2017-18
B.E. (WINTER SEMESTER) EXAMINATION
ELECTRICAL ENGINEERING
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) The open and short-circuit tests data on a 3-phase, 1 MVA, 3.6 kV, star connected synchronous generator is given below:

<table>
<thead>
<tr>
<th>Field current (A)</th>
<th>60</th>
<th>70</th>
<th>80</th>
<th>90</th>
<th>100</th>
<th>110</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open-circuit voltage (V)</td>
<td>2560</td>
<td>3000</td>
<td>3360</td>
<td>3600</td>
<td>3800</td>
<td>3960</td>
</tr>
<tr>
<td>Short-circuit current (A)</td>
<td>180</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Find:
(a) The unsaturated synchronous reactance.
(b) The adjusted synchronous reactance.

1(b) Derive the expression for power developed by a three-phase non-salient pole alternator.

OR

1(b') Explain the alternator load characteristics.

2(a) Describe dark lamp method of synchronizing an alternator with an infinite bus.

2(b) A 400 V, 40 kVA, 50 Hz, 3-phase star-connected alternator has effective armature resistance of 0.2 Ω per phase. A field current of 2 A produces an open-circuit emf of 130 V and the same field excitation produces an armature current of 60 A on short circuit. Calculate synchronous reactance of the machine.

OR

2(b') A 3-phase, 500 V, 50 Hz, star-connected alternator gave the following data for open-circuit and short-circuit tests:

<table>
<thead>
<tr>
<th>Field current (A)</th>
<th>2</th>
<th>4</th>
<th>6</th>
<th>8</th>
<th>10</th>
<th>12</th>
<th>14</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open-circuit voltage (V)</td>
<td>173</td>
<td>347</td>
<td>454</td>
<td>532</td>
<td>585</td>
<td>632</td>
<td>663</td>
</tr>
<tr>
<td>Short-circuit current (A)</td>
<td>40</td>
<td></td>
<td>80</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Cont'd...
The field current for rated terminal voltage under full load current of 40 A under zero power factor condition is 15 A. Draw Potier triangle on Open Circuit Characteristics (OCC) and find the value of armature reaction mmf (F_a) from Potier triangle.

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

3(b) Explain hunting of a synchronous machine. What is the purpose of damper winding in synchronous motor?

OR

3(b') Name the methods of starting of synchronous motor? Describe any one method of starting of synchronous motor?

4(a) With the help of a neat sketch, discuss the construction of a 4-pole dc machine.

4(b) The generated emf in a dc generator is 200 V at 1000 rpm for a useful flux per pole of 0.03 Wb. Calculate the generated emf at 1500 rpm.

OR

4(b') Derive an emf equation for a dc machine. Which quantities in the emf expression are constant?

5(a) Derive and explain the speed-current, torque-current and speed-torque characteristics of a dc series motor.

5(b) Describe four pin starter with a neat sketch.

OR

5(b') With the help of neat diagram, describe the working of a reluctance motor.
2017-18  
B.E. (WINTER SEMESTER) EXAMINATION  
ELECTRICAL ENGINEERING  
ELECTRICAL MEASUREMENT  

EEE-251N

Maximum Marks: 60  
Credits: 04  
Duration: Two 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.</td>
<td>What are standards? What are the different types of standards? Explain the primary and secondary standard of emf.</td>
<td>[12]</td>
</tr>
<tr>
<td>2(a)</td>
<td>What are different types of MI instrument? Also explain any one with help of suitable diagram.</td>
<td>[06]</td>
</tr>
<tr>
<td>2(a')</td>
<td>What is D' Arsonval galvanometer? Also explain briefly its different dynamic behaviour.</td>
<td>[06]</td>
</tr>
<tr>
<td>2(b')</td>
<td>Measure the power in three phase circuit using two wattmeter method. Also show the effect of power factor on the reading of wattmeter.</td>
<td>[06]</td>
</tr>
<tr>
<td>3(a)</td>
<td>Determine the expression for unknown inductance and resistance using Hay's bridge.</td>
<td>[06]</td>
</tr>
<tr>
<td>3(a')</td>
<td>Determine the expression for capacitance and dissipation factor using schering bridge.</td>
<td>[06]</td>
</tr>
<tr>
<td>3(b)</td>
<td>Explain the working of Megger with the help of diagram.</td>
<td>[06]</td>
</tr>
<tr>
<td>4(a)</td>
<td>Determine the B-H curve by step-by-step method</td>
<td>[06]</td>
</tr>
<tr>
<td>4(a')</td>
<td>Explain the rectified capacitor charging current method for the measurement of high voltage.</td>
<td>[06]</td>
</tr>
<tr>
<td>4(b')</td>
<td>What is synchroscope? With the help of diagram explain the working of electrodynamometer type synchroscope.</td>
<td>[06]</td>
</tr>
<tr>
<td>5(a)</td>
<td>Draw the block diagram of CRO and explain its working.</td>
<td>[06]</td>
</tr>
<tr>
<td>5(a')</td>
<td>What is lissajous pattern? Explain.</td>
<td>[06]</td>
</tr>
<tr>
<td>5(b)</td>
<td>What is instrumentation amplifier? Explain its first stage.</td>
<td>[06]</td>
</tr>
</tbody>
</table>
2017 - 18
B.E (WINTER SEMESTER) EXAMINATION
MATLAB for ENGINEERS
EEE-278

