Aliah University

Department of Electrical Engineering, B-Tech
Even (Spring) Semester Examination, 2025 (Reg./Supple)
Subject: Basic Electrical Engineering **[EENUGES01]**

Full Marks: 80 Time: 3 Hours
Year:I 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.

Answer any five questions 5x16=**80 M**arks

1. a) State Ohm's law and explain its limitations with suitable examples. **[4]**
   b) Show that maximum voltage occurs when capacitive reactance is minimum in an AC circuit. **[4]**
   c) Define: (i) Phase angle (ii) Form factor (iii) Crest factor (iv) Root mean square value. **[4]**
   d) Prove that the real power consumed by a pure capacitor is zero. Draw voltage, current and power waveforms of pure capacitor circuit. **[4]**

2. a) Find the voltage across all nodes as represented in **Fig.1.** **[5]**
   b) In the network shown in **Fig. 2**, find the value of $\mathbf{R_L}$ such that maximum possible power will be transferred to it. Find also the value of the maximum power and the power supplied by source under these conditions. **[5]**
   b) Find the Norton equivalent circuit and current through 4 Ohm resistance, as shown in **Fig.3**. **[6]**

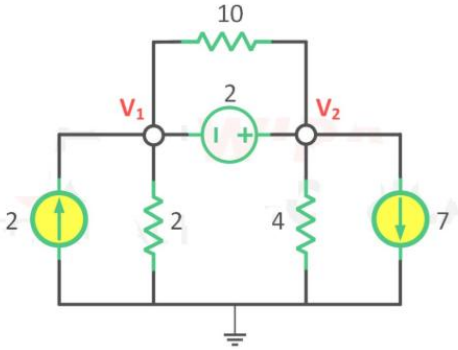


Fig.1

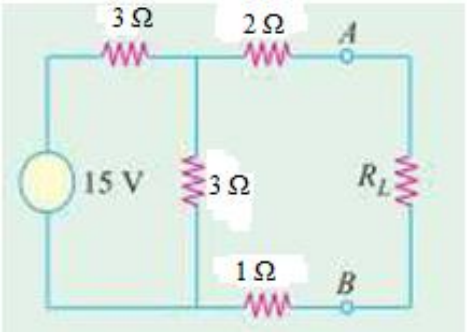


Fig.2

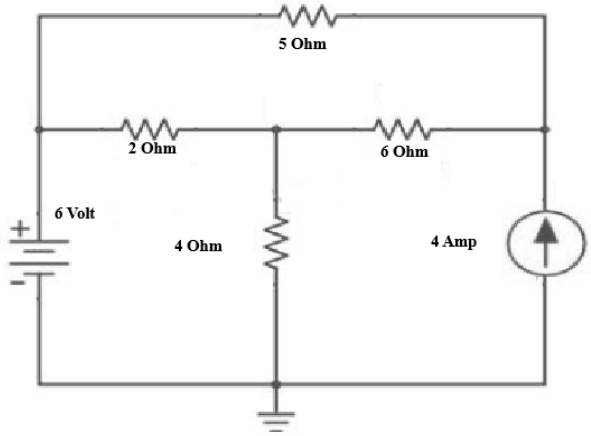


Fig. 3

3. a) In R-L circuit with DC excitation (driven circuit) determine inductor voltage and inductor current. **[8]**

b) In an R-L circuit with the time constant of 1.25s, inductor current increases from the initial value of zero to the final value of 1.2A i) Calculate the inductor current at time 0.2s, 0.4s and 1.2s. ii) Find the time at which the inductor current reaches 0.3A, 0.6A and 0.9A. **[8]**

4. a) How does the back emf regulates the armature current in a D.C. Motor? Explain with relevant equations. **[5]**

b) In a 50 kVA 2000/200V, 50 Hz single phase transformer, the iron and copper losses are found to be 800 Watt and 400 Watt at the full load and unity p.f, respectively. Calculate the efficiency of the transformer with same power factor at i) full load and ii) two third of the load. **[6]**

c) Derive the condition for maximum power transfer from a source to resistive load. **[5]**

5. a) Derive the expression of back emf in a DC motor using standard notations. **[6]**

b) A DC long shunt compound generator delivers a load current of 10A at 420V. The resistance of the armature, series and shunt field are 0.03 Ω, 0.015 Ω and 150 Ω, respectively. Calculate the emf induced in the armature. Consider a brush voltage drop of 1V/brush. **[6]**

c) An alternating voltage is given by V=230sin314t.Calculate i) frequency, ii) maximum value, iii) average value, iv) RMS value. [4**]**

6. a) Define average value of an AC waveform. Derive its relationship with maximum value for a sine wave. **[5]**

b) A series circuit has R = 15 Ω and C = 100 μF connected to a 200 V, 50 Hz supply. Calculate current, power factor and real power. **[6]**

c) Derive an expression for impedance and power factor in an R-C series circuit. Draw the corresponding waveforms. **[5]**

7. a) Draw the phasor diagram for leading p.f load in an ideal transformer. **[4]**

b) A 10 kVA, 230/115 V, 50 Hz transformer has 1.2 V/turn and operates at a maximum flux density of 1.4T. Determine: (i) number of primary and secondary turns, (ii) core area, (iii) full-load primary current. **[6]**

c) Derive an expression for the electromotive force induced in the secondary winding of a transformer. **[6]**

ALIAH UNIVERSITY
END TERM EXAMINATION, AUTUMN 2025
PAPER: MATUGBS01 (Engineering Mathematics I)
All symbols have their usual meanings
Use different answer scripts for different groups.

Full Marks: 80 Time: 3 Hours

GROUP - A (40 marks)

1. Answer all the following questions: $1 \times 5 = 5$

(i) Define a bounded sequence of real numbers.

(ii) Write the definition of the radius of convergence of a series.

(iii) Define global maxima of a function.

(iv) State Rolle's theorem of a function.

(v) Evaluate the value of $\beta(4, 2)$

2. Answer all the following questions: $1 \times 5 = 5$

(i) The value of the $\lim_{x \to 1} \frac{1}{x-1}$ is

(a) $-\infty$ (c) $+\infty$

(b) 1 (d) Doesn't exist

(ii) The improper integral $\int_0^\infty e^{-x} x^{n-1}\, dx$ is convergent, if n is

(a) $n < 0$ (c) $n \geq 0$

(b) $n \leq 0$ (d) $n > 0$

(iii) Find the values of x for which the function $f(x) = |x|$ in $[-1, 1]$ is minimum

(a) 1 (c) 0

(b) -1 (d) Doesn't exist

(iv) The series $\sum \frac{1}{(n+1)^p}$ is convergent, when

(a) $p = 1$ (c) $p > 0$

(b) $p < 1$ (d) $p > 1$

(v) Let $\{x_n\}$ be convergent sequence. Then, which one of the following is correct

(a) $\{x_n\}$ is unbounded (c) $\{x_n\}$ is bounded

(b) $\{x_n\}$ is divergent (d) None of the above

3. Answer any **SIX** of the following questions: $5 \times 6 = 30$

(i) Show that the below sequence is convergent $\sqrt{5}, \sqrt{5\sqrt{5}}, \sqrt{5\sqrt{5\sqrt{5}}}, \sqrt{5\sqrt{5\sqrt{5\sqrt{5}}}}, \ldots$ is convergent. Find out the limit of the sequence. 5

(ii) Find the value of x for which the function $f(x) = \left(\frac{1}{x}\right)^x$ has maximum. 5

(iii) Find the interval of convergence of the series-

$$1 + \frac{x}{1!} + \frac{x^2}{2!} + \frac{x^3}{3!} + \frac{x^4}{4!} + \cdots$$

5

(iv) Check that the following sequences $\sum u_n$ are convergent or divergent. 3 + 2

a) $u_n = (n^3+1)^{\frac{1}{3}} - n$ *b)* $u_n = \frac{n!}{n^n}$.

(v) Analyze the continuity of $f(x) = \begin{cases} \frac{1}{2} - x, & x \in (0, \frac{1}{2}) \\ \frac{1}{2}, & x = \frac{1}{2} \\ \frac{3}{2} - x, & x \in (\frac{1}{2}, 1) \end{cases}$ 5

(vi) a) State the Lagrange's Mean Value Theorem (MVT).

b) Using Lgrange's MVT, show that $|\sin a - \sin b| \leq |a - b|$ for all real a, b. 1 + 4

(vii) Evaluate by L' Hospital rule, $\lim_{x \to 0} \left(\frac{\sin x}{x}\right)^{\frac{1}{x}}$. 5

(viii) If $I_n = \int_0^{\pi/2} x^n \sin x \, dx$ $(n > 1)$ show that $I_n + n(n-1)I_{n-2} = n(\frac{\pi}{2})^n$. 5

(ix) Evaluate the value of the following integration

(a) $\int_0^\infty e^{-x^2} dx$. 2

(b) $\int_0^{\pi/2} \sin^7 x \cos^5 x \, dx$. 3

GROUP - B (40 marks)

Answer question number **1** and **2**, and any **THREE** from question no **3–7**.

1. Answer all the following questions: $1 \times 5 = 5$

(i) The line $\frac{x-1}{2} = \frac{y-1}{1} = \frac{z-0}{-1}$ is perpendicular to the line

(a) $\frac{x}{1} = \frac{y}{-1} = \frac{z}{1}$ (c) $\frac{x-1}{2} = \frac{y-1}{-3} = \frac{z-7}{1}$

(b) $\frac{x-2}{1} = \frac{y-5}{1} = \frac{z-0}{1}$ (d) $\frac{x-2}{0} = \frac{y-4}{1} = \frac{z-0}{-1}$

(ii) The distance between two planes $12x-4y+3z+10=0$ and $12x-4y+3z+36=0$ is

(a) 1 (c) 3

(b) 2 (d) 4

(iii) The angle between two planes $x+y+1=0$ and $y+z+1=0$ is

(a) 0 (c) $\frac{\pi}{3}$

(b) $\frac{\pi}{2}$ (d) $\frac{\pi}{4}$

(iv) The equation of a plane parallel to x-axis is

(a) $x-2y+5=0$ (c) $9x-11z+5=0$

(b) $7y+3z-2=0$ (d) $x+y+z=1$

(v) For which type of curve can we use Green's theorem?

(a) open curve (c) both for open and closed

(b) closed curve (d) all of the above

2. Answer all the following questions: $1\times 5=5$

(i) Convert the point $(3,-3\sqrt{3})$ in to the polar coordinate. 1

(ii) Find out the direction cosine of the straight line $\frac{3x-1}{6}=\frac{4-y}{4}=\frac{3z-3}{24}$. 1

(iii) What do you mean by the curvature of a curve? 1

(iv) What do you mean by torsion of a curve? 1

(v) Find out the value of the double integral $\int_0^1\int_0^1 (5x^3)\,dxdy$ 1

3. (i) Find the angle between the plane $2x+4y-6z=11$ and $3x+6y+5z+4=0$. $2\frac{1}{2}$

(ii) Find out the nature of the quadratic surface $4x^2+9y^2-6z^2+2x-6y+4z+10=0$ and hence evaluate its volume. $2\frac{1}{2}$

(iii) Find the foot of the perpendicular from a point $(-3,8,4)$ to the line

$$\frac{x-2}{3}=\frac{y-2}{2}=\frac{z-2}{1}$$

Also, find the length and the equation of the perpendicular. 5

4. (i) Find the image or reflection of the point $(5,3,2)$ in the plane $x+y-z=5$. 5

(ii) Find the equation of the plane passing through the line of intersection of the planes $2x+5y+z=3$ and $x+y+4z=5$ and parallel to the planes $x+3y+6z=1$. 5

5. (i) Find out the curvature of the curve 5

$$F(t)=(4\cos t, 4\sin t, 3t).$$

at $t=\frac{4\pi}{3}$

(ii) Find out the torsion of the curve 5

$$F(t)=(t^2,\sin t,\cos t).$$

6. (i) Evaluate

$$\iint (x^2 + y^2)\, dxdy$$

over the region bounded by $xy = 1, y = 0, y = x, x = 2$. 5

(ii) Evaluate

$$\iiint (x + y + z + 1) dxdydz$$

over the region defined by $x \geq 0,\ y \geq 0,\ z \geq 0,\ x + y + z \leq 1$. 5

7. (i) Use Green's Theorem to evaluate

$$\oint_C (xydx + x^2y^3)dy$$

where C is the triangle with vertices $(0, 0), (1, 0), (1, 2)$ with positive orientation. 5

(ii) Use Divergence Theorem to evaluate

$$\iint_S \vec{F} \cdot d\vec{S}$$

where $\vec{F} = (3x - zx^2)\hat{i} + (x^3 - 1)\hat{j} + (4y^2 + x^2z^2)\hat{k}$ and S is the surface of the box with
$0 \leq x \leq 1,\ -3 \leq y \leq 0$ and $-2 \leq z \leq 1$. 5

ALIAH UNIVERSITY
END TERM EXAMINATION, AUTUMN 2025
PAPER: MATUGBS01 (Engineering Mathematics I)
All symbols have their usual meanings
Use different answer scripts for different groups.

Full Marks: 80 Time: 3 Hours

GROUP - A (40 marks)

1. Answer all the following questions: $1 \times 5 = 5$

(i) Define monotone increasing sequence and monotone decreasing of real numbers.

(ii) Write the definition of the radius of convergence of a series.

(iii) Define global minima of a function.

(iv) State Rolle's theorem of a function.

(v) Evaluate the value of $\Gamma(\frac{11}{2})$.

