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10MAT41

Fourth Semester B.E. Degree Examination, June/July 2015
Engineering Mathematics - IV

Time: 3 hrs. Max. Marks:100

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

PART - A

1 a. Obtain y(0.2) using Picards method upto second iteration for the initial value problem $\frac{dy}{dx} = x^2 - 2y \quad y(0) = 1.$ **(06 Marks)**

b. Solve by Eulers modified method to obtain y(1.2) given $y' = \frac{y+x}{y-x} \quad y(1) = 2.$ **(07 Marks)**

c. Using Adam Bash forth method obtain y at x = 0.8 given **(07 Marks)**
$\frac{dy}{dx} = x - y^2$, $y(0) = 0$, $y(0.2) = 0.02$, $y(0.4) = 0.0795$ and $y(0.6) = 0.1762$.

2 a. Solve by 4^{th} order Runge Kutta method simultaneous equations given by $\frac{dx}{dt} = y - t$, $\frac{dy}{dt} = x + t$ with $x = 1 = y$ at $t = 0$, obtain y(0.1) and x(0.1). **(06 Marks)**

b. Solve $\frac{d^2y}{dx^2} - x\left(\frac{dy}{dx}\right)^2 + y^2 = 0$, $y(0) = 1$, $y'(0) = 0$. Evaluate y(0.2) correct to four decimal places, using Runge Kutta method of fourth order. **(07 Marks)**

c. Solve for x = 0.4 using Milnes predictor corrector formula for the differential equation y" + xy' + y = 0 with y(0) = 1 , y(0.1) = 0.995 , y(0.2) = 0.9802 and y(0.3) = 0.956. Also z(0) = 0 , z(0.1) = -0.0995 , z(0.2) = -0.196 , z(0.3) = -0.2863. **(07 Marks)**

3 a. Verify whether f(z) = sin2z is analytic, hence obtain the derivative. **(06 Marks)**

b. Determine the analytic function f(z) whose imaginary part is $\frac{y}{x^2 + y^2}$. **(07 Marks)**

c. Define a harmonic function. Prove that real and imaginary parts of an analytic function are harmonic. **(07 Marks)**

4 a. Under the mapping $w = e^z$, find the image of i) $1 \le x \le 2$ ii) $\pi/3 < y < \frac{\pi}{2}$. **(06 Marks)**

b. Find the bilinear transformation which maps the points 1, i, -1 from z plane to 2, i, -2 into w plane. Also find the fixed points. **(07 Marks)**

c. State and prove Cauchy's integral formula. **(07 Marks)**

PART - B

5 a. Prove $J_n(x) = \frac{x}{2n}[J_{n-1}(x) + J_{n+1}(x)]$. **(06 Marks)**

b. Prove $(n+1) P_n(x) = (2n+1) x P_n(x) - n P_{n-1}(x)$. **(07 Marks)**

c. Explain the following in terms of Legendres polynomials.
$x^4 + 3x^3 - x^2 + 5x - 2$ **(07 Marks)**

6 a. A class has 10 boys and 6 girls. Three students are selected at random one after another. Find the probability that i) first and third are boys , second a girl ii) first and second are of same sex and third is of opposite sex. **(06 Marks)**

b. If P(A) = 0.4 , P(B/A) = 0.9 , P($\overline{B}$ / $\overline{A}$) = 0.6. Find P(A/B) , P(A/ $\overline{B}$). **(07 Marks)**

c. In a bolt factory machines A, B and C manufacture 20%, 35% and 45% of the total of their outputs 5%, 4% and 2% are defective. A bolt is drawn at random found to be defective. What is the probability that it is from machine B? **(07 Marks)**

7 a. A random variable x has the following distribution :

x :	-2	-1	0	1	2	3	4
P(x) :	0.1	0.1	k	0.1	2k	k	k

Find k, mean and S.D of the distribution. **(06 Marks)**

b. The probability that a bomb dropped hits the target is 0.2. Find the probability that out of 6 bombs dropped i) exactly 2 will hit the target ii) atleast 3 will hit the target. **(07 Marks)**

c. Find the mean and variance of the exponential distribution. **(07 Marks)**

8 a. A die is tossed 960 times and 5 appear 184 times. Is the die biased? **(06 Marks)**

b. Nine items have values 45, 47, 50, 52, 48, 47, 49, 53, 51. Does the mean of these differ significantly from assumed of mean of 47.5. ($\gamma = 8$, $t_{0.05} = 2.31$). **(07 Marks)**

c. A set of 5 similar coins tossed 320 times gives following table.

