Q.No.  
1(a) A three-phase, 1500kVA, 11kV, star connected alternator has per phase synchronous impedance \( Z_s = 1+j20 \Omega \). Calculate voltage regulation and power angle for a load of 1200kW at power factors of: (a) 0.8 lagging (b) unity (c) 0.8 leading. 

1(b) Explain how values of \( X_d \) and \( X_q \) of a synchronous machine are measured experimentally by slip test? Discuss the necessary precautions. 

OR 
1(b') Derive the expression for power developed by a three-phase non-salient pole alternator. Draw and explain the power-load characteristics. 

2(a) The open circuit characteristics of a three-phase, 50Hz, 11kV star-connected alternator is as under:

<table>
<thead>
<tr>
<th>Field current, A</th>
<th>10</th>
<th>15</th>
<th>20.5</th>
<th>25</th>
<th>30</th>
<th>35</th>
<th>40</th>
<th>45</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excitation emf. kV</td>
<td>6.45</td>
<td>9.0</td>
<td>11</td>
<td>12.2</td>
<td>13.25</td>
<td>14.0</td>
<td>14.5</td>
<td>15.0</td>
</tr>
</tbody>
</table>

A field current of 18A is required to circulate full load armature current of 780A during short circuit test. The field current for rated terminal voltage under full load zero power factor condition is 5.25A, armature resistance is 0.2 \( \Omega \). Find voltage regulation at full load current of 780A at 0.8 lagging power factor using zero power factor method. 

2(b) What is the effect of governor characteristics on load sharing of alternator? 

OR 
2(b') Explain Potier’s triangle method of determining the voltage regulation of an alternator. 

3(a) Derive expression for synchronising power coefficient and synchronising torque coefficient for a cylindrical rotor synchronous machine. 

3(b) What are V-curves and inverted V-curves of a three-phase synchronous motor?
3(b') Explain hunting of a synchronous machine. What is the purpose of damper winding in synchronous motor?

4(a) Describe with suitable diagram how external characteristic of a separately excited DC generator is obtained. Explain the effect of variation of field current resistance on no load voltage.

4(b) Explain armature reaction in DC machines with suitable diagram. Explain the effect of armature reaction on the main field flux distribution.

OR

4(b') Define commutation. With neat diagram explain the commutation process in DC machine.

5(a) Describe the method of Hopkinson's test on two dc shunt machines. How the efficiency of two machines determined?

5(b) Explain construction and operating principle of a repulsion motor. Comment on its characteristics.

OR

5(b') Explain construction and working principle of a permanent magnet DC motor. What are its main advantages and disadvantages?
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 the primary standard for Luminous intensity.</td>
<td>[06]</td>
</tr>
<tr>
<td>1(b)</td>
<td>Define the terms (a) accuracy (b) drift (c)reproducibility (d) static error</td>
<td>[04]</td>
</tr>
<tr>
<td>1(c)</td>
<td>Write dimensional equations for emf in both electrostatic and electromagnetic systems.</td>
<td>[02]</td>
</tr>
</tbody>
</table>

OR

1'(a) Explain the Lorentz method for determination of absolute ohm. Describe the precautions taken to minimize the error.

1'(b) Three resistors have the following ratings:  
\[ R_1 = 37\Omega \pm 5\%, \quad R_2 = 50\Omega \pm 5\%, \quad R_3 = 75\Omega \pm 5\% \]  
Determine the magnitude of resultant resistance and limiting error in ohm and in percentage if the above resistances are connected in (a) series and (b) in parallel.

<table>
<thead>
<tr>
<th>Q.No.</th>
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<th>M.M.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2(a)</td>
<td>Derive the expression for deflecting torque in moving iron type instruments. Comment upon the shape of scale.</td>
<td>[07]</td>
</tr>
<tr>
<td>2(b)</td>
<td>Describe the different methods of producing controlling torque in an analog indicating instruments. List their advantages and disadvantages.</td>
<td>[05]</td>
</tr>
</tbody>
</table>

OR

2'(a) How is the current range of a PMMC instrument extended with help of shunts?  
Describe a method of reducing error due to temperature changes in shunt connected instruments.

