2013 – 2014
B. TECH. AUTUMN (III SEMESTER) EXAMINATION
(COMPUTER ENGINEERING)
HIGHER MATHEMATICS
(AM-261)
Credits: 04

Max. Marks: 60

Duration: Three Hours

Note: Attempt all questions.

1. (a) If \( f(z) \) is an analytic function then show that
\[
\left( \frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2} \right) f(z) = 4|f'(z)|^2
\]

(b) If \( \phi \) and \( \psi \) are functions of \( x \) and \( y \) satisfying Laplace's equation, show that
\( S^2 \) is analytic, where
\[
s = \frac{\partial \phi}{\partial y} - \frac{\partial \psi}{\partial x} \quad \text{and} \quad t = \frac{\partial \phi}{\partial x} + \frac{\partial \psi}{\partial y}
\]

(c) Show that the function \( u(x, y) = 4xy - 3x^2 + 2y \) is harmonic construct the corresponding analytic function \( f(z) = u + iv \) in terms of \( z \).

OR

(c') Use Cauchy integral formula to evaluate \( \int_C \frac{\tan z}{z} \, dz \) where \( C \) is \( |z| = 2 \).

2. (a) Represent \( f(z) = \frac{7z - 2}{z^2 - z - 2} \) in Laurent's series in the region given by
\( 1 < |f(z) + 1| < 3 \).

(b) Use residue theorem to evaluate \( \oint_C \frac{2x^2 + 5}{(x + 2)^3(x^2 + 4)} \), where \( C \) is the square with vertices at \( 1+i, 2+i, 2-2i, 1+2i \).

(c) Using contour integral, evaluate \( \int_0^{2\pi} \frac{\cos \theta}{3 + \sin \theta} \, d\theta \).

3. (a) A particle moves along the curve \( x = 2t^2, y = t^2 - 4t \) and \( z = 3t - 5 \) where \( t \) is time. Find the components of its velocity and acceleration at time \( t = 1 \), in the direction of the vector \( \hat{i} - 3\hat{j} + 2\hat{k} \).

(b) Show that the vector field \( \vec{F} = \frac{\vec{r}}{r^3} \) is irrotational as well as solenoidal. Find its scalar potential.

(c) Find the directional derivative of the divergence of \( \vec{F}(x, y, z) = xy\hat{i} + xy^2\hat{j} + z^2\hat{k} \) at the point \((2, 1, 2)\) in the direction of the outer normal to the sphere \( x^2 + y^2 + z^2 = 9 \).

OR

(c') Find the value of \( n \) for which the vector \( \vec{F} \) is solenoidal, where \( \vec{F} = x\hat{i} + y\hat{j} + z\hat{k} \).

Contd...
4. (a) Verify Green's theorem in plane for \[ \int \left[ (x^2 + 2xy) \, dx + \left( y^2 + x^2y \right) \, dy \right] \]
where \( C \) is the square with vertices \( P(0,0), Q(1,0), R(1,1) \) and \( S(0,1) \).

(b) Use Stoke's theorem to evaluate \[ \int \left[ (x + 2y) \, dx + (x - z) \, dy + (y - z) \, dz \right] \]
where \( C \) is the boundary of the triangle with vertices \( (2,0,0), (0,3,0) \) and \( (0,0,6) \).

(c) Use divergence theorem to evaluate \[ \iiint \left[ x \, dydz + y \, dzdx + z \, dxdy \right] \]
where \( S \) is the portion of the plane \( x + 2y + 3z = 6 \) which lies in the 1st octant.
1. (a) Evaluate following:

(i) \[ L^{-1}\left(\cot^{-1}\frac{s}{k}\right) \]

(ii) \[ L^{-1}\left(\frac{s^2}{(s^2 + a^2)(s^2 + b^2)}\right) \]

by convolution theorem where \( L^{-1} \) denotes inverse Laplace transform.

OR

(a') (i) Solve, by using Laplace transform, the equation \[ \frac{d^2}{dt^2} y(t) + 9y(t) = 18t \]
given that \( y(0) = 0 = y\left(\frac{\pi}{2}\right) \).