No. of heads :	0	1	2	3	4	5
Freq.	6	27	72	112	71	32

Test the hypothesis that data follows binomial distribution (Given $\gamma = 5$, $\chi^2_{0.05} = 11.07$) **(07 Marks)**

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10ES42

Fourth Semester B.E. Degree Examination, June/July 2015
Microcontrollers

Time: 3 hrs. Max. Marks:100

Note: ***1. Answer any FIVE full questions, selecting atleast TWO questions from each part.***
2. Include suitable comments to your programs.

PART – A

1 a. Compare 8051, 8052 and 8031 microcontrollers. **(05 Marks)**

b. Explain the internal RAM section of 8051 µc with required diagrams. **(10 Marks)**

c. For the following µc ICS, determine the ROM memory address of AT89C51 with 4KB, DS89C420 with 16 KB and DS5000 with 32KB. **(05 Marks)**

2 a. What are the merits and demerits of indirect addressing mode? **(05 Marks)**

b. State the type of addressing mode used for the following instructions :
i) ADD A, 30h,
ii) CJNE A, #29h, AGHAIN
iii) INC @ R0
iv) XCH A, R3
v) CLR C. **(05 Marks)**

c. Explain the working of DAA instruction with an example. Assume that data is 99h and 99h. **(05 Marks)**

d. Write a program to covert hexadecimal number to decimal. Include suitable comments. **(05 Marks)**

3 a. Write a program to load accumulator with the value 55h and complement the content of accumulator 900 times. **(05 Marks)**

b. For AT89C51, with a crystal frequency of 22 MHz, write a program to generate a delay of 5 ms. **(05 Marks)**

c. Explain the working of JZ LABEL instruction with an example. Is zero flag present in 8051? **(05 Marks)**

d. Explain the calculation of checksum byte in ROM with an example. **(05 Marks)**

4 a. Explain the features of ADC 0804. Also explain the working of its various pins. **(10 Marks)**

b. Explain the principle of stepper motor. Write a program to rotate motor 64° in clockwise direction. The motor has step angle of 2°. Write the 4 step sequence also. The motor has steps per revolution = 180, number of rotor teeth = 45, movement per 4 step sequence = 8°. **(10 Marks)**

PART – B

5 a. Explain the bit status of TMOD special function resister. Also, explain its various modes. **(05 Marks)**

b. Using P1.5, timer – 1 in mode – 1, write a program to generate the following waveform as shown in Fig. Q5(b). Assume that system clock is 11.0592 MHz. Show the delay calculations. This waveform should be generated continuously. **(10 Marks)**

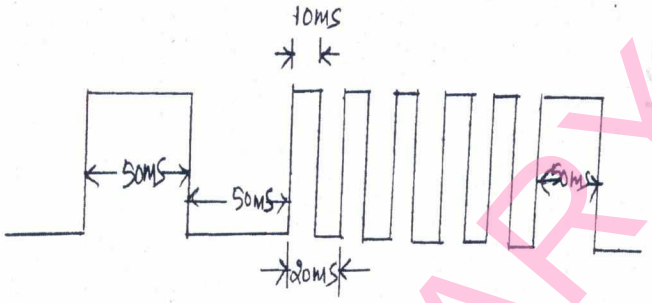

Fig.Q5(b)

c. Write a 'C' program that continuously gets a single bit of data from P1.7 and sends it to P1.0, while simultaneously creating a square wave of 200 μs period on pin P2.5. Use timer – 0 to create the square wave. Assume that crystal is 11.0592 MHz. **(05 Marks)**

6 a. Explain the bit status of SCON special function register. **(05 Marks)**

b. Write a 'C' program for 8051 to transfer the letter 'A' serially at 4800 baud continuously. Use 8 – bit data and 1 stop bit. Use timer 1 in mode 2. **(05 Marks)**

c. Determine the baud rate if THI = –2, SMOD = 1, XTAL = 11.0592 MHz. Is this baud rate supported by IBM PCS? **(05 Marks)**

d. Calculate the control word of 8255 for the following cases :
   i) All the ports A B and C are output ports (mode – 0)
   ii) PA = in, PB = out, PCL = out = PCH. **(05 Marks)**

