Ref. No. EX/ETECH/EE/CSE/T/216A/2016

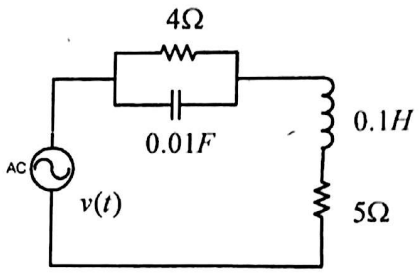
B. CSE 2ND YEAR 1ST SEM. EXAM.-2016

SUBJECT: ELECTRICAL TECHNOLOGY

Full Marks : 100

Time : **Three hours**

Use a separate Answer-Script for each part

No. of questions		Part - I Answer any *three* questions	Marks
1.	a)	Explain the meaning of power factor of an AC circuit.	4
	b)	Explain the phenomena of electrical resonance in AC parallel R-L-C circuits. Evaluate the p.f. at resonant condition, showing related phasor diagram. Why is this called a rejector circuit?	6
	c)	In the circuit shown, current drawn from the source is $i(t) = 3\sqrt{2}\sin(2\pi \times 50 \times t)$. Find (i) $v(t)$ (ii) power drawn from the source. (iii) power factor of the circuit looking from the source (iv) if the inductor is variable what should be its value to achieve series resonance in this circuit? 	10
2.	a)	What is phase sequence of a three phase voltage source?	3
	b)	Show that two wattmeter method of power measurement is applicable for both balanced and unbalanced three phase circuits. Discuss with proper circuit diagram.	7
	(c)	Three identical coils, each having resistance of 5Ω and reactance of 30Ω are connected in delta. This three phase balanced load is connected to a three phase 400V supply. Find the line current. If two wattmeters are used to measure the power drawn by the load find readings of the two wattmeters. Show the circuit diagram.	10
3.	(a)	What is eddy current loss? How can this loss be minimized in an electrical machine?	6
	(b)	Predict on the variation of core loss in an electrical machine with variation of the frequency of operation.	6
	(c)	An iron ring with mean circumferential length of 50cm, cross sectional area 1cm^2, has an air gap of 1mm. A winding of 400 turns is put uniformly over it. Find the inductance value across the two terminals of the winding. Consider relative permeability of iron to be 500. Also, find the flux density in the air gap if current passing through the winding is 2A.	8
4.	(a)	A 50kVA, 2.2kV/220V, 50Hz single phase transformer has following resistance and leakage reactances: HV side R_1=2Ω, X_1=10Ω, on LV side R_2=0.02Ω, X_2=0.1Ω. The transformer is operated at 80% load with load power factor of 0.9 with HV side connected to rated voltage. Find (i) efficiency of the transformer (ii) input current (iii) LV side output voltage. Neglect core loss and magnetizing component of current.	8
	(b)	Compare shell type and core type transformers.	4
	(c)	Derive the primary referred equivalent circuit of a non-ideal single phase transformer. Mention the assumptions made.	8
5.	(a)	Derive and plot the torque speed curve of three phase induction machine. Show the stable range of motoring operation.	6
	(b)	Why the no load current of an induction motor is higher compared to a transformer of equivalent rating?	3
	(c)	Why resistances are added to the rotor of a slip-ring induction motor at starting and removed in steady state of operation?	5
	(d)	How would you determine the equivalent circuit parameters of an induction machine?	6

Part-II

Answer any *two* questions

1. (a) Derive emf and torque equations for d.c. machines. 4
   (b) Discuss how both emf and torque equations are applicable simultaneously for both d.c. motor and d.c. generator. 4
   (c) Describe and compare speed control methods for d.c. shunt motor (i) below base speed, and, (ii) above base speed. 6
   (d) A 200 volt d.c. shunt motor takes 22 Amp at rated voltage and runs at 1000 rpm. Its field resistance is 100 ohm and armature circuit resistance is 0.1ohm. Compute the value of additional resistance required in the armature circuit to reduce the speed to 800 rpm. Assume the load torque to be proportional to the speed. 6

2. (a) Show how d.c. generators can be classified with respective connection diagrams and external characteristics. 8
   (b) Explain how voltage builds up in a d.c. shunt generator. What are the conditions that are to be satisfied to ensure that voltage build-up takes place? 4+4
   (c) A d.c. shunt generator delivers 12 kW at 240 volt while running at 1500 rpm. Calculate the speed of the machine when run as a shunt motor taking 12 kW at 240 volt. The armature resistance is 0.1 ohm and field resistance is 80 ohm. 4

