2012 - 2013
B.TECH. WINTER (IV SEMESTER) EXAMINATION
(ELECTRICAL ENGINEERING)
HIGHER MATHEMATICS – II
(AM - 222)

Maximum Marks: 60
Credits: 04
Duration: Three Hours

Note: Answer ALL the questions.
Programmable calculator is not allowed.

1. (a) Answer any THREE of the following:
   (i) Find \( L [f(t)] \), where
       \[
       f(t) = \begin{cases} 
       t^2 & 0 < t < 2 \\
       t - 1 & 2 < t < 3 \\
       7 & t > 3 
       \end{cases}
       \]
   (ii) Find \( L [\cos(t)] \)
   (iii) Find \( L^{-1} \left[ \frac{s^2 + 2}{s(s^2 + 4)} \right] \)
   (iv) Find by convolution theorem \( L^{-1} \left[ \frac{1}{s^3(s^2 + 1)} \right] \)

(b) Solve the following initial value problem by Laplace method:
   \[
   \frac{d^3y}{dt^3} + y = t \cos 2t, \quad t > 0, \text{ given that } y = 0 = \frac{dy}{dt} \text{ for } t = 0.
   \]
   OR

(b) Solve the following system of equations by Laplace transformation [7.5, 7.5]
   \[
   \frac{dx}{dt} - y = e^t, \quad \frac{dx}{dt} + x = \sin t \text{ given } x(0) = 1, \quad y(0) = 0.
   \]

2. (a) Solve the following system of equations by Gauss-Seidel iteration method
    performing only three iterations.
    \[
    8x - 3y + 2z = 20 \\
    4x + 11y - z = 33 \\
    6x + 3y + 12z = 35
    \]

(b) (i) Find the real root of the equation \( x \log_{10} x - 1.2 = 0 \) by Newton-Raphson
    method correct to three decimal places.
    (ii) Prove that
    \[
    \Lambda = \frac{1}{2} \delta^2 + \delta \sqrt{\left(1 + \frac{1}{4} \delta^2\right)}
    \]

Contd.....2
(b') (i) Find the real root of the equation $x^3 - x - 1 = 0$ correct to two decimal places by general iteration method.

(ii) Prove that \( \left( \frac{A^2}{E^3} \right) x = 6x \) interval of differencing being unity.

3. (a) (i) From the difference table of \( f(x) = x^3 - 3x^2 + 5x + 7 \) for the values of \( x \) equal to 0, 2, 4, 6, 8 and use the table to calculate \( f(10) \), using suitable formula.

(ii) Using Lagrange interpolation formula find the value of \( y \) when \( x = 10 \) form the following table

\[
\begin{array}{c|c|c|c|c}
 x & 5 & 6 & 9 & 11 \\
 y & 12 & 13 & 14 & 16 \\
\end{array}
\]

(b) (i) Obtain the first and second derivative of \( \sqrt{x} \) using the following table.

\[
\begin{array}{c|c|c|c|c|c}
 x & 15 & 17 & 19 & 21 & 23 \\
 \sqrt{x} & 3.873 & 4.123 & 4.359 & 4.583 & 4.796 \\
\end{array}
\]

(ii) Use trapezoidal rule to evaluate \( \int_{0}^{1} \frac{\sin x}{x} \, dx \) taking \( h = 0.2 \).

4. (a) Solve the following differential equation by modified Euler's method

\[
\frac{dy}{dx} = y - \frac{2x}{y}, \quad y(0) = 1 \text{ in the range } 0 \leq x \leq 0.2. \text{ Take } h = 0.1
\]

OR

(a') Using Runge-Kutta fourth order method solve for \( y(0.1) \) given

\[
\frac{dy}{dx} = xy - y^2, \quad y(0) = 1.2. \text{ Take } h = 0.1.
\]

(b) Solve the following boundary value problem by finite difference method taking \( h = 0.5 \),

\[
\frac{d^2y}{dx^2} = y + x, \quad y(0) = 0, \quad y(2) = 3.627.
\]
2012 – 2013
B.TECH. (WINTER SEMESTER) EXAMINATION
OPEN ELECTIVE
HIGHER MATHEMATICS

(AM – 224)
Credits: 04

Duration: Three Hours

Maximum Marks: 60

Note: Answer ALL the questions.
Notations used have their usual meaning.

1. (a) Prove that
\[ \text{Curl } (\mathbf{u} \times \mathbf{v}) = \mathbf{v} \cdot \mathbf{\nabla} \mathbf{u} - \mathbf{u} \cdot \mathbf{\nabla} \mathbf{v} + \mathbf{u} \text{ div } \mathbf{v} - \mathbf{v} \text{ div } \mathbf{u} \]

(b) Prove that
\[ \text{div}(\mathbf{u} \times \mathbf{v}) = \mathbf{v} \cdot \text{curl } \mathbf{u} - \mathbf{u} \cdot \text{curl } \mathbf{v}. \]

Hence prove that if \( \mathbf{A} \) and \( \mathbf{B} \) are irrotational then \( \mathbf{A} \times \mathbf{B} \) is solenoidal.

(b) Fluid motion is given by
\[ \mathbf{v} = ax \mathbf{i} + ay \mathbf{j} + az \mathbf{k}. \]

(i) Is it possible to find out the velocity potential? If so, find it.
(ii) Is the motion possible for an incompressible fluid?

