

**Subject: Electrical Machine-II (EE46101)**

**B.Tech. (EE), 4th semester**

**Date: 18<sup>th</sup> March 2023, FN**

**Time: 2 Hours**

**Full marks: 30**

**Attempt all questions.**

[1][a] Explain the effect of armature reaction in cylindrical rotor synchronous generator for zero power factor leading load.

[1][b] Why is Short circuit characteristic of a cylindrical rotor synchronous generator, a straight line passing through origin.

[1][c] Draw the circuit diagram for synchronization of an alternator using one dark-two bright lamp method.

[1][d] Write the expression for real and reactive power of salient pole synchronous motor.

[1][e] Draw the phasor diagram showing the effect of varying driving torque of an alternator synchronized with infinite bus bar.

**[5x2 marks]**

[2] Explain the operation of synchroscope in the process of synchronizing an alternator. **[5 marks]**

[3] Draw the phasor diagram of salient pole synchronous motor and then prove

$$\tan(\phi + \delta) = \frac{V_t \sin \phi + I_a X_q}{V_t \cos \phi + I_a r_a} \quad [5 \text{ marks}]$$

[4] Explain the on-load operation of an alternator synchronized with an infinite bus by varying excitation. **[5 marks]**

[5] A 6.6 kV, three-phase, 50 Hz, star-connected alternator has the following data for open circuit, short circuit and full-load zero power factor tests:

$I_f$ (A)	3.2	5	7.5	10	14
$E_f$ (kV)	3.1	4.9	6.6	7.5	8.24
$I_{SC}$ (A)	500	778	1170	-	-
ZPF terminal voltage(kV)	-	1.85	4.24	5.78	7.00

Per phase armature resistance is 0.2 ohm. Calculate the voltage regulation at full load current of 500A at 0.8 pf lagging by mmf method. Also draw Potier-triangle in the plot. **[5 marks]**

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NATIONAL INSTITUTE OF TECHNOLOGY PATNA  
 ASHOK RAJPATH, PATNA  
 MID SEM EXAMINATION, March 2024

4<sup>th</sup> Sem EE: Section B

Course code: EE46103

Time: 2:00 H

Course Title: Linear Control system

Max marks: 30

*Note: All questions are compulsory. Each carry equal marks*

1. Drive the transfer function  $E_o(s)/E_i(s)$  of the electric circuit as shown in Fig. 1. The input voltage is a pulse signal given by

$$e_i(t) = \begin{cases} E_i & 0 \leq t \leq t_1 \\ 0 & \text{elsewhere} \end{cases}$$

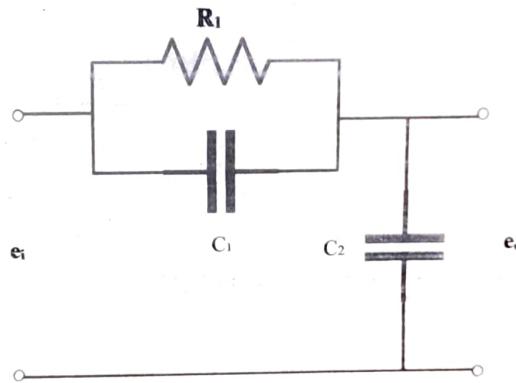


Fig. 1

2. Consider the mechanical system shown in Fig. 2. Assume that  $u(t)$  is the force applied to the cart and is the input to the system. The displacement  $x$  is measured from the equilibrium position and is the output of the system. Obtain the transfer function  $X(s)/U(s)$  of the system.

