End-Semester Examination - 2025 (Spring)
MATUGBS02
(Engineering Mathematics II)
Semester – II (4 Year B.Tech)

Full Marks – 80 **Time – 3 Hours**

Notations and symbols have their usual meaning.
Use separate answer script for Group-A and Group-B

GROUP-A

Section A. Answer ALL questions. Each question carries TWO mark.

1. (a) Define skew symmetric matrix with example.
   (b) Show that any square matrix can be written as sum of two matrices, one is symmetric and another is skew symmetric.
   (c) Obtain the determinant of the matrix

$$A = \begin{bmatrix} 0 & a & -b \\ -a & 0 & c \\ b & -c & 0 \end{bmatrix}.$$

   (d) Let

$$A = \begin{bmatrix} 1 & 2 \\ 2 & 5 \end{bmatrix}, B = \begin{bmatrix} 5 & -2 \\ -2 & 1 \end{bmatrix},$$

   show that $AB = BA$.
   (e) Define rank of a matrix.

Section B. Answer any THREE questions. Each question carries 10 marks.

2. (a) Define echelon form of a matrix with example. Reduce the echelon form of matrix A, where

$$A = \begin{bmatrix} 1 & 0 & 3 \\ 4 & -1 & 5 \\ 2 & 0 & 6 \end{bmatrix}.$$

   Hence comment on the rank of A 3+6+1

3. (a) Show that $Det(A) = (a-b)(a-c)(b-c)$, where

$$A = \begin{bmatrix} a^2 & a & 1 \\ b^2 & b & 1 \\ c^2 & c & 1 \end{bmatrix}.$$

4

(b) Find two matrices P and Q such that $PAQ = I_3$, where

$$A = \begin{bmatrix} 2 & 0 & 1 \\ 3 & 3 & 0 \\ 6 & 2 & 3 \end{bmatrix}.$$

6

4. (a) Let $D_n = Det((a_{ij}))_{n,n}$, where $a_{ij} = a^{|i-j|}$, $a > 0$, show that $D_n = (1-a^2)D_{n-1}$. 4

(b) Solve the following system of equations using Cramer's rule:

$$\begin{aligned} x - 2y + 2z - 2 &= 0 \\ 2x - y - 2z - 1 &= 0 \\ 2x + 2y + z - 7 &= 0. \end{aligned}$$

6

5. (a) If A is a non-singular matrix then show that (i) A^{-1} (ii) $Adj(A)$ is also non-singular. Find the inverse of the matrix A, where

$$A = \begin{bmatrix} 1 & 1 & 2 \\ 2 & 4 & 4 \\ 3 & 3 & 7 \end{bmatrix}.$$

(2+2)+6

6. (a) Define orthogonal matrix. Check whether the below matrix is orthogonal or not.

$$A = \begin{bmatrix} 2/3 & 1/3 & 2/3 \\ 1/\sqrt{2} & 0 & -1/\sqrt{2} \\ 1/3\sqrt{2} & -4/3\sqrt{2} & 1/3\sqrt{2} \end{bmatrix}.$$

2+8

GROUP - B (40 marks)

Answer all the following questions:

(a) The solution of the given exact differential equation $(\frac{1}{y} - \frac{2}{x})dx - (\frac{x}{y^2} - \frac{3}{y})dy = 0$ is

i. $\log(\frac{y^3}{x^2}) + \frac{x}{y} = c$

ii. $\log(\frac{y^2}{x^2}) + \frac{x}{y} = c$

iii. $\log(\frac{y^3}{x^3}) + \frac{x}{y} = c$

iv. $\log(\frac{y}{x}) + \frac{x}{y} = c$

(where c is arbitrary constant) [2]

(b) Which of the following options is integrating factor of the given differential equation $y(2xy + e^x)dx - e^x dy = 0$

i. $\frac{1}{x^2}$

ii. $\frac{1}{xy}$

iii. $\frac{1}{y^2}$

iv. $\frac{1}{x^2y^2}$ [2]

(c) Which of the following options is the particular integral of the given differential equation $(D^2-1)y = 2e^x$ where $D \equiv \frac{d}{dx}$

i. xe^x

ii. x

iii. e^x

iv. e^{x^2} [2]

(d) Find mod z and amp z (principal amplitude) where $z = \frac{1+\sqrt{3}i}{1+i}$

i. $\sqrt{2}, \frac{\pi}{2}$

ii. $\sqrt{2}, \frac{\pi}{4}$

iii. $\sqrt{3}, \frac{\pi}{2}$

iv. $\sqrt{3}, -\frac{\pi}{4}$ [2]

(e) If $z_1 = 1+i$ and $z_2 = 1+\sqrt{3}i$, then the principle amplitude of z_1z_2 is

i. $\frac{7\pi}{12}$

ii. $\frac{9\pi}{12}$

iii. $\frac{3\pi}{4}$

iv. $\frac{2\pi}{3}$ [2]

(f) **Answer any SIX of the following questions:** $(6 \times 5 = 30)$

i. Solve the linear differential equation $\frac{dy}{dx} + \frac{3x^2}{1+x^3}y = \frac{1}{x^3}$. [5]

ii. Test for exactness and solve
$x^2(1+x)D^2y + 2x(2+3x)Dy + 2(1+3x)y = 0$. [5]

iii. Solve $(x^3D^3 - x^2D^2 + 2xD - 2)y = x^3 + 3x$. [5]

iv. Solve the Bernoulli's differential equation $\frac{dy}{dx} - 3x^2y = -e^{x-2x^3}y^3$. [5]

v. Solve the differential equation by using the method 'Variation of Parameter' [5]

$$\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + y = \frac{e^{-x}}{x^2}.$$

vi. Solve: $\frac{d^3y}{dx^3} + 2\frac{d^2y}{dx^2} + \frac{dy}{dx} = 3x + 1$. [5]

vii. Solve: $\frac{d^2y}{dx^2} - 4y = xe^{2x}$. [5]

viii. Solve: $\frac{d^2y}{dx^2} + a^2y = \sin ax$. [5]

ix. Show that the solution of the differential equation (Clairaut's form) $y = px + f(p)$ is $y = cx + f(c)$ where c is an arbitrary constant and hence solve $y = px + p^2 + 2p + 1$. [5]

x. (i) If one of the root of the equation $x^3 - 10x^2 + ax - b$ (where $a, b \in \mathbb{R}$) is $4+i$, then find other two roots and also find the value of a and b. [5]

OR, (ii) If x, y, z are positive real numbers and $x+y+z = 1$, prove that [5]

$$8xyz \leq (1-x)(1-y)(1-z) \leq \frac{8}{27}$$

B.Tech. Examination-2024-2025
Electronics and Communication Engineering Department
(Odd Semester Regular and Supplementary)
Course Title - Basic Electronics Engineering Course Code - ECEUGES01

Full Marks : 80 **Time-3 hrs**

(Answer any five, Symbols have their usual meaning)

1. (a) Compare between metal, semiconductor and insulator concerning their band diagram. 3
   (b) Explain electron-hole pair generation in intrinsic Si semiconductor at room temperature. Can it behave as an insulator at room temperature? Explain 3+2
   (c) How n-type semiconductor is formed ? 4
   (d) Draw the energy band diagram of intrinsic Si-semiconductor. 4
2. (a) Write the Fermi-Dirac distribution function. 3
   (b) Show that Fermi function is symmetrical about E_F i.e. $f(E_F + \Delta E) = 1 - f(E_F - \Delta E)$. 8
   (c) Explain why in n-type semiconductor the Fermi level energy E_F is close to the valence band edge E_v of the band diagram. 5
3. (a) Show that equilibrium concentrations of electrons (n_0) in a semiconductor can be expressed as :- 3+3

$$n_0 = N_c e^{-\left(\frac{E_C - E_F}{KT}\right)}$$

   (b) Show that intrinsic carrier concentration under equilibrium is constant and can be expressed as :- $n_i = \sqrt{N_C N_V}\, e^{-\frac{E_g}{2KT}}$. 6
   (c) An abrupt Si p-n junction has $N_a = 10^{18}\ cm^{-3}$ on one side and $N_d = 5 \times 10^{15}\ cm^{-3}$ on the other. Calculate the contact potential V_0. 4
4. (a) Write down Shockley diode equation for p-n junction diode. 3
   (b) Show that diode dynamic resistance in forward bias is $r_d = \frac{26mV}{I_D}$. 5
   (c) Show that cut-in voltage of p-n junction diode is expressed as : 8

$$V_\gamma = V - \eta V_T \left(1 - e^{-\frac{V}{\eta V_T}}\right)$$

5. (a) Explain the formation of depletion region and barrier potential V_0 ina p-n junction diode under equilibrium. 8
   (b) Explain the avalanche and zener breakdown mechanism in a p-n junction diode. 6
   (c) Draw the ideal diode current-voltage characteristics. 2
6. (a) Draw and explain the output waveform of the circuit in Fig. 1. 5
   (b) Draw and explain the output waveform of the circuit shown in Fig. 2. 5
   (c) Show that in a full wave rectifier circuit output only even cosine harmonics are present. 6

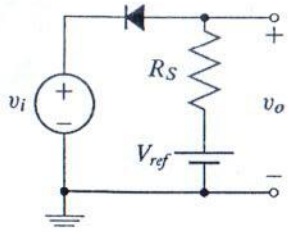

Fig. 1

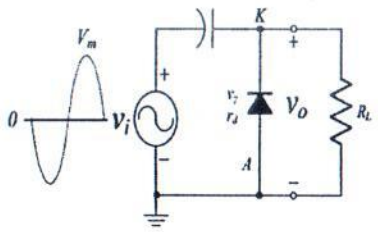

Fig 2

7. (a) Establish the relation for rectifier output, $V_{r(rms)} = \sqrt{V_{rms}^2 - V_{dc}^2}$. 5
   (b) Show that the output DC voltage (V_{dc}) and ripple factor of full wave rectifier output is : (i) $V_{dc} = \frac{2V_m}{\pi}$ (ii) $\Gamma = 48.3\%$ 6
   (c) Draw and explain the output waveform of the circuit in Fig. 3. 5

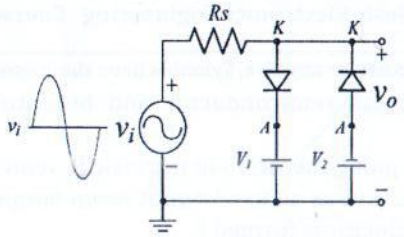

Fig. 3

8. (a) Explain different current components in a p-n-p transistor in active region with a suitable diagram. 6

(b) Establish the relation between current amplification factors α and β. 4

(c) Briefly explain the CB, CE and CC mode of operation in a transistor. 6

9. (a) Determine V_L, I_L, I_Z and I_R for the network of Fig. 1 if $R_L = 180\ \Omega$, $R_s = 220\ \Omega$ and $P_{zmax} = 400$ mW. 12

(b) Repeat part (a) if $R_L = 330\ \Omega$.

(c) Determine the value of R_L that will establish maximum power conditions for the Zener diode.

(d) Determine the minimum value of R_L to ensure that the Zener diode is in the "on "state.

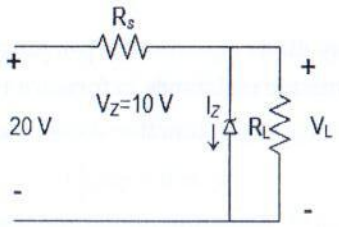

Fig. 4

(e) Define line regulation and load regulation for the zener diode to be used as a Voltage regulator. 4

Aliah University

Dept. of Computer Science & Engineering

End-Semester (Spring Semester) **Examination-2025**

(Question Paper for **2nd Semester Section- A**)

Paper Name: Programming for Problem Solving
Paper Code: CSEUGES01
Full Marks: 80
Times: 3 Hours

GROUP-A
(Multiple Choice Type Question)

1) Answer any ten Questions (choose the right option):- (1X10=10)

a) Array is the following type of memory allocation: [CO3, BTL1]
(i) continuous and homogeneous, (ii) continuous and heterogeneous, (iii) discrete and homogeneous (iv) discrete and heterogeneous.

b) The calloc() function associated with the following type of memory allocation: [CO4, BTL1]
(i) static, (ii) dynamic, (iii) both of these, (iv) none of these.

c) In 'C', '\0' stands for (i) zero, (ii) null character, (iii) string, (iv) End of File. [CO3, BTL1]

d) 'structure' has the following type of elements: [CO5, BTL1]
(i) homogeneous, (ii) heterogeneous, (iii) both of these, (iv) none of these.

e) 'EOF' is related to: [CO6, BTL1]
(i) string, (ii) FILE, (iii) array, (iv) structure.

f) The string size and the array size in the initializer- [CO5, BTL4]
char team[100] = "soldier";
are:
(i) 7 and 7, (ii) 100 and 100, (iii) 7 and 100, (iv) 100 and 7, respectively.

g) Mode 'a' in FILE concerns with: (i) appending data, (ii) reading data, (iii) writing data, (iv) addressing data. [CO6, BTL1]

h) Find the correct: (i) int *p, i=100; p=i; (ii) int *p, i=100; p=&i; (iii) int *p; float j=100.123426; p= &j; (iv) int p*, i=100; p=&i; [CO5, BTL4]

i) The function ***rewind(fp)*** takes the file pointer ***fp*** and resets the position to (i) the middle of the FILE, (ii) the start of the FILE, (iii) the end of the FILE, (iv) the current position of the FILE. [CO6, BTL1]

j) 'sizeof()' is a / an (i) default function, (ii) user defined function, (iii) library function, (iv) operator [CO5, BTL1]

k) Int i=10; i= 5>10; value of variable i for the code segment is: (i) 10, (ii) 0, (iii) 1, (iv) 5. [CO1, BTL5]

GROUP-B

(Answer any five) **(5X5=25)**

2) What Is increment operator? Distinguish pre and post increment with suitable example. [CO1, BTL4]

3) When to use loops? Write small program to explain the function of break and continue. [CO1, BTL1 & BTL5]

4) Conditional operator is equivalent to if else statement. Justify. Write a program to check whether a given number is even or not using tertiary operator. [CO1, BTL5]

5)
```
#include<stdio.h>
int main(){
int i;
while(i)
{
printf("%4d",i)
}
return 0;
}
```
What will be the output of the above code (a) if the variable i is initialized with 0 and (b) if the variable i is initialized with 1. Justify your answer. [CO3, BTL6]

6)
```
#include<stdio.h>
int main(){
```

```
float f=3.31;
if(f==3.31)
 printf("TRUE");
else
 printf("FALSE");
return 0;
}
```

What will be the output of the above code (a) as it is written (b) if the value 3.31 is replaced by 3.50 in both places. Justify your answer. [CO3, BTL6]

7) What is the significance of base/radix of number system? Explain with example. How a negative number is declared in C programming and how it is stored in computer memory? [CO1, BTL1 & BTL3]

8) What is structure tag? Is it essential? Justify with example. Comment on the size of union variable. [CO3, BTL1 & BTL4]