2. Answer all the following questions: $1 \times 5 = 5$

(i) The value of the $\lim_{x \to 1} \dfrac{1}{x-1}$ is

(a) $-\infty$ (c) $+\infty$
(b) 1 (d) Doesn't exist

(ii) The improper integral $\int_0^\infty x^{m-1}(1-x)^{n-1}\,dx$ is convergent, if

(a) $m > 0, \quad n < 0$ (c) $m, n > 0$
(b) $m, n \leq 0$ (d) $m < 0, \quad n > 0$

(iii) Find the values of x for which the function $f(x) = |x|$ in $[-1, 1]$ is minimum

(a) 1 (c) 0
(b) -1 (d) Doesn't exist

(iv) The series $\sum \frac{1}{(n+1)^p}$ is convergent, when

(a) $p = 1$ (c) $p > 0$
(b) $p < 1$ (d) $p > 1$

(v) Let $\{x_n\}$ be convergent sequence. Then, which one of the following is correct

(a) $\{x_n\}$ is unbounded (c) $\{x_n\}$ is bounded
(b) $\{x_n\}$ is divergent (d) None of the above

3. Answer any **SIX** of the following questions: $5 \times 6 = 30$

(i) Show that the below sequence is convergent

$\sqrt{5}, \sqrt{5+\sqrt{5}}, \sqrt{5+\sqrt{5+\sqrt{5}}}, \sqrt{5+\sqrt{5+\sqrt{5+\sqrt{5}}}}, \ldots$ is convergent. Find out the limit of the sequence. 5

(ii) Show that the maximum value of the function $f(x) = x^{\frac{1}{x}}$ is $e^{\frac{1}{e}}$. 5

(iii) Find the interval of convergence of the series-

$$1 + \frac{x}{1!} + \frac{x^2}{2!} + \frac{x^3}{3!} + \frac{x^4}{4!} + \cdots$$

5

(iv) Test the convergence of the following series-

$$1 + \frac{1}{2^2} + \frac{2^2}{3^3} + \frac{3^3}{4^4} + \frac{4^4}{5^4} + \cdots$$

5

(v) Analyze the continuity of $f(x) = \begin{cases} \frac{3}{2} - 2x, & x \in (0, \frac{1}{3}) \\ \frac{5}{6} & x = \frac{2}{3} \\ \frac{3}{2} + 2x, & x \in (\frac{1}{2}, 1) \end{cases}$ 5

(vi) a) State the Lagrange's Mean Value Theorem (MVT).

b) Verify Rolle's theorem of the following function and find that point if exists, $f(x) = 2x^3 + x^2 - 4x - 2, -\sqrt{2} \leq x \leq \sqrt{2}$. 1 + 4

(vii) Evaluate by L' Hospital rule, $\lim_{x \to 0} \left(\frac{\sin x}{x} \right)^{\frac{1}{x}}$. 5

(viii) If $I_n = \int_0^{\pi/2} x \sin^n x \, dx$ $(n > 1)$ show that $I_n = \frac{n-1}{n} I_{n-2} + \frac{1}{n^2}$. 5

(ix) Evaluate the value of the following integration

(a) $\int_0^{\infty} e^{-x^2} x^9 dx$. 2

(b) $\int_0^{\pi/2} \sin^4 x \cos^5 x \, dx$. 3

GROUP - B (40 marks)

Answer question number **1** and **2**, and any **THREE** from question no **3**–**7**.

1. Answer all the following questions: $1 \times 5 = 5$

   (i) The line $\frac{x-1}{2} = \frac{2y-1}{-2} = \frac{z-0}{-1}$ is perpendicular to the line
   (a) $\frac{x}{1} = \frac{y}{-1} = \frac{z}{1}$ (c) $\frac{x-1}{2} = \frac{y-1}{-3} = \frac{z-7}{1}$
   (b) $\frac{x-2}{1} = \frac{y-5}{1} = \frac{z-0}{1}$ (d) $\frac{x-2}{0} = \frac{y-4}{1} = \frac{z-0}{-2}$

   (ii) The distance between two planes $10x-\sqrt{20}y+z+1 = 0$ and $10x-\sqrt{20}y+z-10 = 0$ is
   (a) 1 (c) 3
   (b) 2 (d) 4

   (iii) The angle between two planes $x + y + z + 1 = 0$ and $x - 2y + z + 10 = 0$ is
   (a) 0 (c) $\frac{\pi}{3}$
   (b) $\frac{\pi}{2}$ (d) $\frac{\pi}{4}$

   (iv) The equation of a plane parallel to the yz-plane is
   (a) $x + 1 = 0$ (c) $z + 1 = 0$
   (b) $y + 1 = 0$ (d) $x + y + z = 1$

   (v) For which type of curve can we use Green's theorem?
   (a) open curve (c) both for open and closed
   (b) closed curve (d) all of the above

2. Answer all the following questions: $1 \times 5 = 5$

   (i) Convert the point $(1 + \sqrt{3}, 3 + \sqrt{3})$ in to the polar coordinate. 1

   (ii) Find out the direction cosine of the straight line $\frac{2x-1}{4} = \frac{4-2y}{16} = \frac{3z-3}{12}$. 1

   (iii) What do you mean by the curvature of a curve? 1

   (iv) What do you mean by torsion of a curve? 1

   (v) Find out the value of the double integral $\int_0^1 \int_0^1 (5\sqrt{x})\, dxdy$ 1

3. (i) Find the angle between the two straight lines $\frac{x-5}{2} = \frac{2-3y}{6} = \frac{z-5}{1}$ and $\frac{3x-5}{3} = \frac{2y-5}{8} = \frac{z-5}{1}$. $2\frac{1}{2}$

   (ii) Find out the nature of the quadratic surface $4x^2 + 9y^2 + 6z^2 + 2x - 6y + 4z - 10 = 0$ and hence evaluate its volume. $2\frac{1}{2}$

   (iii) Find the foot of the perpendicular from a point $(-3, 0, 2)$ to the line

   $$\frac{2x-4}{6} = \frac{y-0}{2} = \frac{z-1}{1}$$

   Also, find the length and the equation of the perpendicular. 5

4. (i) Find the image or reflection of the point $(0, 1, 2)$ in the plane $2x + 3y - z = 5$. 5

   (ii) Find the equation of the plane passing through the line of intersection of the planes $2x + 3y + z = 3$ and $x + y + 4z = 5$ and parallel to the plane $x + 2y + 3z = 1$. 5

5. (i) Find out the curvature of the curve 5

$$F(t) = (\cos t, \sin t, e^t)$$

at $t = \frac{\pi}{2}$.

(ii) Find out the torsion of the curve 5

$$F(t) = (\frac{t^3}{3}, -\sin t, \cos t)$$

at $t = 1$.

6. (i) Evaluate 5

$$\iint \left(x^2 + y^2\right) dxdy$$

over the region bounded by $y^2 = x$ and $x = 2y$.

(ii) Evaluate 5

$$\iiint (x + 2y + 3z + 1)dxdydz$$

over the region defined by $x \geq 0,\ y \geq 0,\ z \geq 0,\ x + 2y + 3z \leq 6$.

7. (i) Use Green's Theorem to evaluate 5

$$\oint_C (x\sqrt{y}dx + x^2y^3)dy$$

where C is the triangle with vertices $(0, 0), (1, 0), (1, 3)$ with positive orientation.

(ii) Use Divergence Theorem to evaluate 5

$$\iint_S \vec{F} \cdot d\vec{S}$$

where $\vec{F} = (3x - zx^2)\hat{i} + (x + y)\hat{j} + (4y^2 + x^2z^2)\hat{k}$ and S is the surface of the box with $0 \leq x \leq 1,\ -3 \leq y \leq 0$ and $-2 \leq z \leq 1$.

End Semester Examination 2025

(For the 1st Semester Students of all the Departments of the Engineering Faculties)

ENGUGHU01: Communicative English

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

Section I

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

1. What does the word 'Communicare' mean?
2. What is feedback in communication?
3. What is *lingua franca*?
4. What is the basic difference between general communication and professional communication?
5. What is passive listening?
6. What is skimming in reading?
7. What is modal verb? Give an example.
8. Give an example of Grapevine communication.
9. What is active listening?
10. What is a phrase? Give an example.
11. What are the channels of communication?
12. What is a monologue?
13. What is intra personal communication?
14. What is 'LSRW'?
15. Give two examples of idioms in the English language.
16. Give an example of a definite article and an indefinite article in two different sentences.

Section II

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

1. Distinguish between formal and informal communication.
2. Define body language. Mention some of the gestures we use to communicate.
3. What are the benefits of effective listening?
4. Write a short dialogue between two friends discussing the Women`s Cricket World Cup, 2025.
5. What is the difference between summary and paraphrase?
6. What are the important features of close reading?
7. What is business communication? What are the methods of business communication?

Section III

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

1. Define Communication. What are the functions of Communication? (5+5)
2. Identify the notable barriers of an Effective Communication. Discuss the means to overcome those barriers. (6+4)
3. Define Grapevine Communication. What are the demerits of Grapevine Communication? (5+5)
4. Define and discuss the differences between Verbal Communication and Non-verbal Communication. 10
5. Mention the different presentation strategies of Speaking Skills. 10
6. Explain the different flows of communication in the business organisations. 10
7. Write a report on the 2025 Annual Central Budget of India. 10
8. Attaching a Resume, write a job application for the post of an English Language Teacher in a reputed institution. 10

Autumn (Odd) Semester Examination -2025

Course Code: PHYUGBS01

Course Title: Engineering Physics

Department of Appearing Students: Engineering, SEM-I, 1st Year

Full Marks: 80 **Time:** 3.00 hrs

Answer any eight questions10 × 8 = 80

1. (a) State the parallelogram law of vector addition. Find the magnitude and direction of the resultant of two vectors using parallelogram law.

(b) Find a unit vector perpendicular to the plane of $\vec{A} = 2\hat{\imath} - 6\hat{\jmath} - 3\hat{k}$ and $\vec{B} = 4\hat{\imath} + 3\hat{\jmath} - \hat{k}$

(c) Find the work done in moving an object along the vector$\vec{r} = 3\hat{\imath} + 2\hat{\jmath} - 5\hat{k}$ if the applied force is $\vec{F} = 2\hat{\imath} - \hat{\jmath} - \hat{k}$.

(d) If $\vec{A} = 3\hat{\imath} - 3\hat{\jmath} + 2\hat{k}$, $\vec{B} = 2\hat{\imath} + \hat{\jmath} - \hat{k}$and $\vec{C} = \hat{\imath} - 2\hat{\jmath} + 2\hat{k}$ find $(\vec{A} \times \vec{B}) \times \vec{C}$

((1+3)+2+2+2)

2. (a) The angular speed of a motor wheel is increased from 1200 rpm to 3120 rpm in 16 seconds. (i) What is its angular acceleration, assuming uniform angular acceleration? (ii) How many revolution does the wheel make during this time?

(b) Define torque. Find the relation between torque and angular momentum.

(c) Fund the relation between torque and moment of inertia.

(d) State perpendicular axes theorem of moment of inertia.

(e) State the relation between moment of inertia and angular momentum.

((1+1)+(1+3)+2+1+1)

3. (a) Define modulus of rigidity.

(b) A square lead slab of side 50cm and thickness 10 cm is subject to ashearing force (on its narrow face) of 9.0×10^4 N. The lower edge is riveted to the floor. How much will the upper edge be displaced?

(c) What is viscosity? What is coefficient of viscosity?

(d) Write down Poiseuille's formula and Stoke's law.

(e) Define terminal velocity. A metal ball of radius 2 mm and density 10.5 g/c.c is dropped in glycerin of coefficient of viscosity 9.8 dyne cm^{-2} and density 1.5 g/c.c. Find the terminal velocity of the ball.

(1+2+2+2+(1+2))

4. (a)What is the Ideal gas approximation?

(b) Write down Maxwell's law of distribution of molecular velocities and explain the symbols you use. Indicate graphically how the distribution changes with rise of temperature and pressure. Calculate the average speed of the ideal gas molecules.

(c) Calculate the ratio of the average, r.m.s and most probable speeds at a given temperature.

(2+(2+2+2)+2)

5. (a)What is the first law of thermodynamics?

(b) What is reversible and irreversible processes in thermodynamics?

(c) Deduce the adiabatic relations (PV^{γ} =const.) of an ideal gas.

(d) A Carnot engine whose low temperature reservoir is at 7^0 C has an efficiency of 40%. It is desire to increase the efficiency to 50%. By how many degree should the temperature of the source be increased?

(2+2+3+3)

6. a) State and explain Huygen's principle.

b) What is interference of light? Calculate the fringe width using Young's double slit experiment.

c) What is diffraction of light? Distinguish between Fresnel and Fraunhoffer diffraction.

(2+5+3)

7 a) State Brewster's law and derive the relation ($\tan i_p = \mu$).

b) Write down the uses of polaroids.

c) What is population inversion? With a neat diagram, describethe construction and working of a He-Ne laser.

(4+2+4)

8. a) Write the vector forms for Coulomb's law and the Electric field.

b) Three equal charges, each having a magnitude of 2.0μc, are placed at the three corners of a right-angled triangle of sides 3 cm, 4 cm, and 5 cm. Find the magnitude of the force on the charge at the right-angle corner.

c) Two particles, each having a mass of 5 g and charge 1.0×10^{-7} C, stay in limiting equilibrium on a horizontal table with a separation of 10 cm between them. The coefficient of friction between each particle and the table is the same. Find the value of this coefficient.

d) What is the beauty of Gauss's law?

e) Taking inspiration from electric potential, find the integral relation between the Electric field and the potential.

f) Suppose a charge Q is uniformly distributed in a spherical volume of radius R, find the electric field at an inside point of the sphere. [Hint: Use Gauss's law]

(1+2+2+1+2+2)

9. a) What do you mean by a solid, and what is that one parameter that differentiates solids from other states of matter?

b) For a simple cubic structure, the lattice parameter a = 3 Å for the (101) plane, find the inter-planar separation.

c) Prove Bragg's law and discuss its importance.

d) What do you mean by a unit cell? What is the key difference between a primitive and anon-primitive unit cell?

e) A narrow beam of X-rays with wavelength 1.5 Å is reflected from an ionic crystal with a BCC lattice structure. Find the tangent of the angle corresponding to the (111) reflection plane for the first order. You can take the lattice constant as 0.6 nm.

(1+1+3+(1+1)+3)

10.a) What is a crystalline solid? Give two differences between crystalline and amorphous solids.

b) Why are X-rays used in crystallography? Explain briefly.

c) State Bragg's Law and explain the meaning of each term.

d) A crystal gives a first-order X-ray reflection at an angle of 30° using X-rays of wavelength 1.54 Å. Calculate the inter-planar spacing.

e) Explain the origin of energy bands in solids briefly.

(2+2+2+2+2)

11. a) Explain the difference between metals, semiconductors, and insulators interms of band gap and conductivity.

b) Define diamagnetism, Para magnetism, and ferromagnetism. Give one example of each.

c) What is Moseley's Law? How did it help in determining the atomic numbers of elements?

d) What is superconductor? Write one application of superconductors.

(3+3+2+2)

12. a) What is meant by the photoelectric effect? Write down the Einstein's photoelectric equation.

b) Define stopping potential in the context of the photoelectric effect. State the Heisenberg Uncertainty Principle.

c) Find out the radius of a nucleus whose atomic mass number is 64.

d)Define wave function.

e) Distinguish between isotopes, isobars and isotones

f) Draw the variation of photocurrent with light intensity in the photoelectric effect. Explain why the photocurrent increases with intensity but the stopping potential remains unchanged.