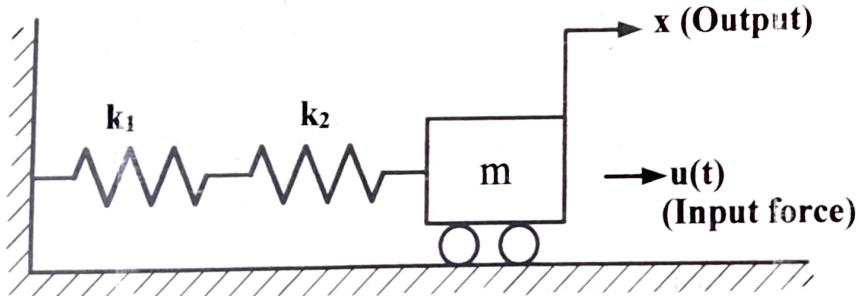


Fig. 2

3. Consider the system shown in Fig. 3. Simplify this diagram by eliminating loops.

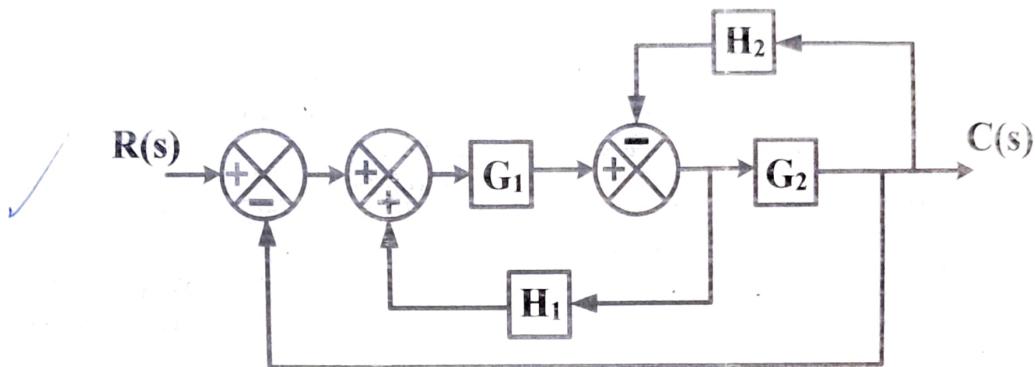
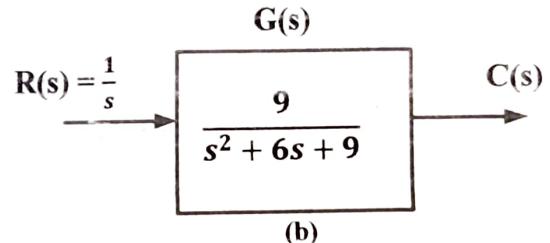
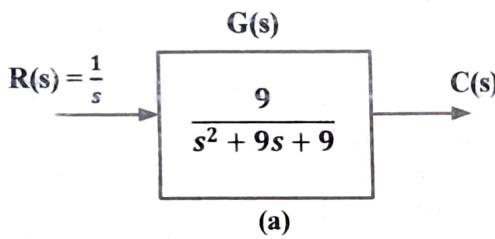


