2016-17
B.E. (WINTER SEMESTER) EXAMINATION
ELECTRICAL
ELECTRICAL MACHINES-II
EEE-213

Maximum Marks: 60  Credits: 04  Duration: Two Hours

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

Q.No.  Question  M.M.

1(a)  Briefly discuss the phenomenon of armature reaction in synchronous generators. What is its effect when the generator is delivering a load current at (i) purely lagging power factor (ii) purely leading power factor.  [06]

1(a') Briefly discuss how the direct axis synchronous reactance (X_d) and quadrature axis synchronous reactance (X_q) of a salient pole alternator are determined using the slip test method.  [06]

1(b) For a salient pole synchronous generator, using the phasor diagram and neglecting the effect of armature resistance, derive an expression for power developed as a function of load angle.  [06]

2(a) Explain the synchronous impedance method for finding the voltage regulation of a 3-phase alternator.  [06]

2(b) A 3-phase, 10 kVA, 400 V, 50 Hz star-connected alternator supplies the rated load at 0.8 power factor lagging. If the armature resistance is 0.5 \( \Omega \) and synchronous reactance is 10 \( \Omega \), find the torque angle and voltage regulation.  [06]

OR

2'(a) What is an infinite bus? What conditions must be satisfied before an incoming alternator is synchronised to an infinite bus?  [05]

2'(b) Two 3-phase alternators operate in parallel. The rating of one machine is 200 MW and that of the other is 400 MW. The droop characteristics of their governors are 4%  [07]

contd... 2.
and 5% respectively from no load to full load. Assuming that the governors are operating at 50 Hz at no load, how would a load of 600 MW be shared between them? What will be the system frequency at this load?

3(a) Describe the principle of operation of three phase synchronous motor. Enumerate the methods used for starting the synchronous motor.

3(b) Discuss direct-axis sub-transient reactance and direct-axis sub-transient open-circuit time constant.

4(a) (i) In dc machines though the brushes are geometrically located along the d-axis, yet in electrical equivalent diagram they are shown along the q-axis, Why?
(ii) On what factors does the magnitude of induced voltage in DC machine depends?
Also explain the reason for making curved stator poles.

4(b) What are Ldi/dt voltages in commutation of dc machines?

OR

4'(a) Discuss simplex lap windings of DC machines in brief.

4'(b) A 12-pole dc generator has a simplex wave-wound armature containing 144 coils of 10 turns each. The resistance of each turn is 0.011 n. Its flux per pole is 0.05 Wb, and it is turning at a speed of 200 rpm.
(a) How many current paths are there in this machine?
(b) What is the induced armature voltage of this machine?
(c) What is the effective armature resistance of this machine? (Ignore the internal armature resistance of the machine.

5(a) Discuss the characteristics of DC series motor.

5(b) With the help of neat diagram discuss the operation of three-point starter employed in dc motor.
2016-17  
B.E. (WINTER SEMESTER) EXAMINATION  
BRANCH: ELECTRICAL  
ELECTRICAL MEASUREMENTS  
COURSE CODE: EEE-251N

Maximum Marks: 60  
Credits: 04  
Duration: Two Hour

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

Q.No.  

Questions  

M.M. 60

1.(a) Describe the primary and secondary standards of e.m.f.  

[6]

1.(b) Explain the Rayleigh’s current balance method for the determination of absolute value of current.  

[6]

OR

1'.(a) Define the terms (a) accuracy (b) drift (c) reproducibility and (d) static error.  

[4]

1'.(b) The four arms of Hay’s a.c. bridge are arranged as follows:  

AB is a coil of unknown impedance.  

BC is a non-inductive resistance  

\[ R_1 = 1000 \, \Omega \] with an error of +1 part in 10,000.  

CD is a non-reactive resistor  

\[ R_3 = 833 \pm 0.25 \, \Omega \] in series with a no loss capacitor  

\[ C = 1.43 \pm 0.001 \mu F. \]  

DA is a non-reactive resistor  

\[ R_2 = 16800 \, \Omega \] with an error of +1 part in 10,000.  