(1+1)+3+1+1+1+2)

"U.G." END SEMESTER EXAMINATION – JANUARY, 2026 (SUPPLEMENTARY)
1ST YEAR (1ST SEMESTER) – MECHANICAL ENGINEERING
ENGINEERING MECHANICS
MENUGES01

[Full Marks: 80] **[Time: 3:00 hrs.]**

Answer any four questions (*Assume suitable data, if not provided*)

1. a) The forces , , and , all of which act on point A of the bracket, are specified in three different ways. Determine the x and y scalar components of each of the three forces. **(Figure 1a)** [6]
   b) Replace the 10 kN force acting on the steel column by an equivalent force-couple system at point O. This replacement is frequently done in the design of structures. **(Figure 1b)** [4]
   c) The cable BC carries a tension of . Write this tension as a force acting on point in terms of the unit vectors , , and . The elbow at forms a right angle. **(Figure 1c)** [10]

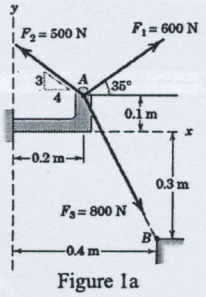


Figure 1a

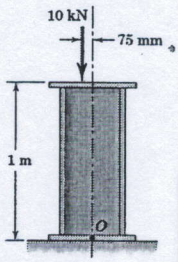


Figure 1b

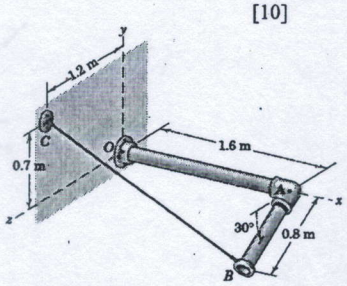


Figure 1c

2. a) Determine the magnitude of the forces and , which, along with the other three forces shown, act on the bridge-truss joint. **(Figure 2a)** [4]
   b) The 500 kg uniform beam is subjected to the three external loads. Compute the reactions at the support point O. **(Figure 2b)** [6]
   c) A uniform 7-m steel shaft has a mass of 200 kg and is supported by a ball-and-socket joint at A in the vertical walls as shown in **Figure 2c**. Compute the forces exerted by the walls and the floor on the ends of the shaft. [10]

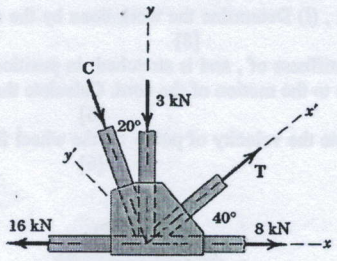


Figure 2a

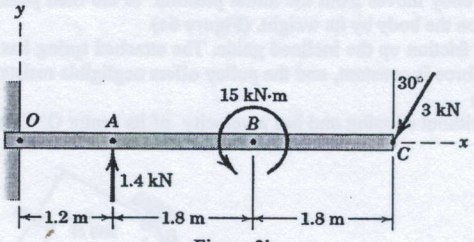


Figure 2b

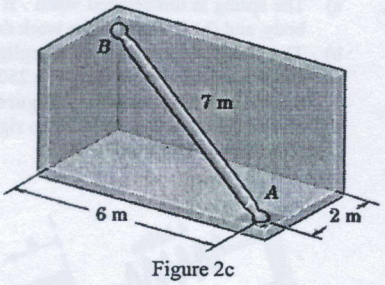


Figure 2c

3. a) Determine the force in each member of the loaded truss as shown in **Figure 3a.** [12]
   b) Calculate the forces induced in members KL, CL, and CB by the load on the cantilever truss. **(Figure 3b)** [8]

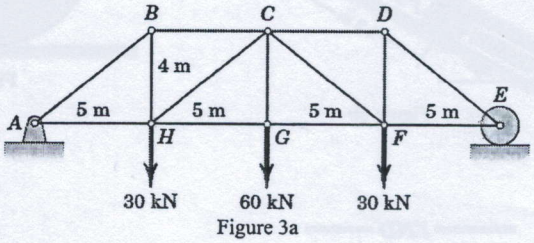


Figure 3a

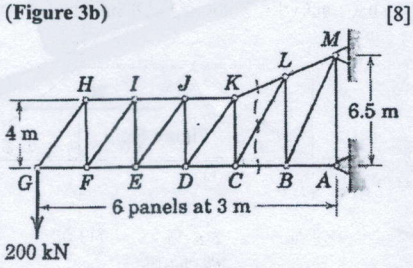


Figure 3b

4. a) Locate the centroid of the shaded area as shown in **Figure 4a.** (All dimensions are in mm) [8]
   b) The three flat blocks are positioned on incline as shown in **Figure 4b**, and a force P parallel to the incline is applied to the middle block. The upper block is prevented from moving by a wire that attaches it to the fixed support. The coefficient of static friction for each of the three pairs of mating surfaces is shown. Determine the maximum value that P can have before any slipping occurs. [12]

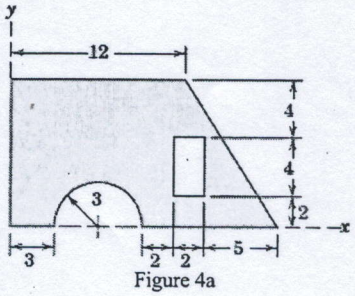


Figure 4a

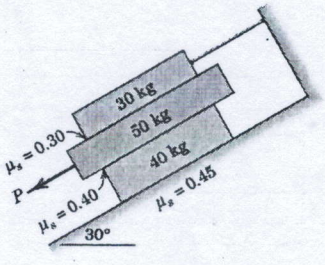


Figure 4b

5. a) The curvilinear motion of a particle is defined by and , where is in meter per second, is in meters, and is in seconds. It is also known that , when . Determine its velocity and acceleration when the position is reached. (*no figure*) [5]

b) A rocket is tracked by radar from its launching point A. When it is 10 seconds into its flight, the following radar measurements are recorded: . For this instant, determine the angle between the horizontal and the direction of the trajectory of the rocket and find the magnitudes of its velocity and . **(Figure 5b)** [6]

c) Car is accelerating in the direction of its motion at the rate of . Car is rounding a curve of radius at a constant speed . Determine the velocity and acceleration that car appears to have to an observer in car if car has reached a speed of for the positions represented. **(Figure 5c)** [9]

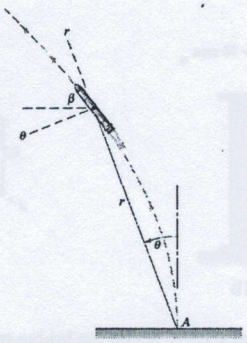


Figure 5b

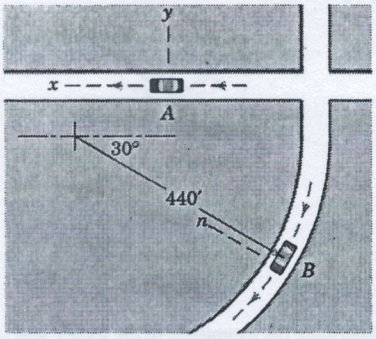


Figure 5a

6. a) The spring is unstretched when . If the body moves from the initial position to the final position , (i) Determine the work done by the spring on the body, and (b) Determine the work done on the body by its weight. **(Figure 6a)** [8]

b) The 10-kg slider moves with negligible friction up the inclined guide. The attached spring has a stiffness of , and is stretched in position , where the slider is released from rest. The 250-N force is constant, and the pulley offers negligible resistance to the motion of the cord. Calculate the velocity of the slider as it passes point . **(Figure 6b)** [6]

c) The wheel of radius rolls to the right without slipping and has a velocity of its center O. Calculate the velocity of point on the wheel for the instant represented. **(Figure 6c)** [6]

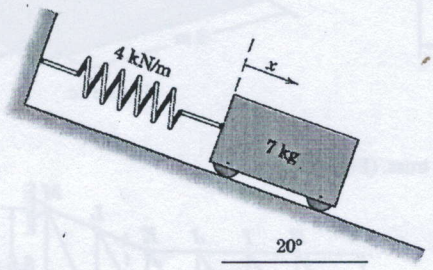


Figure 6a

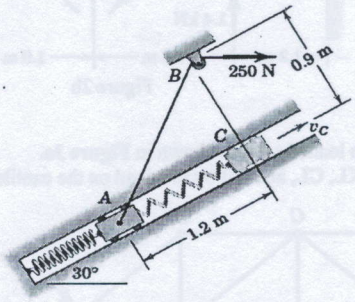


Figure 6b

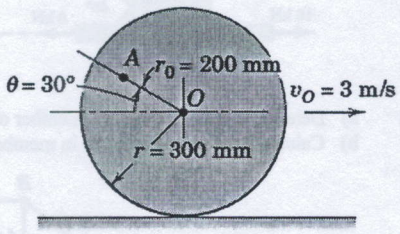


Figure 6c

END

ALIAH UNIVERSITY
END SEMESTER EXAMINATION (AUTUMN), 2025
PAPER MATUGBS03 (Engineering Mathematics III)
(For Sem III of CEN, MEN, ECE, EEN)
Full Marks 80 **Time 3 Hours**
Unless Otherwise Stated Notations Carry their Usual Meanings.
Use Separate Answer Scripts for Groups A and B.

Group A
Answer Any Four questions. 4 × 10 =40

1. (a) Define Fourier Series?
   (b) Find the Fourier Series to represent

$$\begin{aligned} F(x) &= \pi + 2x, -\pi < x < 0 \\ &= \pi - 2x, 0 \le x < \pi. \end{aligned}$$

   (c) Deduce that $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \ldots\ldots = \frac{\pi^2}{8}$ $2+5+3=10$

2. (a) Find Fourier Cosine Transformation of $F(x) = e^{-ax}$, $a \ge 0$.
   Also show that $\int_0^\infty \frac{cosmx}{x^2+a^2}dx = \frac{\pi}{2}e^{-am}$.
   (b) Find the Fourier Transform of

$$\begin{aligned} F(x) &= \frac{\pi}{2}sinx, |x| \le \pi \\ &= 0, |x| > \pi. \end{aligned}$$

   $2+3+5=10$

3. (a) Find the laplace transform of (i) $tcos^2 3t$ and (ii) $e^{2t}sin3tcos2t$. $2+3=5$
   (b) (i) State Convolution Theorem. (ii) If $H(s) = \frac{1}{(s^2+w^2)^2}$ .Then find $h(t)$ by using Convolution Theorem.
   $2+3=5$

4. (a) By eliminating three arbitrary constants a,b, c from the family of ellipsoids $x^2/a^2 + y^2/b^2 + z^2/c^2 = 1$, obtain

$$\begin{aligned} zx\frac{\partial^2 z}{\partial x^2} + x\left(\frac{\partial z}{\partial x}\right)^2 - z\frac{\partial z}{\partial x} &= 0; \\ zy\frac{\partial^2 z}{\partial y^2} + y\left(\frac{\partial z}{\partial y}\right)^2 - z\frac{\partial z}{\partial y} &= 0; \\ z\frac{\partial^2 z}{\partial x \partial y} + pq &= 0. \end{aligned}$$

   (b) Find the partial differential equation arising from $\phi(x+y+z, x^2+y^2+z^2) = 0$. $5+5$

5. (a) Find the general solution of $z(x+y)p + z(x-y)q = x^2 + y^2$ by Lagrange's method.
   (b) Find the complete integral of $2z + p^2 + qy + 2y^2 = 0$ by Charpit's method. $5+5$

6. (a) Find the integral surface of the linear partial differential equation $x(y^2+z)p-y(x^2+z)q=(x^2-y^2)z$.

(b) Eliminate the arbitrary function f and obtain partial differential equation for the following: (1) $x+y+z=f(x^2+y^2+z^2)$ (2) $z=f(x^2-y^2)$. 5 + 5

Group B

Answer Any Four questions. 4 × 10 =40

7. (a) The origin is shifted to the point $(3,-3)$ without changing the direction of axes. Find the coordinates of a point P in the old system, if its coordinates in the new system are $(5,5)$. Find the coordinates of a point Q in the new system, if its coordinates in the old system are $(-2,4)$.

(b) What is the angle of rotation of axes for which the equation $3x^2-5xy+3y^2=1$ will reduce to one being wanted of the xy term?

(c) Show that the distance between two points is an invariant under an orthogonal transformation. 3+4+3

8. (a) Reduce the following to the canonical form and discuss the nature of the conic.
$4x^2-4xy+y^2+2x-26y+9=0$
OR
$7x^2-2xy+7y^2-16x+16y-8=0$.

(b) Show that $x^2+6xy+9y^2-5x-15y+6=0$ represents a pair of parallel lines. 8+2

9. (a) Find the values of a and f for which the equation $ax^2-12xy+9y^2+20x-2fy-11=0$ may represent a pair of parallel lines.

(b) Show that the triangle formed by the lines $ax^2+2hxy+by^2=0$ and $lx+my=1$ is right-angled, if $(a+b)(al^2+2hlm+bm^2)=0$. 5+5

10. (a) Find the locus of the poles of the normal chords of the parabola $y^2=4ax$.

(b) Show that the straight lines $x+y+1=0$ and $2x+3y+4=0$ are conjugate w.r.t. the conic $y^2=4x$.

(c) Find the length of the tangent to $5x^2+5y^2+8x+7y-10=0$ from the point $(-1,2)$. 6+2+2

11. (a) Find the polar equation of the circle which passes through the pole and the two points whose polar coordinates are $(d,0)$ and $(2d,\pi/3)$. Find also the radius of the circle.

(b) Show that the semi-latus rectum of a conic is the harmonic mean between the segments of a focal chord.

(c) Find the nature of the conic: $\frac{5}{r}=2-2cos\theta$. 4+4+2

12. (a) Prove that the equation of the plane through the points $(1,-2,4)$ and $(3,-4,5)$ and parallel to the x-axis is $y+2z=6$.

(b) Perpendicular PL, PM, PN are drawn from the point $P(x,y,z)$ to the co-ordinate planes. Show that the equation of the plane is $\frac{x}{a}+\frac{y}{b}+\frac{z}{c}=2$. 5 + 5

13. (a) Find the equations to the line passing through $(-1,-2,-3)$ and parallel to the line $2x+3y-3z+2=0=3x-4y+2z-4$.

(b) Find the distance of the point of intersection of the line $\frac{x-2}{1}=\frac{y-3}{2}=\frac{z+1}{2}$ and the plane $2x+3y+4z+7=0$ from the point $(2,1,3)$. 5 + 5

EEN-75

End Semester Examination 2025
UCCUGAU03 Indian Constitution

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

Group – A

A. Answer any ten questions (within 30 words each): 2 × 10 = 20

1. What do you understand by Fundamental Rights?
2. When was the Abolition of Untouchability Act enacted?
3. What is the difference between a Fundamental Right and a Legal Right?
4. Why is the judgment in the Kesavananda Bharti case treated as one of the most celebrated judgments?
5. Which principles were added to the Constitution of India by the 42nd Amendment Act?
6. What is impeachment? Has any President been impeached in India?
7. What do you mean by Cooperative Federalism?
8. Write two differences between Fundamental Rights and Directive Principles of State Policy.
9. What is the significance of the 73rd Constitutional Amendment?
10. What is the structure of Municipalities in India?
11. What does Article 21 of the Constitution of India guarantee?
12. Mention two areas where the Rajya Sabha is more powerful than the Lok Sabha

Group – B

B. Answer any four questions (within 100 words each): 5 × 4 = 20

1. Explain the meaning of Constitution, Constitutional Law, and Constitutionalism.
2. Discuss the significance of the Preamble of the Indian Constitution.
3. Write a short note on Freedom of Religion (Articles 25–28).
4. Describe the election procedure of the President of India.
5. Discuss the amendment procedure of the Indian Constitution.
6. Write a short note on Habeas Corpus and Mandamus.