Fig. 3

4. Identify nature of the responses of the given transfer functions as well as draw its approximate output behavior.



5. Using Mason's rule, find the transfer function,  $T(s) = C(s)/R(s)$ , for the system represented in Fig. 4.

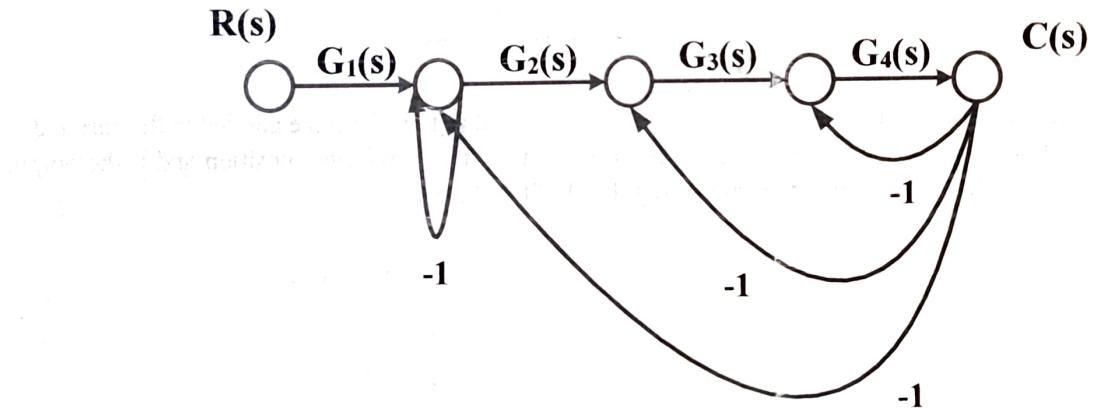


Fig. 4

6. Write short note (attempt any two)

(a) Advantages of feedback

(b) Regenerative feedback

(c) A.C Servo motor

(d) Components of a controller



## NATIONAL INSTITUTE OF TECHNOLOGY PATNA

Department of Computer Science & Engineering

MID SEMESTER EXAMINATION, JAN-JUNE 2024

B. Tech-ECE/EE Semester-IV

Course Name: Object Oriented Programming

Maximum Time: 2 hours

Course Code: CS45101/CS46101

Max. Marks: 30

**Instruction:**

1. Attempt all questions.
2. Assume any suitable data, if necessary.
3. The Marks, CO (Course Outcome) and BL (Bloom's Level) related to questions are mentioned on the right-hand side margin.

		Questions	Marks	CO	BL
Q1		<p>(i) Define Java <b>default</b> access modifier.</p> <p>(ii) For a given String “<b>B.Tech Students of NIT PATNA</b>” Write a line of code to get output: “<b>Students of NIT PATNA</b>” <i>Substring</i></p> <p>(iii) Write the output of the following code:</p> <div style="border: 1px solid black; padding: 10px; width: fit-content; margin: 10px auto;"> <pre>class HelloWorld {     public static void main(String[] args) {         String obj1 = new String("NITP");         String obj2 = new String("NITP");         System.out.println(obj1==obj2);     } }</pre> </div> <p>(iv) What is the default nature of methods of Interface?  <b>OR</b>  What is the difference between the following three literal values: 5, `5`, ``5`` ? Explain.</p> <p>(v) Write a Java program line to convert <b>int = 10</b>; to non-primitive <b>Integer</b></p> <p>(vi) Differentiate <b>String</b> class and <b>StringBuffer</b> class in a single statement.</p>	6	CO1, CO2	Analyze and Understand
Q2		Explain how the <b>Object-Oriented Programming</b> approach is better than the <b>Procedural Programming</b> approach. Write the characteristics of each programming approach.	6	CO1, CO2	Understand
Q3		<p>Discuss the following terms.</p> <p>(i) <b>Super</b> keyword in Java</p> <p>(ii) <b>Wrapper</b> class</p> <p>(iii) <b>Static</b> methods</p> <p>(iv) Properties of <b>the final</b> class <i>or</i> <b>method overloading</b></p> <p>(v) Properties of <b>abstract</b> class <i>or</i> <b>dynamic polymorphism</b></p> <p>(vi) <b>protected</b> access modifier</p>	6	CO1, CO2	Understand



Q4	<p>The hierarchical relationships of the related Classes and/or Interfaces are shown in the figure given below. Define all these blocks to implement the given hierarchy and test it for 5 users.</p> <p><b>Grandparents</b> Last_name; Display():{print Last_name}</p> <p><b>Father</b> First name; Display():{}</p> <p><b>Mother</b> First name; Display(): {}</p> <p><b>Child</b> First name; Display():{print First name Last_name of Mother print First name Last_name of Father print First name Last_name of Child}</p>	6	CO3	Apply
Q5	<p><b>OR</b></p> <p>Write a java program to create a class <b>College</b> with one instance variable of type double and method named <b>Display ()</b> to display the value in that variable. Create another class <b>Demo</b> having <b>main ()</b> function, declare an array of five objects of <b>College</b> type and store the data in all these objects inside the <b>Demo class</b> and call the <b>Display ()</b> method to display the value of each object's data.</p> <p>Write a Java program to calculate the area of four shapes: Rectangle, Circle, Square, and Tringle under the following conditions:</p> <ol style="list-style-type: none"><li>1. The class should not use normal methods (only constructors are allowed).</li><li>2. There should be only one class in the program.</li><li>3. Input should be from the user.</li><li>4. For one user, only one shape's area should be calculated.</li></ol>	6	CO3	Apply

