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10MAT41

# Fourth Semester B.E. Degree Examination, June/July 2016
## Engineering Mathematics – IV

Time: 3 hrs. Max. Marks:100

**Note:** *1. Answer any FIVE full questions, selecting atleast TWO questions from each part.*
*2. Use of statistical tables permitted.*





## PART – A

1 a. Using Taylor's series method, solve $y' = x + y^2$, $y(0) = 1$ at $x = 0.1, 0.2$, considering upto $4^{th}$ degree term. **(06 Marks)**

b. Using modified Euler's method, find an approximate value of y when x = 0.2 given that $\frac{dy}{dx} = x + y$ and y = 1 when x = 0. Take h = 0.1. Perform two iterations in each stage. **(07 Marks)**

c. Using Adams-Bashforth method, obtain the solution of $\frac{dy}{dx} = x - y^2$ at x = 0.8 given that y(0) = 0, y(0.2) = 0.0200, y(0.4) = 0.0795, y(0.6) = 0.1762. Apply the corrector formula twice. **(07 Marks)**

2 a. Employing the Picard's method, obtain the second order approximate solution of the following problem at x = 0.2. $\frac{dy}{dx} = x + yz$, $\frac{dz}{dx} = y + zx$, $y(0) = 1$, $z(0) = -1$. **(06 Marks)**

b. Solve $\frac{dy}{dx} = 1 + xz$ and $\frac{dz}{dx} = -xy$ for x = 0.3 by applying Runge Kutta method given y(0) = 0 and z(0) = 1. Take h = 0.3. **(07 Marks)**

c. Using the Milne's method, obtain an approximate solution at the point x = 0.4 of the problem $\frac{d^2y}{dx^2} + 3x\frac{dy}{dx} - 6y = 0$ given that y(0) = 1, y(0.1) = 1.03995, y(0.2) = 1.138036, y(0.3) = 1.29865, y'(0) = 0.1, y'(0.1) = 0.6955, y'(0.2) = 1.258, y'(0.3) = 1.873. **(07 Marks)**

3 a. Define an analytic function and obtain Cauchy-Riemann equations in polar form. **(06 Marks)**

b. Show that $u = e^{2x}$ (x cos2y – y sin2y) is a harmonic function and determine the corresponding analytic function. **(07 Marks)**

c. If f(z) is a regular function of z, prove that $\left(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}\right)|f(z)|^2 = 4|f'(z)|^2$. **(07 Marks)**

4 a. Evaluate using Cauchy's integral formula $\int_c \frac{\cos \pi z}{z^2 - 1} dz$ around a rectangle with vertices $2 \pm i$, $-2 \pm i$. **(06 Marks)**

b. Find the bilinear transformation which maps 1, i, -1 to 2, i, -2 respectively. Also find the fixed points of the transformation. **(07 Marks)**

c. Discuss the conformal transformation of $w = z^2$. **(07 Marks)**

## PART – B

5 a. Reduce the differential equation:

$x^2\frac{d^2y}{dx^2}+x\frac{dy}{dx}+(k^2x^2-n^2)y=0$ into Bessel form and write the complete solution in terms of $\tau_n(x)$ and $\tau_{-n}(x)$. **(06 Marks)**

b. Express $f(x)=x^3+2x^2-x-3$ in terms of Legendre polynomials. **(07 Marks)**

c. If $\alpha$ and $\beta$ are the roots of $\tau_n(x)=0$ then prove that

$$\int_0^1 x\tau_n(\alpha x)\,\tau_n(\beta x)\,dx=\begin{cases}0, & \alpha\neq\beta\\ \frac{1}{2}[\tau_{n+1}(\alpha)]^2, & \alpha=\beta\end{cases}$$ **(07 Marks)**

6 a. The probability that sushil will solve a problem is 1/4 and the probability that Ram will solve it is 2/3. If sushil and Ram work independently, what is the probability that the problem will be solved by (i) both of them; (ii) at least one of them? **(06 Marks)**

b. A committee consists of 9 students two of which are from first year, three from second year and four from third year. Three students are to be removed at random. What is the chance that (i) the three students belong to different classes; (ii) two belong to the same class and third to the different class; (iii) the three belong to the same class? **(07 Marks)**

c. The contents of three urns are: 1 white, 2 red, 3 green balls, 2 white, 1 red, 1 green balls and 4 white, 5 red, 3 green balls. Two balls are drawn from an urn chosen at random. These are found to be one white and one green. Find the probability that the balls so drawn came from the third urn. **(07 Marks)**