3. (a) Derive from the fundamentals an expression for induced emf in an alternator clearly showing the effects of pitch and distribution factors. 6
   (b) Develop the equivalent circuit for a non-salient pole alternator showing how the synchronous reactance consists of two components of reactance. 4
   (c) Deduce the expressions for real and reactive power for a 3-phase alternator. Draw the power angle characteristics and comment on steady-state stability limit of an alternator. 4
   (d) A 3-phase star connected salient pole alternator has 144 slots with 10 conductors per slot. The alternator is run at 375 rpm. The terminal (line) voltage of the generator is found to be 2.657 kV with a frequency of 50 Hz. Determine the number of poles and the flux per pole. 6

B.C.S.E. 2nd year 1st Semester Examination 2016

NUMERICAL METHODS

Time : 3 hours. Full Marks : 100

Answer question no.1 and any 4 from the rest.
All parts of same question should be answered together.

1. a) Define round-off and truncation errors. 2
   b) Draw a comparison between regula falsi method and secant method. 3
   c) Derive Aitken's acceleration formula 3
   d) Modify Newton- Raphson iteration formula for solution of a nonlinear equation with multiple roots at a point. 2
   e) Define Δ and E. Prove that $(E^{1/2} + E^{-1/2})(1+\Delta)^{1/2} = 2 + \Delta$. 3
   f) Define the terms eigenvalue and eigenvector. 2
   g) Given 4 points: (x_0, y_0), (x_1, y_1), (x_2, y_2), (x_3, y_3) such that $x_i = x_0 + ih$. Fit a polynomial of degree 3 through these points using Newton's forward difference interpolation method. Find the area under this curve over the interval $[x_0, x_3]$. 5

2. a) Given the following table of values:

p	0.5	1.0	1.5	2.0	2.5	3.0
v	1.62	1.00	0.75	0.62	0.52	0.46

Obtain a least squares fit of the following form to the tabular values.

$$pv^{\lambda} = k$$ 10

   b) Derive Lagrange interpolation formula. 6
   c) Fit a polynomial to the following table of values using Lagrange interpolation formula.

x	0	1	3	4
y	-12	0	6	12

Find the value of y when x = 2. 4

3. a) Discuss Jacobi's iterative method for finding the roots of linear simultaneous equations. 6
   b) Write down the method in matrix notation. 4
   c) Hence find the convergence of the method. 4

[Turn over]

d) Solve the following system of equations by Gauss- Seidel iterative method. 6
Solution is required corrected upto 4 decimal places.

$$x + 3y + 10z = 24$$
$$28x + 4y - z = 32$$
$$2x + 17y + 4z = 35$$

4. a) Discuss Modified Euler's formula for solution of differential equations. 6
b) Derive the expression for truncation error of the above method. 4
c) Solve the following differential equation by **Euler's** method.

$$\frac{dy}{dx} = x^2 + y \qquad \text{with } y(0) = 1.0$$

Compute the first **5** steps of the solution with step size $h = 0.1$
Compare the results with those obtained from the exact solution 10

$$y = 3e^x - x^2 - 2x - 2$$

5. a) Prove that Power method finds the largest eigenvalue of a square matrix. 8
b) Discuss predictor-corrector method for solution of ordinary differential equations. Derive the predictor, modifier and corrector formulae for Adams-Bashforth method. 12

6. a) Given the following tabular values:

x	50	60	70	80	90
y	19.96	36.65	58.81	77.21	94.61

Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at $x = 51$.
Derive the requisite formulae. 12
c) Find the inverse of the following matrix using Gauss-Jordan method. 8

$$A = \begin{bmatrix} 2 & 1 & 1 \\ 3 & 2 & 3 \\ 1 & 4 & 9 \end{bmatrix}$$

7. a) Discuss Romberg's method for evaluating the integral of the following form.

$$\int_b^a f(x)\,dx$$ 12

b) Evaluate the following integral by Gaussian quadrature formula. Take n = 2.

$$\int_0^1 \frac{1}{\sqrt{x^2+1}}\,dx$$ 8

8. a) Describe Bairstow's method for finding the complex roots of a polynomial equation. 12

b) Solve the following equation by iterative method using repeated substitution corrected upto 4 decimal places. Take $x_0 = 0$. 8

$$3x - 1 - \cos(x) = 0$$

Take an appropriate form for iteration.