Group – C

C. Answer any four questions (within 350 words each): 10 × 4 = 40

1. Discuss the salient features and characteristics of the Constitution of India.
2. Discuss the scope of the Right to Freedom under Article 19.
3. Explain the nature of India's federal system.
4. Describe the emergency powers of the President of India.
5. Explain the basic features of the 73rd Constitutional Amendment Act.
6. Discuss the composition and functions of the Panchayati Raj Institutions in West Bengal.

B.Tech. Examination-2025-26
Electronics and Communication Engineering Department
(Odd Semester Regular and Supplementary)
Course Title - Analog Electronics Course Code - (ECEUGPC01)

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

(Answer any five taking at least one from each group, Symbols have their usual meaning)

Group A

1. (a) Derive the Shockley p-n junction diode equation as given below :- 8

$$I = I_S\left(e^{\frac{qV}{KT}} - 1\right)$$

(b) Determine the contact potential in an abrupt Si p-n junction with $N_a = 10^{18}cm^{-3}$ in one side and $N_d = 5 \times 10^{15}cm^{-3}$ on the other at room temperature. Derive the necessary formula. 4+4

2. (a) Determine the Q-point $(V_{CEQ}, I_{CQ}, I_{BQ})$ in self bias Si-BJT circuit having $V_{CC} = 10V$, $R_1 = 5.6k\Omega$, $R_2 = 1k\Omega$, $R_C = 4.7k\Omega$, $R_E = 1k\Omega$ & $\beta = 10$. Draw the load line and Q-point of the circuit. 8+2

(b) Determine the current transfer ratio α of the transistor in 2.(a). 2

(c) Explain the operation of bypass and blocking capacitor in CE amplifier. 2+2

3.(a) Draw and explain the Voltage divider bias circuit arrangement of an *n*-channel JFET in common source configuration. 8

(b) An *n*-channel JFET with voltage divider biasing scheme has the following device parameters such as V_P = -5 V, I_{DSS}=12 mA, R_1=400 kΩ, R_2= 90 kΩ, R_D=2 kΩ, R_S=2 kΩ and V_{DD}=18 V. Find the operating point. 8

Group B

4. (a) For the circuit in Fig. 1 the transistor parameters are $\beta = 180$ and $r_0 = \infty$. Determine the *Q*-point values. 6

(b) Find the small-signal hybrid- π parameters. 5

(c) Find the small-signal voltage gain A_v . 5

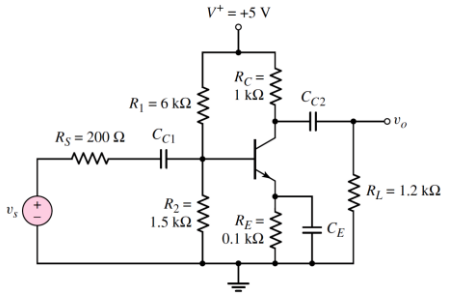


Fig. 1

OR

4. (a) Draw and explain the common emitter configuration-based voltage divider bias network for the ac response with the r_e model inserted between the appropriate terminals by including r_o and derive the expression of Z_i, Z_o and A_v. 8

(b) A voltage divider bias network based on CE configuration has the following specifications such as V_{cc} =16V, R_1= 39 $k\Omega$, R_2= 4.7 $k\Omega$, R_c=3.9 $k\Omega$ $R_E = 1.2\ k\Omega$, C_1= C_2=1 μF , $C_E = 10\ \mu F$ and β =100 . For this network determine the following parameters using the r_e model of transistor. 8

(i) r_e (ii) Z_i (with $r_o = \infty$) (iii) Z_o (with $r_o = \infty$) (iv) A_v

5. (a) Show how the negative-feedback increases the stability of the feedback amplifier. 4

(b) Estimate the input impedance Z_{if} and output impedance Z_{of} of current–series feedback. 6

(c) Determine the voltage gain, input, and output impedance with feedback for voltage-series feedback amplifier having $A = -100\ A$, $R_i = 10k\Omega$, and $R_o = 20k\Omega$, for feedback of $\beta = -0.1$. Discuss the improvement of the amplifier characteristics with respect to input and output impedances with negative feedback. 6

Group C

6. (a) Show that frequency of oscillation of phase-shift oscillator is given by $f_o = \frac{1}{2\pi\sqrt{6}\,RC}$. 10

(b) Determine the frequency of oscillation of the circuit shown in Fig. 2 6

7. (a) Show that frequency of oscillation of Wien-bridge oscillator is given by $f_o = \frac{1}{2\pi\sqrt{R_1C_1R_2C_2}}$. 10

(b) Explain why Clapp oscillator has more accurate and stable frequency of oscillation than Colpitts oscillator. 3

(c) Draw the parallel resonant mode of crystal oscillator circuit. 3

Group D

8. (a) Determine the output voltage for the log amplifier in Fig. 3. Assume $I_R = 50nA$. 5

(b) Find the input-output relation of the circuit shown in Fig. 4. 5

(c) Find out the output voltage V_O of the circuit shown in Fig. 5, for $v_I = 3V$. 6

9. (a) Draw and explain the operation of mono-stable multivibrator using IC-555 timer with waveform diagram. 2+5

(b) Show that the duration of the pulse is $T = 1.1\,RC$. 4

(c) Calculate the frequency of oscillation of astable multivibrator using IC-555 timer having parameters $R_A = 4.7k\Omega$, $R_B = 3.3k\Omega$ and $C = 0.01\,\mu F$. 5

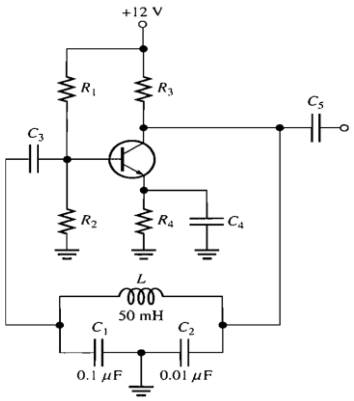


Fig.2

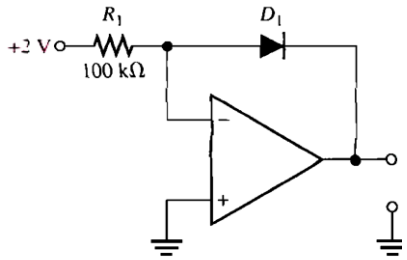


Fig. 3

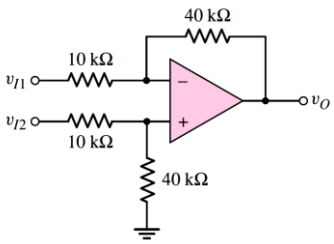


Fig. 4

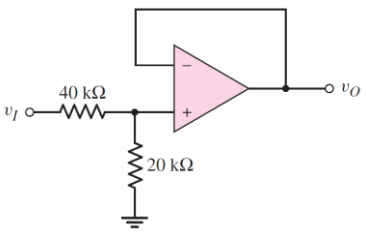


Fig. 5

10 (a) Draw and explain the operation of pulse- generator using OPAMP with waveform diagram. 1+5

(b) Derive the expression for the time duration of output waveform. 7

(c) How the amplitude of the output can be adjusted with back to back zener diodes. 3

AliahUniversity

Department of Electrical Engineering
B.Tech 2nd Year, 3rdSemester Examination–2025

Paper Name: Data Structure and Algorithms **Full Marks: 80**
Paper Code: CSEUGOE01 **Time: 3hrs**

NB: Answers of each Group should be together and answers of all parts of a question number must also be together as well.

Group-A

10×1=10

1. Answer ***all*** questions **:**

i) Define the term *ADT* in data structure.
ii) What is the condition for a connected graph G with ***v*** vertices and ***e*** edges that have no cycles?
iii) If **p** is pointer array, where *Array={50,60,70,10,80}*; **p=Array;* then what will be the value of **(p+2)*?
iv) Which traversal technique lists the nodes of a binary search tree in ascending order?
v) In a Binary Tree, what is the maximum number of nodes at level **L**.
vi) *Insertion* of an element *at beginning* in a *circular linked list* requires the modification of how many pointers?
vii) *BFS* uses which data structure to find out the shortest path in a graph?
viii) What is the best-case complexity for the *Bubble Sort* algorithm?
ix) What do you mean by the term *sparse matrix*?
x) Write down the main difference between a Tree and a Graph.

Group-B

(Answer any ***five*** questions**)** **5×6=30**

2. Define Circular Queue and Circular Linked list. Explain the term *Adjacency matrix* in a Graph with an example. **(4+2)**

3. a) Write down the steps to insert a element in Linear Queue using array.
b) A queue(Q) can store maximum 5 elements. What will be index for Rear(R) and Front (F) after performing the following operation. Show all the steps. **(3+3)**
   i. Insert: 5, 7, 8.
   ii. Delete: 5, 7.
   iii. Insert: 6,3.

4. Sort the list of elements using *Insertion sort* algorithm by mentioning all the steps. **6**
Elements: 4, 3, 2, 10, 12, 1, 5, 6.

5. a) Differentiate between Linear and Non-linear Data structure.
b) Suppose the following sequences of nodes of a binary tree T in inorder and postorder respectively;
Inorder: A B C D E F G H I J Postorder: A B D E C G H J I F
Find the ***preorder*** sequence with the diagram of tree. **(2+4)**

6. Construct the AVL tree for the following elements specifying the various rotations and balance factors used for each element. Sequence: 50, 20, 60, 10, 40, 70, 30, 45, 5, 35 **6**

7. a) What do you mean by the term Collision in Hashing?

b) Elements *44, 45, 79, 55, 91, 18, 63* are inserted into an empty hash table with hash function h(key) = *key mod 7* with *linear probing*. What will be final hash table? **(1+5)**

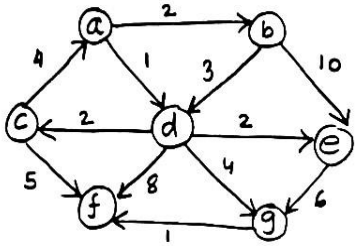
Group-C

(Answer any **four** questions**)** **4×10=40**

8. a) What is the degree of a vertex in a graph?

b) What are the different types of shortest path algorithms?

c) Find the shortest path between two given nodes using *Dijkstra's algorithm*. Show all the steps. **(1+3+6)**



9. a) Write down the steps to convert an Infix expression to postfix form using *stack*.

Expression: A*(B*C+D*E)+F

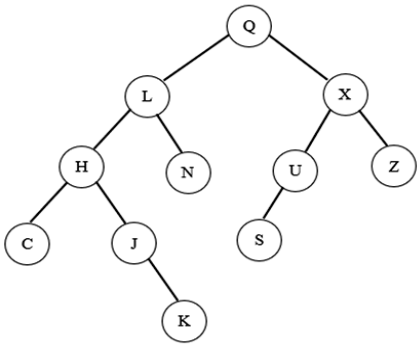
b) Evaluate the following *prefix* expression: (+ - * 7 2 / 8 4 + 3 5)

c) What will be the *index of 'Top'* in a stack having 7 element? **(6+3+1)**

10. a) Define the terms *Degree of a node* and a *Degree of a Tree* in relation to *Tree* terminology.

b) Differentiate between a BST and a AVL tree in data structure.

c)Write inorder, preorder and postorder traversal of the following tree. **(2+2+6)**



11. a) Discuss about any two algorithm design techniques.

b) Consider an array with the following elements.

2, 8, 7, 1, 3, 5, 6, 4

Which elements are present in two sub-arrays after 1st pass using *Quick Sort?* **(3+7)**

12. Write short notes on :

a) Differentiate between BFS and DFS with example.

b) Collision Resolution Protocol. **(5+5)**

Aliah University
Electrical Engineering Department, B.Tech 3rd Year
Odd (Autumn) Semester Examination, 2025-26
Subject: Electrical Network Analysis; Code: EENUGPC01 (Regular + Supplementary)

TOTAL MARKS: **80** **TIME: 3 Hours**

INSTRUCTIONS: -

1. Mention the question number clearly. Answer all parts of a question at one location.
2. Draw circuits& waveforms wherever necessary.
3. Acronyms & symbols have their usual meaning unless otherwise specified.
4. Make suitable assumptions wherever necessary.
5. Write answers to the point, keeping in mind the allotted marks.
6. **Use separate answer scripts for Group A & Group B.**

Group--A **Marks:**
Answer any two questions **2x10=20**

Q-1 **a.** Obtain the Laplace transform of the periodic waveform shown in Fig. 1. **[6]**

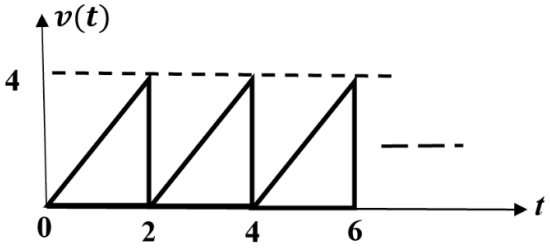


Fig. 1

b. Find the inverse Laplace transform of the function $\boldsymbol{F(s) = \frac{(2s+1)}{(s+1)(s^2+2s+5)}}$ **[4]**

Q-2 **a.** Find the initial value of the function $i(t)$ where $I(s) = \frac{(10s+4)}{s(s+1)(s^2+4s+5)}$. **[3]**

b. In the circuit of Fig.2, the switch **'S'** was in position '**a**' for a long time and moved to position **'b'** at ***t***=0. Find the current through the capacitor for $t>0^+$. **[7]**

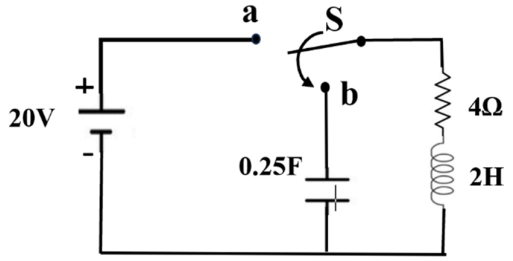


Fig. 2

Q-3 **a.** An initially relaxed *R-C* series network with $R = 1\Omega$ and C= $1F$ is switched on to a $(e^{-2t})V$ voltage source. Determine the current through the capacitor at t = 2s. **[7]**

b. Represent the signal $f(t)$ as shown in Fig. 3 in terms of unit step function. **[3]**

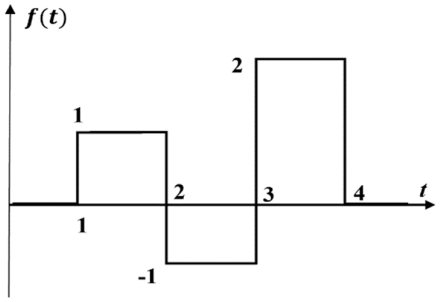


Fig. 3

Group--B **Marks:**

Answer any six questions. **6x10=60**

Q-4 State Thevenin's Theorem. Determine the value of Z in Fig. 4 for maximum power to be transferred to it. Also find the value of maximum power consumed by the load. **[10]**

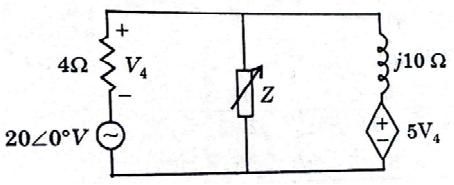


Fig. 4

Q-5 State the reciprocity theorem. Verify the reciprocity theorem for the network shown in Fig. 5 below in which voltage source of 5V cause a current *I* in the 2Ω resistor. Find the value of *I* **[10]**

.