7 a. The probability mass function of a variate X is

| x | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| p(x) | k | 3k | 5k | 7k | 9k | 11k | 13k |

i) Find k

ii) Find $p(x<4)$, $p(x\geq 5)$, $p(3<x\leq 6)$, $p(x>1)$

iii) Find the mean. **(06 Marks)**

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

c. The mean height of 500 students is 151cm and the standard deviation is 15cm. Assuming that the heights are normally distributed, find how many students heights i) lie between 120 and 155cm; ii) more than 155cm. [Given A(2.07) = 0.4808 and A (0.27) = 0.1064, where A(z) is the area under the standard normal curve from 0 to $z>0$]. **(07 Marks)**

8 a. The means of simple samples of sizes 1000 and 2000 are 67.5 and 68.0cm respectively. Can the samples be regarded as drawn from the same population of S.D 2.5cm [Given $z_{0.05}=1.96$]. **(06 Marks)**

b. A random sample of 10 boys had the following I.Q: 70, 120, 110, 101, 88, 83, 95, 98, 107, 100. Do these data support the assumption of a population mean I.Q of 100? [Given $t_{0.05}$ for 9d.f = 2.26]. **(07 Marks)**

c. The following table gives the number of aircraft accidents that occurred during the various days of the week. Find whether the accidents are uniformly distributed over the week.

| Days : | Sun | Mon | Tue | Wed | Thur | Fri | Sat | Total |
|---|---|---|---|---|---|---|---|---|
| No. of accidents : | 14 | 16 | 8 | 12 | 11 | 9 | 14 | 84 |

[Given $\psi^2_{0.05}$ 6d.f = 12.59] **(07 Marks)**

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10ES42

# Fourth Semester B.E. Degree Examination, June/July 2016
## Microcontrollers

Time: 3 hrs. Max. Marks:100

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

### PART – A

1 a. Distinguish between :
i) Microprocessor and Microcontrollers ii) RISC and CISC Architecture. **(08 Marks)**

b. Briefly discuss the features of 8051 Microcontroller. **(06 Marks)**

c. With the help of a diagram, explain how to interface 8KB EPROM and 8KB RAM, to 8051 Microcontroller. **(06 Marks)**

2 a. Explain the different addressing modes of 8051. Give an example for each one of them. **(08 Marks)**

b. Explain the following instructions :
i) MUL AB ii) DAA iii) MOVC A, @A+DPTR iv) LJMP label **(06 Marks)**

c. What is a stack? Explain with examples, the PUSH and POP instructions. **(06 Marks)**

3 a. What are assembler directives? Explain the functions of the assembler directives DB, EQU, END, ORG. **(06 Marks)**

b. Write an ALP in 8051 to find the largest number among the $14_D$, 8 bit number stored in internal RAM. **(07 Marks)**

c. Write an ALP to toggle all bits of P1 every 200ms. Assume that the crystal frequency is 11.0592MHz of 8051. **(07 Marks)**

4 a. Discuss the features of 4 I/O ports of 8051. **(06 Marks)**

b. Interface 4 × 4 keyboard to 8051 and explain how scanning and identifying the key pressed is done. **(07 Marks)**

c. Draw the block diagram to show how 8051 is connected to DAC 0808 at port $P_1$, using O/P buffer for DAC. Write an 8051 program to generate ramp, signal. **(07 Marks)**

### PART – B

5 a. What is the difference between timer and counter? Explain the function of each bit in TMOD. **(04 Marks)**

b. A switch is connected to pin P1.2. write an 8051 C program to monitor SW and create the following frequencies on pin P1.7 SW = 0 : 500 Hz, SW = 1 ; 750 Hz
Use timer 0, mode 1 for both of them. **(08 Marks)**

c. What are external interrupts? Draw the diagrams for activation of external interrupts. How level triggered interrupts are reset? How to set the two external interrupts as edge triggered interrupts? **(08 Marks)**

6 a. Write the steps required for programming 8051 to transfer data serially. **(06 Marks)**

b. Write an 8051 C program to send to two messages "Normal speed" and "High speed" to the serial port. Assuming that SW (switch) is connected to pin P2.0, monitor its status and set the baud rate as follows : SW = 0 ; 28,800 baud rate, SW = 1 ; 56 K baud rate
Assume that XTAL = 11.0592 MHz for both cases. **(08 Marks)**

c. Explain the 4 modes of operation 8255 along with control word format. **(06 Marks)**