EX/CSE/T/215A/2016

B.CSE 2nd YEAR 1st Semester EXAMINATION 2016

Computer Organization

Full Marks : 100

Time : Three Hours

Answer any *five* questions

All parts of a question are to be strictly answered together

1a) What are the advantages of using normalized mantissa and biased exponents in floating point representation of binary numbers? What are the IEEE standards for representing floating point numbers ? Represent +13.0165 in both single precision and double precision IEEE formats.

b) Consider a 16-bit floating number with 6-bit exponent (excess 31 format) 9-bit normalized mantissa. The base is of scale factor 2. Find A+B , A-B and represent the results in the above format, use truncation method of rounding. A = 0 100001 111101111 B = 0 011111 011011011
(Consider an implicit 1 to the left of normalized mantissa as in IEEE format.) (10 + 10)

2a) A non pipelined processor X has clock rate of 250 MHz and CPI (Cycles per instruction) of 4. Another processor Y , the successor of X is designed with 4 stage linear instruction pipeline. It is found that a program containing 10000 instructions took same time for both the processors to execute. What is the clock rate for processor Y ?

b) A virtual memory system has block size 4K bytes. There are 8 secondary blocks and 4 primary blocks. The associative memory page table contains the following entries :

Secondary Block	Primary Block
2	3
5	2
0	0
4	1

Make list of virtual address spaces (in decimal) that cause page fault if addressed by CPU. (10 + 10)

3) A typical computer system has 32K main memory and 2K fully associative cache memory. The cache block size is 128 bytes. (i) How many bits are there in the TAG field ? (ii) Find the successful hit ratio for the following program structure where FIFO replacement policy is used. The program starts from address 25 and continues to address 2500 with a nested loop between addresses 265 and 2200.

Start → 25 → 265 → 800 → 2200 → 2500 → End (20)

4a) Suggest a situation where it would be advantageous to define a virtual memory that may be smaller than available physical memory. Similarly suggest a situation where use of cache memory will be found detrimental.

b) Design a minimal combinational circuit for multiplying two 4-bit signed binary numbers. Also calculate the gate delay for your circuit. (5+15)

5a) Describe Booth's modified algorithm and show that just N/2 partial products are required to multiply two N bit binary numbers. Illustrate the algorithm with the example of multiplication of +29 and -31.

b) Describe restoring binary division algorithm and the corresponding sequential circuit for implementing it. Next verify your circuit with the example of 18 divided by 5. (10+10)

6a) Draw the CSA organization to add 10 signed nos. of 8-bit each having CLA at last stage. Count the minimum no of full adders, basic adders and CLCs (4 function CLC) required for your design. Also calculate the gate delay in your addition process.

b) Design a combinational circuit for BCD subtraction. Indicate properly the borrow-in and borrow-out terminals for cascading. (10+10)

7. Study the microprogram given below. Draw the hardware configuration for implementing the microprogram. Next design the corresponding control unit using D-flip flops as well as Control Memory. What will be the size of the required Control Rom ?

Rom address			Control Signals					Mode bits		Next Address		
A2	A1	A0	C4	C3	C2	C1	C0	M1	M0	A2	A1	A0
0	0	0	1	0	0	0	0	1	1	x	x	x
0	0	1	0	1	0	0	1	0	0	x	x	x
0	1	0	0	0	1	1	0	0	1	1	0	0
0	1	1	0	1	0	0	0	1	1	0	0	0
1	0	0	0	0	0	1	1	1	0	1	1	0
1	0	1	0	0	0	0	1	1	1	0	0	0
1	1	0	0	0	1	0	0	0	0	x	x	x
1	1	1	0	1	0	1	0	1	1	0	0	0

M1	M0	
0	0	Increment
0	1	Load if S0 = 1
1	0	Load if S1 = 1
1	1	Load

(20)

8a) The conventional 4 block micro programmed control system has following propagation delay times. 40ns to generate the next address, 10ns to transfer the microinstruction into the control data register and 40ns to perform the required micro operations specified by the control word. What is the fastest clock frequency that the control can use ? What would the clock frequency be if the control data register is not used ?

b) A program takes 500ns for execution on a non-pipelined processor. Suppose we need to run 100 programs of same type on a five stage pipelined processor with a clock period of 20ns. What is the speed-up ratio of the pipeline ? What is the maximum achievable speed-up? (10 + 10)

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 00111111
 11111000
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 00101111
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 00000101
 10000010
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 10000111
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BACHELOR OF COMPUTER SCIENCE AND ENGINEERING EXAMINATION, 2016

(2nd Year, 1st Semester)

DIGITAL CIRCUITS

Time : Three Hours **Full Marks : 100**

Answer any *five* questions.