The supply frequency is 50 ± 0.1 Hz. The bridge is balanced. Determine \( L \) and \( R \) of the coil and the limits of error. The balance conditions are:

\[
L = \frac{C R_1 R_2}{1 + \omega^2 C^2 R_3^2} \quad \text{and} \quad R = \frac{R_1 R_2 R_3 C^2 \omega^2}{1 + \omega^2 C^2 R_3^2}
\]

2.(a) Describe the construction and principle of operation PMMC instruments.  

[6]

2.(b) Explain in brief the two wattmeter method for the measurement of power in three phase star connected load and show that measured power is equal to the total power consumed by the load.  

[6]

OR

2'.(a) What are the three essential torquer requirement for analog indicating instruments?  

[4]

2'.(b) Describe in brief the construction and principle of operation of single phase energy meter and enumerate various adjustments carried out for its proper functioning.  

[8]

3.(a) Show that the sensitivity of Wheatstone bridge can be improved by increasing the  

[6]
source voltage.

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

OR

3'.(b) Describe in brief the working of Maxwell's inductance capacitance bridge for measurement of self-inductance and draw its phasor diagram.

4.(a) Describe the use of sphere gap for measurement of peak voltage.

4.(b) Discuss in brief step-by-step method for the determination of B.H. curve with appropriate circuit diagram.

OR

4'(b) With the help of appropriate circuit diagram, discuss in brief the principle of operation of Weston type synchro-scope.

5. (a) Discuss the measurements of unknown frequencies by development of Lissajous patterns using CROs.

5. (b) Write a short note on Instrumentation Amplifiers.
Maximum Marks: 60
Credits: 04
Duration: Two Hours

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

Q.No.      Questions                             M.M.
Q. 1.      Define any four the following in brief:
           a) The MATLAB workspace
           b) The semicolon
           c) Polymorphism
           d) Keywords
           e) Local variable
           f) Persistent Variable
           g) Scope of a variable

Q. 2.      a) Discuss operator precedence and associativity. Explain with examples.
           b) For the matrix:

\[
A = \begin{bmatrix}
5 & 6 & 8 & 9 & 2 \\
5 & 4 & 2 & 3 & 8 \\
3 & 8 & 9 & 10 & 11
\end{bmatrix}
\]

find any six of the following

i. \( A(1:3,:) \)           v. \( A(1:end-1,2:4) \)
ii. \( A(1:4,2:3) \)           vi. \( A(:,2:3) \)
iii. \( \text{max}(A(1:3,:)) \)   vii. \( \text{sum}(A([1],2:3)) \)
iv. \( A(:) \)           viii. \( A.*A \)

Q. 3.      a) Write a MATLAB script employing while-loop to find the number of first
           positive integers necessary to obtain a sum equal to or less than 100.

           b) Write a program to plot a labelled sine wave for one cycle whose frequency
           is 50 Hz; keep the x-axis as angle axis (in degrees). Also, plot a cosine wave of three
           times the above frequency and half its amplitude on the same plot. Also insert text
           describing both the waves (using gtext) in the plot. Please ensure that both
           the plots must occupy full length of the x-axis.
Q.3'. Define the statement used to initialize and run a for-loop. Write a function named 'day_of_week' which returns the day of the week corresponding to the number entered (in between 1 and 7). Please ensure that the program must display an error message 'The number must be between 1 and 7', if the data entered is larger than 7, and 'The number must be a positive integer between 1 and 7' if the data is mistakenly entered as a negative or fraction number.

Q.4. Describe the importance of the Simulink in MATLAB environment. Create a Simulink Model that generates a three-phase voltage set. Also explain how one can save the data of these three-phase outputs into the workspace and plot them from there.

Q.5. a) Write the program in using MATLAB syntax to obtain the labelled Bode plot of the system whose open loop transfer function is given as:

\[
\frac{200}{s} \frac{(s + 3)}{(s + 2)(s^2 + 4s + 100)}
\]

OR

a') Write a MATLAB function to obtain the numerical solution of the following first order differential equation:

\[
\frac{dx}{dt} = -2x,
\]

with the initial condition as \( x(0) = 1 \), for time span \( 0 < t < 10 \), using ode45 solver.

b) Write a function named 'quad_eqn' to generate the roots of a quadratic equation. The program must be able to write the answer on the Command Window as:

The roots are: ____ and ____

They are real and distinct/real and equal/ imaginary
Maximum Marks: 60

Credits: 04

Duration: Two Hours

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

Q.No.  Question M.M.
1(a)  Define sampling theorem. What is the effect on signal sampling if it is violated? [06]
1(b)  What are the different types of classification of system? Discuss each one in brief. [06]
2(a)  Derive the output response of a system to internal conditions only. [06]
2(b)  Obtain the state variable representation of the network shown in Figure 1. [06]

![Figure 1](image)

OR

2'   Derive an expression for the output of a LSI system for an arbitrary input using convolution sum. [12]

3(a)  Find the trigonometric Fourier series for the saw tooth waveform shown in Figure 2. [06]

![Figure 2](image)
3(b) Find the Fourier transform of the sequence \( x[n] = a^n u[-n-1]; a \geq 1 \) \[06\]

OR

3'(a) Discuss Fourier theory, also mention the conditions for a signal to be expressed by a Fourier series. \[06\]

3'(b) Find the Fourier transform of \( x(t) = \cos(\omega_0 t) \). Also draw its magnitude spectrum. \[06\]

4(a) Determine the Laplace transform of \( x(t) = \sin(\omega_0 t) u(t) \). \[06\]

4(b) Find the response \( y(t) \) of an LTI system with the transfer function

\[ H(s) = \frac{1}{(s+5)} \text{, } R(s) > -5 \]

and the input is

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

OR

4'(a) Specify values of real parameter \( \sigma \) for which the integral

\[ \int_0^\infty e^{-\sigma t} e^{-\sigma+j\omega} \, dt \]

converges. \[06\]

4'(b) Write the properties of ROC for s-plane. \[06\]

5(a) Find the z-transform of the signal \( x[n] = \cos(\omega_0 n) u[n] \). Also depict the ROC. \[06\]

5(b) Determine the inverse z-transform of the function:

\[ X(z) = \frac{z}{z - 0.5}, |z| > 0.5 \]
2016-17
B.E. (IV SEMESTER) EXAMINATION
(ELECTRICAL)
ELECTROMAGNETIC FIELD THEORY
(EEE-285N)

Maximum Marks: 60  
Credits-04  
Duration: Two Hours

1. Solve all questions.
2. Symbols and notations used carry their usual meanings.
3. Assume suitable data if missing.

Q-1 (a) Find the gradient of scalar function
\[ V = V_0 \left( \frac{a}{R} \right) \cos(2\theta) \]
in spherical coordinates and then evaluate it at point
\( (2a, 0, \pi) \).

Q-1 (b) Evaluate the line integral of \( \mathbf{E} = x\mathbf{i} - y\mathbf{j} \) along the segment \( P_1 \) to \( P_2 \) of the circular path shown in the Fig. 1.

\[ \int_{P_1}^{P_2} \mathbf{E} \cdot d\mathbf{l} = \int_{P_1}^{P_2} (x\mathbf{i} - y\mathbf{j}) \cdot d\mathbf{l} \]

Fig. 1.

OR

Q-1' (a) A vector field is given in cylindrical coordinates by
\[ \mathbf{E} = r \cos \phi \mathbf{r} + r \sin \phi \mathbf{\phi} + z^2 \mathbf{z} \]
Point \( P(2, \pi, 3) \) is located on the surface of the cylinder described by \( r = 2 \).
At point \( P \), find:
(i) the vector component of \( \mathbf{E} \) perpendicular to the cylinder,
(ii) the vector component of \( \mathbf{E} \) tangential to the cylinder.

Q-1' (b) Dielectric breakdown occurs in a material whenever the magnitude of the field \( \mathbf{E} \) exceeds the dielectric strength anywhere in that material. In the coaxial capacitor of Fig. 2,

(i) At what value of \( r \) is \( |\mathbf{E}| \) maximum?
(ii) What is the breakdown voltage if \( a = 1 \text{ cm}, b = 2 \text{ cm}, \) and the dielectric material is mica with \( \epsilon_r = 6 \)? The dielectric strength of mica is 200 MV/m.