7 a. What are the features that make MSP430 suitable for Low-power and portable applications? **(04 Marks)**

b. Explain Registers and peripherals included on chip of MSP430 CPU. **(06 Marks)**

c. Explain the architecture of MSP 430 with a neat diagram. **(10 Marks)**

8 a. Write an assembly program to generate a waveform with ON time of 7 msec and OFF time of 21 msec on P0.5. Assume XTAL of 11.0592MHz. Use timer 0. **(10 Marks)**

b. Explain the bits of SCON register. **(05 Marks)**

c. Draw the Pin diagram of 8255 and briefly explain the signals. **(05 Marks)**

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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.

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10ES43

# Fourth Semester B.E. Degree Examination, June/July 2016
## 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. What are the properties of good control system? **(04 Marks)**

b. Construct mathematical model for the mechanical system shown in Fig. Q1(b). Then draw electrical equivalent circuit based on F–V analogy. **(08 Marks)**

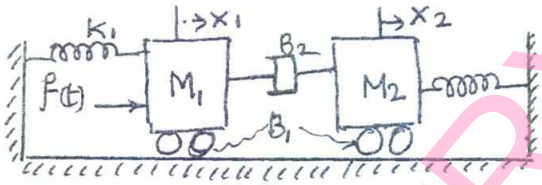


Fig. Q1(b)

c. For electrical system shown in Fig. Q1(C), obtain transfer function $V_2(s)/V_1(s)$. **(08 Marks)**

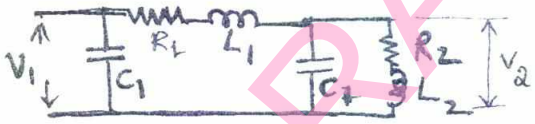


Fig. Q1(c)

2 a. List the features of transfer function. **(04 Marks)**

b. Obtain the transfer function for the block diagram shown in Fig. Q2(b), using block diagram reduction method. **(08 Marks)**

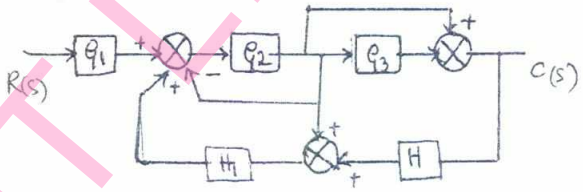


Fig. Q2(b)

c. For the electrical circuit shown in Fig. Q2(c), obtain over all transfer function using Mason's gain formula. **(08 Marks)**

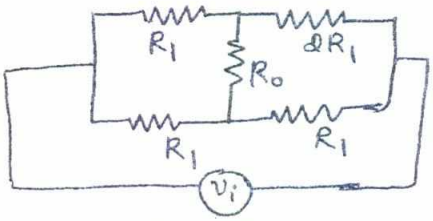


Fig. Q2(c)

3 a. What are static error coefficients? Derive expression for the same. **(06 Marks)**

b. An unity feedback system has $G(s) = \frac{20(1+s)}{s^2(2+s)(4+s)}$, calculate its steady state error co-efficients when the applied input $r(t) = 40 + 2t + 5t^2$. **(06 Marks)**

c. A R–L–C series circuit is an example of second order function. If R = 1 Ω, α = 1H and C = 1F, find response for a step voltage of 10 V connected as input and output across R. **(08 Marks)**

4 a. List the advantages and disadvantages of Routh's criterion (R–H–criterion). **(04 Marks)**

b. A unity feedback control system has $G(s) = \frac{k(s+13)}{s(s+3)(s+7)}$. Using Routh's criterion calculates the range of k for which the system is i) stable ii) has closed loop poles more negative than–1. **(10 Marks)**

c. Find the range of k for which the system, whose characteristic equation is given below is stable. $F(s) = s^3 + (k + 0.5)\, s^2 + 4ks + 50$. **(06 Marks)**

## PART – B

5 a. Sketch the root locus for unity feedback having $G(s) = \frac{k(s+1)}{s(s+2)(s^2+2s+2)}$. Determine the range of k for the system stability. **(16 Marks)**

b. Explain how to determine angle of arrival from poles and zeros to complex zeros **(04 Marks)**