GROUP-C

(Answer any three) **(3X15=45)**

9)

a) Ordinary variable can't hold address. Explain with example. [CO4, BTL5] 2

b) Write down the different uses of '*' in C programming. [CO4, BTL1] 3

c) Distinguish constant pointer and pointer to constant? Give example of both. [CO4, BTL4] 3

d) What are the return types of malloc() and calloc() function? Why is it so? [CO3, BTL1 & BTL5] 3

e) Explain call by value and call by address with suitable example. [CO3, BTL5] 4

10)

a) How array elements are stored in computer memory? Explain with example. [CO2, BTL1] 2

b) Explain any two bitwise operators with suitable example. [CO1, BTL1] 4

c) Distinguish structure and union with required example. [CO5, BTL4] 3

d) What do you mean by Lvalue and Rvalue? What are the restrictions on both. Explain the reasons. [CO3, BTL1 & BTL5] 4

e) What is dot (.) operator? [CO3, BTL1] 4

11)

a) Write down the advantages of modular programming. [CO4, BTL5] 2

b) What is function prototype? Is this essential? Justify. [CO4, BTL1 & BTL5] 3

c) With suitable code explain the static storage class. [CO5, BTL4] 3

d) When to use relational operator and when to use logical operators? explain with suitable examples [CO3, BTL1 & BTL5] 3

e) Distinguish entry controlled and exit controlled loop with suitable example. [CO2, BTL4] 4

12)

a) List the problems of static allocation. [CO2, BTL1] 2

b) Write a C program to find the 2's complement of a given number. [CO1, BTL5] 3

c) Explain functions of fopen() with different mode. [CO6, BTL1] 3

d) What is default return type of any function? What is return by printf()? Explain with example [CO5, BTL1 & BTL5] 3

e) Write a program to display all prime numbers within a given range (from KB). [CO3, BTL5] 4

13)

a) Differentiate 'a' and "a". [CO4, BTL5] 2

b) What is arrow operator (- >) ? When to use this operator? Explain with example. [CO4, BTL1] 3

c) Distinguish '=' and '==' with suitable example of both. [CO1, BTL4] 3

d) Does null character and end of file same? explain [CO3, BTL1 & BTL5] 3

e) How to initialize array? Comment on the size of array and the number of values supplied with example. [CO3, BTL1 &BTL4] 4

Engg./2nd/ 2025

ENGUGHU01: Communicative English

Full Marks: 80 **Time: 3 Hours**

Section I

1. Answer **ANY TEN** of the following questions: **2x10=20Marks**

1. What are the channels of communication?
2. What is the basic difference between general communication and professional communication?
3. What is intra personal communication?
4. Exemplify a barrier in effective listening.
5. Give an example of Grapevine communication.
6. What is code?
7. How many diphthongs are there in English language?
8. What is 'LSRW'?
9. What is phoneme?
10. What is *lingua franca*?
11. What is semantic gap?
12. What is skimming in reading?
13. What is homophone? Give an example.
14. What is phrase? Give an example.
15. What is monologue?
16. Give two examples of idioms in English language.

Section II

2. Answer **ANY FOUR** of the following questions: (word limit 200) **5x4=20 Marks**

1. What are the characteristics of a good communication?
2. What is business communication? What are the methods of business communication?
3. Discuss the barriers of effective listening?
4. Write a short dialogue between two friends discussing the price hike.
5. What is the difference between summary and paraphrase?
6. Write a short report on the metro rail in Kolkata.
7. What are the important features of close reading?

Section III

3. Answer **ANY FOUR** of the following questions. (Word limit 400 **10X4=40 Marks**

1. Define Communication. What are the functions of Communication? (5+5)
2. Define and discuss the differences between Verbal Communication and Non-verbal Communication. (10)
3. Define Grapevine Communication. What are the demerits of Grapevine Communication? (5+5)
4. Explain the different flows of communication in the business organisations.(10)
5. Attaching a Resume, write a job application for the post of a librarian in a university. (10)
6. Mention the different Presentation strategies of Speaking Skills. (10)
7. Write a report of the Annual Teachers Day celebration in your university. (10)

ALIAH UNIVERSITY

Name of the Examination: Even Semester | **Year: 2024-25**
Subject: Engineering Chemistry | **Course code: CHMUGBS01**
Duration: 3 Hrs | **Full Marks: 80**

Use separate answer scripts for each group

Group A

01. Explain the following terms (answer any FOUR): (a) Path function (b) Irreversible process (c) Molar heat capacity (c) Enthalpy (d) Extensive property (e) Joule Thomson phenomenon — 2.5×4

answer any FOUR from the following questions

02. (a) Derive the expression for the work done during the isothermal, reversible expansion of an ideal gas.(b) Draw the pressure-volume (P-V) diagrams depicting the isothermal expansion of an ideal gas, clearly differentiating between reversible and irreversible processes. — 2.5+2.5
03. (a) State the thermodynamic condition for equilibrium. (b) Show Joule Thomson effect is an isoenthalpic process. — 2.5+2.5
04. (a) Prove mathematically that work done in a reversible process is more than that of an irreversible process (b) Differentiate between reversible and irreversible processes. — 2.5+2.5
05. a) Explain the concepts of C_p and C_v for gases. — 2.5+2.5
    (b) Why is C_p always greater than C_v? Establish the relationship between them.
06. (a) Find the work done when one mole of the gas is expanded reversibly and isothermally from 5 atm to 1 atm at 25^0C.(b) 1 gm of water is converted into steam at the same temperature. The volume of water becomes 1671 ml ob boiling. Calculate the change in the internal energy of the system if the heat of vapourization is 540 cal/gm. — 2.5+2.5

Group B (Answer any TEN) — 5× 10=50

07. Give brief account of
    i) Polythene ii) Compounding of rubber
08. (a)Why are silicones called inorganic polymers? (b) Discuss the synthesis procedure of linear chain silicones.
09. (a) What is meant by green chemistry?
    (b) Write informative notes on the mechanism of radical polymerisation
10. Write notes on: (a) Polystyrene (PS) (b) Polyvinyl Chloride (PVC).
11. What is meant by the vulcanisation of rubber? How vulcanisation takes place? Write its uses?
12. What is Biopolymers? How is it prepared? Give some importance of Bio-ploymers.
13. Write down the importance of green chemistry. Give the preparation of Aspirin from salicylic acid using microven technique. Why this technique is preferred.
14. Explain with examples: i) Gutta percha ii) Conducting polyaniline
15. a) What is Ziegler Natta catalyst with some application. b) How will you prepare Styrene-Butadiene Rubber (SBR). Mention its uses.
16. a) What are drawbacks of natural rubber? (b) How will you prepare Novalac resin from phenol and formaldehyde with mechanism
17. a) What is meant by degree of polymerisation? b) Distinguish between addition and condensation polymerization.
18. How the following are prepared? Mention their uses (a) Teflon (b) LDPE
19. a) How is the Crepe rubber obtained from latex? b) What is meant by degree of polymerisation?
20. a) Distinguish between addition and condensation polymerisation with examples. b) Give a short note on microwave radiation in green synthesis.

Aliah University

Electrical Engineering Department

Even (Spring) Semester Examination, 2025 (Regular + Supplementary)

Subject with code: Electrical & Electronic Measurements (EENUGPC05)

TOTAL MARKS: 80 **TIME: 3 HOURS**

All parts of a question should be answered at one place.

Use separate script for each Group A and Group B

Part A

Answer any four questions.

		Marks [10x4 =40]
Que-1	(a) Describe the constructional details of a permanent magnet moving coil (PMMC) instrument. (b) Write advantages and disadvantages of PMMC instrument. (c) A moving-coil milli-voltmeter has a resistance of 200Ω and the full-scale deflection is reached when a potential difference of 100mV is applied across the terminals. The moving coil has effective dimensions of 30mm×25mm and is wound with 100 turns. The flux density in the air gap is 0.2Wb/m^2. Determine the control constant of the springe if the final deflection is 100^0.	4+2+4= 10
Que-2	(a) Define resolution. (b) Derive the expression of deflecting torque of a moving iron (MI) type instrument. (c) The inductance of a moving-iron ammeter is given by $L = (0.01 + C\theta)^2 mH$ where θ is the deflection from the zero position in degree. The angular deflection of the instrument corresponding to 1.5A and 2A are 90^0 and 120^0 respectively. Find the value of C.	1+5+4= 10
Que-3	(a) What are the different problems associated with measurement of low resistances? (b) Draw a neat diagram of a megger and label its different parts. (c) The four arms of a Wheatstone bridge are as follows: $AB = 100\Omega; BC = 10\Omega; CD = 4\Omega$ and $DA = 50\Omega$ The galvanometer has a resistance of 20Ω and is connected across BD. A source of 10V is connected across AC. The sensitivity of the galvanometer is $100mm/\mu A$. Calculate the current through the galvanometer and its deflection. What should be the resistance in the arm DA when no current is flowingthrough the galvanometer?	2+3+5 =10
Que-4	(a) How is the damping torque produced in electrodynamometer instrument? (b) Design a multi-range PMMC ammeter with ranges of 0-2.5A, 0-5A and 0-10A employing individual shunts in each case. A basic meter with an internal resistance of 500Ω and a full-scale current of 5mA is available. (c) A 0-5A ammeter has a guaranteed accuracy of 1.2% of full-scale reading. The current measured by the instrument is 2A. Calculate the limiting values of current and the percentage limiting error.	2+5+3= 10
Que-5	(a) Write the differences between deflection and null type instruments. (b) Define transformation ratio as used for instrument transformer. (c) Derive the expression of phase angle error of a current transformer (CT).	2+1+5+ 2=10

(d) Explain the effect of shorting the secondary circuit of a potential transformer (PT) when primary winding is already energized.

Que-6 (a) Draw the circuit diagram to measure power using CT and PT.
(b) Derive the expression for deflecting torque of a single-phase induction type energy meter. **2+5+3=10**
(c) Two wattmeters connected to measure the power in a 440V, 3-phase balanced system, gave readings of 6500W and 100W. The latter reading is being obtained after reversing the current coil connection of the wattmeter. Calculate the power consumed and power factor of the load. Assume star connection.

Part B

Answer any four questions: **Marks 10x4=40**

Que-7 (a) Describe and derive the equations for balance conditions of the Hay bridge, and draw its phasor diagram under balance conditions. **8+2=10**
(b) Why is this bridge suited for measuring the inductance of high-Q coils?

Que-8 (a) Determine the equivalent parallel resistance R_3 and capacitance C_3 that causes a Wien Bridge to null reading with the following component values: **6+4=10**

$$R_1 = 2.8k\Omega, C_1 = 4.8\mu F, R_2 = 20k\Omega, R_4 = 80k\Omega \text{ and } f = 2kHz$$

(b) Describe the application of a thermocouple to design a meter.

Que-9 (a) Write a suitable diagram of a cathode ray tube and briefly describe it. **7+3=10**
(b) Write a brief note about the Lissajous pattern.

Que-10 (a) Derive the differential gain value from an Instrumentation amplifier of three op-amps with a suitable block diagram. **7+3=10**
(b) The digital meter has $4\frac{3}{4}$ digit display- explain. What is its resolution?

Que-11 (a) What is the Gauge factor? Write its expression and define its terms. **4+5+1=10**
(b) What are the similarities and dissimilarities between a strain gauge and a resistance temperature detector?
(c) What is the function of the bourdon tube?

Que-12 (a) Write the differences between an analog and a digital multimeter. **3+2+3+2=10**
(b) A platinum resistance thermometer has a resistance of 200Ω at 20°C. What is the resistance at 1000°C if the temperature coefficient of resistance of thermometers at 20°C is 0.0004/°C?
(c) Why do we need a linear variable differential transformer (LVDT)?
(d) Draw the block diagram of digital instruments.

2nd Year 4th Sem. B.Tech Electrical Engineering
Even Semester Examination, May – 2025
Paper Name – Thermodynamics

Full marks – 80 **Paper Code – MENUGOE02** **Time – 3hours.**

Candidate are required to give their answers in their own words as far as practicable.

Group – A (Very Short Answer Type Question)

1. Answer any ten of the following: **[1 x 10 = 10]**

(I). Thermodynamic properties are _____ function.

(II). What is thermal energy reservoir?

(III). The entropy of a system approaches a constant value as the temperature _____.

(IV). What do you mean by unsteady process?

(V). What is pyrometer?

(VI). Thermal power plant operates on _____ cycle.

(VII). What is adiabatic process?

(VIII). Entropy is defined in which law of thermodynamics?

(IX). The measurement of energy in a thermodynamic system is referred to as _____.

(X). How does a refrigerator differ from a heat pump?

(XI). What is the *SI unit* of entropy?

Group – B (Short Answer Type Question) [5 x 5 = 25]

Answer any five of the following:

2. Show that $COP_{HP} = COP_R + 1$, Give some examples of thermal energy reservoir. **[5]**

3. Distinguish between control mass and control volume systems. Define Intensive property with example. **[5]**

4. Helium is contained in a 2 m^3 rigid volume at 50 °C and 200 kPa. Calculate the heat transfer needed to increase the pressure to 800 kPa. $[C_V = 3.118\ kJ/kg.k]$ **[5]**

5. Air flows steadily through a compressor. It is compressed reversibly from 0.1 mpa and 30 °C to 0.9 mpa. Find the specific work of compression if the process is reversible adiabatic. $pv^{1.4} = c$. $(R = 0.287\ kJ/kg.k)$ **[5]**

6. At the inlet of the convergent-divergent nozzle the enthalpy of the fluid passing is 3000 kJ/kg, and the velocity is 60 m/s. At the discharge end, the enthalpy is 2757 kJ/kg. The nozzle is horizontal and the heat loss during flow is negligible. Find (a) velocity of the fluid at the exit of the nozzle. (b) If the area is 0.1 m^2 and the specific volume at the inlet is 0.187 m^3/kg, find the mass flow rate of the fluid. **[5]**

7. Derive general change of entropy expression of an ideal gas. **[5]**

Group – C (Long Answer Type Question)

Answer any three of the following: **[15 x 3=45]**

8.

a) What are the limitations of first law of thermodynamics? Define *Kelvin – plank & Clausius Statement.*

b) A heat pump is to be used to heat a house in winter and then reversed to cool the house in summer. The interior temperature is to be maintained at 20 °C. Heat transfer through the walls and roof is estimated to be 0.525 kJ/s per degree temperature difference between the inside and outside. (a) If the outside temperature is 5 °C, what is the minimum power required to drive the heat pump? (b) If the power input is the same as in part (a), what is the maximum outer temperature for which the inside can be maintained at 20 °C. **[7+8=15]**

9.

a) Derive *steady flow energy equation (SFEE)* on mass basis as well as time basis with proper sketch and notations.

b) An inventor claims to have designed a heat engine which absorbs 1 kJ of energy as heat at 727 °C and delivers 0.6 kJ of work when the ambient temperature is 27 °C. Would you agree with this claim?

c) For the Poly-tropic process prove that $Q_{1-2} = W_{polytropic} \times (\frac{\gamma-n}{\gamma-1})$ **[5+4+6=15]**

10.

a) Define- I) Thermal Efficiency, II) Back work ratio; III) Work Ratio; IV) Steam Rate; V) Heat Rate.

b) If power developed by a turbine in a certain steam power plant is 1200 kw. Heat supplied to boiler is 3360 kJ/kg. The heat rejected by the system to cooling water is 2520 kJ/kg, and feed pump work required to condensate back into boiler is 6 kw, then, determine the mass flow rate through the cycle.

c) For a steam turbine (Rankine) enthalpy at inlet to turbine =2800 kJ/kg. Enthalpy at inlet to condensate =2061 kJ/kg, saturated liquid enthalpy at sink=251.5 kJ/kg, work of pump = 2.5 kJ/kg, then what will be the heat rate ($kJ/kwhr$)? **[5+5+5=15]**

11.

a) Explain the Rankine cycle with a proper schematic diagram and T-S diagram. Describe each process involved in the cycle.

b) A lump of steel weighing 30 kg at a temperature of 427 °C is dropped in 150 kg of oil at 27 °C. The specific heats of steel and oil are 0.46 $kJ/kg.k$ and 2.5 $kJ/kg.k$, respectively. Estimate the entropy change of steel, the oil and the system containing oil and lump of steel in kJ/k.