7 a. Explain the expansion of MSP μc. Also explain how MSP μc is different from conventional μc, with an example. **(08 Marks)**

b. Explain the differences between MSP430XIXX, MSP430F2XX, MSP430X3XX, MSP430X4XX and MSP 430X μcs. **(08 Marks)**

c. Explain the salient features of MSP430μc. **(04 Marks)**

8 a. Explain the functions of watchdog timer, basic timer – 1, real time clock, timer A and timer B in MSP430μc. **(10 Marks)**

b. Explain the interfacing of LCD to MSP430μc. **(10 Marks)**

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10ES43

Fourth Semester B.E. Degree Examination, June/July 2015
Control Systems

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. With the help of neat block diagram, define open loop and closed loop control system. **(04 Marks)**

b. For a mechanical system shown in Fig.Q1(b) obtain force voltage analogous electrical network. **(08 Marks)**

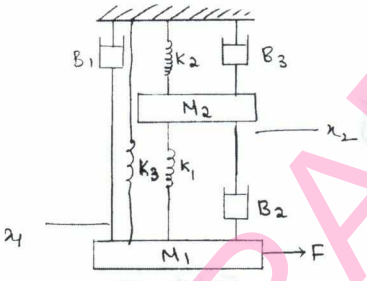

Fig.Q1(b)

c. Draw the electrical network based on torque current analogy and give all the performance equation for the Fig.Q1(c). **(08 Marks)**

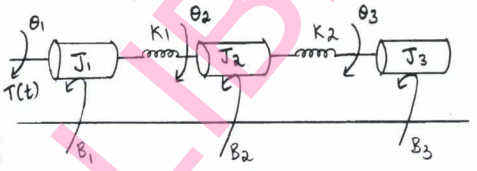

Fig.Q1(c)

2 a. Define the following terms related to signal flow graph with a neat schematic :
i) Forward path ii) Feedback loop iii) Self loop iv) Source node. **(04 Marks)**

b. Obtain the transfer function for the block diagram, shown in Fig .Q2(b). Using :
i) Block diagram reduction technique ii) Mason's gain formula. **(08 Marks)**

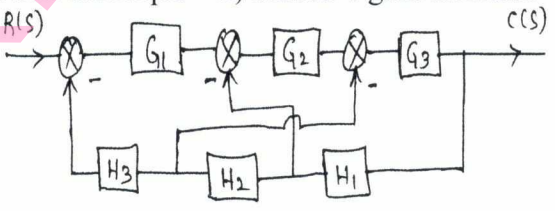

Fig.Q2(b)

c. For the signal flow graph shown in Fig. Q2(c), find the overall transfer function by :
i) Block diagram reduction technique
ii) Verify the result by mason's gain formula. **(08 Marks)**

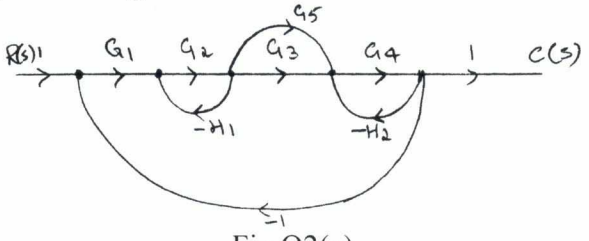

Fig.Q2(c)

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 and derive the expression for : i) Rise time ii) Peak overshoot of an under-damped second order control system subjected to step input. **(06 Marks)**

b. For a unit feedback control system with : $G(s)=\frac{10(s+2)}{s^2(s+1)}$, Find : i) The static error coefficients ii) Steady state error when the input is $R(s)=\frac{3}{s}-\frac{2}{s^2}+\frac{1}{3s^3}$. **(06 Marks)**

c. A system is given by differential equation $\frac{d^2y}{dt^2}+4\frac{dy}{dt}+8y=8x$, where y = output and x = input. Determine : i) Peak overshoot ii) Settling time iii) Peak time for unit step input. **(08 Marks)**