**National Institute of Technology, Patna**  
 Department of Electrical Engineering  
**Mid-Semester Examination, Jan-June 2024**  
 B.Tech: Semester IV (Section B)

Course Name: **Digital Electronics**  
 Maximum Time: **02 hours**

Code Code: **EC4601**  
 Max. marks: **30**

**Attempt all questions**

	<b>Questions</b>	<b>Marks</b>	<b>CO</b>
1	a) Find the gray code for the following binary numbers (a) 1100111 (b) 1011011 (c) 1110110	(02)	CO1
	b) Find the addition of $(-64)_{10}$ and $(80)_{10}$ .	(02)	CO1
	c) What is the equivalent of the Boolean expression $ABC + \overline{ABC} + \overline{AB}\overline{C} + \overline{A}\overline{B}\overline{C}$ .	(02)	CO1
	d) Find the simplified form of the Boolean expression $AB + \overline{BD} + AD$ .	(02)	CO1
	e) $(73)_x$ is equal to $(54)_y$ . Find the possible value of x and y	(02)	CO1
2	Draw the logic symbol and explain the operations of SR flip-flop. <u>Write the excitation table for SR flip flop.</u>	(05)	CO3
3	An equality detector gives the output $Y = 1$ , if both the inputs A and B are either 1 or 0  (a) Construct the truth table. (b) Write the Boolean expression for Y (c) Implement the circuit using logic gates.	(05)	CO2
4	Implement the function $F(W, X, Y, Z) = \sum(0, 1, 3, 4, 8, 9, 15)$ using an 8:1 multiplexer and 4:1 multiplexer.	(05)	CO2
5	Explain the combinational and sequential circuits.	(05)	CO3



**National Institute of Technology, Patna**  
**Department of Electrical Engineering**  
**EC46101: Digital Electronics, Jan-June 2024**  
 Fourth Semester, END Term Examination

Name and Roll Number: Yash Gupta; 2202144

Max marks: 60

Instructions to the Candidate:

1. SECTION A is compulsory consisting of TEN questions, each carrying TWO marks.
2. SECTION B contains FIVE questions, each carrying Five marks and student has to attempt any FOUR questions.
3. SECTION C contains THREE questions, each carrying TEN marks and student has to attempt any TWO questions.

**SECTION A**

1. All questions are compulsory.
  - a) Add hexadecimal numbers 2EC and 3A4 and write results in hexadecimal, binary, octal and decimal. **[CO1, BL2]**
  - b) Explain Demorgan's Laws. **[CO1, BL1]**
  - c) Convert to POS form  $F = xy + \bar{x}z$ . **[CO1, BL2]**
  - d) What is a full subtractor? Give its truth table. **[CO2, BL2]**
  - e) Implement the following function with a  $4 \times 1$  MUX:  $F(a, b, c) = \sum m(1, 3, 5, 6)$ . Choose a and b as select inputs. **[CO2, BL3]**
  - f) What is a register? How it differs from a counter? **[CO3, BL1]**
  - g) What is the difference between combinational and sequential circuits. **[CO3, BL1]**
  - h) Write the characteristic equation for J-K flip-flop. **[CO3, BL1]**
  - i) A digital to analog converter has a maximum output of 15V. Determine the resolution. **[CO4, BL2]**
  - j) A 6-bit ladder digital to analog converter has a maximum output of 10V. What is output voltage for the digital input of 101001 **[CO4, BL2]**.

**SECTION B**

2. Design a 4-bit binary to BCD code converter circuit. **[CO1, BL3]**  
 or
3. A process is described by the logical expression:  $Z = ABC + AC + A\bar{B}C$ . find the expression for the minimal sum of product using K-map and implement the result with the logic gate diagram. **[CO1, BL3]**
4. Design a multiplexer that can be used to generate the logical expression:  $Z = A\bar{B} + B\bar{C}$ . **[CO2, BL3]**
5. What is ring counter and Johnson counter? Design and explain four bit ring and Johnson counters using D-Flip Flop and J-K Flip Flop. **[CO3, BL2]**
6. Explain the principles of operation of Counter type ADC and Single slope ADC. **[CO4, BL1]**