(ii) Using Laplace transform, solve the following integral equation:

\[ y(t) + \int_0^t y(\tau) \, d\tau = 1 - e^{-t}. \]

(b) A voltage \( V_0 e^{-at} \) is applied at \( t = 0 \) to a circuit of inductance \( L \) and resistance \( R \). Use Laplace transform method to show that the current at time \( t \) is

\[ \frac{L}{R - aL} \left( e^{-at} - \frac{R}{L} \right). \]

(c) Obtain the Laplace transform of the periodic saw tooth wave represented in the figure below:

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[Diagram of periodic saw tooth wave]

Contd.....2
(c') Using Laplace transform method, solve the equations \( \frac{dx}{dt} - y = e^{t}, \frac{dy}{dt} + x = \sin t \) \([5, 4, 5]\) given that \(x(0) = 1\) and \(y(0) = 0\).

2. (a) (i) Solve by Gauss-elimination method the equations \(2x + y + 4z = 12,\)
\(8x - 3y + 2z = 20\) and \(4x + 11y - z = 33\).
(ii) Show that the iterative formula for finding the reciprocal of \(N\) is
\[x_{n+1} = x_{n}(2 - N \times x_{n}).\]

OR

(a') Using Gauss-Seidel method, solve the following system of equations, tabulating the results up to the 3rd iteration:
\(10x + 2y + z = 12, 2x - y + 11z = 20\) and \(x + 9y - z = 10\).

(b) Find, by Newton’s method, the root of the equation \(e^x - 4x\), which is approximately 2, correct to three places of decimals.

OR

(b') (i) Construct Newton’s forward interpolation polynomial for the following data:
\[
x : \quad 4 \quad 6 \quad 8 \quad 10 \\
y : \quad 1 \quad 3 \quad 8 \quad 16
\]
Use it to find the value of \(y\) for \(x = 5\).
(ii) In the table below, estimate the missing values:
\[
x : \quad 0 \quad 1 \quad 2 \quad 3 \quad 4 \\
y : \quad 1 \quad 2 \quad 4 \quad \_ \quad 16
\]
Explain why it differs from \(2^3 - 8\).

(c) Using Newton’s divided difference formula find (i) \(f(5)\), (ii) \(f'(5)\) and \([3, 5, 5]\)

(iii) \(\int f(x) \, dx\)
\[
x : \quad 0 \quad 2 \quad 3 \quad 4 \quad 7 \quad 9 \\
f(x) : \quad 4 \quad 26 \quad 58 \quad 112 \quad 468 \quad 922
\]

3. (a) The following table gives the velocity \(v\) of a particle at time \(t\):
\[
t \text{(seconds)} : \quad 0 \quad 2 \quad 4 \quad 6 \quad 8 \quad 10 \quad 12 \\
v \text{(meters/sec)} : \quad 4 \quad 6 \quad 16 \quad 34 \quad 60 \quad 94 \quad 136
\]
Find the distance moved by the particle in 12 seconds by Simpson’s rule and also the acceleration at \(t = 1\) second and \(t = 2\) second.

Contd.....3
(b) Using Modified Euler's method, find the value of y when \( x = 0.1 \) given that 
\[ y(0) = 1 \quad \text{and} \quad \frac{dy}{dx} = x^2 + y. \] 
Take \( h = 0.05 \) and give only two iterations at each step.

OR

(b') Apply the fourth order Runge-Kutta method, to find an approximate value of y 
where \( x = 0.2 \) given that \( \frac{dy}{dx} = x + y \), \( y(0) = 1 \). Take \( h = 0.2 \).

(c) Using finite difference method, solve the boundary value problem \([5, 5, 5]\)
\[ \frac{d^3y}{dx^3} - 64y + 10 = 0 \quad \text{with} \quad y(0) = y(1) = 0. \] 
Compute the value of \( y(0.5) \). Take \( h = \frac{1}{4} \).

4. Answer any THREE of the following:

(a) A problem in mechanics is given to three students A, B, C whose chances of solving it are \( \frac{1}{2}, \frac{1}{3}, \frac{1}{4} \) respectively. What is the probability that the problem will be solved?