4 a. Explain Routh – Hurwitz criterion for determining the stability of the system and mention its limitations. **(06 Marks)**

b. For a system $s^4 + 22s^3 + 10s^2 + s + k = 0$, find K_{mar} and ω at K_{mar}. **(06 Marks)**

c. Determine the value of 'k' and 'b' so that the system whose open loop transfer function is : $G(s)=\frac{k(s+1)}{s^3+bs^2+3s+1}$ oscillates at a frequency of oscillations of 2 rad/sec. **(08 Marks)**

PART – B

5 a. For a unity feedback system, the open loop transfer function is given by:

$$G(s)=\frac{K}{s(s+2)(s^2+6s+25)}$$

i) Sketch the root locus for $0 \le k \le \infty$ ii) At what value of 'k' the system becomes unstable iii) At this point of instability, determine the frequency of oscillations of the system. **(15 Marks)**

b. Consider the system with $G(s)H(s)=\frac{k}{s(s+2)(s+4)}$, find whether s = -0.75 is point on root locus or not using angle condition. **(05 Marks)**

6 a. Explain the procedure for investigating the stability using Nyquist criterion. **(05 Marks)**

b. For a certain control system : $G(s)H(s)=\frac{k}{s(s+2)(s+10)}$. Sketch the Nyquist plot and hence calculate the range of values of 'k' for stability. **(15 Marks)**

7 a. Sketch the bode plot for the open loop transfer function :

$G(s)H(s)=\frac{k(1+0.2s)(1+0.025s)}{s^3(1+0.001s)(1+0.005s)}$, Find the range of 'k' for closed loop stability. **(14 Marks)**

b. Define the following as applied to bode plots :
i) Gain margin ii) Phase margin iii) Gain and phase cross over frequency. **(06 Marks)**

8 a. Define the following terms : i) State ii) State variable iii) State space iv) State transition. **(04 Marks)**

b. A system is described by the differential equation, $\frac{d^3y}{dt^3}+\frac{3d^2y}{dt^2}+\frac{17dy}{dt}+5y=10u(t)$, where 'y' is the output and 'u' is input to the system. Determine the state space representation of the system. **(06 Marks)**

c. Obtain the state equations for the electrical network shown in Fig. Q8(c). **(10 Marks)**

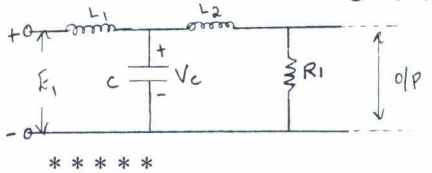

Fig.Q8(c)

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10EC44

Fourth Semester B.E. Degree Examination, June/July 2015
Signals and Systems

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. If x(t) and y(t) are as shown Fig.Q1(a), sketch x (1 – t) · y(t/2). **(06 Marks)**

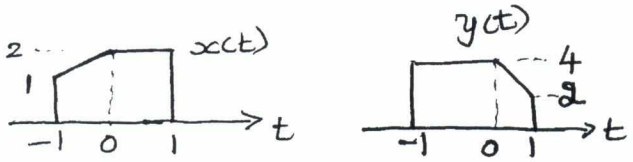


Fig.Q1(a)

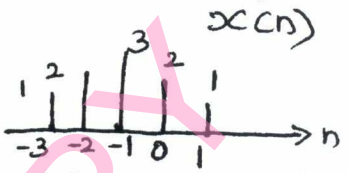


Fig.1Q(b)

b. If x(n) is as shown Fig.1(b), find the energy of the signal x(2n – 1). **(04 Marks)**

c. Find whether the system represented by y(t) = x(t/2) is linear, TI, causal substantiate your answers. **(05 Marks)**

d. Express x(t) in terms of g(t) if x(t) and g(t) are as shown in FigQ1(d): **(05 Marks)**

Fig.Q1(d)

2 a. Perform the convolution of the two signals.