## SECTION C

7. How to implement SR-FF using JK-FF. Draw and explain the working of asynchronous 4 bit up-down counter using JK Flip Flop. [CO3, BL4]  
or
8. Discuss the implementation of D-FF using JK-FF. Design MOD-5 up and down counter using JK Flip-flops. [CO3, BL4]
9. Draw the circuit diagram of R-2R digital to analog converter and explain its working principle in detail. [CO4, BL2]

NATIONAL INSTITUTE OF TECHNOLOGY PATNA  
 ASHOK RAJPATH, PATNA  
 END-SEM EXAMINATION, May 2024

Course code: EE46103 (Section B)  
 Course Title – Linear Control system

Time: 3:00Hr  
 Max marks: 70

**Note: Attempt any seven (7) questions**

1. Find the solution  $X(t)$  of the differential equation

$$\ddot{x} + 3\dot{x} + 2x = 0, \quad x(0) = a, \dot{x}(0) = b \quad \text{where } a \text{ and } b \text{ are constants.}$$

2. Consider the electrical circuit as shown in Fig. 1. Obtain the transfer function  $E_0(s)/E_i(s)$ . Also obtain a state-space representation of the system.

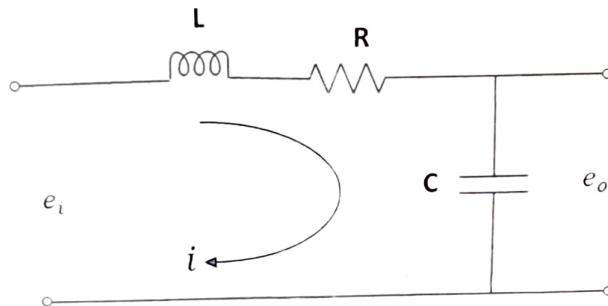


Fig. 1 Electrical Circuit

3. A unity feedback system has  $G(s) = \frac{K}{s(s+1)(0.1s+1)}$  and  $r(t) = 10t$

(a) If  $K = 2$ , determine  $e_{ss}(t)$ .

(b) Find the minimum value of  $K$  for  $e_{ss}(t) < 0.1$ , for a unit-ramp input.

4. Determine stability of the closed loop transfer function

Routh

$$T(s) = \frac{10}{s^5 + 2s^4 + 3s^3 + 6s^2 + 5s + 3}$$

5. Obtain the transfer function of the control system whose block diagram is shown in Fig. 2 by signal flow method.

6. Determine the rise time, peak time, maximum overshoot, and settling time when the control system shown in Fig. 3 is subjected to a unit step input.