6 a. What are the limitations of frequency response methods? **(04 Marks)**

b. A control system having $G(s) = \frac{k(1+0.5s)}{s(1+2s)\left(1+\frac{s}{20}+\frac{s^2}{8}\right)}$ draw bode plot, with k = 4 and find gain margin and phase margin. **(16 Marks)**

7 a. What is polar plot? Explain procedure to sketch polar plot for type 0 and type 1 systems. **(08 Marks)**

b. Sketch the Nyquist plot of a unit feedback control system having the open loop transfer function $G(s) = \frac{5}{s(1-s)}$. Determine the stability of the system using Nyquist stability criterion. **(12 Marks)**

8 a. Find the transfer function for a system having state model as given below :

$$\dot{x} = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} x + \begin{bmatrix} 1 \\ 0 \end{bmatrix} u \quad y = [1 \quad 0]x .$$ **(08 Marks)**

b. Obtain the state model for the electrical system given in Fig. Q8(b) choosing the state variables as $i_1(t)$, $i_2(t)$ and $V_C(t)$. **(12 Marks)**

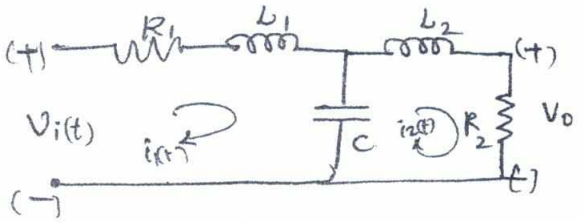


Fig. Q8(b)

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10EC44

# Fourth Semester B.E. Degree Examination, June/July 2016
## 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. Sketch the even and odd part of the signals shown in Fig. Q1(a). **(06 Marks)**

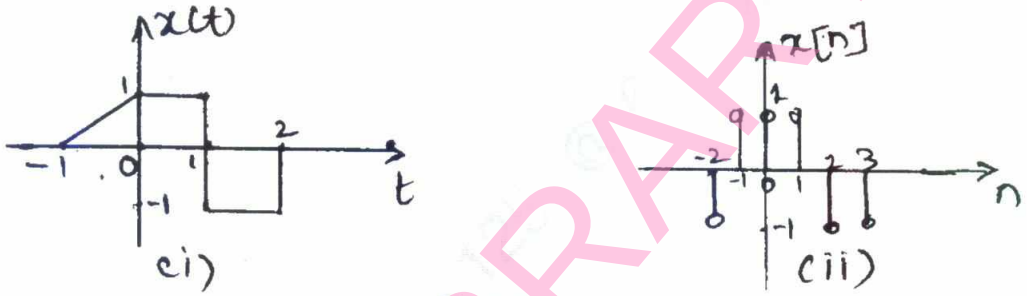


Fig.Q1(a)

b. For the signal x(t) and y(t) shown in Fig.Q1(b) sketch the signals :
i) $x(t+1) - y(t)$
ii) $x(t) \cdot y(t-1)$. **(06 Marks)**

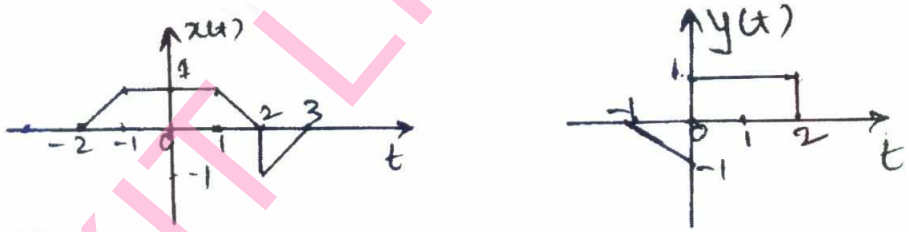


Fig.Q1(b)

c. Determine whether the system described by the following input/output relationship is i) memory less ii) causal iii) time invariant iv) linear.
i) $y(t) = x(2-t)$
ii) $y[n] = \sum_{k=0}^{\infty} 2^k x[n-k]$. **(08 Marks)**