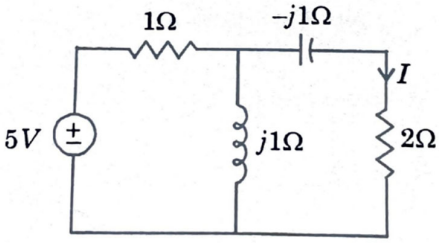


Fig. 5

Q-6 If two two-port networks are connected in series-parallel, then determine the overall parameter of the network. **[10]**

Q-7 Calculate Z-parameters of the network shown in Fig. 6. Also show that the network is not reciprocal. **[10]**

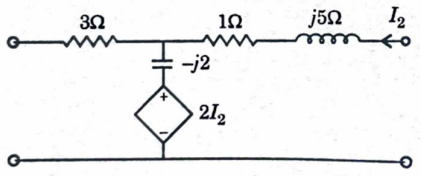


Fig. 6

Q-8 Evaluate the Fourier series co-efficient of the continuous time periodic signal x(t). **[10]**

$$x(t) = 1 + \sin\omega_0 t + 2\cos\omega_0 t + \cos\left(2\omega_0 t + \frac{\pi}{4}\right)$$

Q-9 State the Dirichlet conditions for the Fourier series representation. State and proof the Time Scaling property of the continuous time Fourier series. **[10]**

Q-10 (A) Define the terms: Directed (oriented) graph, Cut-set. **[10]**

(B) The reduced incidence matrix of a graph is given by-

Nodes\Branches →						
↓	1	2	3	4	5	6
a	0	1	0	−1	−1	1
b	0	−1	1	0	1	0
c	1	0	−1	0	0	0

Draw the oriented graph. Select a tree and find *f*-cutset matrix.

Q-11 Write the matrix loop equation for the network shown in below, using loop analysis. **[10]**

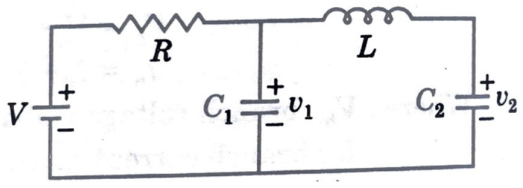


Fig. 7

ALIAH UNIVERSITY

Electrical Engineering Department

Odd (Autumn) Semester Examination 2025-26 (Reg/ Supple)

Subject: Electromagnetic Fields (EENUGPC02)

Year: 2nd | Semester: III

Time: 3 hrs | Full Marks: 80

Instructions: Attempt Question no 1 and any FIVE questions from rest. Different parts of the same question must be answered in one place. Symbols have their usual meaning.

Ques. no	Statement of the Question	Marks
1	(i) Define inductance. (ii) Mention two differences between electric and gravitational force. (iii) What is displacement current? (iv) What is ionic polarization? (v) Define magnetization. (vi) For a ferromagnetic material ($\mu = 4.5\mu_0$), calculate magnetic susceptibility. (vii) Evaluate $6\angle 30° + j5 - 3 + e^{j45°}$ in polar form. (viii) Derive the unit of intrinsic impedance (η), where $\eta = E_0/H_0$. (ix) How reflection of an incident wave can be restricted? (x) Using the cylindrical geometry, show the area of the circle is πr^2.	**2 × 10**
2	(i) What geometry will evolve if constant-*r* and constant-*z* surface intersects each other. (ii) Express the vector $\vec{A} = rz\sin\varphi\,\hat{a}_r + 3r\cos\varphi\,\hat{a}_\varphi + r\sin\varphi\cos\varphi\,\hat{a}_z$ in Cartesian coordinate.	**2** **10**
3	Evaluate the gradient of *U* at $(1, \pi/6, \pi/2)$, divergence of vector field *V* at and curl of vector field *W*: $U = \dfrac{\sin\theta\sin\varphi}{r^2}$ $\vec{V} = r\cos\theta\,\hat{a}_r - \dfrac{1}{r}\sin\theta\,\hat{a}_\theta + 2r^2\sin\theta\,\hat{a}_\varphi$ $\vec{W} = rz^2\,\hat{a}_r + r\sin^2\varphi\,\hat{a}_\varphi + 2rz\sin^2\varphi\,\hat{a}_z$	**4 × 3**
4	(i) Derive Poisson's and Laplace's equation (ii) Derive the expression of energy density for electrostatic field.	**5** **7**
5	A medium is characterized by $\sigma = 0$, $\mu = 2\mu_0$, $\varepsilon = 5\varepsilon_0$. If, $\vec{H} = 2\cos(\omega t - 3y)\hat{a}_z$, calculate ω and $\vec{E}$.	**12**

6 (i) State Coulomb's law of electrostatics. Define electric potential of a point **2 + 2**

(ii) Determine the capacitance of each arrangement as shown in Fig. 1. Take $\varepsilon_{r1}=6$, $\varepsilon_{r2}=2.5$, *d = 10 mm, S = 20 mm*^{2}. **8**

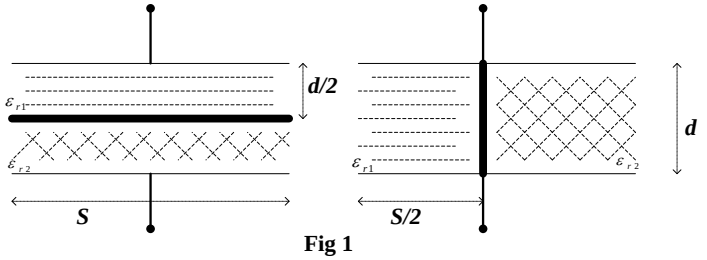


Fig 1

7 A charged particle of mass *5 kg* and charge *2 C* starts at point (*2, -1, 2*) with velocity of $3\hat{a}_x+4\hat{a}_y\,(m/s)$ in an electric field of $8\hat{a}_x+12\hat{a}_y\,(V/m)$. Determine the acceleration, velocity, kinetic energy and position of the particle at *t = 1 s*. **12**

8 (i) Compare electric and magnetic circuit. **4**

(ii) A rectangular iron core (μ_r *= 1400*) is shown in Fig 2. It has a mean length of magnetic path of *100 cm* and cross-sectional area of *4 cm*^{2}. An air gap of *5 mm* is cut from the core. The core has three different coils having N_1 *= 325*, N_2 *= 600*, N_3 *= 600*, respectively. The currents flowing in each coil respectively are *1.8 A*, *3.5 A*, *3.0 A*. Determine the flux through the core. **8**

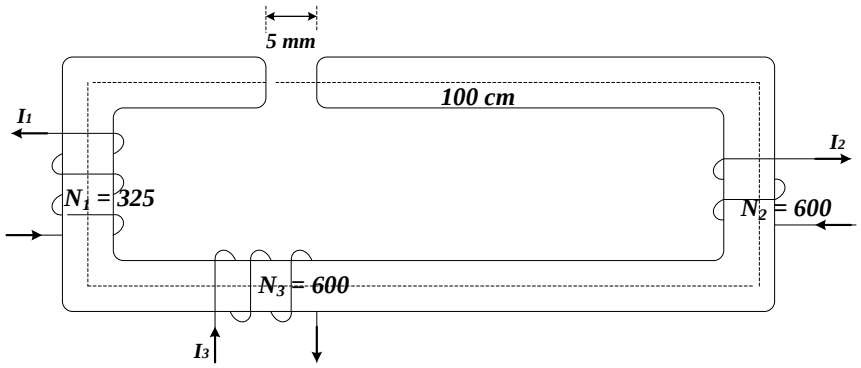


Fig 2

9 **7**

(i) Prove that $\vec{\nabla}\times\vec{H}=\vec{J}+\dfrac{\partial\vec{D}}{\partial t}$

(ii) A surge of *20 kV* magnitude travels along a lossless cable towards its junction with a lossless overhead transmission lines. The inductance and the capacitance of the cable are *0.4 mH* and *0.5 μF* per *km*. The inductance and capacitance of the overhead transmission lines are *1.5 mH* and *0.015 μF* per *km*. Calculate the magnitude of the voltage at the junction due to surge. **5**

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

ALIAH UNIVERSITY
END SEMESTER EXAMINATION (AUTUMN), 2025
PAPER MATUGBS03 (Engineering Mathematics III) (Set 2)
(For Sem III of CEN, MEN, ECE, EEN)
Full Marks 80 **Time 3 Hours**
Unless Otherwise Stated Notations Carry their Usual Meanings.
Use Separate Answer Scripts for Groups A and B.

Group A
Answer Any Four questions. 4 × 10 =40

1. (a) Define Fourier Series?
   (b) Obtain the Fourier expression of $xsinx$, $-\pi \leq x \leq 0$.
   (c) Deduce that $\frac{1}{2} + \frac{1}{1.3} - \frac{1}{3.5} + \frac{1}{5.7} - ..... = \frac{\pi}{4}$ $2+5+3=10$

2. (a) Find Fourier Sine Transformation of $F(x) = e^{-ax}$, $a \geq 0$.
   Also show that $\int_0^\infty \frac{xsinmx}{x^2+a^2}dx = \frac{\pi}{2}e^{-am}$.
   (b) Find the Fourier Transform of

$$\begin{aligned} F(x) &= \frac{\pi}{2}sinx, |x| \leq \pi \\ &= 0, |x| > \pi. \end{aligned}$$

$2+3+5=10$

3. (a) Find the laplace transform of (i) te^{3t} and (ii) $e^{2t}sin3t$. $2+3=5$
   (b) (i) State Convolution Theorem. (ii) If $H(s) = \frac{1}{(s-a)s}$ .Then find $h(t)$ by using Convolution Theorem.

$2+3=5$

4. (a) By eliminating three arbitrary constants a,b, c from the family of ellipsoids

$$x^2/a^2 + y^2/b^2 + z^2/c^2 = 1, \text{ obtain}$$

$$\begin{aligned} zx\frac{\partial^2 z}{\partial x^2} + x\left(\frac{\partial z}{\partial x}\right)^2 - z\frac{\partial z}{\partial x} &= 0; \\ zy\frac{\partial^2 z}{\partial y^2} + y\left(\frac{\partial z}{\partial y}\right)^2 - z\frac{\partial z}{\partial y} &= 0; \\ z\frac{\partial^2 z}{\partial x \partial y} + pq &= 0. \end{aligned}$$

   (b) Find the partial differential equation arising from $\phi(\frac{z}{x^3}, \frac{y}{x}) = 0$. $5+5$

5. (a) Find the general solution of $yzp + zxq = xy$ by Lagrange's method.
   (b) Find the complete integral of $pxy + pq + qy = yz$ by Charpit's method. $5+5$

6. (a) Find the integral surface of the linear partial differential equation $x(y^2+z)p - y(x^2+z)q = (x^2-y^2)z$.
   (b) Eliminate the arbitrary function f and obtain partial differential equation for the following:
   (1) $x+y+z = f(x^2+y^2+z^2)$
   (2) $z = f(x^2+y^2)$. $5+5$

Group B
Answer Any Four questions. $4 \times 10 = 40$

7. (a) Reduce the equation $5x^2-2y^2-30x+8y=0$ in the form $ax^2+by^2=1$ by proper translation of axes without rotation.

   (b) What is the angle of rotation of axes for which the equation $3x^2-5xy+3y^2=1$ will reduce to one being wanted of the xy term?

   (c) The coordinates of the new origin are $(2,1)$ and the axes are rotated through an angle $60°$. If the coordinates of a point in the new system are $(\frac{3-4\sqrt{3}}{2}, -\frac{4+3\sqrt{3}}{2})$, find the coordinates of it in the old system. 3+4+3

8. (a) Reduce the following to the canonical form and discuss the nature of the conic.
   $16x^2 - 24xy + 9y^2 - 104x - 172y + 44 = 0$
   OR
   $7x^2 - 2xy + 7y^2 - 16x + 16y - 8 = 0.$

   (b) Find the angle between the lines $y^2 + xy - 2x^2 - 5x - y - 2 = 0$. 8+2

9. (a) For what value of λ does $\lambda xy - 8x + 9y - 12 = 0$ represent a pair of straight lines?

   (b) Find the equation to the pair of straight lines through the origin, perpendicular to the pair of straight lines given by $2x^2 + 5xy + 2y^2 + 10x + 5y = 0$. 5+5

10. (a) Show that the line $lx+my=n$ is a normal to the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$, if $\frac{a^2}{l^2}+\frac{b^2}{m^2}=\frac{(a^2-b^2)^2}{n^2}$.

    (b) Show that the straight lines $x + y + 1 = 0$ and $2x + 3y + 4 = 0$ are conjugate w.r.t. the conic $y^2 = 4x$.

    (c) Show that the locus of the poles of tangents of the parabola $y^2 = 4ax$ w.r.t. the parabola $y^2 = 4bx$ is the parabola $y^2 = \frac{4b^2}{a}x$. 4+2+4

11. (a) Find the polar equation of a circle when two ends of a diameter are given.

    (b) Show that the semi-latus rectum of a conic is the harmonic mean between the segments of a focal chord.

    (c) Transform the equation $(x^2 + y^2)^2 = ax^2y$ to polar form. 4+4+2

12. (a) Prove that the equation of the plane through the points $(3, -1, 2)$ and $(2, 1, -4)$ and perpendicular to the xz-plane is $6x - z = 16$.

    (b) Perpendicular PL, PM, PN are drawn from the point $P(x, y, z)$ to the co-ordinate planes. Show that the equation of the plane is $\frac{x}{a} + \frac{y}{b} + \frac{z}{c} = 2$. 5 + 5

13. (a) Find the equations to the line passing through $(3, 1, -6)$ and parallel to the line $x + y + 2z - 4 = 0 = 2x - 3y + z + 5$.

    (b) Find the distance of the point of intersection of the line$\frac{x-2}{1} = \frac{y-3}{2} = \frac{z+1}{2}$ and the plane $2x + 3y + 4z + 7 = 0$ from the point $(2, 1, 3)$. 5 + 5

Aliah University

Odd (Autumn) Semester Examination, 2025-2026

Subject: Control Systems; Code: EENUGPC08 (Regular + Supplementary)

Department: EE & ECE; 3rd Year; 5th 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 & waveforms wherever necessary.
3. Acronyms & symbols have their usual meaning unless otherwise specified.
4. Make suitable assumptions wherever necessary.
5. **Use separate answer scripts for Group A & Group B (ECE students only).**

Group A **6×10=60**

Answer Question-1 and any five from the rest.