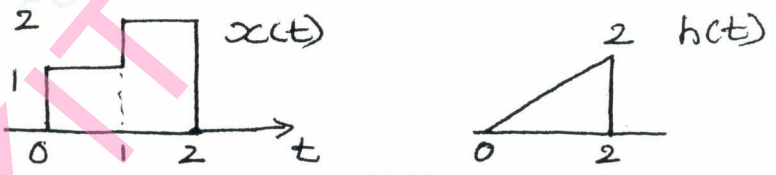


Fig.Q2(a)

Using the formula : $y(t) = \int_{-\infty}^{\infty} h(\tau)x(t-\tau)d\tau$. **(10 Marks)**

b. Perform the convolution of two finite sequences using graphical method only :

$x(n) = \{-1, 1, \underset{\uparrow}{0}, 1, -1\}$ $h(n) = \{1, \underset{\uparrow}{2}, 3\}$. **(10 Marks)**

3 a. Find natural, forced and total responses for the differential equation :
$y''(t) + 4y'(t) + 4y(t) = e^{-2t}u(t)$, assume $y(0) = 1$, $y'(0) = 0$. **(09 Marks)**

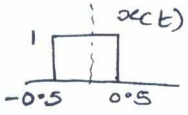
b. Find whether LTI system given by : $y(n) = 2x(n + 2) + 3x(n) + x(n – 1)$ is causal. Justify your answer. **(04 Marks)**

c. Draw DF – I and DF – II implementations for the differential equation :

$$\frac{d^2y(t)}{dt^2} + \frac{5dy(t)}{dt} + 4y(t) = x(t) + \frac{dx(t)}{dt}.$$ **(07 Marks)**

4 a. Consider the periodic waveform $x(t) = 4 + 2\cos 3t + 3\sin 4t$
   i) Find period 'T'
   ii) What is the total average power
   iii) Find the complex Fourier coefficients
   iv) Using Parseval's theorem, find the power spectrum
   v) Show that total average power using Parseval's theorem is same as obtained in part (2) of the question. **(12 Marks)**

b. Find FT of the following :

i) 

ii) $x(t) = \delta(t-2)$ iii) $x(t) = e^{-at}u(t)$. **(08 Marks)**

PART – B

5 a. Find inverse FT of $x(\omega) = \dfrac{j\omega}{(j\omega+2)^2}$. **(06 Marks)**

b. Find the DTFT of the rectangular pulse sequence shown in Fig .Q5(b).

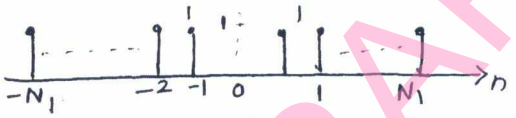


Fig.Q5(b)

Also Plot $X(\Omega)$. **(10 Marks)**

c. Find DTFT of $x(n) = \delta(4-2n)$. **(04 Marks)**

6 a. State sampling theorem. What s aliasing explain? **(04 Marks)**

b. Specify the Nyquist rate and Nyquist intervals for each of the following signals :
   i) $g(t) = \text{sinc}^2(200\,t)$ ii) $g(t) = \sin c\,(200\,t) + \sin c^2(200\,t)$. **(06 Marks)**

c. Find the FT of the signum function, $x(t) = \text{sgn}(t)$. Also draw the amplitude and phase spectra. **(10 Marks)**

7 a. Sate and prove the following properties of Z – transform :
   i) Multiplication by a R amp ii) Convolution in time domain. **(06 Marks)**

b. Find Z – transform of the following and specify its RoC.

$x(n) = \sin\left(\dfrac{\pi}{4}n - \dfrac{-\pi}{2}\right)u(n-2)$; $x(n) = \left(\dfrac{2}{3}\right)^n u(n) * 2^n u(-n-3)$. **(08 Marks)**

c. Find IZT, if $x(z) = \dfrac{\left(\frac{1}{4}\right)z^{-1}}{\left(1-\frac{1}{2}z^{-1}\right)\left(1-\frac{1}{4}z^{-1}\right)}$ for all possible RoC's. **(06 Marks)**

8 a. Solve the difference equation using Z – transform, $y(n) = y(n-1) - y(n-2) + 2$; $n \geq 0$ with initial conditions : $y(-2) = 1$, $y(-1) = 2$. **(08 Marks)**

b. Consider the system described by difference equation,

$y(n) - 2y(n-1) + 2y(n-2) = x(n) + \frac{1}{2}x(n-1)$
   i) find system function H(z)
   ii) find the stability of the system
   iii) find h(n) of the system. **(08 Marks)**

c. Perform IZT using long division method : $x(z) = \dfrac{z}{z-a}$ RoC $|z| > |a|$. **(04 Marks)**