2 a. Compute the following convolutions :
i) $y(t) = e^{-2t}\, u(t-2) * \{u(t-2) - u(t-12)\}$
ii) $y[n] = \alpha^n\{u[n] - u[n-6]\} * 2\{u[n] - u[n-15]\}$. **(14 Marks)**

b. Prove the following :
i) $x(t) * \delta(t-t_0) = x(t-t_0)$
ii) $x[n] * u[n] = \sum_{k=-\infty}^{n} x[k]$. **(06 Marks)**

3 a. Identify whether the systems described by the following impulse responses are memory-less, causal and stable.

i) $h(t) = 3\delta(t-2) + 5\delta(t-5)$

ii) $h[n] = 2^n u[-n]$

iii) $h[n] = (\frac{1}{2})^n \delta[n]$. **(09 Marks)**

b. Find the natural response and the forced response of the system described by the following differential equation : $\frac{d^2y(t)}{dt^2} - 4y(t) = \frac{d}{dt}x(t)$, if $y(0) = 1$ and $\frac{d}{dt}y(t)\big|_{t=0} = -1$. **(08 Marks)**

c. Write the difference equation for the system depicted in Fig. Q3(c). **(03 Marks)**

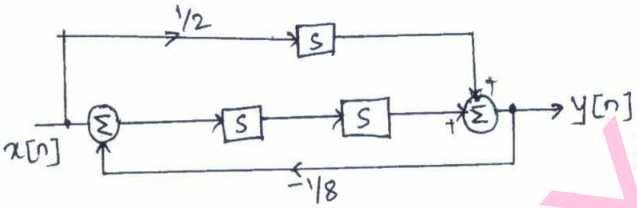


Fig. Q3(c)

4 a. State and prove the Parseval's relation for the Fourier series representation of discrete time periodic signals. **(06 Marks)**

b. i) Find the DTFS of the signal $x(t) = \sin[5\pi n] + \cos[7\pi n]$

ii) Find the FS of the signal shown in Fig. Q4(b)(ii). **(08 Marks)**


Fig. Q4(b)(ii)

c. If the FS representation of periodic signal x(t) is $x(t) \xleftrightarrow{FS;\omega_0} \frac{2\sin[K\omega_0 T_0]}{T K \omega_0}$ where $\omega_0 = \frac{2\pi}{T}$ then find the FS of y(t) without computing x(t) :

i) $y(t) = x(t+2)$

ii) $y(t) = \frac{d}{dt}x(t)$. **(06 Marks)**

## PART – B

5 a. i) Compute the DTFT of $x[n] = (\frac{1}{3})^n u[n+2] + (\frac{1}{2})^n u[n-2]$

ii) Find FT of the signal shown in Fig. Q5(a)(ii). **(10 Marks)**

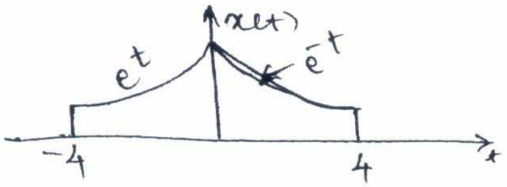


Fig. Q5(a)(ii)

b. Find inverse FT of the following $x(j\omega)$ :

i) $x(j\omega) = \frac{j\omega}{(j\omega)^2 + 6j\omega + 8}$

ii) $x(j\omega) = j.\frac{d}{d\omega}\frac{e^{3j\omega}}{2 + j\omega}$. **(10 Marks)**

6 a. Determine output of the LTI system whose I/P and the impulse response is given as :
i) $x(t) = e^{-2t}u(t)$ and $h(t) - e^{-3t}u(t)$
ii) $x[n] = (\frac{1}{3})^n u[n]$ and $h[n] = \delta[n-4]$. **(08 Marks)**

b. Find the Fourier transform of the signal $x(t) = \cos \omega_0 t$ where $\omega_0 = \frac{2\pi}{T}$ and T the period of the signal. **(04 Marks)**

c. State the sampling theorem and briefly explain how to practically reconstruct the signal. **(08 Marks)**

7 a. State and prove differentiation in z – domain property of z – transforms. **(06 Marks)**

b. Use property of z – transforms to compute x(z) of :
i) $x[n] = n \sin(\pi n/2)\, u[-n]$
ii) $x[n] = (n-2)(\frac{1}{2})^n u[n-2]$. **(06 Marks)**

c. Find the inverse z – transforms of

i) $x(z) = \dfrac{z^2 - 2z}{\left(z^2 + \frac{3}{2}z - 1\right)}$ $\frac{1}{2} < |z| < 2$

ii) $x(z) = \dfrac{z^3}{\left(z - \frac{1}{2}\right)}$ $|z| > \frac{1}{2}$. **(08 Marks)**