Q-1 (a) Distinguish between open-loop and closed-loop control systems. **[2]**

(b) What do you mean by LTI system? **[2]**

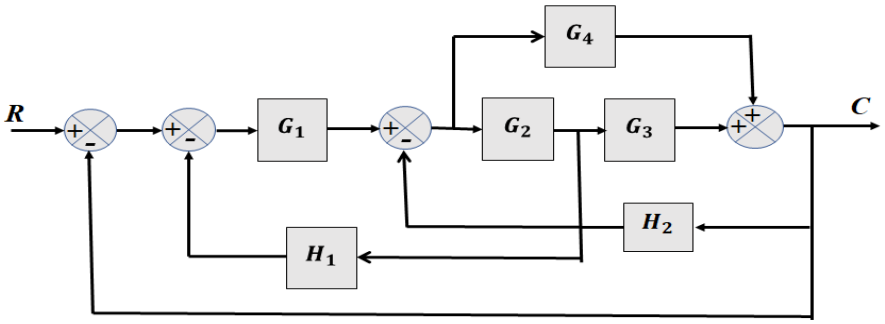
(c) The expression of unit impulse response of a system is given by $c(t) = 10e^{-5t}\sin(4t)$. Determine the transfer function of the system. **[2]**

(d) In the force-voltage analogy, the damping coefficient is analogous to _____ and spring is analogous to _____ . **[2]**

(e) A second-order system has two complex conjugate poles at $\pm j5$. Write the value of the damping ratio and comment on the stability of the system. **[2]**

Q-2 (a) Define the transfer function of a system. **[2]**

(b) Determine the overall transfer function $\left(C/R\right)$ of the system shown in Fig. below. **[8]**



Q-3 (a) A system is described by a differential equation $\frac{d^2c(t)}{dt^2} + 4\frac{dc(t)}{dt} + 16c(t) = 16r(t)$. Determine rise-time, maximum peak overshoot and settling-time for unit step input. **[7]**

(b) Determine the steady-state error for a unity feedback system with forward path transfer function $G(s) = \frac{5(s+4)}{s(s+1)(s+5)}$ for input $r(t) = (2 + 2t)\ for\ t \geq 0$ $= 0\ for\ t < 0$ **[3]**

Q-4 (a) What do you mean by stability of a system? **[2]**

(b) A system is described by the following differential equation

$$s^6 + 2s^5 + 8s^4 + 12s^3 + 20s^2 + 16s + 16 = 0$$

Determine the stability of the system applying Routh's stability criterion. **[8]**

Q-5 (a) Draw the op-amp realization circuit of proportional-integral-derivative (PID) controller and write its effects. **[4]**

(b) Consider a system with $G(s) = \frac{6}{(s+4)}$ and H(s) =1. Design a feed-forward proportional-integral (PI) controller so that the settling-time of the closed loop system for unit step input becomes 1s and natural frequency of oscillation becomes 5rad/s. **[6]**

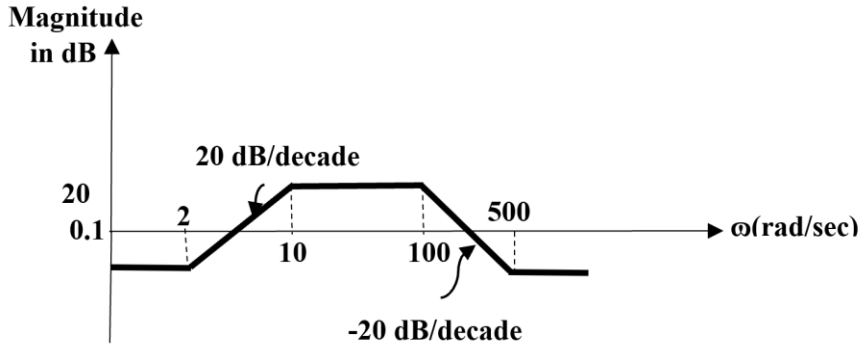
Q-6 (a) Draw the op-amp realization circuit of phase-lead compensator and derive its transfer function. **[4]**

(b) Derive the transfer function $G(s) = \frac{\omega(s)}{E_a(s)}$ of a D.C. servomotor where $\omega(s)$ is the angular velocity of the rotor shaft and $E_a(s)$ is the external voltage applied to the armature winding of the motor. **[6]**

Q-7 (a) What do you mean by frequency response? **[2]**

(b) Write limitation of Bode plot. **[1]**

(c) The asymptotic Bode magnitude plot of a system is given below. Determine its transfer function. **[7]**



Q-7 Sketch the asymptotic Bode plot for the open-loop transfer function $G(s)H(s) = \frac{100(s+10)}{s(s+2)(s+50)}$. Also determine its gain margin (GM), phase margin and stability of the closed-loop system (use semilog graph paper). **[10]**

Group B 2×10=20

Answer any two questions.

Q-8 A negative unity feedback control system has a forward-path transfer function $G(s) = \frac{K}{s(s+2)(s+5)}$. Sketch the root locus of the system as K is varied from 0 to ∞. From the root locus, find the value of K for $\zeta = 0.5$. **[10]**

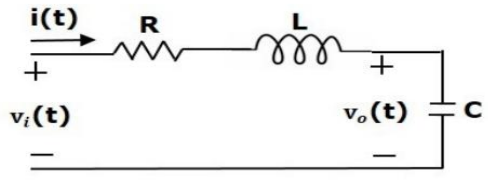
Q-9 Sketch the Nyquist plot and determine the stability of the closed-loop system whose open-loop transfer function is $G(s)H(s) = \frac{10}{(s^2+s+4)}$. **[10]**

Q-10 (a) Define phase crossover frequency and gain margin. **[4]**

(b) Consider the open-loop transfer function $G(s)H(s) = \frac{5}{s(s+1)(s+2)}$. Determine the phase crossover frequency of the system. **[6]**

Q-11 (a) Write the dynamics of a continuous-time system in state-space form and draw its state-space block diagram. Write an observability matrix for the state observability test. **[5]**

(b) Construct the state space model of the Fig. given below, where ***i(t)*** is the current, and the input voltage is $\boldsymbol{V_i(t)}$**.** The output voltage across the capacitor is $\boldsymbol{V_o(t)}$**.** **[5]**



ALIAH UNIVERSITY

Electrical Engineering Department

Odd (Autumn) Semester Examination 2025-26 (Reg/ Supple)

Subject: Power System I (EENUGPC09)

Year: 3rd Semester: V

Time: 3 hrs Full Marks: 80

Instructions: Attempt any EIGHT questions. Different parts of the same question must be answered in one place. Symbols have their usual meaning.

Ques. no	Statement of the Question	Marks
1	(i) Derive the suitable expression of T-parameters for nominal T-section overhead transmission line	**5**
	(ii) Show the regulation of a short overhead transmission line is $IR\cos\varphi_R + IX\sin\varphi_R$	**5**
2	(i) Define visual disruptive voltage. What is local corona?	**2 + 2**
	(ii) A three-phase equilaterally spaced transmission line has a total corona loss of *55 kW* at *110 kV* and a loss of *110 kW* at *120 kV*. What is the disruptive critical voltage between lines? What is the corona loss at *125 kV*?	**6**
3	(i) What is the difference between flashover and puncture?	**2**
	(ii) How many disc insulators are required for a *765 kV* line? Assume factor of safety 1.25	**2**
	(iii) A string of suspension insulators consists of three units. The capacitance between each pin and earth is 15 % of the self-capacitance of the unit. If the maximum peak voltage is 35 kV across an unit adjacent to the conductor, determine the working voltage and string efficiency.	**6**
4	(i) How temperature and ice affects the sag in transmission line conductors?	**2 + 2**
	(ii) Two towers of height *30 m* and *45 m* support a transmission line conductor at water crossing. The horizontal distance between the towers is *325 m*. If the tension in the conductor is *1525 kg*, find the clearance of the conductor at a point midway between the supports. Weight of the conductor is 0.84 kg/m. Assume bases of the towers to be at the water level.	**6**
5	(i) Derive the optimum cable geometry.	**5**
	(ii) A three-phase metal-sheathed cable has the following data: (A) Capacitance between all conductors bunched and sheathed is *0.9 μF*, (B) Capacitance between two conductors bunched with sheath and with a third conductor is *0.7 μF*. Determine the C_C and C_S and also, charging current taken by the cable when connected to three-phase *50 Hz*, *66 kV* system.	**5**
6	(i) Define power factor for sinusoidal voltage and current.	**2**
	(ii) Why does the low power factor harm power system?	**4**
	(iii) Explain one method of improving power factor.	**4**

7	(i) What is the difference between series and shunt compensation?	**2**
	(ii) Explain the working principle of TCSR	**4**
	(iii)Explain how the capacitance can enhance power transfer capacity of a transmission line.	**4**
8	(i) Highlight some essential differences between transmission line and distribution line	**4**
	(ii) Why double-end feeding is advantageous over single-end feeding.	**2**
	(iii) Differentiate overhead and underground system.	**4**
9	A single-phase distributor AB, *1 km* long, has resistance and reactance per conductor of *0.1* Ω and *0.15* Ω, respectively. At the far end, the voltage $V_B = 200\ V$ and the current is *100 A* at p.f. of *0.8 lagging*. At the mid-point M of the distributor, a current of *100 A* is tapped at a p.f. of *0.6 lagging* with reference to the voltage V_M at the mid-point. Determine (a) supply end voltage V_A (b) phase angle between V_A and V_B.	**10**
10	The six conductors of a double-circuit three-phase transmission line (*220 kV, 50 Hz*) are shown in Fig 1. The diameter of each conductor is *2.5 cm*. Find the inductive reactance and capacitive reactance per phase assuming the line is fully transposed.	**10**

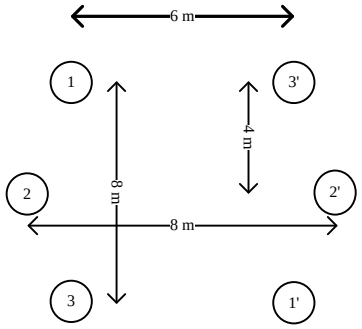


Fig 1

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

Aliah University
Department of Electrical Engineering
Odd (Autumn) Semester Examination 2025 (Regular/Supplementary)

Sub: Power Electronics **Code- EENUGPC07**

Full Marks: 80 Duration: 3 hrs

Instructions:
1. Mention the question number clearly and write all the parts of a question at one place.
2. Write answers to the point, keeping in mind the allotted marks.
3. Draw circuit/figure & waveforms wherever applicable (including numerical).
4. Make suitable assumptions wherever necessary. Symbols and notations have their usual meanings.

Group - A
Answer any 8 (8 X 10 = 80 marks)

Que-1 Discuss the construction, operation and characteristics of a power MOSFET.

Que-2 Explain the circuit of a half-wave uncontrolled rectifier and find the expressions for V_{dc}, I_{dc}, P_{dc}, V_{o_rms}, I_{o_rms} and P_{ac}. Draw the relevant waveforms for both R load and RL load.

Que-3 Describe the working principle of fully controlled bridge rectifier with inductive load through relevant waveforms. Derive the output voltage equations for continuous and discontinuous conductions.

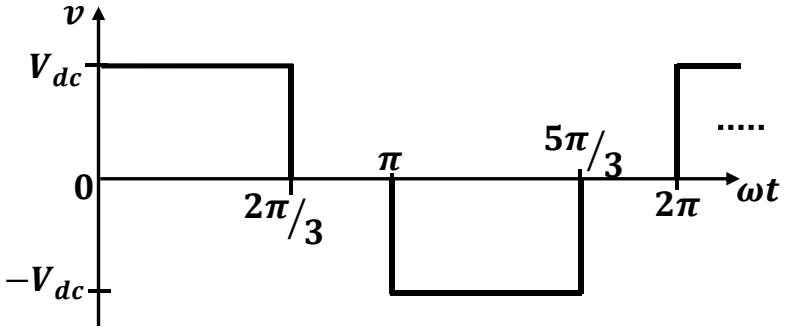
Que-4 What is half-controlled rectifier? Explain with circuit(s) and waveforms.

Que-5 Discuss the integral cycle controlled AC Regulator. Derive the equations, for output voltage and power factor, in terms of duty cycle.

Que-6 **(A)** An R-L-E_b type load is operating in a chopper circuit from a 380 V dc source. For the load, L= 40 mH and R = 0 and for a duty cycle of 0.4, find the chopping frequency to limit the amplitude of load current excursions to 8 A. **[5]**

(B) The speed of a separately excited dc motor is controlled by a step-down chopper. The supply voltage is 200 V, armature circuit resistance is $R_a = 1\ \Omega$, armature circuit inductance is $L_a = 15\ mH$ and motor constant is $K_a\phi = 0.06$ V/rpm. The motor drives a constant torque load requiring an average armature current of 20 A. Assume motor current is continuous. Determine (i) the range of speed control and (ii) the range of duty cycle. **[5]**

Que-7 For the given periodic waveform, find the THD using Fourier series expression.



Que-8 **(A)** A single-phase 230V, 1.5 kW electric room heater is connected across 230 V supply through a TRIAC. For a delay angle of 60^0, calculate the power dissipated by the heater element. **[5]**

(B) A single-phase fully controlled thyristor bridge converter supplies a load consisting of R, L, and a dc voltage E. The output current may be considered constant and ripple free. Assume the thyristors are ideal for the following data: RMS supply voltage $V_s = 230\,V$, Load resistance $R = 0.8\,\Omega$ and Output current $I_o = 10\,A$. Calculate the firing angle α, if (a) $E = 140\,V$ and (b) $E = -120\,V$. **[5]**

Que-9 A three-phase bridge inverter is fed from a 415 V dc source. The inverter is operated in 120^0 conduction mode and is supplying a purely resistive star connected load with R=20 Ω/phase. Determine:

a) RMS value of the load current
b) RMS value of the switch current
c) Total power delivered to the load

Que-10 Draw the waveforms of Phase Voltages, Line Voltages and Output Voltages of 3-Phase Controlled Bridge Rectifier, for $\alpha = 60^0$. Use graph paper.

Que-11 Draw and explain the operation table (table indicating the conducting switches, phase voltages & line voltages in each of the six modes) for a three-phase inverter in 120^0 mode. Using graph paper, draw the gate currents and phase and line voltages for the said inverter.

Aliah University

End-Semester Examination (Autumn Semester) –2025-26

(3rd Year 5th Semester 4-yrs B.Tech)

Subject Name: Object Oriented Programing **Full Marks: 80**

Subject Code: CSEUGOE03 (OEC-III) **Time: 3hrs**

Group-A
(Answer all questions) **10 × 1 = 10**

1. Differentiate between class and object.
2. Arrange in the increasing order A. byte B. Megabyte C. Nibble D. kilobyte
3. Differentiate between a thread and a process.
4. What are the differences between an applet and stand alone java application?
5. Write an example of APPLICATION PROGRAMMING?
6. Which one of the following is an example of a primitive data type in Java?
   A. String B. Array C. int D. Class
7. The built-in class Thread is defined in the package:
   A. java.io B. java.lang C. java.awt D. java.util
8. What is the mechanism in OOP that binds code and the data it manipulates, and keeps both safe from outside interference?
   A. Inheritance B. Polymorphism C. Encapsulation D. Abstraction
9. What is the output of the following Java program snippet?

   Java
   int i = 5;
   System.out.println(++i);

   A. 5 B. 6 C. Compilation Error D. 7
10. (e) The throw keyword in Java is used to:
    A. Declare an exception. B. Handle an exception.
    C. Intentionally raise an exception. D. Define a custom exception.