(b) Urn 1 contains \( x \) white and \( y \) red balls. Urn 2 contains \( z \) white and \( v \) red balls. A ball is chosen at random from urn 1 and put into urn 2. Then a ball is chosen from urn 2. What is the probability that this ball is white?

(c) The diameter on an electric cable, say \( X \), is assumed to be a continuous random variable with pdf
\[ f(x) = 6x(1-x), \quad 0 \leq x \leq 1. \]

(i) Check that the above is a pdf

(ii) Obtain an expression for the cdf of \( X \).

(iii) Compute \( P(\frac{1}{2} < X < \frac{2}{3}) \).

(d) State Bayes' theorem. Find the mean and the standard deviation of the binomial distribution.
1. Attempt any three parts.
   (a) Convert decimal number 123.125 into Binary, Octal, Hexadecimal number and subtract (A3F)\textsubscript{16} from (B92)\textsubscript{16} with the help of 2's complement.
   (b) Express the Boolean function \( F = A + BC \) as a sum of minterms.
   (c) Implement the function \( F = (C + \overline{E})(A \overline{D} + B) \) with only NAND GATES.
   (d) Show that \( A \odot B \odot C \odot D = \sum (0,3,5,6,9,10,12,15) \)


2(b) Convert a Full-Adder into an adder/subtractor with one selection signal.

2(c) Implement the given function with the help of a Decoder.

\[
F(A, B, C, D) = \sum (0,3,5,6,9,10,12,15)
\]

OR

2(c') Implement the given functions with the help of a Multiplexer.

\[
F1(A, B, C) = \sum (0,1,3,6)
\]

\[
F2(A, B, C) = \sum (2,3,4,7)
\]

3(a) Design a sequence generator for following sequence diagram (Fig. 1) with T Flip-
3(b) Design a Shift Register with the following functionalities

1) Parallel Load
2) Left Shift
3) Right Shift
4) No change

You can use any flip-flop of your choice.

OR

3(b') Describe the functionality of a Flip-Flop. Explain the working of a SR, D, T and JK Flip-Flop with the help of a circuit and excitation table.

4(a) Describe the architecture of a CPU and write a brief note on the following

1) Control Unit
2) Arithmetic & Logic Unit
3) Functional Unit

OR

4(a') Design an Arithmetic and Logic Unit with the following functionalities

1) Addition
2) Subtraction
3) Increment
4) Decrement
5) Logical OR
6) Logical AND
7) Logical NOT
8) Logical XOR

4(b) Differentiate between:

1) Microprocessor and Microcomputer.
2) Synchronous Circuit and Asynchronous Circuit.
3) Combinational Circuit and Sequential Circuit.
Answer all the questions.
Assume suitable data if missing.
Notations used have their usual meaning.

Q.No. | Question | Marks
--- | --- | ---
1(a) | Differentiate between the following: 
1. C++ and JAVA 
2. Method overloading and Method overriding 
3. Association and Aggregation in UML | [06]
1(b) | What do you mean by Dynamic Binding? How is it useful in OOP? | [04]
OR
1'(b) | Abstraction and Encapsulation are complementary to each other. Justify. | [04]
1(c) | What are Access Specifiers in JAVA? Explain their meaning in inherited or non inherited classes in same/different packages with example. | [05]
2(a) | Explain Constructor and Destructor with example? Is it mandatory to use them in a C++ class? | [05]
2(b) | Explain the mechanism of Exception Handling in C++. | [06]
2(c) | Write a Class Template to ask three values from user and find the maximum value. | [04]
3(a) | What is Garbage Collection? How does it work? | [05]
3(b) | How can we implement Run-time Polymorphism in JAVA? Explain with a program. | [05]
OR
3'(a) | What is an Interface? What is the general form of defining the Interface? Further write a program in JAVA according to given conditions: 
In package “pkg1”, create a public interface “intf1” with two methods. Inherit a new interface “intf2” from intf1 and add a new method. Now, show the implementation of | [05]

Contd......2
the interface in different package "pkg2".