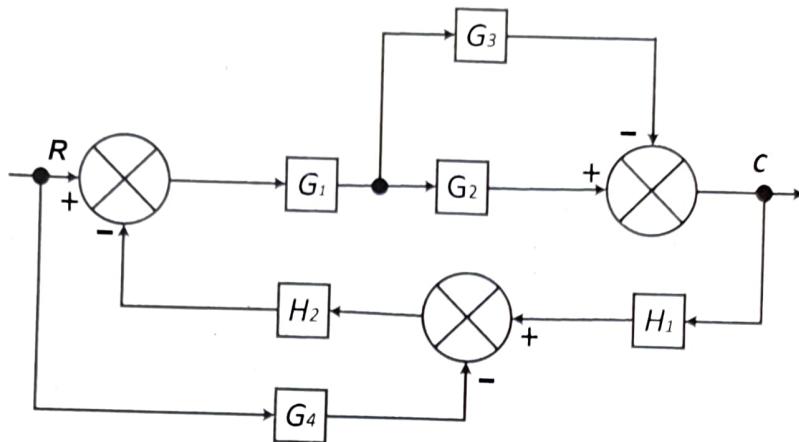


Fig. 2 Closed loop system

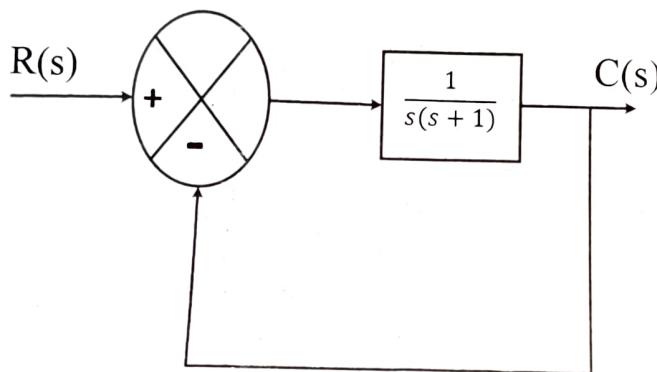


Fig. 3 Control System

- ✓ 7. Determine the value of K and k such that the closed loop system shown in Fig. 4 has damping ratio ( $\xi$ ) of 0.7 and an undamped natural frequency  $\omega_n$  of 4 rad/s.

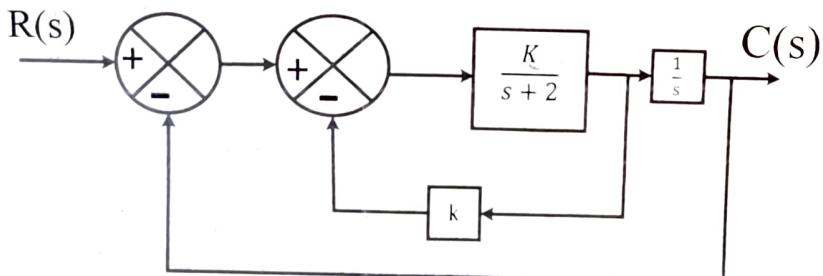


Fig. 4 Closed Loop System

- ✓ 8. Draw a root locus plot for  $G(s) H(s) = \frac{K}{s(s+1)(s+3)}$

9.

- i. Compare open-loop and closed-loop control system.  
 ii. What are the characteristics of negative feedback?  
 iii. How does AC servomotor differ from a normal two phase induction motor?  
 iv. Define gain margin and phase margin?  
 v. What is Nyquist stability criteria?

(2 x 5)



**NATIONAL INSTITUTE OF TECHNOLOGY PATNA**  
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING  
END SEMESTER EXAMINATION, MAY 2024

**BTech: 4<sup>th</sup> Semester**

**Course Name: Object Oriented Programming**

**Maximum Time: 3 hours**

**Branch: ECE & EE (I & II) & DD**

**Course Code: CS45101/CS46101/CS2401**

**Maximum Marks: 60**

All questions & sub-questions must be answered sequentially in one place

Q.No.	Question	Marks	CO
1	<p>a) What is the difference between abstract class and interface? List at least three differences.</p> <p>b) Give the method header for each of the following methods:</p> <ol style="list-style-type: none"><li>Method <i>hypotenuse</i> takes two double-precision, floating-point arguments <i>side1</i> and <i>side2</i> and returns a double-precision, floating-point result.</li><li>Method <i>smallest</i> takes three integers <i>x</i>, <i>y</i>, and <i>z</i> and returns an integer.</li><li>Method <i>instructions</i>, does not take any arguments and does not return a value.</li><li>Method <i>intToFloat</i>, takes an integer argument number and returns a floating-point result.</li></ol> <p>c) How do we create a throw exception in exception handling? Explain in brief.</p>	2 8 2	CO2, CO4
2	<p>a) Can the interface extend to another interface? If yes then explain briefly with example by writing a small Java program for extending the interface.</p> <p>b) An interface named <i>demoArea</i> contains a constant and a method implemented by two classes such as <i>Square</i> and <i>Circle</i>. Write a complete Java program to compute areas as per their shape.</p>	4 8	CO3
3	<p>a) What happens if several catch blocks match the type of the thrown object?</p> <p>b) What happens when a catch block throws an Exception?</p> <p>c) Modify the following demo method so that it will compile:</p> <pre>public static void demo (File named) {     RandomAccessFile input = null;     String line = null;     try {         input = new RandomAccessFile(named, "r");         while ((line = input.readLine()) != null) {             System.out.println(line);         }         return;    catch     } finally {         if (input != null) {             input.close();         } } } } } }</pre>	2 2 8	CO4
4	<p>a) How to compile a source code of Java that is created as a package? Also, write commands for executing the Java Package program.</p> <p>b) Write a program in Java that takes a sentence ended with a full stop (.) as input from the user, and writes that sentence into a file. Take another sentence from the user and append it to the same file. Afterwards, display every sentence inside the file in a new line. (Hint: ASCII code of full stop is 46).</p>	4 8	CO3, CO4
5	<p>a) Give Java AWT hierarchy? Explain each of the components in brief with its diagrams.</p> <p>b) Write a Java program to create an AWT frame, including one text field, label, and button inside the frame. Add an event, so that when the user enters any string in the text field and then presses the button, the entered string is displayed on the Label inside the frame.</p>	4 8	CO4
	<b>OR</b>	4	
	<p>a) Explain briefly the features of Java Applet and the Applet life-cycle.</p> <p>b) Write a complete Java program to create an Applet that displays the message "Hello EE and ECE 2nd Year Students of NIT Patna" on any web page. Also, illustrate the possible procedures to execute the above applet program.</p>	8	