Maximum Marks: 60
Credits: 04
Duration: 2Hrs

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

1(a)  
i) Matlab stand for ________

   ii) What symbol precedes all comments in Matlab ________

   iii) ________ Matlab command clears all data and variables stored in memory.

   iv) ________ symbol is used to see if two elements are equal in Matlab.

   v) To join one or more string in Matlab is known as ________

   vi) To print a newline in an fprintf statement, you must use ________ character.

   vii) What is the ans that is printed when the following code is run: isempty (32) ________


1(b)  
i) The code below is written to roll a die until the sum reach 1000 or higher. But there is one mistake in the code that leads to a high risk that the loop never stops running.

What is the problem and how to correct it?

```matlab
%%%*************
rollCounter = 0;
rollSum = 0;
while rollSum <= 1000
    rollSum = rollSum + randint(6);
    rollCounter = rollCounter + 1;
end
%%%*************
```

   ii) What will be displayed when you run the code below?

```
   a = 0;
b = 2;
for i = 1:3:10
    a = b + i;
end
disp(a)
```

2(a)  Explain the following commands used for plotting in Matlab with syntax (any four)

   (i) plot (ii) subplot (iii) xlabel (iv) ylabel (v) legend (vi) title (vii) axis (viii) grid

    cond...2
2(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 the following:

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

3(a). Explain various array and matrix operations in MATLAB.

OR

What are different logical and relational operators in MATLAB?

3(b). Write a Matlab program to get a Fibonacci sequence of 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144.

OR

Write a program in MATLAB to find the binary equivalent of a number n=1234.

4(a). Obtain the block diagram simulation model for his system in Simulink by using the system equation derived below. This equation indicates that the car's acceleration \((dv/dt)\) is equal to the sum of the forces acting on the car (\(F-bv\)) divided by the car's mass.

\[
\frac{dv}{dt} = \frac{F - bv}{M} = \frac{F - 40v}{1000}
\]

OR

Obtain the block diagram simulation model for implementing a pv cell in SIMULINK. Assume the equivalent circuit shown in the figure.

Circuit model
\[ I_{pv} \]
\[ i_{D} \]
\[ i_{PV} \]

Model equations
\[
i_{D} = I_{o}\left(e^{v_{D}/V_{T}} - 1\right), \quad v_{D} = v_{PV}
\]
\[
i_{PV} = I_{SC} - i_{D}
\]

4(b). Explain the steps required to build a Simulink system, with examples.
5(a). 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

5(b) With reference to Matlab explain any four with example and command syntax.

a) Quadratic Roots.
b) Curve fitting.
c) Interpolation.
d) Integration.
e) Differentiation.
f) Signal processing
g) Polynomials
2017-18
B. E. (IV SEMESTER) EXAMINATION
ELECTRICAL
SIGNALS & SYSTEMS
EEE-282N

Maximum Marks: 60
Credit: 04
Duration: Two Hours

Answer All questions.
Assume suitable data, if missing.
Symbols & notations have their usual meanings.

Q. No. Question M. M.

1(a). Plot and find the total energy of the trapezoidal pulse signal given by the equation:
\[ x(t) = \begin{cases} 
5-t, & 4 \leq t \leq 5 \\
1, & -4 \leq t \leq 4 \\
t+5, & -5 \leq t \leq -4 \\
0, & \text{otherwise} 
\end{cases} \]

\[ [06] \]

1(b). Using the properties of impulse signal, evaluate the following expressions:

(i) \[ \left( \frac{\cos t}{t^2 + 2j} \right) \delta(t) \]

(ii) \[ \left( \frac{5 +jt}{2-jt} \right) \delta(t-t) \]

(iii) \[ \int_{-\infty}^{\infty} (t^2 + \cos \pi t) \delta(t-1) \, dt \]

(iv) \[ \int_{-\infty}^{\infty} e^{-t} \delta(2t-2) \, dt \]

OR

1(b'). Check the following properties for the system shown in figure 1 below:

(i) Causality (ii) Linearity (iii) Stability (iv) Time-invariance

\[ [06] \]

\[ \text{Fig. 1} \]

2(a). Define zero input and zero state responses of a LTI system.

\[ [04] \]

2(b). The system shown in figure 2(a) is formed by connecting two systems in cascade. The impulse responses of the systems are given by \( h_1(t) = e^{-2t}u(t) \) and \( h_2(t) = 2e^{-t}u(t) \), respectively.

\[ [08] \]

Contd... 2.
(i) Find the impulse response \( h(t) \) of the overall system shown in figure 2(b).