(c) Find the values of \( a, b, c \) so that the directional derivative of
\[ \phi = axy^2 + byz + cz^2 x^3 \]
at \((1, 2, -1)\) has maximum magnitude 64 in the direction parallel to z-axis.

2. (a) Verify the divergence theorem for \( \mathbf{A} = 4x \mathbf{i} - 2y^2 \mathbf{j} + z^2 \mathbf{k} \) taken over the region bounded by \( x^2 + y^2 = 4, z = 0 \) and \( z = 3. \)

(b) Verify Green's theorem in the plane for \[ \int_C \left[ (x^2 - x^2 y) \mathbf{dx} + xy^2 \mathbf{dy} \right], \]
where \( C \) is the boundary of the region enclosed by the circles \( x^2 + y^2 = 4 \) and \( x^2 + y^2 = 16 \).

(b) Verify Stokes' theorem for \( \mathbf{F} = (2x - y) \mathbf{i} + yz^2 \mathbf{j} - y^2 \mathbf{k} \) where \( S \) is the upper half of the sphere \( x^2 + y^2 + z^2 = 1 \) and \( C \) is its boundary.

3. (a) (i) Find the Laplace transform of
\[ \frac{1 - \cos t}{t^2} \]

OR

(ii) Find the inverse Laplace transform of
\[ \frac{s^2}{(s^2 + a^2)(s^2 + b^2)} \]
using convolution theorem, \( a, b \) being constants.

Contd.....2
(ii) Find the inverse Laplace transform of \( \cot^{-1} \left( \frac{s}{k} \right) \), where \( k \) is a constant.

(b) Find the Laplace transform of the triangular wave represented in the figure below:

\[ t \]

\[ 0 \quad a \quad 2a \quad 3a \quad 4a \quad 5a \quad 6a \]

OR

(b') An alternating e.m.f. \( E \sin \omega t \) is applied to an inductance \( L \) and a capacitance \( C \) in series. Use Laplace transform method to show that the current in the circuit is

\[ \frac{E}{L \left( R^2 - \omega^2 \right)} (\cos \omega t - \cos at), \]  

where \( n^2 = \frac{1}{LC} \).

(c) (i) Using Laplace transform method, solve the differential equation

\[ y''(t) + 9y(t) = 18t \]  
given that \( y(0) = 0, y \left( \frac{\pi}{2} \right) \).

(ii) Using Laplace transform method solve the integral equation

\[ y + \int_{0}^{t} y \ dt = 1 - e^{-t}. \]

4. (a) The points of trisection of a string are pulled aside through a distance \( b \) on opposite sides of the position of equilibrium, and the string is released from rest. Find an expression for the displacement of the string at any subsequent time and show that the mid-point of the string always remains at rest.

OR

(a') The equation for the conduction of heat along a bar of length \( L \) is

\[ \frac{\partial u}{\partial t} = \alpha^2 \frac{\partial^2 u}{\partial x^2} \]

neglecting radiation. Find an expression for \( u \), if the ends of the bar are maintained at zero temperature and if, initially, the temperature is \( t \) at the centre of the bar and falls uniformly to zero at its ends.

(b) Find the particular solution of the Laplace equation \( \frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0 \) by the method of separation of variables.

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

Q.No.   Question   M.M.

1(a)   Explain why in open-circuit test of a transformer measurement is usually done on the LV side while in short-circuit test measurement is usually done on the HV side.  [06]

1(b)   A 50 kVA, 2200/110 V transformer when tested gave the following results:
       OC test, measurements on the LV side; 400 W, 10 A, 110 V
       SC test, measurements on the HV side; 808 W, 20.5 A, 90 V

       Compute all the parameters of the equivalent circuit referred to the HV and LV sides of the transformer.

OR

1'(a)   Define efficiency of a transformer and find out the condition for maximum efficiency.  [06]

1'(b)   A 20 kVA, 2000/200 V, 50 Hz transformer is operated at no-load on rated voltage, the input being 150 W at 0.12 power factor. When it is operating at rated load, the voltage drops in the total leakage reactance and the total resistance are respectively 2 and 1 per cent of the rated voltage. Determine the input power and efficiency when the transformer delivers 10 kW at 200 V at 0.8 pf lagging to a load on the LV side.

2(a)   Draw the connection and phaser diagrams of a three transformer for the following connections:
       (i) star-delta +30°
       (ii) star-delta -30°

2(b)   An ideal 3-phase step-down transformer, connected delta/star delivers power to a balanced 3-phase load of 100 kW at 0.8 lagging power factor. The input line voltage is 11 kV and the turn-ratio of the transformer, phase-to-phase is 10. Determine the line voltages, line currents, phase voltages and phase currents on both the primary and the secondary sides.

OR

Contd......2
Two single-phase transformers rated 1000 kVA and 500 kVA respectively, are connected in parallel on both HV and LV sides. They have equal voltage ratings of 11 kV/400 V and their per unit impedances are $(0.02 + j0.07)$, and $(0.025 + j0.0875)$ $\Omega$ respectively. What is the largest value of the unity power factor load that can be delivered by the parallel combination at the rated voltage?

3(a) Explain the term pitch factor with reference to a three-phase ac machine. Derive its expression.