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10EC45

Fourth Semester B.E. Degree Examination, June/July 2015
Fundamentals of HDL

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Name the different types of operations in HDL. Explain the bitwise, unary and Boolean logical operations present in verilog with example. **(08 Marks)**

b. Name the VHDL data types. Explain the physical data type and composite data type in VHDL. **(06 Marks)**

c. Write the result of the following operation if A = 10010011 and B = 01101111:
i) A sr*l* 04 ii) B sla 03 iii) A << 02 iv) A % 2 v) ! (&B) vi) A & B in VHDL. **(06 Marks)**

2 a. Write the VHDL code for 2 × 2 unsigned combinational array multiplier using dataflow description. **(06 Marks)**

b. Write the verilog description for 4 bit ripple carry adder. Assume 5ns delay for all the gates and description using dataflow. **(08 Marks)**

c. Explain how signal declaration is done in VHDL and verilog. **(06 Marks)**

3 a. With the help of booth algorithm multiply the numbers (-8) × (7). Also write the VHDL code to realize the same. **(10 Marks)**

b. Write an HDL code to realize the positive edge triggered JK flip flop.
i) Use if statement in VHDL.
ii) Use case statement in verilog HDL. **(10 Marks)**

4 a. Write the logic circuit for performing 3 bit comparision using 3 full adder. Also write the structural description to realize the same in VHDL. **(10 Marks)**

b. What is binding? Explain how binding between entity and architecture is done in VHDL and also binding between library and module in VHDL. **(05 Marks)**

c. Write the truth table of a logic system having 3 input and when the odd number of inputs are high then the output of the system will be high. Also write the verilog code to realize the same using structural description. **(05 Marks)**

PART – B

5 a. What is the need of procedure and task? Explain the declaration and body of the task. **(04 Marks)**

b. Write the procedure for converting an unsigned binary to an integer. **(08 Marks)**

c. What is a function? Write the code for finding greater of two signed numbers in verilog using function. **(08 Marks)**

6 a. What is the need for mixed types description? **(04 Marks)**

b. Using package declaration declare one dimensional array type with N of elements and L number of bits in each element. Write a VHDL code for finding the largest element present in one dimensional array declared using package. **(08 Marks)**

c. Write the truth table for the SRAM shown in Fig.Q.6(c). Write a verilog HDL code to read or write the data from SRAM. **(08 Marks)**

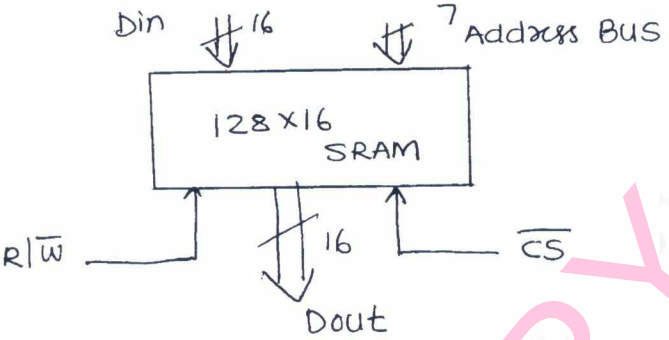

Fig.Q.6(c)

7 a. Write the mixed language description of an adder shown in Fig.Q.7(a). Invoke a VHDL full adder from verilog. **(10 Marks)**

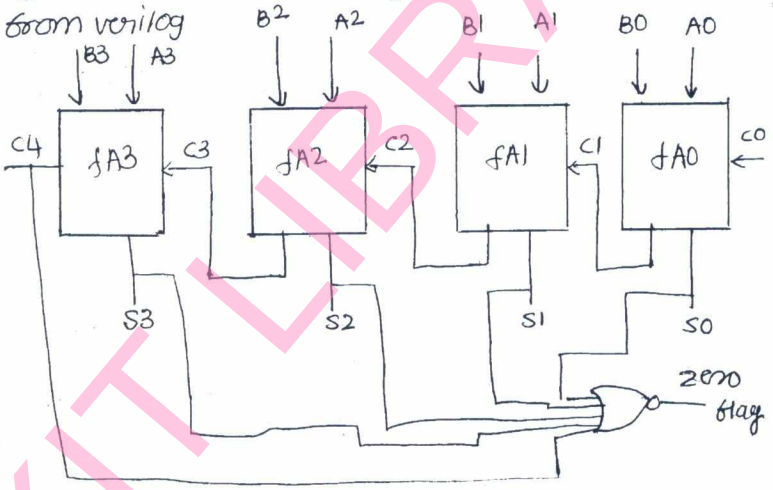

Fig.Q.7(a)

b. Write the truth table of JK flipflop with clear. Describe the JK flipflop with clear using mixed language description. **(10 Marks)**