(ii) Determine if the overall system is BIBO stable.

![Diagram of system with blocks](image)

**Fig. 2**

**OR**

2(b'). Define 'state' of a system. Determine the state variable model of the circuit shown in the figure 3 below, if the input is the applied voltage \( x(t) \) and the output is the current through the resistor \( R_2 \) indicated as \( y(t) \).

![Circuit diagram](image)

**Fig. 3**

3(a). Find the trigonometric Fourier series for the waveform shown in figure 4 below.

![Waveform diagram](image)

**Fig. 4**

3(b). Find the Fourier transform of \( e^{-α|t|}, \alpha > 0 \).

**OR**

3'(a). Find the exponential Fourier series for the impulse train \( x(t) = δ_{T_0}(t) \) shown in figure 5 below.

![Impulse train diagram](image)

**Fig. 5**

Cont'd...
3'(b). Consider the rectangular pulse shown in figure 6 below and defined as

\[ x(t) = A \text{ rect} \left( \frac{t}{2T_0} \right) \]. Find the Fourier transform of \( x(t) \).

![Fig. 6]

4(a). Find the inverse Laplace transform of

\[ X(s) = \frac{-5s - 7}{(s + 1)(s - 1)(s + 2)} \]

if the ROC is:

(i) \( R(s) < -2 \)

(ii) \(-1 < R(s) < 1 \)

OR

4(a'). Find the unilateral Laplace transform of

\[ x(t) = e^{-a(t-1)}u(t+1) \]

4(b). Solve the second-order linear differential equation:

\[ \frac{d^2y(t)}{dt^2} + 5 \frac{dy(t)}{dt} + 6y(t) = \frac{dx(t)}{dt} + x(t) \]

for the initial conditions \( y(0) = 2 \) and \( \frac{dy(t)}{dt} \bigg|_{t=0} = 1 \) and the input \( x(t) = e^{-4t}u(t) \)

5(a). Find the z-transform of the following signal:

\[ x(n) = \cos(\omega_0 n)u(n) \]

5(b). Find the inverse z-transform of

\[ X(z) = \frac{1 - z^{-1} + z^{-2}}{(1 - \frac{1}{2}z^{-1})(1 - 2z^{-1})(1 - z^{-1})} \text{ with ROC } 1 < |z| < 2 \]
Q-1 (a) A vector field in "mixed" coordinate variables is given by
\[ G = \frac{xcos\phi}{\rho}a_x + \frac{2yz}{\rho^2}a_y + \left(1 - \frac{x^2}{\rho^2}\right)a_z \]  
Express G completely in spherical system. Here \( \rho \) is cylinder radius.

Q-1 (b) The electrostatic potential is given in spherical coordinates as \( V(r) = 10r^2 \) V, where \( r \) is in meters.
(i) Find the electric field vector \( E \) as a function of \( r \).
(ii) Find the flux density \( D \) if the medium has relative permittivity \( \varepsilon_r = 4 \).

OR

Q-1' (a) Given that
\[ \rho_V = \begin{cases} 
12\rho \text{ nC/m}^3 & 1 < \rho < 2 \\
0 & \text{otherwise} 
\end{cases} \]  
Determine \( D \) everywhere.

Q-1' (b) Given that \( D = \rho V \text{ C/m}^2 \), calculate the charge density at \((1, \pi/4, 3)\) and the total charge enclosed by the cylinder of radius 1 m with \(-2 \leq z \leq 2 \) m using Gauss's Law.

Q-2 (a) A circular loop located on \( x^2 + y^2 = 9 \), \( z = 0 \) carries a direct current of 10 A along \( a_x \). Determine \( H \) at \((0, 0, 4)\) and \((0, 0, -4)\).