[7+8=15]

Aliah University

Dept. of Electrical Engineering

B. TECH (EEN) 2nd YEAR 4th SEM

Even (Spring) Semester Examination, 2025

(Regular/Supplementary)

SUBJECT NAME: ELECTRICAL MACHINES-I

SUBJECT CODE: EENUGPC04

TOTAL MARKS: 80] **[TIME: 3 HOURS**

INSTRUCTIONS: -

1. Clearly mention the **Question No.** in the left margin of the answer sheet.
2. Write answer **neatly** as practicable as possible.
3. Write answers **to the point**, keeping in mind the allotted **marks.**
4. Write in your own words from your own understanding.
5. All part of a question should be answered **at one place**.
6. Draw circuit/figure & waveforms wherever applicable (including numerical).
7. **Acronyms & symbols** have their usual meaning.

Answer any five

Que-1 (A) Explain the principle, setup, and procedure of Sumpner's Test (Back-to-back or Regenerative Test) used for testing transformers. **[10]**

(B) A 100 kVA, 3300/200-volt, 50 Hz single phase transformer has 40 turns on the secondary, calculate: **[6]**

(i) the values of primary and secondary currents.

(ii) the number of primary turns.

(iii) the maximum value of the flux.

If the transformer is to be used on a 25 Hz system, calculate.

(iv) the primary voltage, assuming that the flux is increased by 10%

(v) the kVA rating of the transformer assuming the current density in the windings to be unaltered.

Que-2 (A) Explain how with the presence of back emf, a DC motor becomes self regulating? **[4]**

(B) Derive the equation of torque for a DC motor. **[4]**

(C) A long-shunt DC dynamo having terminal voltage of 250 V at 1,000 rpm supplies 25 kW. The resistances of armature, shunt field and series field are 0.04 Ω, 50 Ω and 0.05 Ω, respectively. **[8]**
Calculate (i) Cu-losses, (ii) iron and friction losses and (iii) the torque exerted by the prime mover if it has efficiency 89 % of the above load.

Que-3 (A) Describe the construction and working principle of a 4-point starter used for DC shunt motors. Compare the 4-point starter with the 3-point starter in terms of functionality and protection. [8+2]

(B) A 220V, 1.5 kW, 859 rpm, separately excited DC motor has armature resistance of 2.5Ω and it draws current of 8A at rated load condition. If the field current and the armature voltage are fixed at the value of rated load, what will be the no-load speed of the motor? Assume losses remain constant between no load and full load operation. [6]

Que-4 (A) Explain the load characteristics of a DC shunt generator in detail. Discuss how terminal voltage varies with load current and explain the roles of armature reaction and internal voltage drops in shaping the characteristic curves. [8]

(B) A six-pole DC shunt generator supplies full-load current at a terminal voltage of 250V. The armature and field resistances are 0.04 Ω and 100 Ω, respectively. It runs at a speed of 1,000 rpm and has 700 lap-connected conductors. The voltage across armature resistance is 7.2 V. [8]
Find the following: (i) the load current, (ii) the emf generated and (iii) the flux/pole. Neglect brush contact drop.

Que-5 (A) Explain the crawling phenomenon of three phase induction motor. How it can be minimized? [5+1]

(B) Discuss the process of rotating magnetic field generation in a three-phase induction motor. Provide appropriate diagrams to support your explanation. In your discussion include how the three-phase supply interacts with the stator windings arranged 120 degrees apart, how the phase difference in currents leads to time-varying magnetic fields and how these fields combine to form a resultant magnetic field that rotates at synchronous speed. [10]

Que-6 (A) Draw and explain the torque-slip characteristics of a three-phase induction motor. Indicate the regions of stable and unstable operation and explain how starting and maximum torque are affected by rotor resistance. [8]

(B) A 10 H.P., 4 pole, 25 Hz, 3-phase, wound rotor induction motor is taking 9100 watt from the line. Core loss is 290 Watt, stator copper loss is 568 Watt, rotor copper loss in 445 Watt, friction and windage losses are 100 Watt. [8]
Determine; (a) power transferred across air gap; (b) mechanical power in watt developed by rotor; (c) mechanical power output in watt; (d) efficiency; (e) slip.

Que-7 (A) Explain the construction, working and application of a star-delta starter used for starting three-phase induction motors. Outline the sequence of operation, mention key components involved and discuss the advantages and limitations of this method. Support your answer with neat and labeled diagram. [8]

(B) A 3-phase, 4-pole, 50Hz slip-ring induction motor is rotating at a speed of 1440 rpm at full-load. Its rotor resistance is 0.25 ohm per phase. What external resistance should be added in the rotor circuit to reduce the speed to 1320 rpm; the torque is to be kept the same. [8]

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BIOUGBS01 Biology for Engineers

2025

Marks-80 **Time-3Hrs**

A. Answer the following question by selecting the correct options. **1×25=25**

1. Anticodon is present in

(a) DNA (b) tRNA (c) rRNA (d) mRNA

2. Where is DNA present in the eukaryotic cells?

A. Inside the nucleus B. With other cellular contents C. Inside the ribosomes D. Not present

3. A single strand of mRNA attached to complex of ribosomes is called

(a) Okazaki fragments (b) polymer (c) polysome (d) polypeptide

4. The EMP pathway in eukaryotes usually takes place in

(a) nucleus (b) lysosome (c) Golgi apparatus (d) cytosol

5. Which of the following enzyme catalyzes the first step of glycolysis?

a) Hexokinase b) Pyruvate kinase c) Glucokinase d) Phosphofructokinase-1

6. Book lungs are respiratory organs in

A. Insects B. Aarachnids C.Molluscans D. Echinoderms

7. The crossing of F1 to either of the parents is known as

A. Test cross B. Back cross C. F1 cross D. All of the above

8.Which is the largest phylum of Animal on the earth.

A. Mollusca B. Amphibia C. Arthropoda D. Aves

9.*Taenia Solium* is under the Phylum of

A. Aschelminthes B. Annelids C. Platyhelminths D. Mollusca

10.Which of thefollowingisaflightlessbird?

A. Pigeon B.vulture C.Parrot D. ostrich

11. Whocoinedthetermmitochondria?

A. Kolliker B. Benda C. Fleenming D. Robert Brown

12. Plasmamembrane is

A. Permeable B. Selectivelypermeable C. Impermeable D. Semi-permeable

13. The excretory organ in the cockroach is

(A) green gland (B) malpighian tubules (C) nephridia (D) kidney

14. The mammary are found in

(A) Aves (B)Mammalia (C)Amphibian (D) Reptile

15.Air bladder is absent in

(A) Dog fish (B) Catla (C) Pohu (D) Flying fish

16. The plasma membrane is made up with

A. Lipid B. Protein C. Lipid & Protein D. Protein & Carbohydrate

17. Which of the following immunity is present from our birth?

A. Innate Immunity B. Active immunity C. Passive immunity D. Acquired immunity

18.Which of the following purine bases is present in RNA?

(a) Uracil (b) Thymine (c) Cytosine (d) Guanine

19. Which of the following RNAs are the most abundant in an animal cell?

(a) mRNA (b) tRNA (c) miRNA (d) rRNA

20. In DNA, the enzyme which breaks the H_2 bonds is

(a) Ligase (b) Helicase (c) Topoisomerase (d) Polymerase

21.Which substrate is used in the last step of glycolysis?

a) Glyceraldehyde 3-phosphate b) Pyruvate
c) Phosphoenolpyruvate d) 1, 3-bisphosphoglycerate

22. Ctenophores, commonly known as

(A) Flat worms (B) Sea walnuts (C) Round worms (D) Sponges

23. The canalsystem is a characteristic feature of

(A) Arthropods (B) Mollusca (C) Sponges (D) Echinoderms

24. Whichofthefollowingisthefunctionoflysosomes?

A. Autophagy B.Autolysis C.Digestion D.Alloftheabove

25. Which is a cold-blooded animal

(A) Horse (B) Sea-horse (C) Bat (D) Crane

B. Answer any 5 questions **2×5= 10**

1. What is Nephridia? Where is it found?
2. What is Humoral immunity?
3. What is Nucleosome?
4. Mention the location and function of Book Lung.
5. Define Allele.
6. What is Osculum? Mention its one function.
7. Define Codon.

C. Answer any 5 questions **5×5= 25**

1. Mention the four differences between antibody and antigen.
2. Describe the steps of the Glycolysis process.
3. Mention the characteristic features of class Amphibia with a suitable example.
4. Write down a short note on the Central Dogma.
5. Mention the differences between Prokaryotic and Eukaryotic cells.
6. Mention the structure of DNA with a suitable diagram.

D.Answer the following questions **10×2= 20**

1. Describe the Krebs cycle with a suitable diagram.
2. Describe the structure and function of mitochondria.

UCCUGMC02 Environmental Science
2025

Full Marks: 80 **Time: 3 Hours**

Group-A

(Answer any 20 questions from the following)

(Each question carries 1 mark $20 \times 1 = 20$)

1. A consumer that eats only plants is called:
A) Carnivore B) Herbivore C) Omnivore D) Decomposer

2. Solar energy is:
A) Non-renewable B) Renewable C) Finite D) Limited

3. Which is a secondary pollutant?
A) CO_2 B) NO_2 C) PAN (Peroxyacetyl nitrate) D) SO_2

4. Smog is a mixture of:
A) Dust and rain B) Smoke and water vapor C) Smoke and fog D) Dust and oxygen

5. World Biodiversity Day is celebrated on:
A) June 5 B) April 22 C) May 22 D) October 16

6. Which of the following practices leads to land degradation?
A) Terrace farming B) Afforestation C) Overgrazing D) Drip irrigation

7. The most abundant gas in the atmosphere is:
A) Oxygen B) Nitrogen C) Carbon dioxide D) Helium

8. Natural pollutants are:
A) CO_2 from industries B) Volcanic ash C) Plastic D) Fertilizer runoff

9. The zone of atmosphere closest to Earth is:
A) Troposphere B) Stratosphere C) Mesosphere D) Thermosphere

10. Greenhouse effect is due to:
A) Reflection of solar radiation B) Absorption of infrared radiation
C) Absorption of UV rays D) None

11. Which one is a point source of water pollution?
A) Agricultural runoff B) Factory outlet C) Urban runoff D) Storm drains

12. Primary consumers are:
A) Herbivores B) Carnivores C) Omnivores D) Decomposers

13. Food chain starts with:
A) Herbivores B) Carnivores C) Producers D) Decomposers

14. Which of the following has the longest food chain?
A) Grassland ecosystem B) Forest ecosystem C) Desert ecosystem D) Pond ecosystem

15. Energy flow in ecosystem is:
A) Unidirectional B) Circular C) Multidirectional D) Reversible

16. Which one is a fossil fuel?
A) Wood B) Uranium C) Coal D) Water

17. Which gas causes maximum global warming?
A) Methane B) Carbon dioxide C) Nitrous oxide D) Water vapor

18. Which of the following ecosystems has the highest productivity?
A) Desert B) Tundra C) Tropical rainforest D) Grassland

19. Which law deals with water pollution control?
A) Water Act 1974 B) Air Act 1981 C) EPA 1986 D) Forest Act 1927

20. Noise pollution limit in residential areas during night is:
A) 75 dB B) 65 dB C) 70 dB D) 45 dB

21. Which one is not a fossil fuel?
A) Oil B) Coal C) Natural gas D) Solar energy

22. Human activities have the most impact on which sphere?
A) Atmosphere B) Biosphere C) Lithosphere D) Hydrosphere

23. Which of the following is a keystone species?
A) Rabbit B) Tiger C) Deer D) Peacock

24. Which gas is produced in landfills?
A) CO_2 B) Methane C) Ozone D) Oxygen

25. EIA stands for:
A) Environmental Impact Assessment B) Energy Information Analysis
C) Environmental Improvement Act D) Environmental Impact Act

26. Hydroelectric power uses:
A) Sunlight B) Wind C) Water D) Biomass

27. In India, Forest Survey is done every:
A) 2 years B) 2 years C) 5 years D) Annually

28. "Green Revolution" is related to:
A) Forest growth B) Industrial development
C) Agricultural productivity D) Environmental conservation

Group-B

(Answer any 6 questions from the following)

(Each question carries 10 marks $6 \times 10 = 60$)

1. What is an ecosystem? Discuss its structure and functions?

2. What are ecological pyramids? Discuss types of ecological pyramids with examples.

3. Explain causes, impacts, and control measures of water pollution.

4. Discuss the causes of biodiversity loss and strategies for biodiversity conservation.

5. Define and distinguish between renewable and non-renewable resources with examples.

6. Write a detailed note on the Environmental Protection Act, 1986.

7. Discuss global warming and measures to control it.

8. What is sustainable development? Explain its objectives and importance.

9. Explain acid rain: causes, effects, and preventive measures.

10. Write short notes on:

a) Ecological succession

b) Phosphorus cycle

B.Tech. Examination-2024-2025
Electronics and Communication Engineering Department
(Even Semester Regular and Supplementary for ECE & EEN)
Course Title: Digital Electronics and Logic Design Course Code: ECEUGPC05

Full Marks : 80 **Time-3 hrs**

Answer Question no. 1 with proper reasoning and any four from the rest
(Symbols have their usual meaning)

1. (a) For the circuit shown in Fig. 1 the output is equal to 3
(i) $\bar{A}\bar{B}\bar{C}$ (ii) $\bar{A}+\bar{B}+\bar{C}$ (iii) $\bar{A}\bar{B}+\bar{B}\bar{C}+\bar{A}+\bar{C}$ (iv) $\bar{A}\bar{B}+\bar{B}\bar{C}$

(b) The output F in digital logic circuit shown in Fig 2 is 3
(i) $F=\bar{X}YZ+X\bar{Y}Z$ (ii) $F=\bar{X}Y\bar{Z}+XY\bar{Z}$ (iii) $F=\bar{X}\bar{Y}Z+XYZ$ (iv) $F=X\bar{Y}\bar{Z}+XYZ$

(c) The Boolean expression for the truth table shown in Fig. 3 is 2
(i) $\bar{B}(A+C)(\bar{A}+\bar{C})$ (ii) $B(A+\bar{C})(\bar{A}+C)$ (iii) $B(A+C)(\bar{A}+\bar{C})$ (iv) $B(A+C)(A+\bar{C})$

(d) In the circuit shown in Fig. 4, diodes D1, D2 and D3 are ideal and the inputs E1, E2 and E3 are 0V for logic '0' and 10V for logic '1'. What logic gate does the circuit represent. 3
(i) 3 input OR gate (i) 3 input NOR gate (i) 3 input AND gate (i) 3 input XOR gate

(e) The number of product terms in the minimized sum-of-products expression obtained through the K-map in Fig. 5 is (where, "d" denotes don't care states) 2
(i) 2 (ii) 3 (iii) 4 (iv) 5

(f) The logic realized by the circuit shown in Fig. 6 is 3
(i) $F=A\oplus C$ (ii) $F=A\odot C$ (iii) $F=B\oplus C$ (iv) $F=B\odot C$

(g) The circuit shown in Fig. 8 is a 2
(i) J-K flip-flop (ii) Johnson's counter (iii) R-S latch (iv) None of above.