2'(b) The inductance of a moving iron ammeter with a full scale deflection of 90° at 1.5 A, is given by the expression \( L = (200 + 400 - 40^2 \cdot \theta^2) \, \mu H \), where \( \theta \) is the deflection

Contd.....2.
in radians from the zero position. Estimate the angular deflection of the pointer for a current of 1.0 A.

3(a) Describe the working of Kelvin's double bridge method for low resistance measurement. What are the different problems associated with measurement of low resistance?

3(b) Discuss Drysdale phase shifting transformer used in ac potentiometer.

4(a) Describe the Lloyd Fisher square for measurement of iron loss in a magnetic specimen.

4(b) Describe the use of sphere gap for measurement of peak voltage. Explain their advantages and disadvantages.

OR

4'(a) Draw the phasor diagram of current transformer. Derive the expression ratio and phase angle error.

4'(b) Explain the methods of separation of iron losses if the maximum value of flux density is maintained constant and

(a) frequency is varied keeping the form factor constant.

(b) form factor is varied keeping the frequency constant.

5(a) Derive the expression of output voltage in terms of two input voltage of a 3 amplifier configuration of an instrument amplifier.

5(b) Write a short note on CRO.
MAXIMUM MARKS: 60

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

1(a) Evaluate in steps showing precedence.
   a. \( 2 > 3 | 5 \ - 16 / 8 + \ ~ (4 * 42 / 7 \ > 9 \ - \ ~ 0) \)
   b. \( (24 / 6 * 4 \ ~ = \ 8 + 50 / 5 - 2 * 3 \ > 9 = = 9) + 1 \)

(b) Write a program in MATLAB to calculate the following sum
    \[ S = \frac{1^2}{1!} + \frac{3^2}{2!} + \frac{5^2}{3!} + \ldots \text{for first 10 terms} \]

(c) Write a program in MATLAB to find the sum of digits of a two digit number.
    OR

(c') What are the various data types in MATLAB. Explain with examples.

2(a) If vectors \( X \) and \( Y \) are given as
    \( X = [2 \ 3 \ 4], \ Y = [2 \ 5 \ 1] \)

    Find
    i) \( \text{xor}(\sim X, X \& \sim Y) \)
    ii) \( X \sim \sim Y | X > Y \)

(b) For the matrix given below
    \[
    A =
    \begin{bmatrix}
    9 & 2 & 3 & 9 \\
    2 & 5 & 7 & 2 \\
    9 & 2 & 3 & 9 \\
    \end{bmatrix}
    \]

    Find
    a. \( A (: , 1:3) \)
    b. \( A ([2], 2:4) \)

Contd.......2
c. \( A(2,:) ; 3 \)
d. \( A(1: end-1, end-1 : 4) \)

(c) Explain the following
   a. \( \text{Plot}(x,y,'-b',a,b,'g:','c,d,'r') \)
   b. \( \text{hold on and hold off} \)

3(a) What are the parts of a M-file function? Explain each of them in detail.

(b) Write a function named “primefactors” in MATLAB to display the prime factors of N, N could be taken as the argument.

(c) Ten numbers are entered from the keyboard into an array. The number to be searched is entered through the keyboard by the user. Write a program to find if the number to be searched is present in the array and if it is present, display the number of times it appears in the array and its position.

OR

(c') A positive integer is entered through the keyboard, write a function to find the binary equivalent of this number.

4. Obtain the block diagram simulation model for implementing a PV cell in SIMULINK. Assume the equivalent circuit shown in the figure. Assume \( I_0, a, R_{sh}, R_s, I_o \) to be constant under STC as provided by manufacturer.

OR

4'. Obtain the block diagram steady state simulation model of a dc series motor in SIMULINK. The model should plot the torque vs armature current, speed vs armature current, torque vs speed characteristic.
5. Answer **ANY TWO** of the following:

(a) Define the following
   1. LTI system
   2. Causal system

Write a program to plot the following basic signals
   1. unit step with a delay of 3 units.
   2. ramp of slope 2

(b) Write a program to solve the first order ordinary differential equation
\[ \frac{dx}{dt} = x + t. \] With the initial conditions \( x(0) = 0. \) How the plot for \( x \) versus \( t \) is incorporated in the program.

(c) Write a program in MATLAB to plot the step and impulse time response of a second order system. The program should ask the user to input the values of natural frequency, damping ratio and then calculate rise time, peak time, max. overshoot and settling time.