OR

3(a') With the help of neat diagrams, explain the construction of a 3-phase squirrel cage induction motor. What are the advantages and disadvantages of this motor over a wound rotor motor?

3(b) A 3-phase, 50-Hz, star-connected alternator with a two-layer winding runs at 600 rpm. It has 12 turns/coil, 4 slots/pole/phase and a coil-pitch of 10 slots. If the flux per pole is 0.035 Wb, find the phase and line emf's induced. Assume that the total turns per phase are series connected.

A 400 V, 3-phase, stator-connected induction motor gave the following test results:

- No-load 400 V 8.5 A 1100 W
- Blocked-rotor 180 V 45 A 5700 W

Determine the ohmic values of the components in the circuit model and calculate the line current, power factor and efficiency of the motor when it is operating at 5% slip. The stator resistance per phase is 0.5 $\Omega$ and the standstill leakage reactance of the rotor winding referred to the stator is equal to that of the stator winding.

OR

4(a) Explain why a 3-phase induction motor draws a large current at the time of starting. Explain how the starting current is reduced in a star-delta starter. What is the effect of using this starter on the starting torque of the motor?

4(b) A 3.3 kV, 20-pole, 50 Hz, 3-phase star-connected induction motor has a slip-ring rotor of resistance 0.025 $\Omega$ and standstill reactance of 0.28 $\Omega$ per phase. The motor has a speed of 294 rpm when full-load torque is applied. Compute (a) slip at maximum torque, and (b) the ratio of maximum to full-load torque. Neglect stator impedance.

5. With the help of rotating field theory explain why a single-phase single-winding induction motor is not self starting. Based on the above theory draw the torque speed characteristic of the motor and explain how the motor develops a unidirectional torque when it is manually rotated in any one direction. Enumerate the various methods used to make the motor self-starting.
2012 – 2013
B.TECH. (WINTER SEMESTER) EXAMINATION
ELECTRICAL ENGINEERING
ELECTRICAL MACHINE – II
EE – 213

Maximum Marks: 60

Credits: 04

Duration: Three Hours

Answer all the questions.
Assume suitable data if missing

Q.No. Questions

1 (a) Explain how the values of Xd and Xq of a synchronous machine are measured experimentally by ‘Slip test’. Discuss the precautions used. [6]

(b) Write short answers:
(i) For salient pole machines value of Xd is more than Xq.
(ii) Unsaturated and saturated values of synchronous impedance.
(iii) OCC of a three phase alternator starts from origin, but Zero Power Factor characteristics do not.

OR

1' (a) Explain what do you understand by the term ‘Armature Reaction’ of a synchronous machine. Discuss its effects at unity, lagging and leading power factor loads. [6]

(b) The following data gives the open circuit and short circuit test result of a three-phase, star connected, 1000 kVA, 2200 V, 50 Hz alternator:

Field current (amp.) 10 20 25 30 40 50
O.C. Voltage (Volt) 800 1500 1760 2000 2350 2600
S.C. Current (Amp) – – – 300 – –

Calculate voltage regulation by m.m.f. method when the alternator supplies full load current at 0.8 p.f. lagging. Armature resistance per phase is 0.5 ohm.

2 (a) What are the conditions which should be satisfied in order that an incoming alternator may be connected in parallel with infinite bus bar. Describe all Dark Lamp method of synchronizing a three phase alternator with bus bar. [6]

(b) A three-phase star-connected alternator is supplying 300 Amp at 0.8 power factor lagging to 11 KV infinite bus bar. It has a synchronous reactance of 6 ohms per phase and the armature resistance is negligible. If the steam input of the alternator is increased by 30% and the excitation is also decreased by 25% find the current and power factor at which the alternator supplies power to the bus bar.

OR

Contd…….2
2(a) Explain the effect of governor characteristics on load sharing between alternators operating in parallel. Also derive an expression of power shared between two alternators in terms of their no load and full load frequencies of governor characteristics.

(b) A three phase alternator has rated voltage of 6.6 kV and a synchronous reactance of 5 ohm/phase and supplies 300 Amp at 0.8 p.f. lagging to infinite bus bar. Calculate the current and its power factor supplied by alternator if the steam input is decreased by 25% keeping excitation unchanged.

3(a) Explain effect of change of excitation of a synchronous motor at constant load and hence explain the V-curves.

(b) Why a three phase synchronous motor is not self starting? Explain how it can be started as a squirrel cage induction motor using damper windings.

4(a) Explain the characteristics of a d.c. shunt generator and discuss the causes of failure of voltage build up.

(b) Define and explain 'armature reaction' in d.c. machine. Derive the expression for 'demagnetizing' and 'cross magnetizing' ampere turns.

OR

4(b') A d.c. shunt generator gave the following open circuit characteristics:

<table>
<thead>
<tr>
<th>Field current (A)</th>
<th>0.5</th>
<th>1.0</th>
<th>1.5</th>
<th>2.0</th>
<th>2.5</th>
<th>3.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open Circuit emf (V)</td>
<td>54</td>
<td>107</td>
<td>152</td>
<td>185</td>
<td>210</td>
<td>230</td>
</tr>
</tbody>
</table>

The armature and field resistance are 0.1 and 80 ohms respectively, calculate

(i) The voltage to which the machine will excite when run as a shunt generator at the same speed.