*All the best*

NATIONAL INSTITUTE OF TECHNOLOGY PATNA

Department of Electrical Engineering  
END SEMESTER EXAMINATION JAN-JUNE 2024.

Semester: IV (B.Tech-EE)

Course Name: Power Transmission & Distribution

Maximum Time: 3 hours

Section: B

Course Code: EE46102

Max. Marks: 60

Instruction:

1. Attempt all questions. 2) Assume any suitable data, if necessary. 3) The Marks, CO (Course Outcome) and BL (Bloom's Level) related to questions are mentioned on the right-hand side margin.

S. No.	Description of the question	Marks	CO	BL
1	Drive the expression for the inductance per phase for a 3-phase overhead transmission line when: A) Conductors are symmetrical placed. B) Conductors are unsymmetrical placed but the line is completely transposed.	8	2	R, A
2	The three conductors of a 3-phase line are arranged at the corners of a triangle of sides 2 m, 2.5 m and 4.5 m respectively. Calculate the inductance per kilometer of the line when the conductors are regularly transposed. The diameter of each conductor is 1.24 cm.	6	3	U, A
3	Each line of a 3-phase transmission system is suspended by a string of three similar insulators. If the voltage across the line unit is 17.5 kV, calculate the line to neutral voltage. Assume that the shunt capacitance between each insulator and earth is $(\frac{1}{8})$ th of the capacitance of the insulator itself. Also, find the string efficiency.	6	1	U, A
4	A transmission line has a span of 200 meters between level supports. The conductor has a cross-sectional area of $1.29 \text{ cm}^2$ , weighs $1170 \text{ kg/km}$ and has a breaking stress (ultimate strength) of $4218 \text{ kg/cm}^2$ . Calculate the sag for a safety factor of 5, allowing a wind pressure of $122 \text{ kg per square meter of projected area}$ . Also, find is the vertical sag? $\frac{WL^2}{8T}$	6	3	R, U
5	Deduce an expression for voltage regulation and transmission efficiency of a short transmission line, giving vector diagram.	8	6	U
6	A 100 km long, 3-phase, 50 Hz transmission line has the following line constants: A) Resistance/Phase/ km = $0.1 \text{ Ohm}$ B) Reactance/ Phase/ km = $0.5 \text{ Ohm}$ C) Susceptance/Phase/ km = $10 \times 10^{-6} \text{ S}$ If the line supplies load of $20 \text{ MW}$ at $0.9$ power factor lagging at $66 \text{ KV}$ at the receiving end, calculate by nominal $\pi$ - method: i) Sending end power factor ii) Regulation iii) Transmission efficiency.	6	4	U, A
7	Explain skin effect for the power transmission system? Why is it absent in Direct Current System?	6	6	U
8	What is corona? Explain the factors affecting the corona and different methods for reducing the corona effect.	6	2	U, A
9	Define and explain with suitable diagram for grading of the underground cables and its different methods.	8	5	U, A

**Subject: Electrical Machine II (EE46101)**

**B.Tech. (EE), 4th semester, Section B**

**Date: 18<sup>th</sup> May 2024, FN**

**Time: 3 Hours**

**Full marks: 60**

**Attempt all questions. Each question carries equal marks.**

**[4X15 marks]**

[1] Explain the effect of armature reaction in cylindrical rotor synchronous generator for different type of loads.