8 a. Determine the impulse response of the following transfer function if :
i) The system is causal
ii) The system is stable
iii) The system is stable and causal at the same time : $H(z) = \dfrac{3z^2 - z}{(z-2)\left(z + \frac{1}{2}\right)}$. **(08 Marks)**

b. Use unilateral z – transform to determine the forced response and the natural response of the system described by: $y[n] - \frac{1}{4}y[n-1] - \frac{1}{8}y[n-2] = x[n] + x[n-1]$ where $y[-1] = 1$ and $y[-2] = 1$ with I/P $x[n] = 3^n u[n]$. **(12 Marks)**

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10EC45

# Fourth Semester B.E. Degree Examination, June/July 2016
## 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. Describe VHDL scalar data types with an example. **(08 Marks)**

b. Explain composite and access data types with an example for each. **(08 Marks)**

c. If A, B and C are three unsigned variables with A = 11110000, B = 01011101 and C = 0000 0000 find the value of i) A NAND B ii) A&&C iii) A ror2 iv) B<<1. **(04 Marks)**

2 a. Write a VHDL code in data flow description for a 2 bit magnitude comparator with help of truth table and simplified Boolean expressions. **(12 Marks)**

b. Write a HDL codes for 2 × 2 bit combinational array multiplier (Both VHDL and verilog). **(08 Marks)**

3 a. Write behavioral description of a half-adder in VHDL and verilog with propagation delay of 10ns. Discuss the important features of their description in VHDL and verilog. **(08 Marks)**

b. Mention the names of sequential statements associated with behavioral description. **(02 Marks)**

c. Write VHDL code for a D latch using variable assignment statement and signal assignment statements. With simulation waveforms clearly distinguish between the two statements. **(10 Marks)**

4 a. Explain with suitable examples, how binding is achieved in VHDL between.
i) Entity and architecture
ii) Entity and component
iii) Library and module. **(06 Marks)**

b. Write a structural description using VHDL to implement a 2:1 multiplexer with active low enable. **(10 Marks)**

c. Explain the use of generate statement. Write down format for it both in VHDL and verilog. **(04 Marks)**

### PART – B

5 a. Explain the following syntax with examples: i) Procedure; ii) Task; iii) Function. **(06 Marks)**

b. Write verilog description to convert signed binary to the integer using task. **(08 Marks)**

c. Write a VHDL function to find the greater of two signed numbers. **(06 Marks)**

6 a. Describe procedure for invoking a VHDL entity from a verilog module and a verilog module from a VHDL module. **(08 Marks)**

b. Develop mixed-language description of a 9 bit adder. **(08 Marks)**

c. Write note on VHDL packages. **(04 Marks)**

7 a. What is the necessity of mixed type description? **(04 Marks)**

b. Describe the development of HDL code for an ALU and write VHDL/verilog code for ALU shown below.

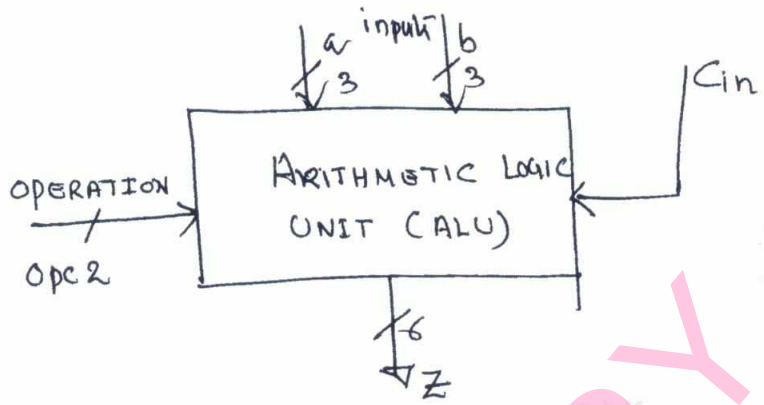


Fig.Q.7(b)

Assume the following operations: Addition, multiplication, division, no operation. **(16 Marks)**

8 a. What is synthesis? List the general steps involved in synthesis. **(08 Marks)**

b. Write VHDL code for signal assignment statement Y = 2* x + 3. Show the synthesized logic symbol and gate level diagram. Write structural code in verilog using gate level diagram. **(12 Marks)**

