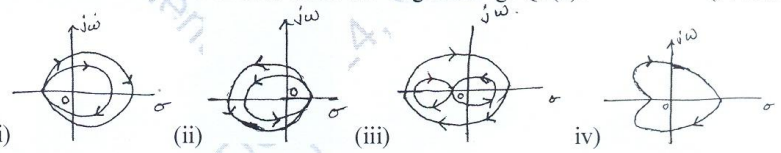

Fig.Q7(a)(i) (ii) (iii) iv)

b. Draw polar plot of $G(s)H(s)=\frac{100}{(s+2)(s+4)(s+8)}$. **(08 Marks)**

c. Using Nyquist stability criterion, investigate the closed loop stability of a negative feedback control system whose open – loop transfer function is given by

$G(s)H(s)=\frac{K(ST_a+1)}{S^3}$, K, $T_a > 0$. **(08 Marks)**

8 a. Obtain the state transition matrix for the following system.

$$\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\end{bmatrix}=\begin{bmatrix}-1 & -0.5\\ 1 & 0\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix}+\begin{bmatrix}0.5\\ 0\end{bmatrix}u.$$ **(10 Marks)**

b. Develop a state model for the electrical network shown in Fig. Q8(b) choosing the current through the inductance and voltage across the capacitor as states. The output is $Y=\begin{bmatrix}V_{R_2} & i_{R_2}\end{bmatrix}^T$. **(10 Marks)**

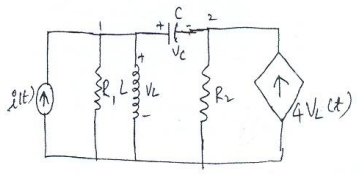

Fig. Q8(b)

* * * * *

USN | | | | | | | | | | |

10EC44

Fourth Semester B.E. Degree Examination, Dec.2013/Jan.2014
Signals and Systems

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Sketch the even and odd part of the signal shown in Fig.Q1(a). **(06 Marks)**

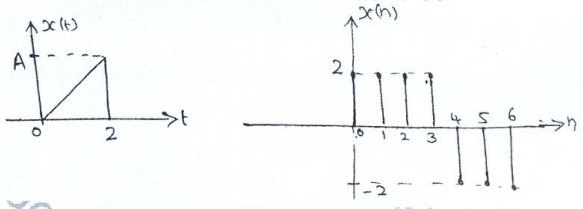

Fig.Q1(a)

b. Check whether the following signals is periodic or not and if periodic find its fundamental period.
(i) $x(n) = \cos(20\pi n) + \sin(50\pi n)$ (ii) $x(t) = [\cos(2\pi t)]^2$ **(06 Marks)**

c. Let x(t) and y(t) as shown in Fig.Q1(c). Sketch (i) x(t)y(t – 1) (ii) x(t)y(–t –1) **(08 Marks)**

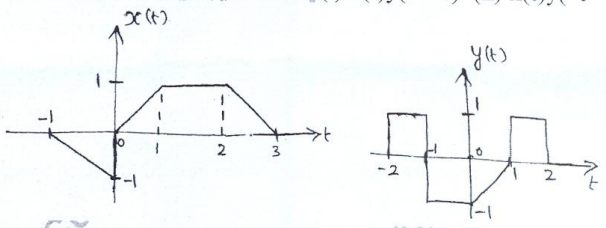

Fig.Q1(c)

2 a. Determine the convolution sum of the given sequences
$x(n) = \{1, -2, 3, -3\}$ and $h(n) = \{-2, 2, -2\}$ **(04 Marks)**

b. Perform the convolution of the following sequences:
$x_1(t) = e^{-at}$; $0 \le t \le T$
$x_2(t) = 1$; $0 \le t \le 2T$ **(10 Marks)**

c. An LT1 system is characterized by an impulse response, $h(n) = \left(\frac{1}{2}\right)^n u(n)$. Find the response of the system for the input $x(n) = \left(\frac{1}{4}\right)^n u(n)$. **(06 Marks)**