(h) Find the Boolean expression of the following circuit and identify the logic gate in Fig 7. 2

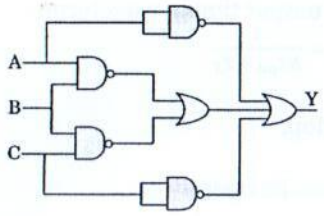


Fig. 1

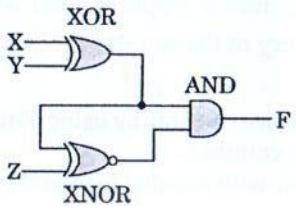


Fig. 2

A	B	C	F
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	1
1	1	1	0

Fig. 3

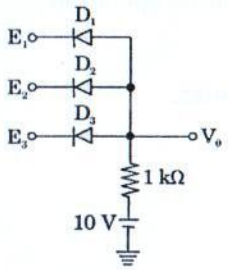


Fig. 4

1	0	0	1
0	d	0	0
0	0	d	1
1	0	0	1

Fig. 5

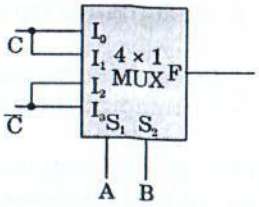


Fig. 6

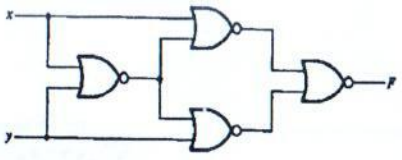


Fig. 7

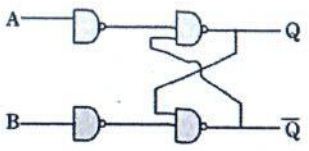


Fig. 8

2. (a) Prove the following Boolean logic identities with algebraic methods only :- 5+6
(i) $xy+\bar{x}z+yz=xy+\bar{x}z$ (ii) $\overline{w\oplus x\oplus y\oplus z}=w\odot x\odot y\odot z$

(b) Show that NAND gate is an universal logic element. 4

3. (a) Design a BCD-to-excess-3 code converter. 8

(b) Implement a Full-Adder circuit with a 3× 8 decoder and two OR gates. 7

Or

(a) Design a 3-bit Comparator Circuit by using basic gates. 5

(b) Design a look ahead carry generator for a 4-bit serial adder. 5

(c) Draw the NAND-NAND gate implementation of the following function after simplifying it in sum-of-products form 5

$$F(A,B,C,D) = \sum(0,2,5,6,7,8,10)$$

4. (a) Simplify the following function using K-Map in (i) sum of products (taking '1's) and (ii) product of sums (taking '0's). Also show they are equivalent. 4+4+2

$$F(A,B,C,D) = \sum(0,1,2,5,8,9,10)$$

(b) Obtain the simplified expression in product of sums form of the following logic function with don't-care conditions: 5

$$F(w,x,y,z) = \sum(1,3,7,11,15), \quad d(w,x,y,z) = \sum(0,2,5)$$

5. (a) Implement 8×1 MUX with two 2×1 MUX. 7

(b) Implement the following function with a multiplexer : 5

$$F(A,B,C,D) = \sum(0,1,3,4,8,9,11,15)$$

(c) Realise $(AB + CD)$ using minimum number of NOR gates. 3

6. (a) Draw and explain the operation of mod-8 ripple counter with output timing waveforms. 7

(b) Show that maximum clock frequency of the counter is $f_{max} = \frac{1}{Nt_{pd}+T_S}$ 8

Or

(a) Design a 4 bit asynchronous up/Down counter by using T-flip-flop. 6

(b) Describe the design of a 4-bit Ring counter. 4

(c) Draw a 4 bit universal shift register with parallel load and explain its operation. 5

7. (a) Draw a logic diagram of SR flip flop by using NAND gates and write down the truth table. Explain its operation. 6

(b) Draw a logic diagram of a clocked master slave JK flip-flop and explain its operation. 6

(c) Convert JK flip-flop into D flip-flop. 3

8. (a) With suitable logic diagram explain the operation of mod-4 ring counter. 8

(b) Explain the operation of 4-bit shift register with timing waveform. 7

9. (a) Design NAND gate by using CMOS and explain its operation. 4

(b) Design 2-input NOR gate by using MOS. 2

(c) Design a basic TTL NAND gate and explain its operation. 5

(d) Explain the operation of R-2R ladder type D/A convertor. 4

B.Tech. Examination-2025
Department of Electronics and Communication Engineering
(Even Semester Regular & Supplementary)
Course Title: Microelectronics **Course Code: ECEUGOE05**

Full Marks: 80 **Time: 3.00 Hrs**

- ***Answer all parts of a question in same place.***
- ***Figures on the right hand side margin indicate full marks.***
- ***Symbols have their usual meaning***

Question No. 1 & 2 are compulsory. Answer any 6 questions from section C

(Section A: Short Questions 2x5 = 10)

1.	(a)	What are mechanical and electrical applications of Si.	2
	(b)	Give examples of compound and alloy semiconductor?	2
	(c)	What are modes of operation of BJT	2
	(d)	What are the applications of Operational-Amplifier?	2
	(e)	Classify different Filters.	2

(Section B: Write short notes on any four topics 5x2 = 10)

2.	(a)	Semiconductor classification	5
	(b)	Comparison of Half-wave and full-wave rectifier	5
	(c)	voltage clipper circuit	5
	(d)	Differentiator circuit	5

(Section C : Answer any six Questions 6x10 = 60)

3.	(a)	Draw a Full-wave rectifier circuit using centre tap transformer and diodes and explain its operation	5
	(b)	The forward resistance of each diode of full wave rectifier is 100 Ω. The secondary voltage from the centre tap to each end is 12 V rms. The rectifier supplies current to a 1000 Ω load resistance. Calculate 1) dc load current 2) dc output power 3) ripple voltage across the load 4) percentage regulation 5) rectification efficiency.	5
4.	(a)	Draw the current components in the three regions of a pnp BJT structure.	6
	(b)	Explain briefly the current equations of a pnp transistor	4
5.	(a)	Draw the output characteristics of common-emitter BJT	5

(b) A BJT having $\alpha = 0.975$ and a reverse saturation current $I_{CO} = 10\ \mu A$, is operated in common-emitter (CE) mode. Calculate the β of the BJT. If the base current $I_B = 250$ uA, calculate the I_C (collector current) and I_E (emitter current) of the BJT 5

6. (a) Draw an Enhancement-mode MOSFET Structure 4

(b) Explain the Enhancement-mode MOSFET operation with output characteristics 6

7. (a) What are Feedback Network topologies? 2

(b) Draw a block diagram of voltage-series feedback network and explain its operation. 4

(c) Derive the closed loop transfer function of the voltage-series feedback network. 4

8. (a) What are the properties of an ideal OPAMP 3

(b) Draw input-output characteristics of OPAMP 2

(b) Draw an inverting amplifier and derive the voltage transfer function (gain) 5

9. (a) Describe an Adder circuit using an OPAMP 5

(b) Find out the output voltage of the circuit shown in figure 1 5

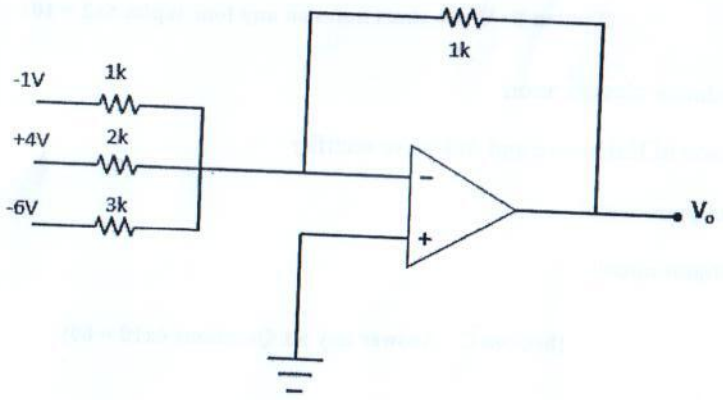


Figure 1: Adder circuit

10. (a) Draw a circuit diagram of a Low Pass Filter (LPF) 3

(b) Derive the transfer function of the LPF 4

(c) Plot normalised transfer function of the LPF 3

Aliah University
Department of Electrical Engineering
Even (Spring) Semester Examination, 2025
B. Tech. VI semester

Sub: Electrical Machines II **Code: EENUGPC13**
Full Marks: 80 Duration: 3 hrs

Instructions:
1. **Use separate answer scripts for the two sections.**
2. Mention the question number clearly and write all the parts of a question at one place.
3. Draw circuit/figure/phasor diagram wherever applicable (including numerical).
4. Make suitable assumptions wherever necessary, symbols and notations have their usual meanings.

Section-A
(Answer any Four: 4 X 10 = 40 Marks)

1. **A.** Define distribution factor and determine the expression of distribution factor for the fundamental frequency component for synchronous machine. **[5+5]**

   B. A 6 pole, 3 phase, 50 Hz, alternator has 12 slots per pole and 4 conductors per slot. The winding is five/sixth pitch span and the flux per pole is 1.5 Wb. The armature coils are all connected in series with star connection. Calculate the induced emf per phase.

2. The following table gives the data for occ and zpfc for a 6 pole, 440V, 50Hz, 3-phase, star connected alternator. The resistance between two terminals of this alternator is 0.3Ω. Find the regulation of the alternator at full load current of 40A at 0.8p.f. lagging using ZPF method. **(use graph paper)** **[10]**

Field current (A)	2	4	6	7	8	10	12	14	16	18
OCC voltage (V)	156	288	396	440	474	530	568	592	-	-
SC line current (A)	11	22	34	40	46	57	69	80	-	-
ZPFC terminal voltage (V)	-	-	-	0	80	206	314	398	460	504

3. **A.** Derive an expression for the power developed in a salient pole synchronous machine in terms of power angle and synchronous impedance. **[6+4]**

   B. In an alternator, a lagging current has the effect of weakening the main field; but in a synchronous motor, the effect of lagging current is to strengthen the main field. Explain

4. With the help of two reaction theory draw and explain the phasor diagram for salient pole synchronous machine at lagging or leading p.f. Clearly mentioning the parameters involved. **[10]**

5. **A.** State the conditions for parallel operation of three phase synchronous generator. **[3+7]**

   B. Two single phase alternators run in parallel and supply to a load impedance of $3 + j4$ Ω. Determine the terminal voltage, power factor, and kW output of each machine if the

impedance of each machine is 0.2+j2 Ω and EMF are (200 + j0)V and (220 +j0) V, respectively.

6. **A.** Explain Scott connection of single-phase transformer and why 86.6% tapping is done in teaser transformer? **[7+3]**

B. Explain how 3rd harmonic current in three phase transformer results in a oscillatory neutral.

Section -B

(Answer any Four: 4 X 10 = 40 Marks)

1. Discuss briefly the various types of a single-phase induction motor based on their starting methods. **[10]**

2. (A) Explain how a single-phase induction motor is not self-starting and describe with the help of Cross Field Theory how it will continue to rotate if given an initial torque in any direction. **[6+4]**

   (B) A 50 Hz split phase induction motor has a resistance of 6.2 Ω and an inductive reactance of 23.4 Ω in both main & auxiliary windings. Determine the value of resistance & capacitance to be added in series with the auxiliary winding to send the equal current in each winding with a phase difference of 87.5 degree.

3. A 230 V, 4 pole, 50 Hz, single-phase induction motor gave the following test results: **[10]**

Block rotor test:	117 V,	16.5 A,	682 W
No load test:	230 V,	7.8 A,	387 W

   The stator winding resistance is 1.3 ohm measured with direct current. Estimate the power factor, output and efficiency. Take slip as 0.04 and skin effect factor as 1.25.

4. With the help of neat phasor diagram, discuss the effects of change in field excitation of a synchronous motor while having constant load, and thereby explain the 'inverted-V' curves of synchronous motor. **[7+3]**

5. A 3-phase, 6600 V, 400 kVA, 6-pole, star connected synchronous motor has synchronous reactance of 10.5 Ω per phase and negligible resistance. The motor is initially operating at a load of 340 kW with field current adjusted such that the armature current is minimum. The field current is now decreased so that the armature current is 125 % of its previous value, without changing the load. With this field current, the load is reduced to 225 kW. Calculate the new values of armature current and power factor. **[10]**

6. Explain the vector group with reference to the connection of three-phase transformers with the help of connections and phasor diagram for the following connections: $Yd1, Dy11, Dd6 \& Yy0$ **[10]**

----- END OF QUESTION PAPER -----

Aliah University

Even Semester (Spring) Examination, 2025

Subject: Modern Control Systems; Code: EENUGPE07 (Regular + Supplementary)

Department: EE; 3rd Year; 6th Semester

TOTAL MARKS: 80 **TIME: 3 HOURS**

INSTRUCTIONS:
1. Mention the question number clearly. Answer all parts of a question at single location.
2. Draw block diagram wherever necessary.
3. Acronyms & symbols have their usual meaning unless otherwise specified.
4. Make suitable assumptions wherever necessary.