Or

Discuss the method of excitation in synchronous machine.

[2] Develop the equation of real and reactive power of salient pole synchronous motor. Also define reluctance power as well as electromagnetic power. From this, also compute the real and reactive power of cylindrical rotor synchronous motor.

Or

Develop and explain V and inverted V curve of synchronous motor with the help of suitable phasor diagram.

[3] Discuss the starting methods of single phase induction motor.

Or

Explain all the tests carried out to develop the equivalent circuit of single-phase induction motor. Also draw its equivalent circuit diagram.

[4] Discuss any one of the following:

- a. Brushless DC (BLDC) Motor
- b. Universal motor

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# NATIONAL INSTITUTE OF TECHNOLOGY PATNA

Department of Electrical Engineering

End Semester Examination (Session: July – Dec. 2023)

B. Tech-EE: 3<sup>rd</sup> Semester (Section – B)

Course Name: Electrical Measurement and Instrumentation  
Time Duration: 3 hours

Course Code: EE36103  
Full Marks: 60

**Instructions:** The marks, CO (Course Outcome), and BL (Bloom's Level) related to questions are mentioned on the right-hand side margin.

1. All questions are compulsory.
2. Assume any suitable data, if necessary.
3. Draw suitable diagrams, if necessary.

Sl. No.	Questions	CO	BL
Q1.	(a) Discuss the classification of analog instruments. Explain three torques associated with electromechanical instruments. [Marks: 5]	CO2	U(L2)
	(b) What is a Galvanometer? Explain the basic principle of a Galvanometer. Write various types of Galvanometers and their applications briefly. [Marks: 5]	CO3	
Q2.	(a) Define DC potentiometer and its working principle. Explain how potentiometer can be used to measure low resistance using suitable diagram? [Marks: 8]	CO4	A(L3)
	(b) In the measurement of resistance by potentiometer, the voltage drops across resistor under test and across $0.05\Omega$ standard resistor are 0.9V and 1.1V respectively. Determine the value of resistor under test. [Marks: 2]		
Q3.	(a) Describe the construction of a PMMC instrument. Derive the equation for deflection if the instrument is spring controlled. Discuss their merits and demerits. [Marks: 6]	CO2	A(L3)
	(b) A moving coil ammeter has a coil resistance of $99\Omega$ and a full-scale deflection (FSD) current of $0.1mA$ . Shunt resistance is $1\Omega$ . Determine the current passing through the ammeter at (i) FSD and (ii) 0.5FSD. [Marks: 4]	CO5	
Q4.	(a) What is a transfer instrument? Explain its importance. [Marks: 2]	CO3	A(L4)
	(b) In a single-phase electrodynamometer-type wattmeter, the load voltage is 100V and load current is 9A at a lagging power factor of 0.1. The wattmeter voltage circuit has a resistance of $3000\Omega$ and an inductance of $30mH$ . Estimate the percentage error in the wattmeter reading when the pressure coil is connected (i) on the supply side and (ii) on the load side. [Marks: 8]	CO1	
Q5.	Discuss four different methods used to measure medium resistance including their <u>Substitution, ammeter-voltmeter, Wheatstone</u> limitations. Also, derive the expression for Wheatstone bridge sensitivity. [Marks: 10]	CO4	U(L2)
Q6.	(a) What is Q factor? Find the Q-factor expression for the Maxwell bridge. [Marks: 3]	CO4	R(L1)
	(b) Derive the equations of balance for Anderson's bridge. [Marks: 4]		
	(c) Explain the B-H curve determination methods for a magnetic material. [Marks: 3]		

$$L_1 = \frac{C R_3}{R_4} (a_1 (R_2 + R_4) + R_2 R_4)$$

$$R_1 = \frac{R_3 R_4}{R_2} (1 - a_1)$$