Group-B
(Answer any six questions) **6 × 5 = 30**

1. What are the advantages of OOPs?
2. What is a static variable and a static method in Java? Explain their use with a suitable code snippet. **(2+3)**
3. What is meant by byte code? Briefly explain how Java is platform independent. **(2+3)**
4. What is constructor? Illustrate it with a suitable programming example by passing parameters. **(1+4)**
5. Explain the role of the try-catch block in exception handling. Write a short Java program to demonstrate a Divide by Zero exception. **(2+3)**
6. Write a Java program to calculate the factorial of a number accepted as a command-line argument. (5) **(1+4)**
7. Explain the polymorphism with an example. **5**
8. Write the differences between interface and abstract class.? **5**
9. How is garbage collection managed in Java? State the key differences between the C++ and Java programming languages. **(2+3)**

Group-C
(Answer any four questions) **4 × 10 = 40**

1. What are access modifiers in Java? Explain the difference between public and protected access modifiers with an example. (4+3) (b) How can one prevent inheritance for a class in java? **10**
2. Write a program to demonstrate hierarchical and multiple inheritance using interfaces. **5+5**
3. What is a constructor in Java? Explain the characteristics of a constructor. (3) (b) Write a Java program to create a Student class with attributes name and roll_number and a method displayInfo() to show the details. Create an object of this class and call the method? **10**
4. Write a short Java program to demonstrate the use of the switch statement for checking the day of the week (1=Monday, 7=Sunday). (5) (b) What is Encapsulation? Explain how data hiding is achieved in Java. (2+3) **10**
5. What is exception handling? Explain an example of exception handling in the case of division by zero. **3 + 7**
6. What is a thread? Describe the complete life cycle of thread. **2 + 8**

B.Tech. Examination-2025
Electronics and Communication Engineering
(Odd Semester Regular & Supplementary Examination)
Microprocessor and Microcontroller (ECEUGPC10)

F M: 80 **Time: 3.00 Hrs**

Answer Question No. 1 and any Seven (7) Questions from 2 to 12

Q. No.		Questions	M
1.		**Answer any five question from question No.1**	
	(a)	Difference between microprocessor and microcontroller	2
	(b)	Explain the function of memory point registrar SP and PC.	2
	(c)	Why are the lower byte address bus (A0-A7) and data bus (D0-D7) are multiplexed?	2
	(d)	Explain the instruction of 8085 that uses auxiliary carry flag.	2
	(e)	Explain the function of HOLD & READY pin of 8085 microprocessor.	2
	(f)	Write a program to exchange the contents of BC register pair with the HL register pair.	2
	(h)	What is the purpose of queue in 8086 microprocessor?	2
2.		Draw and explain the architecture of 8085 microprocessor.	10
3.	**(a)**	PUSH and POP are the only instructions of 8085 that uses stack. Comment on this statement. Write a assembly language program (ALP) to clear the all flags without affecting the content of accumulator.	5
	(b)	Write a program to generate a 10 msec time delay considers the operating frequency of 8085 is 2MHz.	5
4.	**(a)**	Draw the timing diagram of INR M (Opcode:34) instruction stored from memory location 8000H.	5
	(b)	Interface the 4KB EPROM memory devices in 8085 microprocessor in absolute decoding method.	5
5.	**(a)**	Explain different types of interrupts of 8085 microprocessor. Write a program to enable RST 7.5, RST 6.5 and disable RST 5.5 interrupt.	5
	(b)	Explain the addressing modes of 8085 Microprocessor with proper examples.	5
6.		Write a ALP to subtract a 16-bit binary number stored in memory location 9500h from another 16-bit binary number stored in 9600h. Store the difference along with borrow from memory location 9700h.	10
7.	**(a)**	Write a program to multiply 12H with 07H. Store the result from 9600H memory location.	5
	(b)	Design a seven-segment LED output port with the device address F5H, using a 3-to-8 decoder, 4 input NAND gate, NOR gate and a common anode seven segment LED. Write program to display digit 7 at the port.	5

8.	**(a)**	What are the different operating modes of 8255? Explain any one operating mode of 8255.	5
	(b)	Draw and explain the block diagram of 8255. Write a control word for port A and port C as an output port and port B as an input port.	5
9.	**(a)**	Draw and discuss the architecture of 8086microprocessor.	5
	(b)	Describe the functions of each flags present in the 8086 microprocessor.	5
10.	**(a)**	Explain how 20-bit physical address is generated in 8086 microprocessor.	5
	(b)	Explain the addressing modes of 8086 Microprocessor with proper examples.	5
11.	**(a)**	Draw and explain the block diagram of 8051 microcontroller	5
	(b)	Write an ALP in 8051 to add 10 data staring from memory location 8000h of external ram and store the result in 9000h and 9001h memory location.	5
12.	**(a)**	Explain the RAM organization of 8051 microcontroller.	5
	(b)	Write down the characteristics of ARM Processor and explain why it is RISC Processor	5

-End-

Aliah University

Electrical Engineering Department

B. Tech. Odd (Autumn) Semester Examination, 2025 (Regular)

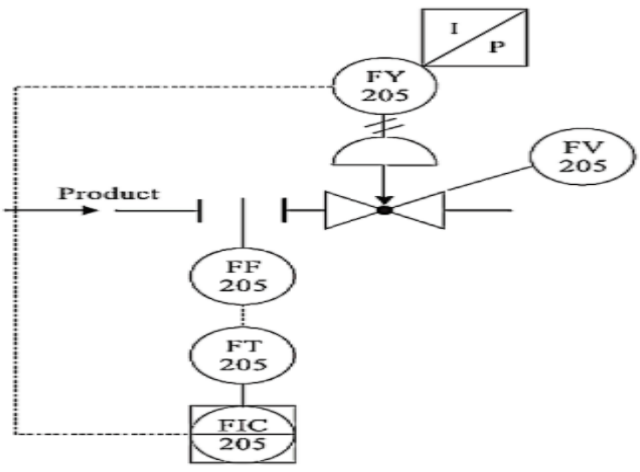
Subject: Process Control Code: EENUGPE17

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

INSTRUCTIONS:

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

Qu.	Group-A: Answer any two questions (10x2=20)	Marks
1.	a. What do you mean by automatic control?	**1+1+8**
	b. Calculate the PB setting if the gain of the process is 8.	
	c. Derive the transfer function from the mathematical model of single tank liquid level liquid level (LLS) process. Draw the block diagram of a closed loop LLS with proportional-integral controller and find the type and order of the system.	
2.	a. What is the delay time? Write the transfer function of delay time. Explain the method to find out the time constant and delay time of a first-order system.	**1+1+4+4**
	b. The closed loop system has a process transfer function $G(s) = \frac{1}{s(s+4)}$. Calculate the stability of the system connected with proportional-integral control for a ramp input.	
3.	a. Write the differences between hydraulic and electronic controllers.	**5+5**
	b. Explain the P &I diagram shown in Fig. below.	



Qu.		Group-B: Answer any four questions (12x5=60)	Marks
4.	a.	Discuss different types of processes with examples.	**6+6**
	b.	What are the differences between internal model control-based tuning and the Z-N tuning method for a PID controller?	
5.		Write short notes on:	**6+6**
	a.	Anti-windup control.	
	b.	Override controller with a neat and clean diagram.	
6.	a.	What are the disadvantages of proportional plus derivative controller?	**2**
	b.	A unity feedback control system with proportional plus derivative control is shown in Figure 1. Calculate the value of K_d so that the system is critically damped. Also, for a ramp input, calculate the values of steady-state error, maximum overshoot, and settling time for the system without and with control actions.	**10**

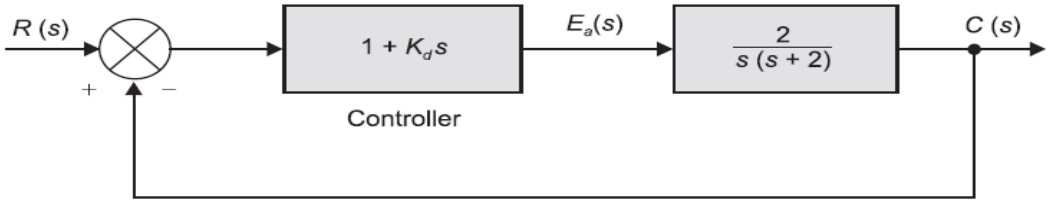
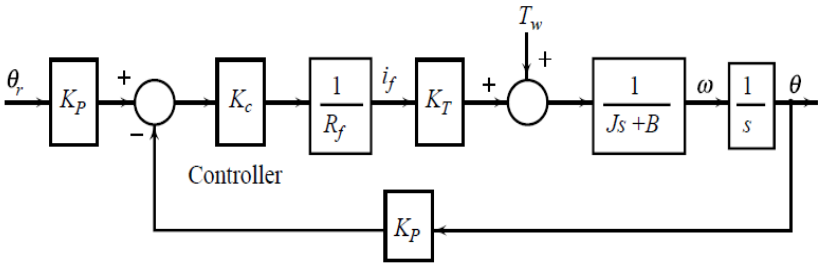


Figure 1

7.	a.	What are the main reasons for manufacturers to control a process?	**2**
	b.	Derive the possible transfer functions from Figure 2 and find out the no of degrees of freedom of control. For a unit step command input position θ_r, find out the steady-state error (e_{ss}). Also, find the steady-state error when a unit-step disturbance i.e. T_w is present. Here, θ is the output position. K_c, K_p, and K_T are constant values.	**10**



c.

Figure 2

8.	a.	Explain the on-off type pneumatic controller with a suitable diagram.	**5**
	b.	Draw a block diagram of the programmable logic controller. Draw a ladder diagram of the given Boolean expression: $X = (\overline{A + B.C}) + A(B + \bar{C})$	**3+4**
9.		Describe the temperature control of the heat exchanger system as a batch process and explain its temperature control loop with a suitable P &I diagram.	**12**

----------x----------

ALIAH UNIVERSITY

Electrical Engineering Department

Odd (Spring) Semester Examination 2025-26 (Supple)

Subject: High Voltage Engineering (EENUGPE13)

Year: 4th | Semester VII

Time: 3 hrs | Full Marks: 80

Instructions:

- **Attempt any EIGHT questions.**
- Figures in the margin indicate full marks.
- 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)**	Explain the working principle of Cockroft-Walton voltage multiplier circuit.	**8**
	b)	Define ripple voltage.	**2**
2	**a)**	What is the difference between PT and CVT?	**2**
	b)	Write a short note on Capacitive Voltage Transformer (CVT).	**8**
3		An underground cable of inductance $0.189\,mH/km$ and of capacitance $0.3\,\mu F/km$ is connected to an overhead line having an inductance of $1.26\,mH/km$ and of capacitance of $0.009\,\mu F/km$. Calculate the reflected and transmitted voltage and current waves at the junction, if a surge of $100\,kV$ travels to the junction, (i) along the cable, (ii) along the overhead line.	**10**
4		Explain with necessary expressions Townsend's mechanism of breakdown in gaseous medium in details.	**10**
5		Discuss in details the working principle of electrostatic voltmeter.	**10**
6		Discuss the sphere gap method of measuring high voltage.	**10**
7	**a)**	Discuss how SLG fault and Ferranti effect can cause high voltage in the power system.	**3 + 3**
	b)	What is meant by impedance matching? Why is it necessary?	**2 + 2**
8	**a)**	Define a standard impulse wave with a suitable waveform.	**3**
	b)	Explain the working principle of Marx generator with a suitable diagram.	**7**
9	**a)**	Explain the working principle of Lightning Arrester.	**7**
	b)	What do you mean by back-flashover of insulator?	**3**

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

Aliah University

Dept. of Electrical Engineering

B. TECH., SEM. - VII

Odd (Autumn) Semester Examination, (Regular/Supplementary), **2025**

SUBJECT NAME: **RENEWABLE ENERGY**

SUBJECT CODE: **EENUGPE14**

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) What do you understand by primary and secondary energy sources? Provide examples of prominent commercial and non-commercial energy sources. **[3+3]**

(B) What is meant by renewable energy sources? Discuss different renewable sources of energy with special reference to Indian context. **[2+8]**

Que-2 (A) What is a fuel cell and what are its main advantages? What are potential applications of fuel cell? **[2+3+3]**

(B) A fuel cell battery is to be used in a satellite power supply. It must deliver a steady 2 kW at 24 V for 1 week. The mass of the cell must be the minimum possible. The fuel cell manufacturer has a design with the following characteristics: Open-circuit voltage: 1.10 V, Internal resistivity: 92×10^{-6} Ω m, Cell mass: 15 kg per m^2 of active electrode area. There is a linear relationship between V_L and I_L. How many cells must be connected in series? What is the total mass of all fuel cells in the battery? **[8]**

Que-3 (A) Establish that the maximum output of a wind turbine can be attained when $V_d = (1/3)\ V_u$. **[6]**

(B) Following data are given for a propeller type Horizontal-axis Wind turbine (HAWT) - Speed of wind: 10m/sec; Air density: 1.226 kg/m^3; Rotor diameter: 120m; Rotor speed: 40 rpm; Coefficient of performance may be taken as 40%. Now calculate – i) Total power density in wind system ii) Total power available in the wind system iii) Maximum extractable power iv) Maximum torque and axial thrust. **[10]**

Que-4 (A) Explain the VI characteristics of a fuel cell and describe the different types of polarizations. **[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: $3/2\ O_2 + 6\ H^+ + 6e^- \rightarrow 3\ H_2O\ (l)$

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, ΔG° =, –39.59 kCal/mol and the change in enthalpy, ΔH° = –56.8 kCal/mol.