3 a. Determine the following LT1 systems characterized by impulse reponse is memory, causal and stable.
(i) $h(n) = 2u(n) - 2u(n-2)$ (ii) $h(n) = (0.99)^n u(n+6)$. **(06 Marks)**

b. Find the natural response of the system described by a differential equation
$\frac{d^2y(t)}{dt^2} + 2\frac{dy(t)}{dt} + 2y(t) = 2x(t)$, with $y(0) = 1$, and $\left.\frac{dy(t)}{dt}\right|_{t=0} = 0$ **(06 Marks)**

c. Find the difference equation description for the system shown in Fig.Q3(c). **(04 Marks)**

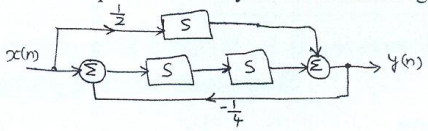

Fig.Q3(c)

d. By converting the differential equation to integral equation draw the direct form-I and direct form-II implementation for the system as

$$\frac{d^3y(t)}{dt^3}+4\frac{d^2y(t)}{dt^2}+2\frac{dy(t)}{dt}=x(t)+6\frac{d^2x(t)}{dt^2}$$ **(04 Marks)**

4 a. State and prove the following properties of DTFS: (i) Modulation (ii) Parseval's theorem. **(10 Marks)**

b. Find the Fourier series coefficients of the signal x(t) shown in Fig.Q4(b) and also draw its spectra. **(10 Marks)**

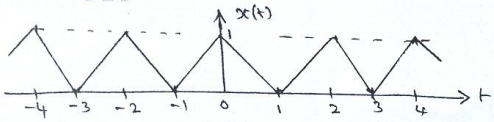

Fig.Q4(b)

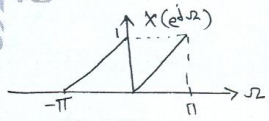

Fig.Q5(b)

PART – B

5 a. Find the DTFT of the following signals:
(i) $x(n)=a^{|n|}$; $|a|<1$ (ii) $x(n)=2^n u(-n)$ **(08 Marks)**

b. Determine the signal x(n) if its DTFT is as shown in Fig.Q5(b). **(06 Marks)**

c. Compute the Fourier transform of the signal

$$x(t)=\begin{cases}1+\cos\pi t & ; \ |t|\le 1\\ 0 & ; \ |t|>1\end{cases}$$ **(06 Marks)**

6 a. Find the frequency response of the system described by the impulse response
$h(t)=\delta(t)-2e^{-2t}u(t)$
and also draw its magnitude and phase spectra. **(08 Marks)**

b. Obtain the Fourier transform representation for the periodic signal
$x(t)=\sin w_0 t$
and draw the magnitude and phase. **(07 Marks)**

c. A signal $x(t)=\cos(20\pi t)+\frac{1}{4}\cos(30\pi t)$ is sampled with sampling period τ_s. Find the Nyquist rate. **(05 Marks)**

7 a. What is region of convergence (ROC)? Mention its properties. **(06 Marks)**

b. Determine the z-transform and ROC of the sequence $x(n)=r_1^n u(n)+r_2^n u(-n)$. **(07 Marks)**

c. Determine the inverse z-transform of the function, $x(z)=\frac{1+z^{-1}}{1-z^{-1}+0.5z^{-2}}$, using partial fraction expansion. **(07 Marks)**

8 a. An LT1 system is described by the equation
$y(n)=x(n)+0.8\,x(n-1)+0.8x(n-2)-0.49y(n-2)$

b. Determine the transfer function H(z) of the system and also sketch the poles and zeros. **(06 Marks)**

c. Determine whether the system described by the equation
$y(n)=x(n)+b\,y(n-1)$ is causal and stable where $|b|<1$. **(08 Marks)**

Find the unilateral z-transform for the sequence $y(n)=x(n-2)$, where $x(n)=\alpha^n$. **(06 Marks)**