(ii) The voltage drop due to armature reaction when 100 Amp current is passing in the armature at a terminal voltage of 175 volt.

(iii) The percentage reduction in speed at which the machine would fail to excite on open circuit.

5(a) Why testing is compulsory for a d.c. machine? Explain the regenerative testing of a d.c. shunt motor.

(b) Write short notes on:

(i) Reluctance motor

(ii) Stepper motor
2012-13
B.TECH. (IV SEMESTER) EXAMINATION
ELECTRICAL ENGINEERING
ELECTRICAL POWER GENERATION
EE-232 N

Maximum Marks: 60  Credits: 04  Duration: Three Hours

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

1(a) What do you mean by pulverization? Discuss the advantages and disadvantages of pulverizing the fuel in thermal power plants. [06]

1(b) Explain the construction and working principle of electrostatic precipitator for arresting ash from flue gases also and name the methods available for it. [06]

OR

1’ Draw a layout of a thermal power plant and explain its working in brief. Also explain why the efficiency of such type of plant is poor? Suggest measures to be adopted to improve it. [12]

2(a) Discuss various factors that should be kept in view while selecting a site for hydro station. [06]

2(b) What are various types of turbines used for hydro power plant? Discuss applications of each of them, in regard to heat and discharge. Compare their performance. [06]

OR

2’(a) What are the pumped storage plants? Describe with a sketch the principle of operation of such a plant. Also discuss the role of this plant in large interconnected power system. [06]

2’(b) What is the specific speed of a turbine? How can turbines be classified according to the specific speed? Also discuss their applications. [06]

3(a) What is a nuclear reactor? Describe briefly various components of a nuclear reactor. [06]

3(b) What do you understand by the term half life of a nuclear material? A sample of uranium has $1.7 \times 10^{24}$ atoms of $^{235}U$. If half life of $^{235}U$ is $7.1 \times 10^8$ years, find decay constant, initial activity and number of $^{235}U$ atoms remaining after $10 \times 10^{10}$ years. [06]

......... 2
OR

3'(a) Define/Explain the following:
   (i) Fission Reaction (ii) Coolant (iii) Moderator

3'(b) Draw a neat sketch of Pressurised water reactor (PWR) and explain its working.

4(a) Draw a neat layout of diesel power plant and discuss its salient features.

4(b) Discuss the principle of operation of an open cycle gas turbine plant. Why is its efficiency low?

5(a) Discuss the benefits of co-generation. What technologies are used for it? Explain anyone.

5(b) Explain the terms
   (i) Energy Banking (ii) Energy Wheeling (iii) Co-generation Plants
Maximum Marks: 60  
Credits: 04  
Duration: Three Hours

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

<table>
<thead>
<tr>
<th>Q.No.</th>
<th>Question</th>
<th>M.M.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1(a)</td>
<td>Describe primary standard of e.m.f. in detail.</td>
<td>[07]</td>
</tr>
<tr>
<td>1(b)</td>
<td>Differentiate between &quot;Precision&quot; and &quot;Accuracy&quot; with suitable example.</td>
<td>[05]</td>
</tr>
</tbody>
</table>

OR

1'(a) What is "Loading Effect"? Explain the role of input impedance and output admittance on loading effect.

1'(b) A four dial decade box has 
decade \( a \) of \( 10 \times 100 \, \Omega \pm 0.1\% \), decade \( b \) of \( 10 \times 10 \, \Omega \pm 0.1\% \),
decade \( c \) of \( 10 \times 1 \, \Omega \pm 0.5\% \), decade \( d \) of \( 10 \times 1 \, \Omega \pm 1.0\% \),
It is set at 4639 \( \Omega \). Find the percentage limiting error and range of resistance value.

| 2    | What are "Electrodynamometer" types of instruments? Derive torque equation and explain its operation with D.C. and A.C. | [12] |

OR

2'(a) How can 3-\( \Phi \) power measurement be performed using one 1-\( \Phi \) wattmeter? Explain.

2'(b) The operating coil of a 250 V moving iron voltmeter has a resistance of 500 \( \Omega \) and inductance of 0.1 H. The series resistance is 2000 \( \Omega \). The instrument reads correctly when a direct voltage of 250 V is applied. What will it read when 250V at 50Hz is applied? With what value of capacitance must the series resistance be shunted to make the meter read correctly at 50Hz?
3. Give a schematic of "Drysdale's Polar Potentiometer". Explain its standardisation and principle of operation.

4(a) Explain "Step by Step Method" to obtain the B-H curve of magnetic specimen.

4(b) Why should not secondary winding be open when C.T. is in operation? Explain

OR

4'. A.C.T. of turn ratio 1:199 is rated as 1000/5, 25VA. The core loss and magnetising component of the primary current are 4 and 7 A under rated conditions. Determine the phase angle and ratio errors for the rated burden and rated secondary current at 08. p.f. lagging and 08. p.f. leading. Neglect the resistance and leakage reactance of secondary winding.

5(a) Describe the "Saw-tooth" wave generator.