8 a. Write the general steps of synthesis in form of a flowchart and explain it. **(10 Marks)**

b. Write VHDL and verilog code for signal assignment statement y = 3x with x as of size 2 bits. Also show the mapping of this signal assignment to gate level. **(10 Marks)**

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10EC46

Fourth Semester B.E. Degree Examination, June/July 2015
Linear Integrated Circuits and Applications

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Explain the working of a basic operational amplifier circuit with R_c = 7.5 KΩ, R_E = 3.8 KΩ and powered by ± 12V supply. **(08 Marks)**

b. Design a bias-current compensated inverting amplifier to amplify a dc input of 150 mV by a factor of 40. Use a bipolar op-amp with $I_{B_{max}} = 500\,nA$. **(06 Marks)**

c. Derive an expression to relate the input and output common mode voltage (V_{icm} and V_{ocm}) of a non-inverting amplifier. **(06 Marks)**

2 a. Explain the realization of a C-coupled voltage follower for AC amplifier applications, discussing cut-off frequency design concept. **(06 Marks)**

b. Design a BIFET op-amp based high input impedance C-coupled non-inverting amplifier for a lower cut-off frequency of 120 Hz. Given: V_{in} = 20 mV, V_0 = 5V and $R_{L\text{-}min}$ = 10KΩ. **(08 Marks)**

c. Explain the concept and construction of a C-coupled inverting amplifier using a single-polarity supply (+ V_{cc}). **(06 Marks)**

3 a. Considering the frequency and phase responses of an uncompensated op-amp with a three-stage model, discuss the concept of circuit stability. **(10 Marks)**

b. Explain frequency compensation based on Miller effect, also explaining the capacitance-amplification principle. **(06 Marks)**

c. A voltage follower is to operate at a unity gain bandwidth of 1 MHz, and the op-amp has a slew rate of 0.75 V/μs. Determine the permissible peak output voltage, and the cut-off frequency related rise time. **(04 Marks)**

4 a. Design a current source to produce an output of 150 mA to a grounded load of maximum value 30 Ω. Use an op-amp with ±12V supply and a power MOSFET with $R_{D\text{-}on}$ = 6Ω as the current booster. **(08 Marks)**

b. Derive an expression for the differential gain of an instrumentation amplifier. **(06 Marks)**

c. Explaining the operation briefly, design a non-saturating half wave precision rectifier to produce a 3 Volt peak output from an input of peak value 0.25 V, and frequency of 5 kHz. Use a bipolar op-amp with ±15V power supply. **(06 Marks)**

PART – B

5 a. Explain the operation of a voltage follower peak detector circuit, discussing capacitor selection procedure. **(08 Marks)**

b. Design an RC-phase shift oscillator to generate sustained oscillations at a frequency of 1.5 kHz. Use a 741 op-amp and ±12V power supply. **(06 Marks)**

c. Deriving an expression, discuss the fundamental log-amplifier circuit. **(06 Marks)**

6 a. Explain the operation of an inverting Schmitt trigger circuit with the help of waveforms and transfer characteristics. **(08 Marks)**

b. Design an op-amp based monostable multivibrator to generate a pulse of width PW = 2ms. The trigger is a pulse of amplitude 3V and duration 150 μs. Use a bipolar op-amp and a supply of ±12V. **(08 Marks)**

c. Design a first order high pass active filter for a cut-off frequency of 2 kHz. **(04 Marks)**

7 a. Briefly explain the operation of a series voltage regulator. **(06 Marks)**

b. Design a voltage regulator circuit using LM723 to obtain $V_0 = 5V$, and $I_0 = 2A$. **(06 Marks)**

c. Explain the basic principle of operation of switching regulators. Also list any four merits. **(08 Marks)**

8 a. Design an astable multivibrator using 555 timer to obtain a square wave of frequency 5 kHz at 50% duty cycle. **(06 Marks)**

b. Discuss the operating principle of PLLS and define the lock-in and capture ranges. **(08 Marks)**

c. Explain the binary weighted technique of digital to analog conversion. What is its major disadvantage? **(06 Marks)**