3′(b) Describe in detail about JAVA Architecture with appropriate diagram.

3′(c) Write in short about any two:

i. Inner Class
ii. Wrapper class
iii. String class

4′(a) Explain the following with example:

i. Completion Transition
ii. Association Class

4′(b) What are Actors and Use Cases in Use case model? Also write the guidelines for constructing use case model.

4′(c) Prepare a class diagram for a graphical document editor that that supports grouping.

Assume that a document consists of several sheets. Each sheet contains drawing objects including Text, Geometrical objects, and Groups. Geometrical objects include circles, ellipse, rectangles, lines, and squares. A group is simply a set of drawing objects, containing at least two drawing objects while drawing object can be a direct member of at most one group.

OR

4′(a) Explain the following with example:

i. Enumerations
ii. Composition

4′(b) What is an activity model? How is it different from flowchart? Draw an activity model for debit card verification of ATM machine.

4′(c) Prepare a class diagram for the following scenario:

Electrical machines are categorized into alternating current (ac) or direct current (dc). Some machines run on ac, some on dc and some on either. Synchronous and induction motors run on ac only. Universal motors are typically used where high speed is needed. They will run on either ac or dc. Permanent magnet motors are frequently used in toys and will work only on dc.

Use Multiple Inheritance, if required.
2013-14

B.TECH. IIIrd (AUTUMN SEMESTER) EXAMINATION
COMPUTER ENGINEERING
ELECTRONIC DEVICES AND CIRCUITS
EL-211

Maximum Marks: 60  Credits: 04  Duration: Three hours

Answer all the questions.
Assume suitable data if missing.
Notations used have their usual meaning.

Q.No.  Question  M.M.
1(a). Explain construction and working of Schottky diode. Why it is called Hot carrier diode. [06]
1(b). Explain minority profile in bipolar junction transistor in active mode. [06]

2(a). Prove that the stability factor $S$ for the circuit shown below is:

\[
S = \frac{(1 + \beta)}{1 + \frac{\beta(B+F+R_G)}{(R_E + R_K + R_C)}}
\]

2(b). Define compensation techniques in amplifiers. Explain the operation of a circuit which uses a diode to compensate for changes in $V_{BE}$. [6]

OR

2'(b). Determine the Stability factor $S''$ if $\beta = 50$, $V_{CC} = 5V$, $R_B = 51K\Omega$ and $R_C = 2.3K\Omega$ [6]

Contd......2
for the circuit shown below:

3. Draw small signal equivalent model for the circuit shown below if terminal Z is grounded, terminal X is connected to a signal source having resistance 1MΩ, and terminal Y is connected to a load resistance of 40KΩ, find the voltage gain from signal source to load. The amplifier has \( V_{DD} = -V_{SS} = 5V \), \( I_D = 0.1mA \), \( V_i = 1V \), \( K_NW/L = 0.8mA/V^2 \), \( V_A = 40V \), \( R_G = 10MΩ \) and \( R_N = R_S = 35KΩ \).

OR

3'(a). Draw the small signal equivalent model for a common base amplifier. Derive the expression for short circuit current gain \( (A_{ib}) \) and overall voltage gain.

3'(b). The transistor amplifier circuit shown below is biased with a current source \( I \) and has a very high \( \beta \). Find the dc voltage at the collector, \( V_C \). Also find the value of \( g_m \).

Replace the transistor by its small signal equivalent model and find the voltage voltage gain \( v_C/v_i \). The amplifier has \( V_{PR} = 5V \), \( R_C = 7.5KΩ \), \( I = 0.5mA \) and \( \alpha = 1 \).

Contd......3
4(a) Draw the frequency response curve of RC coupled amplifier circuit. Explain why gain falls at high frequencies.

4(b) Determine the common emitter short-circuit current (β) gain taking high frequency model. Also define unity-gain bandwidth (ω₁).

OR

4'(b) Determine the break frequencies ω₁ and ω₂ due to C_c and C_e of common source amplifier.

5(a) Determine the input and output impedances of
(i) Current series feedback
(ii) Voltage series feedback

5(b) Discuss the various desirable properties obtained by the use of negative feedback.