5(b) Explain the "Electrostatic Focusing" of CRO.
Maximum Marks: 60
Credits: 04
Duration: Three Hours

Answer all the questions.
Assume suitable data if missing.
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<table>
<thead>
<tr>
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<th>M.M.</th>
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<tbody>
<tr>
<td>1(a)</td>
<td>Explain the function <code>ceil(x)</code>, <code>floor(x)</code> and <code>fix(x)</code> with the help of examples.</td>
<td>[06]</td>
</tr>
<tr>
<td>1(b)</td>
<td>Write a script file to generate the Fibonacci series and also compute the sum of the series up to 'n' number of lines.</td>
<td>[06]</td>
</tr>
</tbody>
</table>

Fibonacci series: 0 1 1 2 3 5 8 13 ... n

**OR**

1'(a)  | Compute the value of `rem(floor(125*ceil(36.5)/7.8))` and also show the steps involved.                                                                                                           | [03] |
1'(b)  | Explain in detail for and while loops with examples.                                                                                                                                              | [06] |
1'(c)  | Write a script file to find the sum of the digits of a number.                                                                                                                                  | [03] |
2(a)   | What are multidimensional structures? Explain with an example.                                                                                                                                    | [04] |
2(b)   | Explain linear and subscript indexing for matrix in MATLAB with example.                                                                                                                           | [04] |
2(c)   | What is the relation between `linspace(a,b,n)` and `u=x:y:z`                                                                                                                                     | [02] |
2(d)   | Write a command to sort the matrix B row wise. Also write a command to generate an identity matrix `I` of order 4X4.                                                                                 | [02] |

**OR**

2'(a)  | What are the different methods for concatenation of matrices in MATLAB. Give examples.                                                                                                           | [02] |
2'(b)  | Create an embedded structure to store information (author, price, publisher, year of publication etc.) of 3 electrical, 2 civil and 1 computer book.                                                   | [04] |

Contd........2
2(c) Write a program to display the following chart. The program should perform the respective operation when a particular option is selected. This task is to be repeated until the option for exit is entered. (Refer to Fig.1.)

1. Average value of alternating voltage
2. R.M.S. value of ac voltage
3. Form factor
4. Peak factor
5. Power consumed in the circuit
6. Plot voltage versus time curve
7. Exit

\[ V_{\text{average}} = 0.637V_{\text{max}}, \quad V_{\text{rms}} = V_{\text{max}}/\sqrt{2}, \quad PF = \text{RMS value/Average value}, \quad \text{PF} = \text{Max value/RMS value, } f = 50 \text{ Hz} \]

\[ \text{R} = 10 \Omega \]

3(a) What is a workspace? Explain the function of which, what and whose command when executed by MATLAB.

3(b) What is the function of \texttt{HI} and \texttt{help text} lines in a function. What output will MATLAB display when exist command is executed when used with a function name?

3(c) Write a function to check whether the given number is palindrome or not. Also write a script file which checks the number of digits of the entered number, then if the number have more than one digit it calls the palindrome function else display the required message.

4(a) What do you mean by Simulink?

4(b) Write & explain the steps involved to build the model shown in Fig.2. using model building command and actions.
What output will you obtain after running the above simulation model?

5(a) Write a program to plot the curve: $P(t) = P_0 e^{-ot}$

<table>
<thead>
<tr>
<th>t</th>
<th>0</th>
<th>0.5</th>
<th>7.0</th>
<th>9.0</th>
<th>10.0</th>
<th>20.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>760</td>
<td>625</td>
<td>528</td>
<td>85</td>
<td>14</td>
<td>0.16</td>
</tr>
</tbody>
</table>

Also give the necessary labels, title and grid to the plot.

5(b) Write a script file to find the roots of the given polynomial:

$$x^5 - 3x^3 + x^2 - 9 = 0$$

5(c) Write a program to solve the first order linear differential equation $dx/dt = x + t$ with the initial conditions $x(0) = 0$. Also give the necessary labels and title to the plot.

OR

5'(a) Write a function to solve the equation of motion of a non-linear pendulum:

$$\ddot{\Theta} + \alpha^2 \sin(\Theta) = 0$$

With the initial conditions: $\Theta(0) = 1, \dot{\Theta}(0) = 0$

5'(b) What is the function of `cumtrapz(X)`, `sort(A,2, 'descend')` and `diff(x)` command. Give examples.

5'(c) Write a program to evaluate the following integral:

$$I = \int_0^1 \int_0^2 (1 - 6x^2y) \, dx \, dy$$

Explain the steps involved.
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) Differentiate between the following: [06]

   i. Even and Odd signals
   ii. Energy and Power signals
   iii. Deterministic and Random Signals

1(b) Draw the waveforms of the following signals:

(i) \( x(t) = u(t) + r(t) - 2r(t-1) + r(t-2) - u(t-2) \)
(ii) \( y(t) = -u(t+1) + r(t+1) - r(t-1) - u(t-1) \)

OR

1'(a) Determine whether the following CT signals are periodic or not? If periodic determine fundamental period [06]

(i) \( \cos(100\pi t) + \sin(50\pi t) \)  
(ii) \( e^{-t} \)  
(iii) \( \cos^2(2\pi t) \)

1'(b) For a system with \( x(t) \) as input and \( y(t) \) as output, determine whether it is [06]

(i) memoryless  
(ii) stable  
(iii) causal  
(iv) linear  
(v) time-invariant.