1. a) With the help of a circuit diagram explain the operations of a DTL gate. 8
   b) Estimate the reverse recovery current. 4
   c) How is the circuit modified for Integrated version? What are its advantages over the discrete version? 8

2. a) Explain the operation of a TTL gate. 12
   b) Estimate the no-load Power Supply Currents of the same. 4
   c) Why do you require open-collector gates? 4

3. a) Explain the operation of an n-MOS Inverter. 8
   b) How can the NAND and NOR gates be implemented using n-MOS FET? 4
   c) Estimate the rise time of an n-MOS gate. 8

4. a) With the help of a block diagram explain the operations of a 555 IC-Timer chip. 6
   b) How can you connect the same for generating a clock? 4
   c) Deduce the expressions for frequency and duly cycle for the same. 6
   d) How can a clock with 50% duly cycles be generated? 4

5. a) With the help of a circuit diagram explain the operations of a bipolar memory cell using two dimensional selection technique. 10
   b) How the same may be implemented by using MOS FET ? 10

6. a) Explain the operation of a R-2R Ladder Type DAC. 10
   b) How can the effect of R_L be eliminated? What will be the modified output? 2+4
   c) What are its relative merits and demerits? 4

7. a) Explain the operation of a 3-bit direct comparison type ADC. 8
   b) Design the encoder circuit. 4
   c) How can a 6-bit ADC be implemented using 3-bit ADC's? 8

8. Write notes on any four of the following : 4x5 =20

   a) HTL gates;
   b) Tristate gates;
   c) C-MOS gates;
   d) Frequency Multiplication;
   e) EPROM's;
   f) 1's complement DAC;
   g) Sample/Hold circuits;
   h) Analog Multiplexers.

Ref. No.: Ex/MATH/CSE/T/211/2016

B.CSE, 2ND YR. 1ST SEMS EXAM, 2016

Mathematics

(Paper-IV)

Full Marks:100 Time: Three Hours

Answer Question number 1. and any six from the rest.

1. Find a particular integral of the differential equation (4)

$$\frac{d^2y}{dx^2} - 9y = e^{3x}\cos x$$

2. (a) Find the series for $log(1+x)$ by integration and use Abel's Theorem to prove that (6)

$$1 - \frac{1}{2} + \frac{1}{3} - \frac{1}{4} + \ldots\ldots\ldots = log2$$

(b) Find a power series solution of the initial value problem (10)

$$(x^2-1)\frac{d^2y}{dx^2} + 3x\frac{dy}{dx} + xy = 0, \qquad y(0) = 4, \qquad y'(0) = 6$$

Write atleast first five terms of the series.

3. (a) Find Frobenius series solution about the regular singular point of the following differential equation (10)

$$x^2\frac{d^2y}{dx^2} - x\frac{dy}{dx} + 8(x^2-1)y = 0$$

Write atleast first three terms of each series.

(b) State the orthogonality property of Chebyshev ploynomials of first kind. Use that property to find the expansion of $f(x) = x^3 + x, -1 \leq x \leq 1$ in terms of the Chebyshev polynomials of first kind. (6)

4. (a) Prove that (10)

$$\int_{-1}^{1} P_m(x)P_n(x)dx = \begin{cases} 0 & ,m \neq n \\ \frac{2}{2n+1} & ,m = n \end{cases}$$

where $P_n(x)$ is the Legendra polynomial of degree n.

(b) Write generating function of Legendre ploynomials. Use that function to prove (6)

i. $P_n(1) = 1$

ii. $P_{2n}(0) = (-1)^n \frac{1.3.5.\ldots\ldots(2n-1)}{2^n n!}$

5. (a) Use the method of variation of parameters to find general solution of the equation (8)

$$\frac{d^2y}{dx^2} + y = tan\ x$$

(8)

(b) Solve

$$x^2\frac{d^2y}{dx^2} + x\frac{dy}{dx} + 4y = 2x\ ln\ x$$

6. (a) If $f(z) = e^z$, describe the image under $f(z)$ of horizontal and vertical lines i.e. find the sets $f(a+it)$ and $f(t+ib)$, where a,b are constants and t runs through all real numbers. (5)

(b) If the function $\frac{\bar{z}}{z}$ analytic in its domain of definition? (3)

(c) Suppose $f(z) = az^2 + bz\bar{z} + c\bar{z}^2$, where a, b, c are fixed complex numbers. By differentiating $f(z)$, show that $f(z)$ is complex differentiable at z iff $bz + 2c\bar{z} = 0$. (4)

(d) Derive the polar form of the Cauchy-Riemann equations for u and v: $\frac{\partial u}{\partial r} = \frac{1}{r}\frac{\partial v}{\partial \theta}$, $\frac{\partial u}{\partial \theta} = -r\frac{\partial v}{\partial r}$ (4)

7. (a) Use Liouville's theorem to prove that every polynomial in z of degree $n(\geq 1)$ has a zero. (6)

(b) Find harmonic conjugate of $xy + 3x^2y - y^3$. (4)

(c) Define $u(z) = Im(\frac{1}{z^2})$ for $z \neq 0$ and set $u(0) = 0$, then show that (6)

i. $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$.

ii. u is not harmonic on C.

iii. $\frac{\partial^2 u}{\partial x \partial y}$ does not exists at $(0, 0)$.