(d) Write a program to fit the polynomial of degree 2 for the data given below. The program should plot the curve also.

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>x</td>
<td>3</td>
<td>8</td>
<td>10</td>
</tr>
<tr>
<td>y</td>
<td>22</td>
<td>79</td>
<td>107</td>
</tr>
</tbody>
</table>

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2015-16  
B.E. (WINTER SEMESTER) EXAMINATION  
ELECTRICAL  
SIGNALS & SYSTEMS  
EEE-282N

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.  
1(a)  
(i) Write the characteristics of a Linear time invariant system.  
(ii) Find odd and even decomposition of discrete time signal $x[n]$ given by:  
$$x[n] = [-2, 1, 2, -1, 3]$$  
for $n = -2, -1, 0, 1, 2$.  

1(b) Determine whether the system defined by $y[n] = n \times x[n]$ is:  
(a) Linear or non-linear  
(b) Time-variant or time-invariant  
(c) Stable or Unstable  

2(a) Find the zero input response of a LTIC system described by:  
$$(D^2 + 4D + 4)y(t) = (3D + 5)f(t); \quad y_0(0) = 3; \quad y_0(0) = -7$$  
where $f(t)$ is the input and $y(t)$ is the output.  

2(b) Obtain the state variable representation of the network shown in Figure 1.  

![Figure 1](image_url)  

OR  

2(b') Find the convolution of the two continuous-time signals:  
$$f(t) = 3\cos(t), \text{ for all } t \quad \text{and} \quad g(t) = e^{-t}.$$  

Contd...2.
3(a) Find the trigonometric Fourier series for the waveform shown in Figure 2

3(b) Find the exponential Fourier series for the waveform given in Figure 3

OR

3'(a) Find the Fourier transform of the continuous time signal \( x(t) = e^{-at} u(t) \). Also plot magnitude and phase spectrum of \( x(t) \).

3'(b) What are the benefits of Fourier transform over Fourier series? Write the sufficient conditions of a signal for its Fourier transform to exist?

4(a) The unit step response of an LTI system is given by \( s(t) = (1 - e^{-t} - te^{-t}) u(t) \). For a certain input \( x(t) \) the output is obtained to be equal to \( y(t) = (2 - 3e^{-t} + e^{-3t}) u(t) \). Find \( x(t) \).

4(b) Determine the unilateral Laplace transform of \( x(t) = \cos(t) \) and show the Region of convergence on s-plane

OR

4'(a) Derive the relationship between Laplace transform and Continuous time Fourier transform. Also mention the properties of ROC on s-plane.

Contd.....3.
4'(b) Find the response $y(t)$ of an LTI system with the transfer function

$$H(s) = \frac{1}{s+5}, \quad R(s) > -5$$

and the input is

$$x(t) = e^{-t} u(t) + e^{-2t} u(-t).$$

5(a) Mention the difference between unilateral and bilateral z-transform in analysis of signals & systems. Compute the unilateral and bilateral z-transform of the signal $x(t) = a^n$.

5(b) Find the z-transform of the signal $g(n) = |n| a^{|n|}$. Also depict its ROC.
2015-16
B.E. (WINTER SEMESTER) EXAMINATION
ELECTRICAL
ELECTROMAGNETIC FIELD THEORY
EEE-285N

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)          Three uniform line charges of infinite length and with \( p_1 = 3 \text{nCm}^{-1} \) are placed along the \( x, y, z \) axes of the coordinate system. Find the electric field \( \vec{E} \) along the line \( x = y \) in the region \( x > 0, y > 0 \) and \( z = 0 \). [06]

1(b)          Four identical 3nC charges are located at \( P_1(1,1,0), P_2(-1,1,0), P_3(-1,-1,0), \) and \( P_4(1,-1,0) \). Find the electric field \( \vec{E} \) and the potential \( V \) at the point \( P(1,1,1) \). [06]

   OR

1'             Derive the expression for Energy Density in the electrostatic field. [12]

2(a)          A certain magnetic field in free space is given as \( \vec{B} = \frac{20 \mu_0 (x\hat{a}_x + y\hat{a}_y)}{x^2 + y^2} \). Find the current density \( \vec{J} \). [06]