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MATDIP401

Fourth Semester B.E. Degree Examination, June/July 2015
Advanced Mathematics - II

Time: 3 hrs. Max. Marks:100

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

1 a. Find the angle between 2 diagonals of a cube. **(06 Marks)**

b. If A(0 9 6), B(1 2 3) , C(7 - 25) are vertices of a triangle. Find the coordinates of the foot of the perpendicular drawn from A to BC. **(07 Marks)**

c. Find the equation of the plane in the Intercept form $\frac{x}{a}+\frac{y}{b}+\frac{z}{c}=1$. **(07 Marks)**

2 a. Find the equation of the plane passing through the three points (2, 3, 4) , (-3, 5, 1) (4, -1, 2). **(06 Marks)**

b. Find the equation of the plane through the points (1, 2, -1) and perpendicular to the planes $x + y - 2z = 5$ and $3x - y + 4z = 12$. **(07 Marks)**

c. Find the equation of the plane through the points (-1, 2, 0) and containing the plane $2x + 3y + 5z - 1 = 0$ and $3x + y - z + 2 = 0$. **(07 Marks)**

3 a. Find the unit vector parallel to the sum of the vector $\vec{A} = 2i + 4j - 5k$ and $\vec{B} = i + 2j + 3k$. **(06 Marks)**

b. Determine λ such that $\vec{A} = i + j + k$, $\vec{B} = 2i - 4k$. $\vec{C} = i + \lambda j + 3k$ are coplanar. **(07 Marks)**

c. Prove that $(\vec{a}\times\vec{b})\times\vec{c} = (\vec{a}.\vec{c})\vec{b} - (\vec{b}.\vec{c})\vec{a}$. **(07 Marks)**

4 a. Prove that $\frac{d}{dt}[\vec{F}.\vec{G}] = \vec{F}.\frac{d\vec{G}}{dt}+\frac{d\vec{F}}{dt}.\vec{G}$. **(06 Marks)**

b. Find the velocity and acceleration for the curve $\vec{r} = (1-t^3)\,i + (1+t^2)j + (2t - 5)k$ at $t = 1$ and also find their magnitude. **(07 Marks)**

c. If $\frac{d\vec{a}}{dt} = \vec{w}\times\vec{a}$ and $\frac{d\vec{b}}{dt} = \vec{w}\times\vec{b}$ then show that $\frac{d}{dt}[\vec{a}\times\vec{b}] = \vec{w}\times(\vec{a}\times\vec{b})$. **(07 Marks)**

5 a. Find the directional derivative of $\phi = x^2yz + 4xz^2$ at (1, -2, -1) along $2i - j - 2k$. **(06 Marks)**

b. If $\vec{F} = (x + y + 1)\,i + j - (x + y)k$. Find $\vec{F}.\text{curl}\,\vec{F}$. **(07 Marks)**

c. Show that $\nabla.(\nabla\times\vec{A}) = 0$. **(07 Marks)**

6 a. Find L f(t) given that $f(t) = \begin{cases} t\ ; & 0 < t < 4 \\ 5\ ; & t > 4 \end{cases}$ **(05 Marks)**

b. Find i) $L[e^{3t}\sin 5t\ \sin 3t]$ ii) $L[t^5\cosh 3t]$ iii) $L[t^3 e^{-3t}]$. **(15 Marks)**

7 a. Find $L\left[\frac{1-e^t}{t}\right]$. **(05 Marks)**

b. Find i) $L^{-1}\left[\frac{4s+5}{(s-1)^2(s+2)}\right]$ ii) $L^{-1}\left[\frac{4s+15}{16s^2-25}\right]$ iii) $L^{-1}\left[\frac{s}{s^2-6s+9}\right]$. **(15 Marks)**

8 a. Using Laplace transform solve :

$$\frac{dzy}{dt^2} + 4\frac{dy}{dt} + 3y = e^t \quad ; \quad y(0) = 0 \quad y'(0) = 1.$$ **(10 Marks)**

b. Solve using Laplace transformation method

$y'' + 2y' - 3y = \sin t, \quad y(0) = y'(0) = 0.$ **(10 Marks)**

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