\[
    y(t) = \begin{cases} 
    0 & t < 0 \\
    x(t) + x(t-2) & t \geq 0 
    \end{cases}
\]

2(a) Differentiate between zero-input and zero-state response of a system [04]

2(b) Find \( y(t) \) the zero-input component of the response for an LTI system described by [08]

the following differential equations:

(i) \( (D^2 + 6D + 9)y(t) = (3D + 5)f(t) \) with initial conditions \( y_0(0) = 3 \) and \( y_s(0) = -7 \)

(ii) \( (D^2 + 4D + 40)y(t) = (D + 2)f(t) \) with initial conditions \( y_0(0) = 2 \) and \( y_s(0) = 16.78 \)

OR

Contd.......2
2(b)

Impulse response of an LTI system is given by: 

\[ h(t) = \begin{cases} 
  e^{-2t} & t \geq 0 \\
  0 & \text{else} 
\end{cases} \]

Find and sketch the system output if the input is: 

\[ x(t) = \begin{cases} 
  A & 0 \leq t \leq 2 \\
  0 & \text{else} 
\end{cases} \]

3(a)

How do we interpret a negative frequency in the spectrum?

3(b)

Find the exponential Fourier series for the periodic signal 

\[ x(t) = \frac{10}{2\pi} \]

with period \( T = 2\pi \). Using the coefficients of this exponential series, obtain the trigonometric Fourier series coefficients.

OR

3(b')

Find the Fourier Transform of the Signum function. Use the result to obtain the Fourier Transform of unit step function.

4(a)

Find the unilateral Laplace Transform of 

\[ x(t) = e^{-t}(t - 2)u(t - 2) \]

Specify the properties used.

4(b)

Consider the system \( S \) characterized by the differential equation:

\[ \frac{d^3 y(t)}{dt^3} + 6 \frac{d^2 y(t)}{dt^2} + 11 \frac{dy(t)}{dt} + 6y(t) = x(t) \]

(i) Determine the zero-state response of this system for the input 

\[ x(t) = e^{-t}u(t) \]

(ii) Determine the zero-input response of the system for \( t > 0 \) given that: 

\[ y(0^+) = 1, \quad y'(0^+) = -1, \quad y''(0^+) = 1. \]

5(a)

Use power series expansion to determine the time-domain signal corresponding to the following z-transforms:

(i) \( X(z) = \frac{1}{1 - z^{-2}}, \quad |z| > 1 \)  
(ii) \( X(z) = \frac{1}{1 - z^{-2}}, \quad |z| < 1 \)

5(b)

Determine the \( z \)-transform of the following signal:

\[ x[n] = \left( -\frac{1}{2} \right)^n u[n] * \left( \frac{1}{4} \right)^n u[-n] \]. Specify the properties used.
Maximum Marks: 60  Duration: Three Hours

Assume suitable data if missing.

Notations used have their usual meaning.

1 (a) Define indefinite admittance matrix and write its properties. [6]
(b) Find short circuit admittance parameters of the circuit shown in fig.1. [6]

OR

1' (a) Derive the relationship for current gain (A) and input impedance (Z_in) in case of hybrid model equivalent circuit of a transistor. [6]
(b) Determine the IAM for the network shown in fig.2 under the following conditions:
   i) All nodes are accessible
   ii) Node 4 is suppressed

2 (a) Design a band pass filter to operate into input and output resistance of 100 Ω and have a pass band between 4.8 KHz and 5.2 KHz. [6]
(b) What is a filter? Define pass band, stop band and cut off filter frequency. Also mention the advantages of active filters. [6]

OR

2' (a) Obtain m-derived filter π-section from constant K-prototype π-section. [6]
(b) Derive a mathematical expression to show that the resonant frequency of individual arms of a constant K band filter is the geometrical mean of upper and lower cutoff frequencies. [6]

3 (a) For the network shown in fig.3, draw network graph. Also draw its possible trees. [6]
(b) For the graph shown in fig.4, find the tie set and cut set matrix. [6]

OR

(b) Define the fundamental loop and fundamental cutset matrix. Prove that:

\[ A = A_U - (B^{-1}D)' \]

4 (a) Realize the given RC network impedance function using Foster II form: [6]

\[ Z(s) = \frac{(s + 1)(s + 4)}{s(s + 2)} \]

(b) Write the properties of positive real functions. Check whether the function

\[ F(s) = \frac{3s^2 + 15}{s(s^2 + 1)} \]

is positive real?

Contd......2
5 (a) Obtain the state transition matrix of the following system:

\[
\begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} -5 & -1 \\ 6 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 1 \\ 0 \end{bmatrix} u
\]

where \( u(t) \) is the unit step function at \( t=0 \). It is given that the system is initially relaxed.