* * * * *

USN | | | | | | | | | | |

10EC45

Fourth Semester B.E. Degree Examination, Dec.2013/Jan.2014
Fundamentals of HDL

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Explain VHDL and verilog? Evaluate the expression E = (A and not B or C or 2 and D) where A = "11", B = "1111", C = "011000", D = "111011" **(07 Marks)**

b. Explain the following data–types:
i) Physical data types ii) User-defined data type iii) Array type iv) Nets and v) Parameters. **(10 Marks)**

c. Write a verilog code for the circuit given in Fig. Q1 (c), using switch level description. **(03 Marks)**

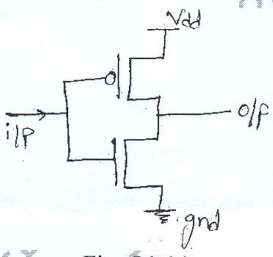

Fig. Q1 (c)

2 a. Explain concurrent execution. **(03 Marks)**

b. Write a verilog code in data flow description for a 2-bit magnitude comparator with the help of truth table and simplified Boolean expressions. **(10 Marks)**

c. Write a VHDL code for 3-bit parallel subtractor using 1-bit full adder in data flow modeling style. **(07 Marks)**

3 a. Compare signal with variable. Give an example for each. **(04 Marks)**

b. Using Booth algorithm, find the product of two signed 4-bit numbers –3 and 5. Write a verilog code using behavioral style of description. **(10 Marks)**

c. Write a VHDL code to determine the number of one's in an 8-bit vector. The output of the detector must be '0' for even number of one's, while '1' for odd number of one's. **(06 Marks)**

4 a. Explain binding between library and module. **(02 Marks)**

b. Write a verilog code to implement S-R latch in structured description. **(06 Marks)**

c. Define state machine using the state machine concept, showing all the details design a counter, which counts 0, 2, 3, 5, 7. Write the VHDL code for the same. (Use JK flip-flop). **(12 Marks)**

PART – B

5 a. What are the significance of procedure, task and functions? Bring out the difference between procedure, task and function with an example. **(08 Marks)**

b. Write a code to convert the fraction binary (4-bit) to real using procedure. **(08 Marks)**

c. Write a note on verilog file processing. **(04 Marks)**

6 a. With syntax, explain package declaration and package body. **(04 Marks)**

b. Write a verilog code to find the greatest element of an array. **(06 Marks)**

c. Write a VHDL code to describe the finite sequential state machine given in Fig.Q6 (c). **(10 Marks)**

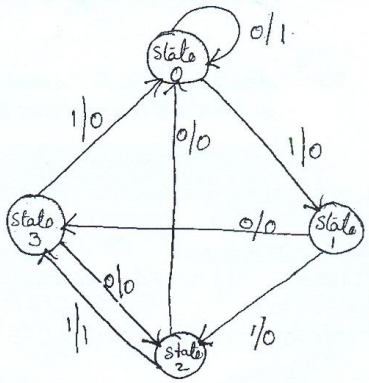

Fig. Q6 (c)

7 a. Write mixed-language description of a master slave D flip flop invoking VHDL entity from a verilog module. **(10 Marks)**

b. Write mixed-language description of a simple JK flip flop with active low clear. **(10 Marks)**

8 a. Define synthesis. Synthesize the VHDL code given in the Fig. Q8 (a)

```
entity Ex is
        Port (a : in natural range 0 to 7;
              Y : out integer range 0 to 15);
end Ex;
architecture Ex1 of Ex is
begin
        Process (a)
            Variable temp : integer range 0 to 15;
        begin
            if (a<3) then temp : = 15;
            elseif (a > = 5) then temp : = 0;
            else
                temp : = a * (-5) + 25;
            end if;
        end process;
end Ex1;
```

Fig. Q8 (a) **(10 Marks)**

b. Write verilog code for signal assignment y = 2 * x + 3. Show the synthesized logic symbol and gate level diagram. **(10 Marks)**

* * * * *

USN | | | | | | | | | | |

10EC46

Fourth Semester B.E. Degree Examination, Dec.2013/Jan.2014
Linear ICs and Applications

Time: 3 hrs. Max. Marks:100

Note: *1. Answer FIVE full questions, selecting at least TWO questions from each part.*
2. Missing data, if any, may be assumed.