Group – A (5)

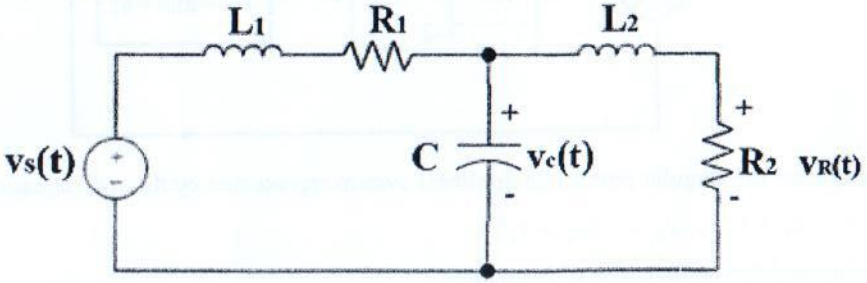
Answer any five questions. (8×5=40)

Q - 1 A linear system is represented by the state-space model **[8]**

$$\dot{X}(t) = \begin{bmatrix} -2 & -3 \\ 0 & 1 \end{bmatrix} X(t) + \begin{bmatrix} 1 \\ 0 \end{bmatrix} u(t); y(t) = [1 \quad 0] X(t)$$

Determine the output of the system for zero initial condition and unit impulse input.

Q - 2 An electrical network shown in figure below where $v_s(t)$ and $v_R(t)$ are the input and output of the network respectively. Obtain the state-space model of the network. **[8]**



Q - 3 A system is described by the differential equation **[8]**

$$\ddot{y}(t) + 2\dot{y}(t) + 4y(t) = u(t)$$

where $u(t)$ and $y(t)$ are input and output of the system respectively.
Comment on controllability and observability of the system.

Q - 4 An LTI continuous time system is represented by the state model **[8]**

$$\dot{X}(t) = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -1 & -5 & -6 \end{bmatrix} X(t) + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u(t); y(t) = [1 \quad 0 \quad 0] X(t)$$

By using state feedback control u=-kx(t), it is desired to have the closed-loop poles at $s = -8, -3 + j5, -3 - j5$. Determine the value of k.

Q – 5 The overall transfer function of a system is given by $\frac{Y(s)}{U(s)} = \frac{2s^2+6s+5}{(s+1)(s+2)(s+3)}$. **[8]**

Obtain state-space model of the system and also draw the state diagram.

Q - 6 Convert the system matrix A into diagonal form where $A = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -1 & -3 & -2 \end{bmatrix}$. **[8]**

Group-B

Answer any three questions. (10×3=30)

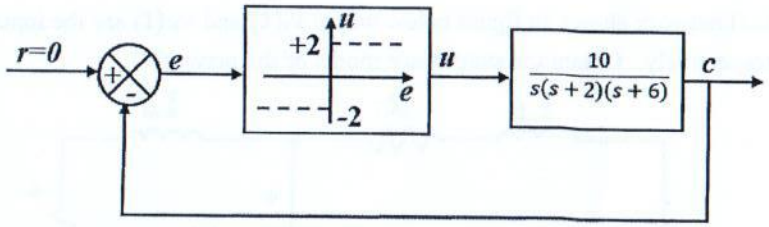
Q - 7 Derive the describing function for a nonlinear element with dead-zone and saturation. **[10]**

Q - 8 Draw the phase trajectory starting from the initial point (4, 0) for the following system. **[10]**

$\ddot{y}(t) + 0.5\dot{y}(t) + 0.5y(t)\dot{y}(t) + y(t) - 1 = 0$

Discuss about the stability of the system (use graph sheet).

Q - 9 Use the describing function analysis to investigate the possibility of a limit cycle for the nonlinear system shown in figure below. If a limit cycle is predicted, determine its amplitude and frequency and investigate its stability. **[10]**



Q - 10 a) Determine the singular points of a nonlinear system represented by the state equations **[3]**

$\dot{x}_1 = -x_1 + x_1^2 x_2; \dot{x}_2 = -(x_1 + x_2)$

b) Define stability in the sense of Lyapunov. **[2]**

c) A nonlinear system is represented by the state equations **[5]**

$\dot{x}_1(t) = x_2(t); \dot{x}_2(t) = -x_1(t) - x_2(t) + x_1(t)x_2(t)$

Check the stability of the system using Lyapunov stability criterion.

Group-C

Answer any one question. (10×1=10)

Q-11 a) Draw a typical block diagram of closed-loop digital control system. **[2]**

b) State Nyquist sampling theorem. **[2]**

c) Determine z-transform of unit ramp sequence. **[3]**

d) Determine inverse z-transform of $F(z) = \frac{z}{(z^2+z-30)}$. **[3]**

Q-12 a) Define z-transfer function. **[2]**

b) The z-transfer function of a linear time-invariant discrete-time system is $G(z) = \frac{0.18z}{(z^2-1.82z+0.82)}$. **[2]**

Plot the zeros and poles on the z-plane and comment on stability of the system.

a) Consider the characteristic equation of a discrete-time system as- **[6]**

$$Q(z) = z^3 - 1.1z^2 - 0.08z + 0.2 = 0$$

Comment on the stability of the system using Jury's stability criterion.

Aliah University
Department of Electrical Engineering
Even (Spring) Semester Examination, 2025
B. Tech. VI semester

Sub: Switchgear & Protection **Code: EENUGPE05**
Full Marks: 80 Duration: 3 hrs

Instructions:
1. **Use separate answer scripts for the two sections.**
2. Mention the question number clearly and write all the parts of a question at one place.
3. Draw circuit/figure/phasor diagram wherever applicable (including numerical).
4. Make suitable assumptions wherever necessary, symbols and notations have their usual meanings.

Section-A
(Answer any five) [50 Marks]

Q1 (A) What do you understand by zones of protection? Draw a typical power system diagram clearly marking the various zones of protection. **[5]**

(B) What are the essential peculiarities of a Current Transformer (CT) as compared to conventional power transformers? Also, distinguish between instrument CT and protection CT. **[5]**

Q2 (A) Describe the operating principle, constructional features and area of applications of reverse power or directional relay. **[5]**

(B) Discuss the earth leakage protection for single-phase and three-phase appliances. **[5]**

Q3 (A) The time-current (PSM) characteristic of an over-current relay for TMS of **1** is given below: **[3]**

PSM	2	3	5	7	9	13	15	18	20
Operating Time (sec)	14	11.2	8.6	6.4	3.8	3.5	3.4	3.3	3.1

If the current plug setting is adjusted to 75% and the time multiplier is adjusted to 0.4, calculate the time of operation of the relay when fault current is 2700 A and the relay is connected to CT ratio 400/5.

(B) What is Buchholz relay? Which equipment is protected by it? For what type of faults is it employed? Discuss its working principle. **[7]**

Q4 (A) What are the various faults and abnormal conditions to which an induction motor is likely to be subjected? What are the possible remedies/protections? **[7]**

(B) Explain the phenomenon of 'current chopping' in circuit breakers. **[3]**

Q5 (A) With the help of a neat waveform, explain the various voltages and currents that appear in the circuit breaker during arc interruption process. **[8]**

(B) State any of the important arc interruption theories. **[2]**

Q6 (A) The no load magnetizing current of a 250 MVA, 232/33 kV transformer is found to be 4.8% of the rated current. Find the maximum voltage that may occur across the circuit breaker contacts when the magnetizing current is interrupted at 65% of its peak value. Take system capacitance as 7 nF. **[6]**

(B) For the same system data as given/found in the above question (Q6(A)), calculate (i) natural frequency of oscillation, (ii) maximum value of restriking voltage and (iii) maximum value of RRRV, for a circuit breaker connected on the HV side. **[4]**

Q7 (A) A three-phase, 400 V/11 kV Y-Δ connected transformer is protected by differential protection scheme. The CTs on the LV side have a current ratio of 1000/5. What must be the ratio of CTs on the HV side and how should they be connected? Show all the connections and currents flows in different parts with a proper diagram. **[5]**

(B) A 20 MVA, 11.6 kV, 3-phase star connected alternator is protected by Mertz-Price circulating current system. If the ratio of the CT is 2000/5, the minimum operating current for the relay is 1.4 A and the neutral point earthing resistance is 5.7 Ω, calculate: **[5]**

i. The percentage of each of the stator windings which is unprotected against earth faults when the machine is operating at normal voltage.
ii. The neutral resistance to provide protection for 92% of the stator winding.

Section-B

(Attempt any five from Ques 1, any two from Ques 2, any 1 from Ques 3)

Ques no.	Statement	Marks
1	What is the difference between fault and overload? Why Mho relay is called voltage restrained directional relay? Why protection of transmission line is called distance protection? What is over-reach and under-reach of a relay? How do you define the speed of the protection system? What is the economic policy adopted to design a protective system for any power system apparatus? What is the major drawback of impedance relay?	2 x 5
2	With the help of a suitable diagram, explain the difference between real and apparent impedance seen by distance relay. Derive a necessary equation to identify the locus of the operating point of power system during swing. Explain why distance mal-operates in the event load encroachment. Explain the current inversion phenomenon in series compensated transmission line.	5 x 2
3	The transmission line is protected by the relay R as shown in Fig 1, is a Mho relay with characteristics angle of *65°*. The three zone setting of R is k_1= *5.2*, k_2= *17.32*, k_3= *22.72*, respectively. Determine zone I, zone II, zone III reach of R in *km*.	

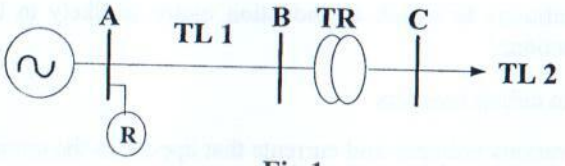


Fig 1

Relay	$k_1 = 5.2, k_2 = 17.32, k_3 = 22.72$ $\theta = 65°$,
TL 1	*220 kV, 0.03 + j 0.1265 Ω/km, 95 km*
TL 2	*132 kV, 0.04 + j 0.16 Ω/km, 100 km*
TR	250 MVA, 220/132 kV, $X_d'' = 0.1$
CT	*1000/1 A*
PT	*220 kV/ 110 V*

OR

Explain the philosophy of directional relay. What is the significance of characteristic angle (θ) in the directional relay? Explain with phasor diagram different quantities to be fed to the CTs and PTs that are connected to the different phases for $\theta = 90°$ connection in directional relay. **2 + 2 +6**

---- END OF QUESTION PAPER ----

Aliah University

Electrical Engineering Department

Even (Spring) Semester Examination, 2025

B. Tech. VI semester

Sub: Power System 2 **Code: EENUGPC14**

Full Marks: 80 **Time: 3 hrs**

Instructions:

- **Figures in the margin indicate full marks**
- **Attempt any 10 from compulsory Ques. No. 1. Attempt any five questions from rest**
- **All parts of a question must be answered at the same place.**
- **Symbols have their usual meaning.**
- **Do necessary assumptions whenever required**

Ques. No	Statement of the question	Marks
1	a) Evaluate $X = 3\alpha^2 - 4\alpha + 2$ in polar form.	2 x 10
	b) What is a sparse matrix?	
	c) Define critical clearing angle.	
	d) Can a PV bus be treated as PQ bus? Justify your answer.	
	e) Mention two advantages of per unit system.	
	f) Does an alternator attain sub-synchronous speed?	
	g) What is flat-voltage start?	
	h) What criterion is normally adopted to check the convergence of load flow solution using Newton Raphson method?	
	i) Mention one reason each for which LL and SLG fault occurs.	
	j) Write the exact coordination equation.	
	k) What is the difference between unit commitment and economic load scheduling problem?	
	l) Mention two types of fault where zero sequence component does not exist.	
2	a) Mention few assumptions made for approximate load flow solution. From SLFE, derive the expression of ***Pi*** & ***Qi*** for approximate load flow solution.	2 + 4
	b) Evaluate power (***P*** & ***Q***) flow through the each line of the power system shown in **Fig. 1** using approximate load flow solution.	6

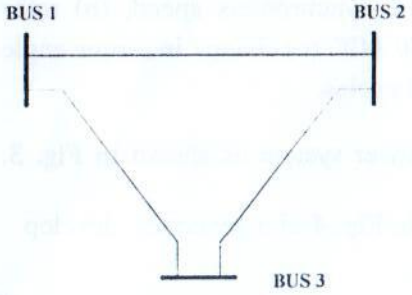


Fig 1

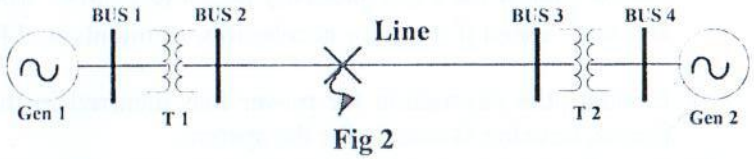


Fig 2

Table for Q. 2b (Fig 1)

Bus 1:	$V_1 = 1.02\angle 0\ pu$
Bus 2:	$V_2 = 1.005\angle -5\ pu$
Bus 3:	$V_3 = 0.997\angle 3\ pu$
Lines:	$Z_{12} = j0.6\ pu$, $Z_{23} = j0.75\ pu$, $Z_{13} = j0.85\ pu$

Table for Q. 3b (Fig 2)

Component	Rating
Gen 1	*50 MVA, 11 kV,* $X_d'' = 12\%$
Gen 2	*25 MVA, 6.6 kV,* $X_d'' = 8\%$
T1	*50 MVA, 11/66 kV,* $X_d'' = 8\%$
T2	*30 MVA, 66/6.6 kV,* $X_d'' = 10\%$
Line	*150 km, 0.1 Ω/km*

3	a) What is the difference between symmetrical and unsymmetrical fault?	2
	b) For the power system shown in **Fig. 2**, the ratings of various components are shown in the above table. Find the fault current in *kA* when a double-line fault occurs at the point located	10

115 km from bus 2.