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10EC46

# Fourth Semester B.E. Degree Examination, June/July 2016
## Linear IC's and Applications

Time: 3 hrs. Max. Marks:100

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



### PART – A

1 a. What is CMRR in an operational amplifier? A 741 op-amp is used in a non inverting amplifier with a voltage gain of 50. Calculate the typical output voltage that would result from a common mode input with a peak level of 100 mV. **(06 Marks)**

b. Design a non-inverting direct coupled amplifier using a bipolar op-amp. Write the circuit diagram. **(07 Marks)**

c. Design an inverting amplifier using a 741 op-amp. The voltage gain is to be 50 and the output voltage amplitude is to be 2.5 V. **(07 Marks)**

2 a. Explain about the High input impedance capacitor coupled voltage follower circuit, with relevant equations. **(07 Marks)**

b. The inverting designed (say $A_V = 50$ and $V_0 = 2.5V$) is to be capacitor coupled and to have a signal frequency range of 10 Hz to 1 kHz. If the load resistance is 250 Ω. Calculate the required capacitor values. **(06 Marks)**

c. Explain about capacitor coupled voltage follower using a single polarity supply, with circuit diagram. **(07 Marks)**

3 a. i) Calculate the slew rate limited cut off frequency for a voltage follower circuit using a 741 op-amp if the peak of sinewave output is to be 5V.
ii) Determine the maximum peak value of the sinusoidal output voltage that will allow the 741 voltage follower circuit to operate at the 800 kHz unity-gain cut off frequency.
iii) Calculate the maximum peak value of sine wave output voltage that can be produced by the amplifier in part (i) equation and the op-amp is a 741 and $f_2$ is 8 kHz. **(09 Marks)**

b. Explain briefly about input impedance modification ($Z_{in}$ Mod) technique of frequency compensation with circuit diagram. **(06 Marks)**

c. Explain the 'circuit stability precautions' for the operational amplifier using the manufacturer's recommended compensating components. **(05 Marks)**

4 a. Explain the 'current amplifier' circuit using operational amplifier. **(06 Marks)**

b. Explain the instrumentation amplifier with differential input/output which accepts a differential input voltage and amplifies it to produce a differential output using op amps. **(08 Marks)**

c. Design a non saturating precision half wave rectifier, which produce a 2 V peak output from a sinewave input with a peak value of 0.5 V and frequency of 1 MHz. Use a bipolar op-amp with a supply voltage of ±15V. **(06 Marks)**

### PART – B

5 a. Explain the multiplier circuit with schematic symbol. **(06 Marks)**

b. Explain the operation of the phase-shift oscillator circuit with relevant waveforms. **(08 Marks)**

c. Using a BIFET op-amp with a supply of ±12V, design a wein bridge oscillator to have an O/P frequency of 15 kHz. **(06 Marks)**

6 a. Explain the operation of the Astable multivibrator circuit using operational amplifier with relevant waveforms. **(08 Marks)**

b. Explain the operation of the first order active low pass filter circuit with frequency response characteristics using operational amplifier. **(06 Marks)**

c. Design a first order high pass active filter circuit to have a cut off frequency of 5 kHz. Use an LM108 op amp and estimate the highest frequency can be passed. **(06 Marks)**

7 a. Explain the following terms such as (i) Line regulation (ii) Load regulation (iii) Ripple rejection briefly. **(06 Marks)**

b. Explain the operation of the 723 integrated circuit voltage regulator contains a reference voltage sources ($D_1$) an error amplifier ($A_1$), a series pass transistor ($Q_1$) and a current limiting transistor ($Q_3$). **(07 Marks)**

c. Calculate the resistances of $R_1$ and $R_2$ for the LM217 voltage regulator to produce an output voltage of 9 V. (Assume $C_1 = 0.1$ μF and $C_2 = 1$ μF) **(07 Marks)**