2(b)          Assume that \( \mu_1 = 4 \mu \text{H/m} \) in region-1 (\( z > 0 \)) and \( \mu_2 = 7 \mu \text{H/m} \) in region-2 (\( z < 0 \)). If the sheet current density on the surface \( z = 0 \) is \( \vec{K} = 80 \hat{a}_x \text{A/m} \) and \( \vec{B}_i = 2\hat{a}_x - 3\hat{a}_y + \hat{a}_z \text{ mT} \) in region-1, then evaluate \( \vec{B}_2 \) in region-2. [06]

   OR

2'(a)         Derive the expression for the magnetic field due to straight wire of finite length carrying a current \( I \). [07]

2'(b)         Write the expression and statement of Ampere’s circuital law. Also describe how to choose an Amperian path. [05]

Contd......2.
3 Write the expression and statement of Integral form and Point form of Ampere-Maxwell law. Also, describe the meaning of each term in the expressions. [12]

OR

3' The displacement current density is given to be \( \vec{J}_D = 5\cos(10^8 t - k z)\hat{x} \, \mu\text{Am}^{-2} \) in a material for which \( \sigma = 0, \varepsilon = 5\varepsilon_0 \) and \( \mu = 4\mu_0 \). Determine \( \vec{D}, \vec{E}, \vec{B} \) and \( \vec{H} \). [12]

4 Derive the expression of wave equation for both free space and conducting medium. [12]

5(a) Write a note on the sources of electromagnetic field and its effect on human health. [04]

5(b) Describe various applications of electromagnetic field. [04]

5(c) Describe the Finite Difference Method (FDM) to solve a partial differential equation. [04]
2015-2016
B. E. (IV SEMESTER) EXAMINATION
(ELECTRICAL)
LOGIC AND DIGITAL CIRCUITS
(EEL – 203)

Max Marks: 60
Duration: Three Hours

Note: Answer all questions. Abbreviations used have their usual meanings. Assume suitable data, if missing.

1. (a) What do you understand by Boolean Theorems? State all the Boolean theorems with proof. [07]
   (b) Prove that NAND gate is universal gate.
   (b’) Represent each of the following signed decimal numbers in the 2’s complement system. Use a total of eight bits, including sign bit.
      (i) -23  (ii) +112  (iii) -100  (iv) +41
      (v) +89  (vi) -104  (vii) -1  (viii) +125 [05]

2. (a) How will you implement NAND gate using TTL logic? Explain the operation with clear diagrams in both HIGH and LOW case of the output.
   (b) With the help of clear circuit diagrams explain the operation of ECL OR/NOR gate.
   (b’) Implement the following functions using CMOS logic having minimum number of transistors.
      (i) \( y = A + \overline{B} + \overline{C}D \)  (ii) \( z = \overline{PQ} + RS \) [04]

3. (a) Design a 4-to-16 line decoder.
   (b) Minimize the following functions using k-map:
      (i) \( y = \Sigma (0, 1, 2, 4, 6, 7, 10, 12, 13, 15) \)
      (ii) \( x = \pi (1, 2, 3, 5, 9, 12, 13, 14, 15) \)
      Draw the minimized circuit also.
   (b’) What do you mean by programmed and not programmed FAMOS? Explain with clear diagrams.
   (c) Design a 8 x 4 bit MOS ROM having following stored words.

   \[
   \begin{array}{c|cccc}
   & b_3 & b_2 & b_1 & b_0 \\
   \hline
   W_0 & 0 & 0 & 0 & 1 \\
   W_1 & 1 & 0 & 1 & 1 \\
   W_2 & 1 & 1 & 0 & 0 \\
   W_3 & 1 & 0 & 1 & 0 \\
   W_4 & 0 & 0 & 1 & 1 \\
   W_5 & 0 & 1 & 0 & 0 \\
   W_6 & 1 & 0 & 0 & 1 \\
   W_7 & 1 & 0 & 0 & 0 \\
   \end{array}
   \]

4. (a) Design a MOD – 13 synchronous counter and draw the designed circuitry.
   (b) What are shift Register and what are their different types?
   (b’) Explain the cell structure of static RAM.

5. (a) Explain the working of successive approximation type ADC, with example.
   (b) Describe how R-2R ladder DAC converts a digital input to analog data. How this type of DAC is better than weighted Resistor DAC?

*****