PART – A

1 a. Explain common mode voltage, common mode voltage gain and common mode rejection ratio for operational amplifiers. Show that $V_{\theta(cm)} = \frac{V_{i(cm)}}{CMRR} * A_v$ **(10 Marks)**

b. Sketch an op-amp difference amplifier circuit. Derive an equation for the output voltage and explain the operation. **(05 Marks)**

c. A non-inverting amplifier is to amplify a 100 mV signal to a level of 3V, using 741 op-amp design a suitable circuit. [Consider $I_{B(max)} = 500$ nA, $R_s = 1$ kΩ]. **(05 Marks)**

2 a. Sketch and explain the operation of a capacitor coupled inverting amplifier circuit using a single polarity supply with necessary design steps. **(08 Marks)**

b. Sketch the circuit of a high input impedance capacitor coupled non-inverting amplifier. Briefly explain its operation and show that the input impedance is very high compared to capacitor coupler non-inverting amplifier. **(06 Marks)**

c. Design high input impedance capacitor coupled voltage follower using an op-amp having lower cut-off frequency of 50 Hz and maximum input bias current of 500 nA. The load resistance is 3.9 kΩ. If the open loop gain is 2×10^5. Find the value of input impedance. [Consider $M_{(min)} = 50{,}000$]. **(06 Marks)**

3 a. Explain phase-lag and phase-lead compensation methods. **(08 Marks)**

b. List the precautions to be observed for op-amp circuit stability. **(08 Marks)**

c. Determine the upper cut-off frequency and maximum distortion free output amplitude of a voltage follower when a 741 op-amp is used. **(04 Marks)**

4 a. Draw the circuit of instrumentation amplifier, discuss the characteristics of the circuit and show how voltage gain can be varied. Also show the method of nulling common mode outputs and how dc output voltage can be level shifted. **(12 Marks)**

b. A voltage source is to be designed to provide constant output voltage of approximately 6V. The load resistance has a minimum value of 150 Ω and the available supply voltage is ±12V. Design a suitable circuit using IC 741 and a zener diode with a V_Z of 6.3 V. Sketch the circuit with designed components. [Consider $I_z = 20$ mA]. **(08 Marks)**

PART – B

5 a. Draw and explain an op-amp sample and hold circuit with signal control and output waveforms. **(08 Marks)**

b. Explain op-amp square wave/ triangular wave generator with circuit diagram, waveform and expressions. **(08 Marks)**

c. Using a BIFET op-amp with a supply of ±12V, design a wein bridge oscillator to have an output frequency of 15 kHz. **(04 Marks)**

6 a. With a neat circuit diagram, waveform and expressions, explain the capacitor coupled non-inverting cross detector. **(08 Marks)**

b. With a neat circuit diagram, explain how diodes may be used to select the trigger points of an inverting Schmitt trigger circuit. **(06 Marks)**

c. Design a second order low pass filter circuit to have a cutoff frequency of 1 kHz (for 741 frequency extends upto 800 kHz with $A_v = 1$). **(06 Marks)**

7 a. With a neat functional diagram, explain the operation of low voltage regulator using IC 723. **(08 Marks)**

b. List out the limitations of linear voltage regulators. **(06 Marks)**

c. Define the following performance parameters of a voltage regulator:
(i) Line regulation (ii) Load regulation (iii) Ripple regulation. **(06 Marks)**

8 a. Explain the working of monostable multivibrator using 555 timer with a neat functional diagram and waveforms. Derive the equation for its pulse width. **(08 Marks)**

b. Draw the block diagram representation of PLL and explain. **(06 Marks)**

c. An 8-bit ADC outputs all 1's when $V_i = 2.55$ V. Find its (i) resolution in mV/LSB and ii) Digital output when $V_i = 1.28$ V. **(06 Marks)**

* * * * *