(b) List the advantages of state variable analysis.

\[\text{Fig. 1}\]

\[\text{Fig. 2}\]

\[\text{Fig. 3}\]

\[\text{Fig. 4}\]
1(a) State Gauss's law in point form and hence deduce Poisson's equation. 

\[ J = \frac{100}{\rho^2} A \rho \frac{A}{m^2}, \text{ Find} \]

(i) The rate of increase in the volume charge density
(ii) The total current passing through the surface defined by
\[ \rho - 2m, 0 < z < 2m, 0 < \phi < 2\pi \]

1(b) Region 1, \( z < 0 \) contains a perfect dielectric for which \( \varepsilon_1 = 2.5 \), while region 2, \( z > 0 \) is characterized by \( \varepsilon_2 = 4 \). Let \( \mathbf{E}_1 = -30\hat{a}_x + 50\hat{a}_y + 70\hat{a}_z \) V/m. Find: (i) \( \mathbf{D}_2 \) (ii) \( \mathbf{P}_2 \)

(iii) the angle between \( \mathbf{E}_1 \) and normal to the surface

OR

1'(a) Derive the relationship that governs the behaviour of \( \mathbf{D} \) and \( \mathbf{E} \) at the boundary separating the two dielectric media characterized by \( \varepsilon_1 \) and \( \varepsilon_2 \), and also determine the boundary conditions for a conductor - dielectric interface.

1'(b) Derive the relation for electric field due to a volume charge.

2(a) Stat Ampere's law in point form as well in integral form.

With the help of Ampere's law derive an expression for magnetic field intensity due to an infinitely long coaxial transmission line carrying a uniformly distributed total current \( I \) in the central conductor and \(-I\) in the outer conductor.

2(b) Region 1, described by \( 3x + 4y \geq 10 \), is free space whereas region 2, described by \( 3x + 4y \leq 10 \), is a magnetic material for which \( \mu = 10\mu_0 \). Assuming that the boundary between the material and free space is current free, find \( \mathbf{B}_2 \) if \( \mathbf{B}_1 = 0.1\hat{a}_x + 0.4\hat{a}_y + 0.2\hat{a}_z \) Wb/m².

OR

Contd.....
2'(a) Why concept of magnetic vector potential considered to be more appropriate for practical problems involving magnetic field? Derive the relationship between magnetic vector potential and electrostatic potential with the help of Ampere's law and Poisson's equation.

2'(b) Given the magnetic vector potential \( \mathbf{A} = -\mathbf{r} / 4a \), Wh/m, calculate the total magnetic flux crossing the surface \( \phi = \pi / 2, 1 \leq \rho \leq 2m, 0 \leq z \leq 5m \).

3(a) State Faraday's law of electromagnetic induction. What is its physical significance? With the help of Faraday's law discuss the concept of transformer and motional e.m.f.

3(b) A parallel-plate capacitor with plate area of 5 cm² and plate separation of 3 mm has a voltage 50 sin100t V applied to its plates. Calculate the displacement current assuming \( \varepsilon_r = 2\varepsilon_0 \).

4(a) Derive expression for electromagnetic wave propagation in a linear, isotropic, homogenous, lossy dielectric medium. With the help of above expression define following: Attenuation factor (\( \alpha \)), Wave number (\( \beta \)) and Intrinsic impedance (\( \eta \)).

4(b) A lossless transmission line is 80 cm long and operates at a frequency of 600 MHz. The line parameters are \( L = 0.25 \) \( \mu F/m \) and \( C = 100 \) F/m. Calculate characteristic impedance, the phase constant and the phase velocity.

OR

4' (a) State and prove Poynting theorem and explain the relevant terms used. Also show that the Poynting theorem follows the energy conservation argument for EM field. Derive the expression for average power.

4'(b) A lossy dielectric has an intrinsic impedance of 200±10 \( \Omega \) at a particular frequency. If at that frequency the plane wave propagating through the dielectric has the magnetic field component

\[
H = 10 e^{-\pi x} \cos \left( \omega t - \frac{1}{2} x \right) a_y A/m
\]

Find \( E \) and \( \alpha \). Determine the skin depth and wave polarization.

5(a) Name the two numerical methods to find electric field distribution. Discuss all the four steps involved in Finite Element analysis for estimation of electric field.

5(b) Define electromagnetic field. Discuss its effects and applications in real life.
### Question

1(a) Convert Gray code 1011 to BCD.

1(b) Find the F's complement of (FABE)_10 and 6's complement of (5452)_6.

1(c) Represent -12110 and 7510 in signed 2's complement using 10-bits.

OR

1(c') Signed 2's complement representation of two numbers A & B is

\[ A = 11101001 & B = 10101010 \]

Find A-B & B-A

1(d) Construct EX-OR gate by using 2-input NAND gates only.

2(a) Sketch the circuit of 2-input TTL NAND (totem pole) gate.

OR

2(a') Draw the transfer characteristic of CMOS inverter marking all regions of operations of transistors.

2(b) Realize the following function using CMOS:

\[ Y = (AB+C) \overline{D} \]

2(c) Design a transistor (BJT) inverter to operate from a 1.5V supply with the input connected to the 1.5V supply through a resistance equal to R_C, the total power dissipated should be 1mW and forced \( \beta \) should be 10. Use \( V_{BE} = 0.7V \) and \( V_{CEsat} = 0.2 \)

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Contd......

---
3(a) Simplify the following Boolean function $F$, together with the don't care conditions in POS and SOP form.
\[
F(A, B, C, D) = \Sigma(1, 3, 5, 7, 9, 15) \\
d(A, B, C, D) = \Sigma(4, 6, 12, 13)
\]
3(b) Design a 5x32 decoder using four 3x8 decoders.

3(b') Design a 4 to 1 line multiplexer. Also write the output expression in terms of inputs and select lines.