8 a. Explain the 555 Timer circuit used as astable multivibrator, with relevant waveforms. **(08 Marks)**

b. Explain the operating principles of phase locked loop with relevant diagram. **(07 Marks)**

c. Write a short notes on voltage controlled oscillator. **(05 Marks)**

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MATDIP401

# Fourth Semester B.E. Degree Examination, June/July 2016
## Advanced Mathematics – II

Time: 3 hrs. Max. Marks:100

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



1 a. Find the angle between any two diagonals of a cube. **(07 Marks)**

b. Prove that the general equation of first degree in x, y, z represents a plane. **(07 Marks)**

c. Find the angle between the lines,

$$\frac{x-1}{1}=\frac{y-5}{0}=\frac{z+1}{5} \text{ and } \frac{x+3}{3}=\frac{y}{5}=\frac{z-5}{2}.$$ **(06 Marks)**

2 a. Prove that the lines,

$$\frac{x-5}{3}=\frac{y-1}{1}=\frac{z-5}{-2} \text{ and } \frac{x+3}{1}=\frac{y-5}{3}=\frac{z}{5}$$ are perpendicular. **(07 Marks)**

b. Find the shortest distance between the lines.

$$\frac{x-8}{3}=\frac{y+9}{-16}=\frac{z-10}{7} \text{ and } \frac{x-15}{3}=\frac{y-29}{8}=\frac{z-5}{-5}.$$ **(07 Marks)**

c. Find the equation of the plane containing the point (2, 1, 1) and the line,

$$\frac{x+1}{2}=\frac{y-2}{3}=\frac{z+1}{-1}$$ **(06 Marks)**

3 a. Find the constant 'a' so that the vectors $2\hat{i}-\hat{j}+\hat{k}$, $\hat{i}+2\hat{j}-3\hat{k}$ and $3\hat{i}+a\hat{j}+5\hat{k}$ are co-planar. **(07 Marks)**

b. If $\vec{a}=2\hat{i}+3\hat{j}-4\hat{k}$ and $\vec{b}=8\hat{i}-4\hat{j}+\hat{k}$ then prove that $\vec{a}$ is perpendicular to $\vec{b}$ and also find $\left|\vec{a}\times\vec{b}\right|$. **(07 Marks)**

c. Find the volume of the parallelopiped whose co-terminal edges are represented by the vectors,

$\vec{a}=\hat{i}+\hat{j}+\hat{k}$, $\vec{b}=2\hat{i}+3\hat{j}-\hat{k}$ and $\vec{c}=\hat{i}-\hat{j}-\hat{k}$ **(06 Marks)**

4 a. Find the velocity and acceleration of a particle moves along the curve $\vec{r}=e^{-2t}\hat{i}+2\cos 5t\hat{j}+5\sin 2t\hat{k}$ at any time 't'. **(07 Marks)**

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

c. Find the divergence of the vector $\vec{F}=(xyz+y^2z)\hat{i}+(3x^2+y^2z)\hat{j}+(xz^2-y^2z)\hat{k}$. **(06 Marks)**

5 a. $\vec{F}=(x+y+1)\hat{i}+\hat{j}-(x+y)\hat{k}$, show that $\vec{F}\cdot\text{curl}\,\vec{F}=0$. **(07 Marks)**

b. Show that the vector field, $\vec{F}=(3x+3y+4z)\hat{i}+(x-2y+3z)\hat{j}+(3x+2y-z)\hat{k}$ is solenoidal. **(07 Marks)**

c. Find the constants a, b, c such that the vector field,

$\vec{F}=(x+y+az)\hat{i}+(x+cy+2z)\hat{j}+(bx+2y-z)\hat{k}$ is irrotational. **(06 Marks)**

6 a. Prove that $L(\sin at) = \frac{a}{s^2 + a^2}$. **(07 Marks)**

b. Find $L[\sin t \quad \sin 2t \quad \sin 3t]$. **(07 Marks)**

c. Find $L[\cos^3 t]$. **(06 Marks)**

7 a. Find the inverse Laplace transform of $\frac{1}{(s+1)(s+2)(s+3)}$. **(07 Marks)**

b. Find $L^{-1}\left[\log\left(1 + \frac{a^2}{s^2}\right)\right]$. **(07 Marks)**

c. Find $L^{-1}\left[\frac{s+2}{s^2 - 4s + 13}\right]$. **(06 Marks)**

8 a. Solve the differential equation, $y'' + 2y' + y = 6te^{-t}$ under the conditions $y(0) = 0 = y'(0)$ by Laplace transform techniques. **(10 Marks)**

b. Solve the differential equation, $y'' - 3y' + 2y = 0 \quad y(0) = 0, \quad y'(0) = 1$ by Laplace transform techniques. **(10 Marks)**

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