OR

5(b') Determine the frequency and condition of oscillation for Hartley oscillator
2013 – 2014
B. TECH. AUTUMN (III SEMESTER) EXAMINATION
(ELECTRONICS/computer engineering)
COMMUNICATION SKILLS
(HU-202)
Credits: 04

Max. Marks: 40

Duration: Three Hours

Note: Answer all questions.

1. Write a letter of enquiry to Vijay Furniture Company, Cuttack-795361 enquiring about the furniture supply, rates and brochure. You are interested in buying latest furniture for newly established office in Cuttack.

OR

Write a job application and create a CV in response to the following advertisement:

GRADUATE / TRAINEE MEDIA SALES EXECUTIVE - £38,000 - 25,000 + COMMISSION – LONDON

EMPLOYER: MEDIA EXCHANGE

POSTED: 21/11/2013

REF: JJKY21

LOCATION: LONDON

INDUSTRY: ADVERTISING, MEDIA-PRINT, MEDIA-ADVERTISING

FUNCTION: HR

LEVEL: GRADUATE/POST GRADUATE

CONTRACT: PERMANENT

HOURS: FULL TIME

SALARY: £18,000-25,000

APPLY NOW

2. Write short notes on any two of the following:

(a) Telexes
(b) Memos
(c) e-mails
(d) Tenders

Contd...2,
3. Read the following passage carefully and make notes.

Passage:
Governments looking for easy popularity have frequently been tempted into announcing give-aways of all sorts: free electricity, virtually free water, subsidized food, cloth at half price, and so on. The subsidy culture has gone to extremes. The richest farmers in the country get subsidized fertilizers. University education, typically accessed by the wealthier sections, is charged at a fraction of cost. Postal services are subsidized, and so are railway services. Bus fares cannot be raised to economical levels because there will be violent protest, so bus travel is subsidized too. In the past, price control on a variety of items, from steel to cement, meant that industrial consumer of these items got them at less than actual cost, while the losses of the public sector companies that produced them were borne by the taxpayer! A study done a few years ago, came to the conclusion that subsidies in the Indian economy total as much as 14.5 per cent of gross domestic product. At today's level, that would work out to about Rs. 1,50,000 crore.

And who pay the bill? The theory-and the political fiction on the basis of which it is sold to unsuspecting voters-is that subsidies go to the poor, and are paid for by the rich. The fact is that most subsidies go to the 'rich' (defined in the Indian context as those who are above the poverty line), and much of the tab goes indirectly to the poor. Because the hefty subsidy bill results in fiscal deficits, which in turn push up rates of inflation-which, as everyone knows, hits the poor the hardest of all. That is why taxmen call inflation the most regressive form of taxation.

The entire subsidy system is built on the thesis that people cannot help themselves, therefore governments must do so. That people cannot afford to pay for variety of goods and services, and therefore the government must step in. This thesis has been applied not just in the poor countries but in the rich ones as well; hence the birth of the welfare state in the west, and an almost Utopian social security system; free medical care, food aid, old age security, etc. But with the passage of time, most of the wealthy nations have discovered that their economies cannot sustain this social safety net, which in fact reduces the desire among people to pay their own way, and takes away some of the incentive to work. In short, the bill was unaffordable, and their societies were simply not willing to pay. To the regret of many, but because of the laws of economics are harsh, most Western societies have been busy pruning the welfare bill.

In India, the lessons of this experience over several decades, and in many countries-do not seem to have been learnt. Or they are simply ignored in the pursuit of immediate votes. People who are promised cheap food or clothing do not in most cases look beyond the gift horses to the question of who picks up the tab. The uproar over higher petrol, diesel and cooking gas prices ignored this basic question; if the user of cooking gas does not want to pay for its cost, who should pay? Diesel in the country is subsidized, and if the user of cooking gas does not want to pay for its full cost, who does he or she think should pay the balance of the cost? It is a simple question, nevertheless it remains unasked.

4. Generate a group discussion on any one of the following topics taking four participants:
   (a) Corporate Culture and personal values.
   (b) Importance of Communication Skills for Engineers.