3(e) Show the diagram of 16x5 ROM.

4(a) Draw the diagram for a MOD-16 up counter. What will be the state of counter after 237 clock cycles?

4(a') Explain the operation of Master Slave flip flop.

(i) Show how a J-K flip flop can be operated as a toggle FF.

4(b) What will be the frequency at the output of each flip flop of a 6-bit ripple counter?

Find same for 6-bit synchronous counter.

4(c) What is the difference between RAM & ROM? Show the timing diagram of write cycle of SRAM.

5(a) A 12-bit (three digit) DAC which uses the BCD input code has a full scale output of 9.99V. Determine the step size, the percentage resolution and the value of $V_{out}$ for input code of 011010010101.

5(a')(i) Show the diagram of digital ramp Analog to Digital converter.

(ii) An 8-bit digital ramp ADC with a 40mV resolution uses a clock frequency of 2.5MHz and a comparator with $V_T = 1$ mV. Determine digital output for $V_X = 6.0$ V. Also find maximum conversion time.

5(b) Compare the performance of Successive Approximation ADC, Digital Ramp ADC and Flash ADC in terms of conversion time and complexity of circuit.
2012 – 2013

B. TECH. WINTER (IV SEMESTER) EXAMINATION
(ELECT./CHEMICAL/MECH./PETRO-CHEMICAL ENGINEERING)
COMMUNICATION SKILLS
[TU - 202]
CREDITS – 04

Max. Marks: 40

Note: Answer all questions.

Duration: Three Hours

UNIT – I

1. You bought a laptop from DELL VISION, ALIGARK with a warranty of two years. After six months you discover that the screen gets blurred every now and then and the sound system is also giving trouble. Write a letter to the dealer complaining about the problem and requesting him to get the defects repaired or replace it.

OR

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

THE HINDU

THE GULF ENGINEERING SERVICES
19, K.G. Marg, New Delhi

May 10, 2013

Applications are invited from all branches of fresh engineering graduates to work in different projects such as Metro Rail, Oil Fields etc. in Saudi Arabia. Apply with a detailed CV.

Excellent communication skills in English is a must. Working knowledge of Arabic will be an added advantage. Those who do not have a valid passport need not apply.

Last Date: May 30, 2013

UNIT – II

2. Define and draft any one of the following business messages assuming an appropriate business situation.

(a) Telex
(b) Memo
(c) e-mail

UNIT – III

3. Make note or write an abstract of the following passage:

- The Scandinavian countries are much admired all over the world for their enlightened social policies. Sweden has evolved an excellent system for protecting the individual citizen from high-handed or incompetent public officers. The system has worked so well that it has been adopted in other countries like Denmark, Norway, Finland and New Zealand. Even countries with large populations are now seriously considering imitating the Swedes.

Contd….2,
The Swedes were the first to recognize that public officials like civil servants, police officers, health inspectors or tax collectors can make mistakes or act over-zealously in the belief that they are serving the public. As long ago as 1809, the Swedish Parliament introduced a scheme to safeguard the interest of the individual. A parliamentary committee representing all political parties appoints a person who is suitably qualified to investigate private grievances against the State. The official title of the person is ‘Justice of Ombudsman’, but Swedes commonly refer to him as the ‘J.O.’ or ‘Ombudsman’.

The Ombudsman is not subject to political pressure. He investigates complaints large and small that come to him from all levels of society. As complaints must be made in writing, the Ombudsman receives an average of 1200 letters a year. He has eight lawyer assistants to help him, and he examines every single letter in detail. There is nothing secretive about the Ombudsman’s work, for his correspondence is open to public inspection. If a citizen’s complaint is justified, the Ombudsman will act on his behalf. The action he takes varies according to the nature of the complaint. He may gently reprimand an official or even suggest to Parliament that a law be altered. The following case is a typical example of the Ombudsman’s work.

A foreigner living in a Swedish village wrote to the Ombudsman complaining that he had been ill-treated by the police, simply because he was a foreigner. The Ombudsman immediately wrote to the Chief of Police in the district asking him to send a record of the case. There was nothing in the record to show that the foreigner’s complaint was justified and the Chief of Police stoutly denied the accusation. It was impossible for the Ombudsman to take action on the complaint, but when he received a similar complaint from another foreigner in the same village, he immediately sent one of his lawyers to investigate. The lawyer ascertained that a policeman had indeed dealt roughly with foreigners on several occasions. The fact that the policeman was prejudiced against foreigners could not be recorded in the official files. It was only possible for the Ombudsman to find this out by sending one of his representatives to check the facts on the spot. The policeman in question was severely reprimanded and was informed that if any further complaints were received against him, he would be prosecuted. The Ombudsman’s prompt action in the matter put an end to an unpleasant practice which might have gone unnoticed.

UNIT - IV

4. Generate a group discussion choosing one of the following topics with at least four participants.
   (a) The changing value system – a need for re-orientation
   (b) The future of information technology
   (c) Increasing crime against women in India: Causes and ways to curb.

UNIT - V

5. Write the transcript of a telephonic conversation you had with the receptionist of a Guest House in Bangalore to book a room for three days as you are going there to attend a seminar.

OR

Reproduce the transcript of a job interview you have attended recently with three interviewers as a fresher.