8. (a) Find

$$\int_\nu f(z)dz$$ (6)

where $\nu = 3e^{it}$ for $t \in [0, 2\pi]$ and $f(z) = \bar{z}$.

(b) Show that if z_0 is an isolated singularity of $f(z)$ that is not removable, then z_0 is an essential singularity of $e^{f(z)}$. (4)

(c) By estimating the coefficient of the Laurent series, prove that if z_0 is an isolated singularity of f , and if $(z - z_0)f(z) \to 0$ as $z \to z_0$, then z_0 is removable. (6)

9. (a) Define Fourier series of a function $f(x)$. Find the Fourier series generated by a periodic function $f(x) = x^2$ in $-\pi \leq x \leq \pi$ and deduce that (8)

i. $\frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + ... = \frac{\pi^2}{6}$.

ii. $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + ... = \frac{\pi^2}{8}$.

(b) Find the Fourier series for $f(x) = |x|, \quad -\pi < x < \pi$

(8)

CSE/T/213A/2016

BACHELOR OF COMPUTER SC. & ENGINEERING EXAMINATION, 2016
(2nd Year, 1st Semester)
DATA STRUCTURES AND ALGORITHMS

Time : Three hours **Full Marks : 100**

Answer question no. 1 and any *four* from the rest.

1. (a) What are the required qualities of a good hash function? 2

(b) Show how the following polynomial can be represented using a linked list: 2
$$6.7x^{90} - 10.5x^{77} + 13x^{25} + x^3 - 25.3$$

(c) What do you mean by a sentinel? Explain when you use sentinels. 3

(d) Explain how you can detect errors in a post-fix expression during evaluation. 4

(e) Draw the Binary Search Tree formed by the insertion of the following characters in the order they are given: 3

K L F T D Y M E A Z

(f) What do you mean by a Stable Sorting Algorithm? Explain with an example. 4

(g) Show how the following array will be sorted in increasing order using Insertion Sort algorithm: 2

80 90 70 100 10 20 40 60 50.

2. Explain the rationale of Quicksort. Why does the algorithm perform so fast? What are the cases when the Quicksort algorithm behaves like a slow sort? What is the effect of the choice of pivots on the performance of Quicksort algorithm?

Describe the algorithm of Quicksort and explain its working with the help of the following input array:

25, 14, 57, 16, 69, 17, 70, 18, 88, 99.

5+2+2+3+8=20

3. Write a C program to accept two integers from the user and to find and print the Greatest Common Divisor of the two numbers. Your program should take care of all possible bad inputs from the user.
Write the approach you have taken to develop the above algorithm and find out the time complexity of your program. 20

4. What do you mean by Binary Recursion? Explain in detail with two examples.

Explain how recursive calls are implemented using stack. Write a recursive function for finding out the nth Fibonacci number and show how the runtime stack changes for computing the 3rd Fibonacci number using your function.

2+6+4+8 = 20

5. Give the ADT for Threaded Binary Tree. Define the data type for nodes of Threaded Binary tree in C language. Develop the C functions for inserting a leaf to and deleting a leaf from a threaded binary tree node

Write a function to inorder-traverse a threaded binary tree. What are the benefits you get in your function compared to a recursive inorder-traverse algorithm for a straight-forward binary tree? Explain.

3+2+6+6+3 = 20

6. A rat has entered in a checkerboard maze through one corner, where the white boxes are open and black boxes represent obstacles. Develop an algorithm by which the rat can exit the maze though the opposite corner (these two corner boxes are open). Clearly explain the representation of the maze and any specific data structure you have used for the algorithm.

20

7. Explain Dijkstra's Shortest Path Algorithm. Show its working using a suitable graph.

What do you mean by Hashing? What is the complexity of insertion, deletion and search in a hash table. Explain how you can delete an element from a hash table. Explain how coalesced chaining works.

10 + 10

5. Write the following functions in C with proper comments:
   a. To test whether two stacks are equal or not, stacks remaining unchanged after the test. (Define what you mean by equality of two stacks).
   b. To compute the hash value of a large integer using the folding hash function.
   c. To rotate right a binary tree.
   d. To search a Graph using the Breadth First Search Algorithm.

6+6+3+5=20

----------X----------