4 a) IEEE 57-bus system has 6 generators, 17 transformers, 80 transmission lines. How many elements are non-zero of bus admittance matrix (BAM)? 2

b) Evaluate the BAM for IEEE 5-bus system. Refer to the line impedance data given in the following table and neglect the shunt admittance of each line. 10

Table for Q. 4b

L_{12}: 0.02 + j0.06	L_{13}: 0.08 + j0.24	L_{23}: 0.06 + j0.18	L_{24}: 0.06 + j0.18
L_{25}: 0.01 + j0.03	L_{34}: 0.02 + j0.06	L_{45}: 0.08 + j0.24	

5 Three phase voltage reading has been recorded in a faulty event as $V_a = 200\angle 0° kV$, $V_b = 100\angle 250° kV$, $V_c = 190.6\angle 150.6° kV$. Determine the respective sequence components and hence, determine the nature of the fault. 12

6 A power plant has 3 generators with fuel cost coefficients as given in the following table. If total demand is 18 MW, evaluate the cost incurred for each of the following cases mentioned in the table (right most column) and hence, obtain most economic condition using unit commitment method. 12

Table for Q. 6

Fuel cost characteristics $F_i(P_{Gi}) = a_i P_{Gi}^2 + b_i P_{Gi} + c_i$

Unit no	P_{max}	P_{min}	a_i	b_i	c_i
1	10	1	0.1	10	25
2	12	1	0.25	12	35
3	8	1	0.08	7.5	18

Different scheduling condition $F_3(18)$

$\{f_1(7), f_2(3), f_3(8)\}$,
$\{f_1(9), f_2(1), f_3(8)\}$
$\{f_1(10), f_2(1), f_3(7)\}$
$\{f_1(8), f_2(2), f_3(8)\}$
$\{f_1(10), f_2(0), f_3(8)\}$
$\{f_1(10), f_2(2), f_3(6)\}$

7 a) Derive an expression for active and reactive power to be delivered to an infinite bus by a generator in a lossless transmission system. 6

b) A *50 Hz*, 4-pole turbo generator rated *100 MVA*, *11 kV*, has an inertia constant of *8.5 MJ/MVA*. Find, (a) the stored energy in the rotor at the synchronous speed, (b) rotor acceleration if the P_m is suddenly raised to *70 MW*, from *50 MW*, (c) change in torque angle and rotor speed if the rotor acceleration is maintained for 8 cycles. 6

8 a) Evaluate the expression for power loss incurred in the power system as shown in **Fig. 3**. Hence, develop B-matrix for the system. 8

b) From the incremental fuel cost characteristics (IC) shown in **Fig. 4** of a generator, develop the expression for IC. 4

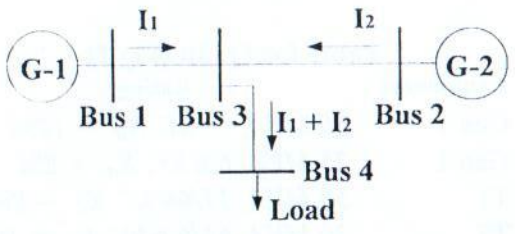


Fig 3

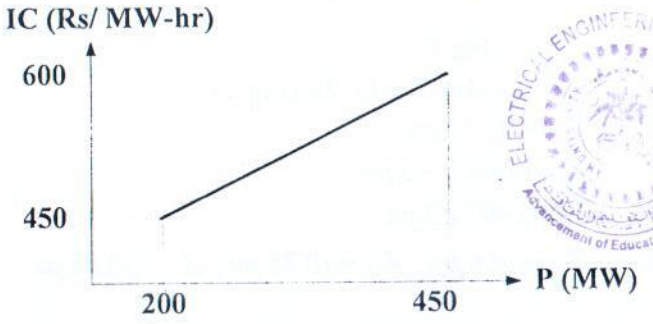


Fig 4

---------- END OF QUESTION PAPER ----------

MEN

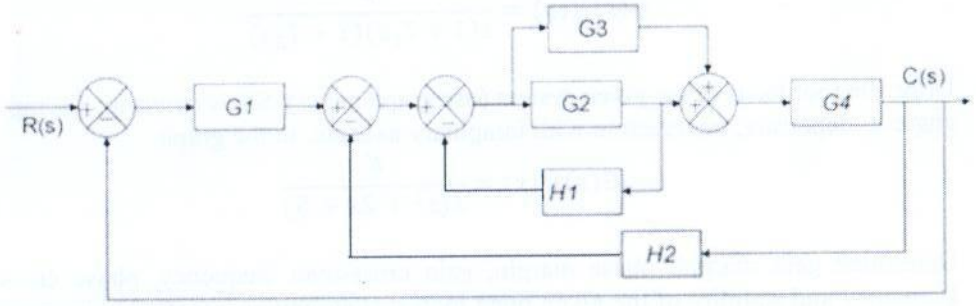
Aliah University
Electrical Engineering Department
Even (Spring) Semester Examination, 2025
(Regular and Supplementary)
Mechanical Engineering
Subject: Control System
Sub Code:EENUGOE04

Time: 3 hour
Semester:6th

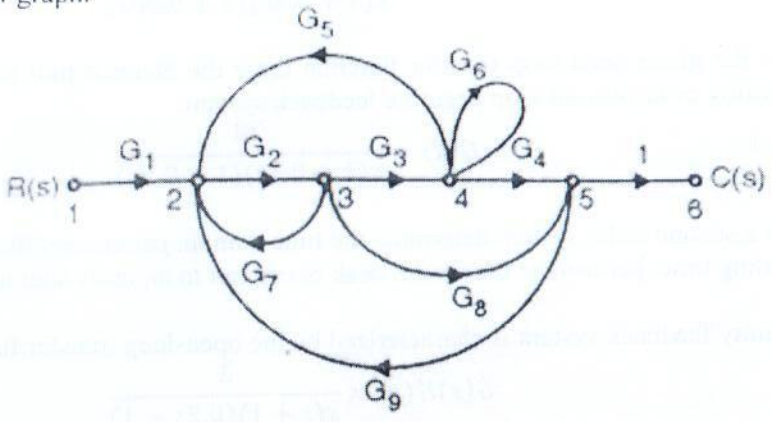
Full Marks: 80

Answer any Eight Questions (8X10=80)

1. Define any five 5X2=10
   i) Closed loop system
   ii) Phase margin
   iii) Nyquist criterion for stability
   iv) Settling time
   v) Position error constant
   vi) BIBO stability
2. Using block diagram reduction technique, find C/R. Show the steps. 10



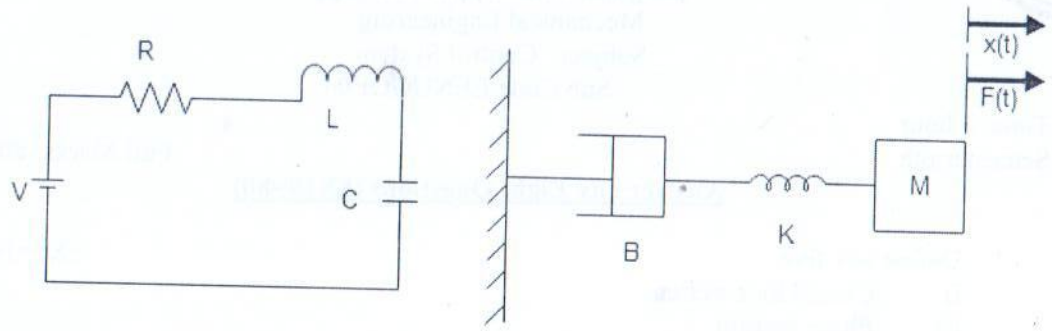
3. Find the overall transfer function, C/R by using Mason's gain formula for the following signal flow graph.



10

4. One R-L-C series circuit and one mass-spring and damper circuits are given below. Write their mathematical equations in Laplace domain. Find the analogy between them. Symbols have their usual meanings.

MEN



5. The open loop transfer function is given by the following equation. Determine the range of k for stability of the closed loop system using R-H criterion. The open loop transfer function is given as follows- 10

$$G(s)H(s) = \frac{k}{s(1+T_1 s)(1+T_2 s)}$$

6. Draw the root locus of the given system (use graph paper). Show centroid, Asymptotes, angle of departure, intersection with imaginary axis etc. in the graph. 10

$$G(s)H(s) = \frac{K}{s(s^2+2s+5)}$$

7. Determine gain margin, phase margin, gain cross-over frequency, phase crossover frequency and stability of the given open loop system having negative unity feedback using Bode plot. Show the magnitude and phase plot. (Use semi log graph paper) 10

$$G(s) = \frac{10}{s(1+0.4s)(1+0.08s)}$$

8. For the given open loop transfer function draw the Nyquist plot and state about the stability of the closed loop negative feedback system. 10

$$G(s) = \frac{20}{s(1+0.3s)(1+0.5s)}$$

9. For a second order system determine the time domain parameters like peak time, settling time, percentage maximum peak overshoot to an unity step input. 10

10. A unity feedback system is characterized by the open-loop transfer function 10

$$G(s)H(s) = \frac{1}{s(s+1)(0.2s+1)}$$

Determine the steady state error for unit step, unit ramp and unit parabolic input.

----------X----------

B.Tech. Examination-2025
Department of Electronics and Communication Engineering
(Even Semester Regular and Supplementary Examination)
Course Title: Neural Network **Course Code: ECEUGOE08**

(For EEN & MEN Department)

Full Marks: 80 **Time: 3.00 Hrs**

Q. No.			M
1.	(a)	Describe the relationship between artificial intelligence (AI), machine learning (ML), artificial neural network (ANN) and deep learning (DL) in detail with appropriate examples.	8
	(b)	Define the following (i) weights (ii) activation function (iii) bias (iii) threshold in ANN	8
2.	(a)	Draw the architecture of McCulloch Pitts neuron model and discuss how it is inspired by the biological neuron.	6
	(b)	Implement XOR function using the McCulloch Pitts neuron model.	10
3.	(a)	Explain various types of network topology of neural network in detail with appropriate diagrams.	10
	(b)	Compare between weight and bias in neural network with suitable example.	4
	(c)	Define linear separability.	2
4.	(a)	Draw the single layer perceptron network.	4
	(b)	Write down the algorithm used for training the perceptron net.	6
	(c)	Develop a perceptron net for the AND logic function with binary inputs and bipolar targets without bias.	6
5.	(a)	What do you mean by supervised and unsupervised learning in neural network? Give examples for each category.	6
	(b)	Justify that all deep learning algorithms are part of neural networks but all neural networks are not are not part of deep learning algorithms.	6
	(c)	What is meant by training and testing of neural network?	4

6. (a) What is meant by Hebb learning? 2

(b) Discuss the architecture of Hebb network and also its learning algorithm 6

(c) Using the Hebb rule, find the weights required to perform the following classifications: vectors (1 1 1 1) and (-1 1 -1 -1) are members of class (with target value 1);vectors (1 1 1 -1) and (1 -1 -1 1) are not members of class(with target value -1) . 8

7. (a) Write short notes on (any two): 8+8

(i) Various types of activation function used in neural network.
(ii) Back propagation
(iii)Multi layer feed forward network

M: Marks;

-End-

Aliah University

Electrical Engineering Department

B. Tech. Even (Spring) Semester Examination, 2025 (Regular + Supplementary)

Subject with code: Process Control (EENUGPE17)

TOTAL MARKS: 80 **TIME: 3 HOURS**

INSTRUCTIONS:

1. Clearly mention the **Question No.** in the left margin of the answer sheet.
2. **Each group of questions should be answered in one place.**
3. Acronyms & symbols have their usual meaning unless otherwise specified.
4. Make suitable assumptions wherever necessary.

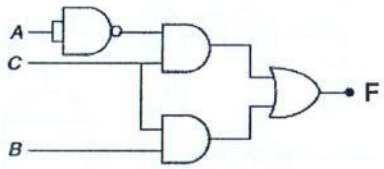
Qu. Group-A Answer all questions **6x2=12**

1.a. What is a manipulated variable? Give the name of one process variable.
1.b. Write the names of different types of advanced controllers.
1.c. Give the applications of on-off control and ratio control.
1.d. Write the advantages of an automatic controller over a manual controller.
1.e. What are the advantages of an override controller?
1.f. What devices are used in the hydraulic system?

Qu. Group B Answer any five questions **7x5=35**

2.a. Discuss different types of processes with examples. Write any two real-time applications of a programmable logic controller. **5+2**

2.b. Why do we need process control? Find out the Boolean Expression for the output F and draw a Ladder diagram (Follow Siemens standards). **3+4**



2.c. Explain any batch process with a suitable diagram. **7**

2.d Explain the electronic PID controller using an inverting amplifier. Draw the relevant diagram. **7**

2.e. Discuss briefly two schemes of ratio control with suitable diagrams. **7**

2.f. Explain the two stages of amplification of a pneumatic control system with a suitable diagram. **7**

Qu. Group-C Answer any four questions **11x3=33**

3. a. Draw and explain the level control loop with a suitable P&I diagram. **4**

b. Design PI controller using Zeigler-Nichols tuning rules for the closed-loop system, which consists of the controller and process in the forward path. A process transfer function is $\frac{1}{s(s+1)(s+2)}$. **7**

4. a. Find out $\frac{Y(s)}{D(s)}, \frac{Y(s)}{N(s)}$. Find out the controller's degree of freedom from Fig. 1: 6

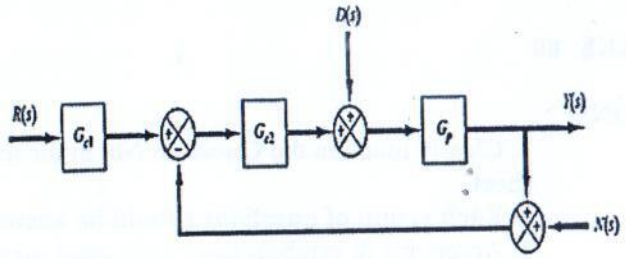


Fig. 1. 5

b. Write the differences between cascade control and feedback control.

5. The thermal system shown in Fig. 2 has an insulated tank to eliminate the heat loss to the surroundings, along with a heater and a mixer. Determine the transfer function of the system relating the temperature to the input heat flow rate. 11

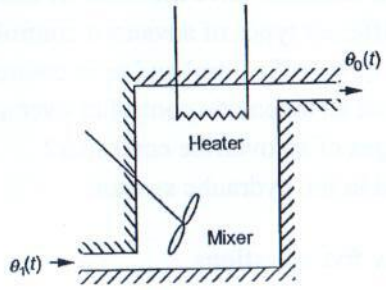


Fig. 2

6. a. Describe the P &I diagram of the furnace shown in Fig. 3: 4

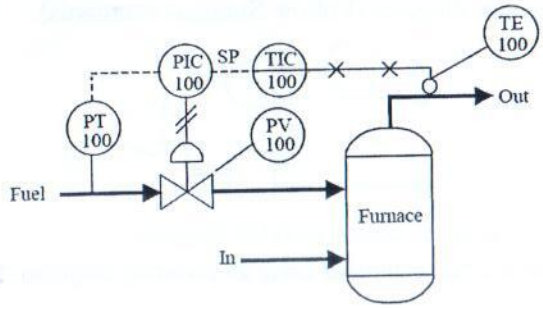


Fig. 3.

b. Determine the values of K and a of the closed-loop system shown in Fig. 4, so that the maximum overshoot in unit-step response is 25% and the peak time is 2 sec. Assume that J = 1 $kg - m^2$. 5

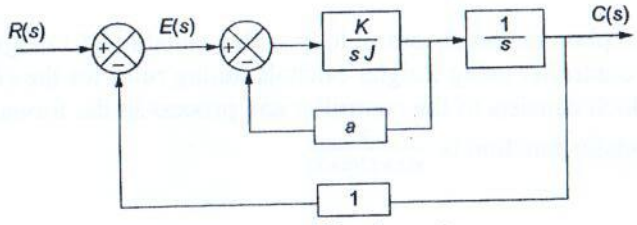


Fig. 4

c. What is distributed processes? 2

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Even (Spring) Semester Examination May-June, 2025

Paper Code: MBAUGHU02; Paper name: Professional Values and Ethics B.Tech CSE/ECE/EEN/MEN/CEN VIIIth Semester

Full Marks: 80; **Time: 3Hrs.**

(The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as possible)

GROUP: A (*Answer all the questions*) (1 x 10 = 10)

1. Choose and write ONLY the correct option (a/b/c/d). DO NOT write full sentences.

I. The rule of ethics are also called as
A. Rule B. Law C. Responsibility D. None of the above

II. Ethical issues that can affect an engineer's professional and personal life are termed as

A. Macro-ethics B. Micro-ethics C. Morals D. Rights

III. Business malpractice does not include
A. Black Marketing B. Advertisement C. Duplication D. Adulteration

IV. Which philosopher suggested wisdom, courage, temperance and justice as four cardinal virtues? A. Aristotle B. Plato C. Socrates D. Aquinas

V. Ethics is the science of
A. beauty B. conduct C. truth D. mind

VI. ..... is recognized as the father of 'Emotional Intelligence'.
A. Salovey& Mayer B. Daniel Goleman C. Rokeach D. John Piaget

VII. The word 'ethics' was derived from the Greek word
A. ethies B. ethos C. ethees D. ethise

VIII. Aesthetics deals with the standard of
A. truth B. beauty C. goodness D. trust

IX. Business ethics has a _____ application.
A. natural B. universal C. practical D. none of the above

X. The relevance of ethics is in its
A. Context B. Applications C. Principles D. Understanding

GROUP: B (*Answer any five questions*) (5 x 5 = 25)

2. What do you mean by 'Values', 'Morals' and 'Ethics'?
3. Define empathy and sympathy.
4. What is a Moral Dilemma? Explain it with an example.
5. What are 'Intellectual Property Rights'(IPR)? Mention the different types of IPR.