Q-2 (b) A conductor of radius \( a \) carries a uniform current with \( J = J_0a_z \). Show that the magnetic vector potential for \( \rho > a \) is
\[ A = -\frac{1}{4\mu_0I}\rho^2 a_z \text{ Wb/m} \]

Q-3 (a) A square loop of side \( a \) recedes with a uniform velocity \( u_xa_y \) from an infinitely long filament carrying current \( I \) along \( a_z \) as shown in Figure 1. Assuming that \( \rho = \rho_0 \) at time \( t = 0 \), show that the emf induced in the loop at \( t > 0 \) is
\[ V_{emf} = \frac{u_0a^2\mu_0I}{2\pi\rho(\rho + a)} \]

Contd....2.
Q-3  (b) A conducting circular loop of radius 20 cm lies in the $z = 0$ plane in a magnetic field $\mathbf{B} = 10 \cos 377t \, \mathbf{a}_x \, \text{mWb/m}^2$. Calculate the induced voltage in the loop.

OR

Q-3'  A conducting bar is connected via flexible leads to a pair of rails in a magnetic field $\mathbf{B} = 6 \cos 10t \, \mathbf{a}_x \, \text{mWb/m}^2$ as in Figure 2. If the $z$-axis is the equilibrium position of the bar and its velocity is $2 \cos 10t \, \mathbf{a}_y \, \text{m/s}$, find the voltage induced in it.

Figure 2 For Q 3'.

Q-4  A plane wave in a nonmagnetic medium has $E = 50 \sin (10^5 t + 2z) \, \mathbf{a}_y \, \text{V/m}$. Find

(a) The direction of wave propagation
(b) $\lambda, f, \sigma$, 
(c) $H$

OR

Q-4'  (a) A transmission line operating at 500 MHz has $Z_0 = 80 \, \Omega$, $\sigma = 0.04 \, \text{Np/m}$, $\beta = 1.5 \, \text{rad/m}$. Find the line parameters $R, L, G,$ and $C$.

(b) An air line has characteristic impedance of 70 $\Omega$ and phase constant of 3 rad/m at 100 MHz. Calculate the inductance per meter and the capacitance per meter of the line.

Q-5  The nodal potential values for the triangular element of Figure 3 are $V_1 = 100 \, \text{V}$, $V_2 = 50 \, \text{V}$, and $V_3 = 30 \, \text{V}$. Determine where the 80 V equipotential line intersects the boundaries of the element.

Figure 3. For Q 5.
Question 1

(a) A five bit DAC has a current output. For a digital input of 10100, an output current of 10 mA is produced. What will $I_{OUT}$ be for a digital input of 11101?

OR

(a') What is the largest value of output voltage from an eight-bit DAC that produces 1.0 V for a digital input of 00110010?

(b) Identify the type of ADC circuit given in Fig. 1a. Give the digital output ($B_0$ and $B_1$) for the given input voltage ranges as in Fig. 1b.

![Circuit Diagram](image)

Figure 1: Circuit and input-output.

Question 2

(a) Design a logic circuit that has three inputs, A, B, and C, and whose output will be HIGH only when a majority of the inputs are HIGH.

OR

(a') Write the sum-of-product expression for a circuit with four inputs and an output that is to be HIGH only when input A is LOW at the same time that exactly two other inputs are LOW.

contd...
(b) Use a Karnaugh-map to simplify \( y = \overline{C} \left( \overline{A} \overline{B} \overline{C} + D \right) + A \overline{B} C + \overline{D} \).

OR

(b') Write down the Boolean expression of 2x1 multiplexer. Also implement NOT gate using a 2x1 multiplexer.

Question 3  
\[ 4 + 4 + 4 = 12 \text{ marks} \]

(a) Write the next four numbers in this hex counting sequence: E9A, E9B, E9C, E9D, __________.

(b) Use DeMorgan's theorem to convert the expression \( Z = \overline{(A + B)} \cdot \overline{C} \) to one that has only single-variable inversion.

OR

(b') Implement a circuit having output expression \( z = \overline{A} \overline{B} C \) using only a NOR gate and an INVERTER.

(c) Simplify \( z = (\overline{A} + B) (A + B) \)

OR

(c') Show how two-input NAND gate can be constructed from two-input NOR gates.

Question 4  
\[ 6 + 6 = 12 \text{ marks} \]

(a) Consider the NAND gate SR Latch given in Fig. 2a. Sketch the waveform of output \( Q \) for \( S \) and \( R \)

![NAND gate SR Latch circuit.](image1)

![S and R inputs.](image2)

Figure 2: NAND gate SR Latch circuit, and S & R inputs.

(b) Implement a D-type Latch using a 2:1 Multiplexer.

OR

(b') Implement a D Flip-Flop from two D-latches.

Question 5  
\[ 6 + 6 = 12 \text{ marks} \]

(a) Realize the two input NOR gate using emitter couple logic.

(b) Draw the circuit diagram of CMOS inverter and discuss its working principle.