Q-2 (a) Consider the following arbitrary fields. Find out which of them can possibly represent electrostatic or magnetostatic field in free space.

\[ \text{Cond} \ldots 2 \]
(i) \( A_1 = \frac{(r+1)}{r} \cos \varphi \alpha_r + \frac{\sin \varphi}{r} \alpha_\varphi \) (Cylindrical) (3)

(ii) \( A_2 = \frac{1}{r^2} (2 \cos \theta \alpha_r + \sin \theta \alpha_\theta) \) (Spherical) (3)

Q-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 \( B_2 \) if \( B_1 = 0.1 \alpha_x + 0.4 \alpha_y + 0.2 \alpha_z \), Wb/m².

Q-3 (a) The loop shown in Fig. 3 is inside a uniform magnetic field \( B = 50 \ a_x \) mWB/m². If side DC of the loop cuts the flux lines at the frequency of 50 Hz and the loop lies in the \( yz \)-plane at time \( t = 0 \), find the induced emf at \( t = 1 \) ms.

\[ \text{Fig. 3} \]

Q-3 (b) In free space, \( E = 20 \cos(\omega t - 50x) \alpha_y \) V/m. Calculate \( J_d \).

OR

Q-3' The electric field and magnetic field in free space are given by

\[ E = \frac{50}{\rho} \cos(10^6 t + \beta z) \alpha_\varphi \ \text{V/m} \]

\[ H = \frac{H_o}{\rho} \cos(10^6 t + \beta z) \alpha_\rho \ \text{V/m} \]

Express these in phasor form and determine the constants \( H_o \) and \( \beta \) such that the fields satisfy Maxwell's equations.

Q-4 An EM wave travels in free space with the electric field component \( E_x = 100e^{j(0.866y+0.52z)} \alpha_x \) V/m

Determine

(a) \( \omega \) and \( \lambda \)

(b) The magnetic field component

(c) The time average power in the wave

OR

Q-4' A uniform plane wave in air with \( E = 8 \cos(\omega t - 4x - 3z) \alpha_y \) V/m

is incident on a dielectric slab \( (z \geq 0) \) with \( \mu_r = 1.0, \epsilon_r = 2.5, \sigma = 0 \). Find

(a) The polarization of the wave

(b) The angle of incidence

(c) The reflected E field

(d) The transmitted H field

Q-5 (a) What are the sources of sources of electromagnetic field and its effects?

(b) Write various applications of electromagnetic field.

(c) Compare basic principle, advantages and disadvantages of numerical methods i.e. Finite Difference Method (FDM), Finite Element Method (FEM) and Method of Moments (MoM)
Q.No. | Question | M.M.
--- | --- | ---
1(a) | Implement the basic gates i.e. AND, OR and NOT with the help of
  - NAND Gates only
  - NOR Gates only | [06]
1(b) | Express the following Boolean functions in a sum of minterms
  - \( F(A,B,C) = A + BC \)
  - \( F(A,B,C) = 1 \) | [06]

2 (a) | Briefly discuss about the comparison of various logic circuit families. | [06]
2 (b) | Implement the given function \( F = A(B+CD) \) with the help of Complimentary CMOS Logic family. | [06]

3(a) | What are Multiplexers? With the help of gate level logic diagram, explain the operation of 4-line-to-1-line Multiplexer. | [06]
3(b) | Simplify the Boolean function :
  \( F(w,x,y,z) = \sum(1,3,7,11,15) \) & the don't care conditions : \( d(w,x,y,z) = \sum(0,2,5) \)
  OR | [06]

3'(a) | What are Encoders? With the help of a logic diagram, explain the operation of 8-line-to-3-line encoder? | [06]
3'(b) | Implement the circuit of a 1-bit full adder with the help of 3-line-to-8-line decoder. | [06]

4(a) | Discuss the operation of clocked \( D \) flip flop with the help of detailed gate level logic diagram. | [06]
4(b) | Design a MOD 14 Asynchronous Up-counter with the help of \( J-K \) flip flops. | [06]
  OR | [06]
4'(a) | Explain the operation of a NAND latch with the help of a logic diagram. | [06]
4'(b) | Design a MOD-8 Synchronous Up-counter with the help of \( J-K \) flip flops | [06]

5(a) | With the help of a circuit diagram, explain the operation of a 3-bit Flash ADC | [06]
5(b) | For a R-2R Ladder type DAC, show that the output voltage is directly proportional to the applied digital input. | [06]