OR

Define 'Whistleblowing'. What are the different types of 'Whistleblowing'? Explain

6. Write a short note on 'Civic Virtues'.
7. What are the 'Codes of Ethics'? Discuss the importance of 'Codes of Ethics.'
8. What do you mean by the term 'Globalisation'? Explain the key components of globalisation in detail.

GROUP: C (*Answer any three questions*) (15 x 3 = 45)

9. Discuss the essential skills for Engineers as effective managers in detail.

OR

Compare and contrast engineering experiments/Projects with standard experiments.

10. What are the factors that affect risk acceptability?

OR

What are the four stages in Piaget's theory of moral development? Explain.

11. Justify your view on inclusion of 'Professional Values and Ethics' course in the Engineering domain.
12. Explain any five ethical theories in the context of engineering ethics.
13. Explain in detail any two analytical methods for testing the safety of an engineering product.

Aliah University
Electrical Engineering Department
M.Tech Even Sem Examination 2025 (Regular)
Subject with code: Intelligent Control (EENPGPE02)

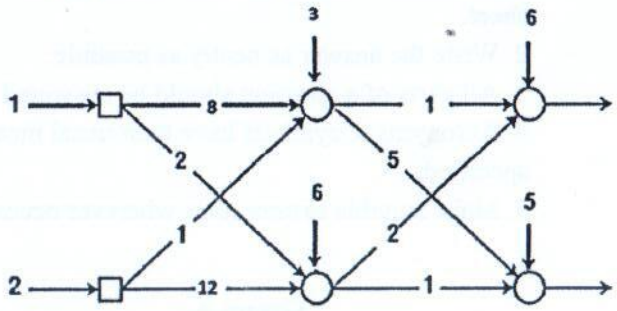
TOTAL MARKS: 80 **TIME: 3 HOURS**

INSTRUCTIONS:

1. Clearly mention the Question No. in the left margin of the answer sheet.
2. Write the answer as neatly as possible.
3. All parts of a question should be answered in one place.
4. Acronyms & symbols have their usual meaning unless otherwise specified.
5. Make suitable assumptions wherever necessary.

Q. No.	Group A Answer any eight questions	Marks 8x10=80
1.	a. What is intelligent control? Explain with an example.	4
	b. Write the names of different types of intelligent control techniques. Describe it briefly.	6
2.	a. Draw the synergy of computational intelligence.	3
	b. Give an example of a competitive learning network. Explain this network briefly with a diagram.	1+6
3	a. Describe a recurrent neural network with a neat and clean diagram.	5
	b. Consider a polynomial equation: $x^5 + 8x^4 + 9x^3 + 2x^2 - 7x - 6 = 0$. Draw an artificial neural network structure of this equation. Describe this structure briefly.	5
4.	Consider the washing machine problem. Design it with a triangular membership function for the Mamdani method. Discuss the fuzzy rules for this system. What do you mean by defuzzification method?	8+2
5.	Discuss any two types of fuzzy systems with a suitable block diagram. Give an example of the intersection of two fuzzy sets.	8+2
6.	a. What is a perceptron learning neural network?	2
	b. What is a radial basis function (RBF) neural network? Discuss 2-.5-1 RBF neural network structure.	4+4
7.	Write the difference between i. Fuzzy logic controller and conventional controller. ii. Neural Processing and Fuzzy Processing	6+4

8. Calculate the output of the neural network in the figure shown below. Discuss the sigmoidal activation function. Find out the output of the neural network in the same figure by applying the binary sigmoidal function. **10**



9. Write any one **10**

   i. The clustering algorithm for four input vectors.

   ii. Genetic Algorithm

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Aliah University

Even (Spring) Semester Examination, 2025

M.Tech, 2nd Semester Examination

Subject: Optimal & Robust Control; Code: EENPGPC03

TOTAL MARKS: 80 **TIME: 3 HOURS**

(Notations used have their usual meaning)

Answer any five questions (5×16=80)

Q - 1 a) What do you mean by dynamic optimization technique? **[2+6 +8]**

b) Formulate the performance indexes for time-optimal control system, terminal control system and minimum-energy control system.

c) Minimize the performance index

$$J = \int_0^1 [x^2(t) + u^2(t)]dt$$

with boundary conditions $x(0)=1$ and $x(1)=0$ subject to the condition

$$\dot{x}(t) = -x(t) + u(t)$$

Q - 2 a) State fundamental lemma of calculus of variations. **[2+10 +4]**

b) Consider the performance index $J = \int_{t_0}^{t_f} V(x_1(t), x_2(t), \dot{x}_1(t), \dot{x}_2(t), t)dt$

subject to the condition $g(x_1(t), x_2(t), \dot{x}_1(t), \dot{x}_2(t)) = 0$

with fixed-end-point conditions $x_1(t_0) = x_{10}$; $x_2(t_0) = x_{20}$; $x_1(t_f) = x_{1f}$; $x_2(t_f) = x_{2f}$.

Derive Euler-Lagrange equation to minimize the performance index.

d) Find the extremal of the following functional

$$J = \int_0^2 [2x^2(t) + \dot{x}^2(t)]dt$$

with boundary conditions $x(0)=0$; $x(2)=5$.

Q – 3 Consider a system described by $\dot{x}_1(t) = x_2(t)$; $\dot{x}_2(t) = -2x_1(t) + 5u(t)$ **[16]**

with the following performance index to be minimized

$$J = \frac{1}{2}\int_0^2 [x_1^2(t) + u^2(t)]dt$$

Boundary conditions are $x_1(0) = 3$; $x_2(0) = 5$; $x_1(2) = 0$ and $x_2(2) = 0$.

a. Determine state equation
b. Determine co-state equation
c. Determine the control input that minimizes the cost function using the method of Hamiltonian.

Q - 4 a) Write the differences between linear quadratic regulator (LQR) and linear quadratic Gaussian (LQG) controllers. **[4+12]**

b) Proof that $\dot{\boldsymbol{P}}(\boldsymbol{t}) + \boldsymbol{P}(\boldsymbol{t})\boldsymbol{A}(\boldsymbol{t}) + \boldsymbol{A}^{\boldsymbol{T}}(\boldsymbol{t})\boldsymbol{P}(\boldsymbol{t}) + \boldsymbol{Q}(\boldsymbol{t}) - \boldsymbol{P}(\boldsymbol{t})\boldsymbol{B}(\boldsymbol{t})\boldsymbol{R}^{-1}(\boldsymbol{t})\boldsymbol{B}^{\boldsymbol{T}}(\boldsymbol{t})\boldsymbol{P}(\boldsymbol{t}) = \boldsymbol{0}$ for a linear time varying system described by $\dot{X}(t) = A(t)X(t) + B(t)u(t)$.

where $P(t)$is the solution of the matrix differential Riccati equation, $Q(t)$ &$R(t)$ are weight matrices.

Q - 5 The state model of a plant is described as **[16]**

$\dot{x}_1(t) = x_2(t); \quad \dot{x}_2(t) = -2x_1(t) - 3x_2(t) + u(t)$

and the cost function $J = \int_0^\infty [2x_1^2(t) + 4x_2^2(t) + 0.5u^2(t)]dt$

Determine Algebraic Riccati equation (ARE) and gain of Linear Quadratic Regulator (LQR) controller of the system.

Q - 6 a) Consider the vector $x = (-6, -1, 2, 0, 4)$ which belongs to the vector space $\mathbb{R}^5$. Determine 2nd norm of the vector. **[2+6+3 +5]**

b) Determine one norm and infinity norm of matrix $A = \begin{bmatrix} 5 & 8 & -9 \\ -7 & 3 & 5 \\ 1 & -8 & 2 \end{bmatrix}$.

c) Define H_2 norm of a system.

d) Calculate H_2 norm of a system with transfer function $F(s) = \frac{1}{(s+2)(s+4)}$.

Q - 7 a) State small gain theorem. **[4+6+6]**

b) What do you mean by model uncertainty? What are the different types of unstructured model uncertainty?

c) What is sensitivity function? Derive the expression of sensitivity function of closed-loop transfer function with respects to the relative change of forward path transfer function.

Aliah University

Department of Electrical Engineering, M-Tech (Power System)

Even (Spring) Semester Examination, 2025

Subject: Computer Applications to Power System [**EENPGPC13**]

Full Marks: 80
Year: I

Time: 3 Hours
Semester: II

Instructions :

1. Mention the question number clearly and write all the parts of a question at one place.
2. Draw circuit/figure/phasor diagram wherever applicable (including numerical).
3. Make suitable assumptions wherever necessary, symbols and notations have their usual meanings.
4. All questions carry **equal marks** unless specified.

Answer **any five** questions.

Q1. a) Explain the concept and objective of economic load dispatch. Why is it important in power system operation?

b) Derive the condition for economic load sharing between two generators without transmission losses.

c) Using the Lambda Iteration Method, solve an ELD problem for two generators with the following cost functions:

$C_1(P_1) = 0.005P_1^2 + 7P_1 + 300$

$C_2(P_2) = 0.01P_2^2 + 6.5P_2 + 250$

Subject to $P_1 + P_2 = 250$ MW

Q2. a) What are the main objectives of load flow studies?

b) Describe the classification of buses used in load flow analysis.

c) Compare Gauss-Seidel and Newton-Raphson methods in terms of speed, accuracy, and memory requirements.

d) What are the input data required for load flow analysis?

Q3. Using the Gauss-Seidel method, perform one iteration of load flow analysis for a 3-bus power system. Assume bus data and line admittances as follows:

Bus 1: Slack Bus ($V = 1.05\angle 0°$)

Bus 2: PQ Bus ($P = 1.0$ pu, $Q = 0.5$ pu, initial $V = 1.0\angle 0°$)

Bus 3: PQ Bus ($P = 0.5$ pu, $Q = 0.3$ pu, initial $V = 1.0\angle 0°$)

Use simplified Y-bus matrix as needed.

Q4. a) Define power system stability. Explain the differences between transient, steady-state, and dynamic stability.

b) Derive the swing equation for a synchronous generator and explain each term.

c) Describe the equal area criterion for stability with the help of a diagram and its application in a sudden short circuit scenario.

Q5. a) What is SCADA? Describe its architecture with a neat diagram.

b) Discuss the key functions of SCADA in power system operation and control.

c) Explain the role of RTUs (Remote Terminal Units) and MTUs (Master Terminal Units) in SCADA.

d) Mention two common SCADA communication protocols used in power systems.

Q6. Short Notes (Any Four) **[4×4=16 Marks]**

a) Optimal load flow

b) Applications of SCADA in renewable energy integration

c) Stability improvement methods in power systems

d) Bus Admittance Matrix (Y_{bus})

e) Computational challenges in Load Flow Analysis

f) Real-time monitoring using PMUs

Aliah University
Electrical Engineering Department
Even (Spring) Semester Examination, 2025
Stream: M.Tech in Electrical Engineering (Control System)
(For regular and supplementary)
Subject: Non-Linear Control
Sub Code: EENPGPC04

Time: 3 hour
Semester: 2nd

Full Marks: 80

Answer any **Eight** (08) number of given questions **8X10=80**

1. A. What are the various salient properties exhibited by non-linear system? Mention them. Explain any two of them.
   B. What are meant by inherent nonlinearity and intentional nonlinearity? Give examples. Draw i/o responses for one of each category.

   10

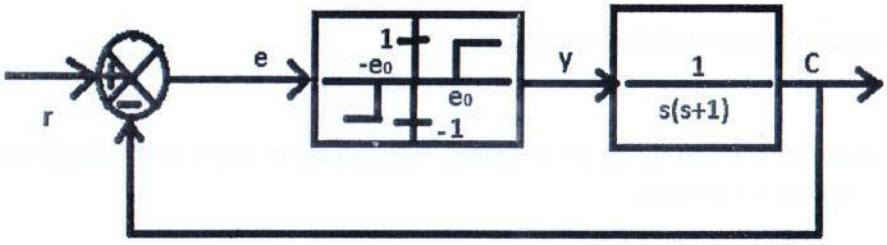
2. (i) What is called singular point?
   (ii) Define phase portrait.
   (iii) Classify various singular points. Draw their phase portraits with respect to their pole locations.

   10

3. For the following systems classify the singular points and draw the phase portrait of the singular points.
   (i) $\begin{bmatrix}\dot{x}\\ \dot{y}\end{bmatrix} = \begin{bmatrix}-2 & 3\\ -3 & -2\end{bmatrix}\begin{bmatrix}x\\ y\end{bmatrix}$
   (ii) $\dot{x} = y$
   $\dot{y} = -5x$

   10

4. Consider the nonlinear system given below. Draw the phase trajectory of the system-

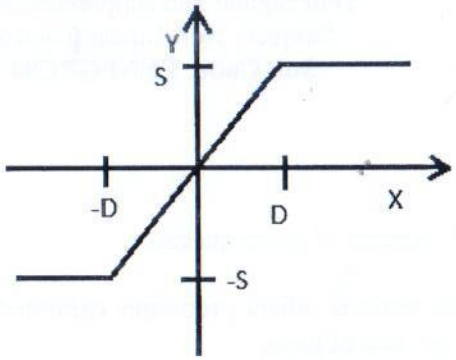


   10

5. (i) Explain the stability analysis of limit cycle using describing function method.
   (iii) What are the differences between phase plane technique and describing function method.

   10

6. Determine the describing function of the following non-linearity-



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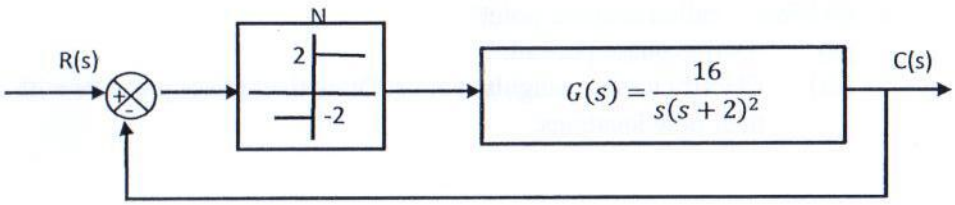
7. For the non-linear system shown in figure below determine the amplitude and the frequency of the limit cycle.



10

8. (i) Determine the definiteness of the given function

$$V(x) = x_1^2 + x_2^2 + 3x_3^3 - x_3^4$$

(ii) Determine the condition for positive definiteness of the function. Use Sylvester's theorem.

$$V(x) = ax_1^2 + ax_2^2 + ax_3^2 + 2x_1x_3 + 4x_2x_3$$ 10

9. Consider the system following system -

$$\dot{x}_1 = -3x_1 + x_2$$
$$\dot{x}_2 = x_1 - x_2 - x_2^3$$

Examine the stability of the given system with respect to origin as the equilibrium point by Krasovskii's method.

10

10. Determine the stability of the system by Lyapunov's method given by

$$\dot{x}_1 = x_2 + x_1(x_1^2 + x_2^2)$$
$$\dot{x}_2 = -x_1 + x_2(x_1^2 + x_2^2)$$

Use the function $V(x) = x_1^2 + x_2^2$. 10

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Aliah University

Department of Electrical Engineering

Even (Spring) Semester Examination, 2025

M. Tech. II semester

Sub: Advanced Power System Protection **Code: EENPGPC14**

Full Marks: 80 Duration: 3 hrs

Instructions:
1. **Use separate answer scripts for the two sections.**
2. Mention the question number clearly and write all the parts of a question at one place.
3. Draw circuit/figure/phasor diagram wherever applicable (including numerical).
4. Make suitable assumptions wherever necessary, symbols and notations have their usual meanings.

Section - A

Answer any five (5 X 10 = 50 marks)

Q-1 Discuss the following protection schemes for an induction motor: (a) phase and ground fault combined protection, (b) percentage differential relay protection & (c) high impedance ground fault protection. **[4 + 3 + 3]**

Q-2 Discuss the methods of discrimination in the protection of transmission line by over-current relay. **[10]**

Q-3 Design a protection scheme by calculating the PSM and TMS of IDMT relays used for the protection of a distribution feeder which is described as below: It is a radial feeder having three sections divided by buses A, B & C. The bus A is on the generator side and the bus C is the farthest bus. The loads on the buses A, B & C are 270 A, 175 A & 90 A, respectively. The IDMT relays are to be applied at buses A and B. The backup protection selectivity must be maintained between the two relays. Take the maximum fault current at bus B to be 1850 A. **[10]**

Q-4 What is the data acquisition system in numerical relays? Discuss the functions of various components of the data acquisition system. Also explain sampling and aliasing with reference to the data acquisition. **[2 + 5 + 3]**

Q-5 Draw and describe the block schematic diagram of interface for resistance and reactance measurement by a microprocessor/microcontroller. Explain the theoretical calculation behind the process. **[10]**

Q-6 Draw and explain the block diagram of a microprocessor/microcontroller-based distance relay. **[10]**

Section - B

Answer any five (5 x 6 = 30 marks)

Q-1 Why does the distance relay mal-operate in the event of load encroachment? **[6]**

Q-2 Explain the difference between real impedance and apparent impedance measured by distance relay. **[6]**

Q-3 Explain the philosophy of impedance relay. What is stepped distance protection? **[3 + 3]**

Q-4 What is the difference between stable swing and unstable swing? With a suitable diagram, explain how relay mal-operates in the event of swing. **[1 + 5]**

Q-5 A transmission line has impedance of $(1 + j10)\ \Omega$. A Mho relay can protect the entire line in its 1st zone of protection. Using graph paper, show the percentage of under-reach of the relay, if a fault occurs with $R_f = 4\Omega$. **[6]**

Q-6 Why the protection of transmission line is called distance protection? Why over-current relay is not found suitable in transmission line protection? **[2 + 4]**

—— END OF QUESTION PAPER ——

Aliah University

Even (2nd) Semester Examination, 2024-2025

Course: Civil Engineering Year: M.Tech (1st Yr) Subject: Waste to Energy

Subject Code: CENPGOE01 Max. Marks: 80 Time: 3 hrs

1. Answer all questions:

a) Derive approximate chemical formula for the organic portion of a 100 kg solid waste sample with the compositions provided below: (20)

Components	Wet Mass (kg)	Dense Mass (kg)	C	H	0	N	S	Ash
Food Waste	28	6.8	5.2	0.45	1.95	0.18	0.04	0.46
Paper	48	54	25.5	2.78	18.50	0.19	0.09	2.89
Card Board	15	11.6	7.25	0.79	4.80	0.09	0.03	0.76
Plastics	11	9.5	8.9	0.86	2.28	---------	--------	0.99
Garden Trimmings	12	5.2	4.1	0.55	2.78	0.19	0.08	0.35
Wood	9	8	3.2	0.42	1.80	0.05	--------	0.16

b) With reference to the chemical composition derived above in 1a), determine the energy potential, the net electric power that can be generated from the municipal solid waste for a city, whose per capita municipal solid waste generation is 0.3 kg/capita/day for the year 2050. Population data for the city is provided below: (25)

Year	Population (in thousands)
1960	110
1970	120
1980	160
1990	180
2000	200
2010	230
2020	260

c) Consider the following data to calculate the savings in greenhouse gas emissions for a thermal power plant having two units of 210 MW capacity, one unit of 250 MW and two units of 60 MW. (25)

i) For 100 MW of electricity generation- 53800 kg of coal is required.

ii) Average emission coefficient of CO_2 in kg per kg of coal and for CO, SO_2 and NO in gm per kg of coal is 1.705, 1.663, 19.23 and 3.61 respectively with respect to 210 MW capacity.

iii) Average emission coefficient of CO_2 in kg per kg of coal and for CO, SO_2 and NO in gm per kg of coal is 1.565, 0.272, 13.835 and 3.635 respectively with respect to 250 MW capacity.

iv) Average emission coefficient of CO_2 in kg per kg of coal and for CO, SO_2 and NO in gm per kg of coal is 1.550, 0.493, 10.918 and 4.235 respectively with respect to 60 MW capacity.

d) What is meant by Ultimate Analysis of Municipal Solid Waste. How can energy recovery be done from it? (10)

Aliah University

Dept. of Electrical Engineering

M. TECH (CS & PS) 1st YEAR 2nd SEM

Even (Spring) Semester Examination, 2025

(Regular/Supplementary)

SUBJECT NAME: RENEWABLE POWER GENERATION & CONTROL

SUBJECT CODE: EENPGPE03

TOTAL MARKS: 80] **[TIME: 3 HOURS**

INSTRUCTIONS: -

1. Clearly mention the **Question No**. in the left margin of the answer sheet.
2. Write answer **neatly** as practicable as possible.
3. Write answers **to the point**, keeping in mind the allotted **marks.**
4. Write in your own words from your own understanding.
5. All part of a question should be answered **at one place**.
6. Draw circuit/figure & waveforms wherever applicable (including numerical)**.**
7. **Acronyms & symbols** have their usual meaning.

Answer any **five**

Que-1 (A) Discuss the working principle, construction, and applications of flat plate solar collectors. Elaborate on the key differences and relative efficiencies of flat plate air collectors and flat plate liquid collectors. **[8]**

(B) Explain the working principle of a solar pond. Describe its typical layered structure and how this structure contributes to heat collection and storage. What are some applications of the heat trapped in a solar pond? **[8]**

Que-2 (A) What is a fuel cell and what are its main advantages? **[2+2]**

(B) Discuss about potential applications of fuel cell. **[4]**

(C) A 100 cm^2 fuel cell is operating, under typical conditions of 1 atmosphere pressure and 80°C, at 0.7 V and generating 0.6 A/cm^2 of current, for a total current of 60 A. Calculate the excess heat generated. **[8]**

Que-3 (A) List and elaborate on most impactful factors that should be considered when selecting a suitable site for installing a wind turbine or a wind farm. For each criterion, explain its importance. **[8]**

(B) Derive the expression for the total power available in a wind stream, showing how it is proportional to the cube of the wind speed. Clearly define all terms used in your derivation. **[8]**

Que-4 (A) Describe the basic working principle of a Solid Oxide Fuel Cell (SOFC). Include the key components (anode, cathode, electrolyte) and the types of materials typically used for them. What role does the high operating temperature play in its operation? **[8]**

(B) Find the ideal fuel cell voltage at no load and maximum efficiency for the direct methanol fuel cell having following reactions: [8]

Anode Reaction: $CH_3OH + H_2O$ (l) $\rightarrow CO_2 + 6H^+ + 6e^-$

Cathode Reaction: $3/2\ O_2 + 6\ H^+ + 6e^- \rightarrow 3\ H2O$ (l)

Overall, Cell Reaction: $CH_3OH + 3/2\ O_2 \rightarrow CO_2^* + 2\ H_2O$ (l)

What flow rate in kg/h of methanol and oxygen would be required to produce an electrical power output of 100 kW? At what rate heat is to be removed from the cell? Given for standard conditions, the change in Gibb's free energy, $\Delta G° = -56.8$ kCal/mol, and the change in enthalpy, $\Delta H° = -39.59$ kCal/mol.

Que-5 (A) With the help of diagram, explain the terms (i) wind shear, (ii) gradient height, (iii) free atmosphere, (iv) planetary boundary, (v) surface layer and (vi) Ekman layer. [8]

(B) An aero generator produces an electrical output of 1200 watts when operating under standard atmospheric conditions, specifically, at a wind speed of 5 meters per second (m/s), an atmospheric pressure of 1.0 atm, and a temperature of 20°C (293 K). Assuming the performance of the aero generator depends on air density and wind speed, determine the expected power output when the same generator is relocated to the top of a hill. At the hilltop, the temperature is 10°C (283 K), the atmospheric pressure is 0.85 atm, and the wind speed increases to 6 m/s. Assume the generator's efficiency remains constant and that the power output is proportional to the air density and the cube of the wind speed. Take R = specific gas constant for dry air as 287 J/kg·K. [8]

Que-6 (A) Explain the meaning of anaerobic digestion. Also, discuss processes involved during anaerobic digestion. [6]

(B) Calculate the digester volume for a cow dung-based biogas plant to meet the cooking needs of five people, where each person requires 230 liters of gas per day. Additionally, account for lighting three 100 Candle Power (CP) mantle lamps, each consuming 120 liters of gas per hour for 3 hours daily. Also, determine the number of cows needed to sustain the plant, assuming each cow produces 10 kg of dung per day with a collection efficiency of 70%. Assume that the dung contains 16% solids, and 340 liters of gas are produced per kilogram of solid. The slurry density is taken as 1090 kg/m³. [10]

Que-7 (A) Sketch a typical V-I (voltage-current) characteristic curve (also known as a polarization curve) for a fuel cell. Clearly label the axes and identify the distinct regions of operation on this curve. [6]

(B) Explain "Activation Polarization" in a fuel cell. What is its primary cause, under what operating conditions (current densities) is it most significant and what methods can be employed to reduce it. [10]

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Aliah University

Department of Electrical Engineering
Even (Spring) Semester Examination, 2025 (for ECE)
M. Tech., II semester

Sub: Optimization in Engineering — Code: EENPGOE01
Full Marks: 80 — Time: 3 hrs

Instructions:
- **Figures in the margin indicate full marks**
- **Attempt any eight questions**
- **All parts of a question must be answered at the same place.**
- **Do necessary assumptions whenever required**
- **Solve Ques. No 5 by graph paper.**

Ques. no	Statement of the question	Marks
1	Solve the following problem using big-M method Minimize $Z=4x_1+5x_2$ Subject to, $2x_1+3x_2 \geq 6$ $3x_1+x_2 \geq 3$ $x_1 \geq 0,\ x_2 \geq 0$	10
2	Solve the following problem using simplex method Maximize $Z=19x_1+7x_2$ Such that $7x_1+6x_2 \leq 42$ $5x_1+9x_2 \leq 45$ $x_1-x_2 \leq 4$ $x_1 \geq 0,\ x_2 \geq 0$	10
3	**(a)** Determine definiteness of the matrix $A=\begin{bmatrix} 4 & 2 & -7 \\ -2 & 3 & -2 \\ -4 & 0 & 1 \end{bmatrix}$	5
	(b) Comment, whether Kuhn-Tucker (KT) condition can be applied to minimize $f=5x_1^2+3x_2^2+x_3^2-x_1x_2+8x_2x_3$ subject to some inequality constraints or not.	5
4	**(a)** State the necessary and sufficient conditions for unconstrained single-variable optimization problem.	4
	(b) The profit per acre of a farm is given by $20x_1+26x_2+4x_1x_2-4x_1^2-3x_2^2$, where, x_1 and x_2 denote the labour cost and the fertilizer cost, respectively. Find the values of x_1 and x_2 to maximize the profit.	6

5 Solve the following linear programming graphically: 10

Maximize $Z=50x_1+100x_2$

Subject to: $10x_1+5x_2\leq 500$

$x_1+2x_2\leq 200$

$x_1+3x_2\leq 100$

$x_1\geq 0,\ x_2\geq 0$

6 The AKT Corporation manufactures two electrical products: air conditioners and large fans. The assembly process for each item is similar in that both require a certain amount of wiring and drilling. Each air conditioner takes 3 hours of wiring and 2 hours of drilling. Each fan must go through 2 hours of wiring and 1 hour of drilling. During the next production period, 240 hours of wiring time are available, and up to 140 hours drilling time may be used. 10

Management decides that, to ensure an adequate supply of air conditioners for a contract, at least 20 air conditioners should be produced. Due to the fact of AKT incurred an oversupply of fans in the preceding period, management also insists that, no more than 80 fans to be produced during this production period. Each air conditioner yields a profit of Rs 25. Each fan assembly may be sold for a profit of Rs 15.

Formulate the above problem and solve to find the best combination of air conditioners and fans that yields a highest profit.

7 Starting from the point (0,0), show two steps of iteration of the steepest descent method for finding the minimum point of the function: $f(x_1,x_2)=2x_1-x_2+5x_1x_2+x_1^2+x_2^2$ 10

8 Starting from the point (0, 0), show one iteration of the BFGS method for finding the minimum point of the function: $f(x_1,x_2)=x_1-x_2+5x_1x_2+2x_1^2+x_2^2$ 10

9 **(a)** Point out some drawbacks of Newton's method of unconstrained multi-variable optimization. 3

(b) Compute two iterations to minimize $f(x_1,x_2)=x_1^3+x_2^3+2x_1^2+4x_2^2+6$ using Newton's method. 7

10 Minimize $f(X)=9-8x_1-6x_2-4x_3+2x_1^2+4x_2^2+x_3^2+x_1x_2+4x_1x_3$ subject to $x_1+x_2+2x_3=3$ by Lagrange multiplier method. 10

----------END OF QUESTION PAPER ----------