Que-5 (A) With the help of neat diagram explain the working of fixed dome type biogas plants. What are the different types of fixed dome biogas plant designs widely adopted in India? **[6+2]**

(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/m^3. **[8]**

Que-6 (A) What is Maximum Power Point Tracking (MPPT)? Using the appropriate diagram, explain how the MPPT helps to maximize the output of the solar photovoltaic system and load matching. **[2+6]**

(B) A solar cell having area of 0.9 cm^2, receives solar radiation with photons of 1.8 eV energy having an intensity of 0.9 mW/cm^2. Measurements show open-circuit voltage of 0.6V/cm^2, short circuit current of 10mA/cm^2 and the maximum current is 50% of the short circuit current. The efficiency of the cell is 25%. Calculate the maximum voltage that the cell can give. Also find the fill factor of the cell. **[8]**

Que-7 (A) Discuss the implementation of the Solar PV Hybrid system in Sagar Island, West Bengal. Explain the geographical challenges that led to the selection of this system and list the detailed technical specifications of the power plant. **[6]**

(B) Design a solar photovoltaic (PV) system tailored for rooftop installation to meet the specified load requirements outlined below. Assume a minimum of 5 hours of daily sunshine for design purposes. **[10]**
Use PV module "BP380" from BP Solar. Details are given below –

Peak Power (Wp)	80W
Voltage at peak power (Vpp)	17.6V
Current at peak power (Ipp)	4.55A
Operating factor	0.8
Battery efficiency	85%
Inverter efficiency	95%
Charge controller efficiency	95%
Days of autonomy	1

Load Table

Type of Load	Rating (W)	Number	Power (W)	Hours/day	Wh
CFL/LED Light	15	5	75	4	300
BLDC Fan	75	4	300	3	900
LED TV	100	1	100	3	300
Desktop PC	250	1	250	2	500
Refrigerator	150	1	150	12	1800

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

ALIAH UNIVERSITY

Electrical Engineering Department

Odd (Autumn) Semester Examination 2025-26 (Supple)

Subject: Linear Programming Problem (EENUGPE19)

Year: 4th | Semester: VII

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

Instructions:

- **Separate scripts must be used for each group**
- **Figures in the margin indicate full marks**
- **Attempt any two from Group-A and all the questions from Group-B.**
- **Symbols have their usual meaning.**
- **Use of graph sheet for question no 8 is mandatory. For clarity, Utilization of the full graph sheet is must.**

Group-A

Ques. no	Statement of the question	Marks
1	a. Write the difference between integer and mixed integer programming problems.	**4**
	b. Write the application of the Branch and Bound method.	**4**
	c. What do you mean by a feasible solution?	**2**
2	a. Fig. 1 shows an electric circuit that is designed to use a 40V source to charge 15V, 10V, and 20V batteries connected in parallel. Physical constraints limit the current I_1, I_2, I_3, I_4, & I_5 to a maximum of *4A, 3A, 2A, 1A* & *2A*, respectively. In addition, batteries must not be discharged, and currents must not be negative. Formulate the optimization problem.	**7**

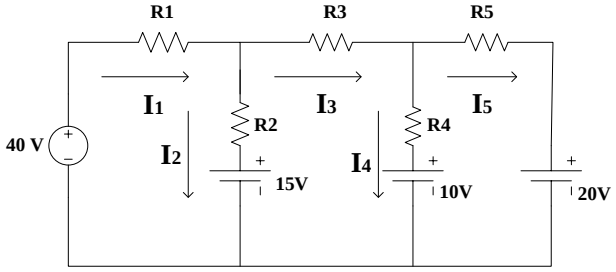


Fig 1

	b. Name the four names of software for solving an optimization problem.	**2**
	c. Write the quadratic form.	**1**
3	a. Explain the graphical method for solving a linear programming problem.	**5**
	b. Determine whether the following quadratic form is negative definite:	**5**

$$f = x_1^2 + 3x_2^2 + 2x_3^2 - x_1x_2 + 8x_2x_3, x \in R^3$$

Group-B

4 Solve the following LPP using regular simplex method **10**

Maximize $Z = 19x_1 + 7x_2$

Subject to, $7x_1 + 6x_2 \le 42$

$5x_1 + 9x_2 \le 45$

$-x_1 + x_2 \ge -4$

$x_1 \ge 0,\ x_2 \ge 0$

5 Solve the following LPP using big-M method **10**

Minimize $Z = x_1 + x_2$

Subject to, $x_1 + 2x_2 \ge 3$

$2x_1 + x_2 \ge 3$

$x_1 \ge 0,\ x_2 \ge 0$

6 Solve the following problem using two-phase method: **10**

Maximize $Z = x_1 + 3x_2$

Subject to: $-4x_1 + 3x_2 \le 12$

$x_1 + x_2 \le 7$

$x_1 - 4x_2 \ge 7$

Assume x_1, x_2 as non-negative variable

7 Solve the following equations using canonical form of realization: **10**

$x_1 + x_2 + x_3 + x_4 = 10$

$2x_1 + x_2 - x_3 + 5x_4 = 21$

$-x_1 + x_2 - x_3 + x_4 = 2$

$x_1 + x_2 - x_3 + 2x_4 = 8$

8 Solve the problem graphically **10**

Maximize $Z = 25x_1 + 15x_2$

Subject to, $3x_1 + 2x_2 \le 240$

$2x_1 + x_2 \le 140$

$x_1 \ge 20,\ 0 \le x_2 \le 80$

9 Solve the following LPP using dual simplex method **10**

Minimize $Z = 4x_1 + 7x_2$

Subject to, $2x_1 + 3x_2 \ge 5$

$x_1 + 7x_2 \ge 9$

$x_1 \ge 0,\ x_2 \ge 0$

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

ALIAH UNIVERSITY

Odd (Autumn) Semester Examination 2025–26

Paper Code: MBAUGHUO1 ;Paper Name: Industrial Economics & Management

Programme: B.TECH VII Semester, 4TH YEAR

Full Marks: 80; Time: 3 Hours.

(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 × 10 = 10)**

1. Economics is primarily concerned with:
(a) Unlimited wants & unlimited resources
(b) Limited wants & unlimited resources
(c) Unlimited wants & limited resources
(d) Limited wants & limited resources
2. Demand law explains the relationship between:
(a) Price and supply
(b) Price and demand
(c) Income and demand
(d) Demand and cost
3. Which of the following is a part of organizational behaviour?
(a) Consumer behaviour
(b) Machine behaviour
(c) Employee motivation
(d) Natural behaviour
4. Maslow's theory is related to:
(a) Cost reduction
(b) Hierarchy of needs
(c) Product quality
(d) Market segmentation
5. Production management mainly deals with:
(a) Finance and profit
(b) Buying of goods
(c) Conversion of raw materials into finished products
(d) Packaging only
6. The main aim of Total Quality Management (TQM) is:
(a) Minimum output and maximum cost
(b) Zero defect and continuous improvement
(c) Customer avoidance
(d) Increase waste

7. Which tool is used for quality control?
(a) Control charts
(b) Balance sheet
(c) Marketing mix
(d) Job evaluation
8. Fixed capital refers to:
(a) Wages paid to labour
(b) Investment in machinery and buildings
(c) Transport cost
(d) Short-term loans
9. The recruitment process in HRM is concerned with:
(a) Terminating employees
(b) Selecting the wrong candidates
(c) Hiring and attracting eligible candidates
(d) Producing goods
10. 4Ps of marketing include:
(a) People, Price, Product, Profit
(b) Product, Price, Place, Promotion
(c) Policy, Promotion, Process, People
(d) Plan, Price, People, Place

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

1. Define economics and explain its importance in industry.
2. What are the different types of market structures? (Explain any four)
3. Explain motivation and its importance in organizational behavior.
4. What are the main functions of production management?
5. Define quality and explain the concept of TQM.
6. What are the objectives of financial management?
7. Explain the various sources of recruitment in HRM.
8. What is marketing mix? Explain its elements.

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

1. Discuss the law of supply and demand with diagrams and examples. Explain its application in industrial decision-making.
2. Explain the major theories of motivation and their importance in organizational behavior.
3. Describe the stages involved in production planning and control. How does it help in effective manufacturing?
4. Discuss the various financial statements used in financial management and their significance in business decision making.

ALIAH UNIVERSITY

Odd (Autumn) Semester Examination 2025–26

Paper Code: MBAUGOE01 ; Paper Name: Entrepreneurship Development

Programme: B.TECH VII Semester, 4TH YEAR

Full Marks: 80; Time: 3 Hours.

(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 × 10 = 10)**

1. Entrepreneurship refers to:
(a) Managing existing business only
(b) Innovation and risk-taking to start a business
(c) Government-owned enterprises
(d) Non-profit organizations

2. Which of the following is NOT a characteristic of an entrepreneur?
(a) Risk-taking
(b) Innovation
(c) Laziness
(d) Leadership

3. MSME stands for:
(a) Micro, Small and Medium Enterprises
(b) Medium Scale Marketing Enterprise
(c) Micro Service Management Enterprise
(d) None of the above

4. District Industries Centre (DIC) mainly assists:
(a) Large scale industries
(b) Micro and small entrepreneurs
(c) Government employees
(d) Export traders only

5. An example of a business idea source is:
(a) Market research
(b) Horoscope reading
(c) Rumors
(d) Luck

6. A feasibility study mainly examines:
(a) Entrepreneur's family background
(b) Practical viability of the business idea
(c) Number of workers available
(d) Modern fashion trends only

7. Which of the following is a financial resource?
(a) Land
(b) Machinery
(c) Bank loan
(d) Skilled labor

8. Entrepreneurs Associations primarily function to:
(a) Increase business competition
(b) Provide support, networking, and policy advocacy
(c) Entertain entrepreneurs
(d) Control business failures

9. Which one is an example of intangible resource?
(a) Building
(b) Trademark
(c) Raw materials
(d) Tools

10. Venture Capital refers to:
(a) Loan given without documents
(b) Investment in high-risk innovative projects
(c) Money saved at home
(d) Government subsidy

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

1. Define entrepreneurship and explain its importance in economic development.

2. Describe the characteristics and qualities of a successful entrepreneur.

3. Write a short note on the role of MSME in business development.

4. Explain the importance and functions of entrepreneurial associations.

5. What are the various sources of business ideas? Explain with examples.

6. Explain market feasibility and its importance in business planning.

7. Describe the different types of financial resources available for entrepreneurs.

8. What is the process of mobilizing human resources in a business?

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

1. Discuss the role of entrepreneurship in socio-economic development of a country. Provide relevant examples.

2. Explain in detail the major support institutions and entrepreneur associations in India and their roles in entrepreneurship development.

3. Describe the concept, need, and steps involved in generating and selecting business ideas. Give a practical illustration.

4. Discuss various types of resources required to start a business and methods of mobilizing them effectively.

Aliah University
Department of Electrical Engineering
Odd (Autumn) Semester Examination 2025 (Regular & Supplementary)

Course- M.Tech, Power System **Sem-1st**

Sub: Power Quality **Code- ENPGPC11**

Full Marks: 80 Duration: 3 hrs

Instructions:
1. Mention the question number clearly and write all the parts of a question at one place.
2. Write answers to the point, keeping in mind the allotted marks.
3. Make suitable assumptions wherever necessary, symbols and notations have their usual meanings.

Answer any five (5 X 16 = 80 marks)

1. A. Explain the following terms according to IEEE standard- (8+8)

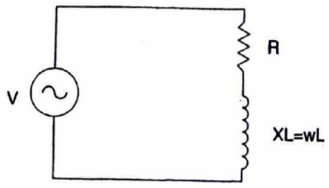
   (i) Impulsive transient (ii) Oscillatory transient

   (iii) Voltage sag (iv) Notching

   B. The phase-to-phase voltages in a delta-connected 240V system are measured to be $281\angle 0°VV$, $288\angle -115°VV$ and $270\angle 125°VV$ respectively. Determine the, positive sequence and negative sequence components and % of voltage imbalance.

2. A. Explain the use of static var compensator (SVC) in power factor improvement. (8+8)

   B. In the circuit shown beside, V=480V, R=1Ω, and L=1mH. Find the active power, reactive power, power factor angle, and power factor. Determine the value of capacitance to be added to improve the power factor to 0.98.



3. A. Explain the effect of harmonics in Cables and Transformer. (8+8)

   B. Determine the *k* rating of a transformer required to carry a load consisting of 450 A of fundamental, 165 A of third harmonics, 100 A of fifth harmonics, and 50 A of seventh harmonics.

4. A. Write the IEEE and IEC standards on harmonics distortions. (8+8)

   B. Find the harmonic distortion THD and IHD of a voltage waveform with following harmonic frequency make up: fundamental=114V, 3rd harmonic=4V, 5th harmonic=27V, 7th harmonic=1.5V and 9th harmonic=1V

5. A. What is called reflection in EMI. How it can help in protecting victim from EMI. (4+4+8)

   B. Define: (i) Conducted Emission, (ii) Radiated Emission.

   C. Explain high frequency interference and the health concern of Electromagnetic interference.

6. A. List out the elements of ground electrode system as per NEC guidelines. (4+4+8)

   B. Describe the benefits of proper grounding system.

   C. Describe the following wiring and grounding problems-(i) Multiple neutral to ground connections (ii) Ground Loops)

7. A. Describe the function and working of the following power quality measuring devices- (8+8)

   (i) Spectrum analyzers (ii) Harmonic analyzers

   B. Explain the function of active filters and how it overcomes the drawbacks of passive filter in controlling harmonic.

Aliah University

Department of Electrical Engineering

Odd (Autumn) Semester Examination, 2025 (Regular/Supplementary)

M. Tech. 1st semester

Sub: **Power System Analysis & Control** Code- **EENPGPC12**
Full Marks: 80 Duration: 3 hrs

Instructions: 1. Mention the question number clearly and write all the parts of a question at one place.

2. Write answers to the point, keeping in mind the allotted marks.

3. Draw circuit/figure & waveforms wherever applicable (including numerical).

4. Make suitable assumptions wherever necessary, symbols and notations have their usual meanings.

Group-A

1. Answer five questions **[5 x 5 = 25]**

i) What is the objective of power system control?

ii) Define complex power. Write its expression in terms of voltage and current phasors.

iii) What is a single-line diagram? Why is it used in power system studies?

iv) Explain per-unit quantities and state two advantages of using the per-unit system.

v) State the need for system neutral grounding.

vi) What do you mean by bus admittance matrix (Y_{bus})?

Group-B

2. Answer any five questions **[5 x 6 = 30]**

i) Explain reactive power generation and absorption in a power system.
ii) What are tap-changing transformers? State their purpose.
iii) Discuss the modification of Z_{bus} when a branch is added between an existing bus and the reference bus.
iv) Explain load sharing between two synchronous generators operating in parallel.
v) Discuss the methods of voltage control used in transmission lines.
vi) With a neat diagram, explain impedance and reactance diagrams of a power system.

3. What are the components of speed governor system of an alternator? Derive the transfer function model of a Single area system LFC and draw its block diagram. **[15]**

4. Two synchronous generators operating in parallel. Their capacities are 300 MW and 400 MW. The droop characteristics of their governor are 4% and 5% from no load to full load. Assuming that the generators are operating at 50Hz at no load, how would a load of 600 MW be shared between them. What will be the system frequency at this load? Assume free governor action. **[10]**

Aliah University

Dept. of Electrical Engineering

M. TECH. (POWER SYSTEM & CONTROL SYSTEM), **SEM. - I**

Odd (Autumn) Semester Examination, (Regular), **2025**

SUBJECT NAME: **PRINCIPLES OF INDUSTRIAL INSTRUMENTATION**

SUBJECT CODE: **EENPGPE04**

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 wherever applicable.
7. **Acronyms & symbols** have their usual meaning.

Answer any five

Que-1 (A) Explain the error distribution relating to measurement system, with the help of Gaussian law of error or normal law. **[8]**

(B) A set of current measurements were taken and reading were recorded as 11.3mA, 11.6mA, 10.9mA, 12.1mA, 11mA, 12.5mA & 11.9mA Calculate i) arithmetic mean ii) deviation from mean and iii) average deviation of the measurements. **[5]**

(C) Explain the concept of probable error using a relevant example. **[3]**

Que-2 (A) Explain the operating principle of a Rotameter. How does it differ from a variable head meter? Derive the force balance equation for the float when it is in equilibrium. **[8]**

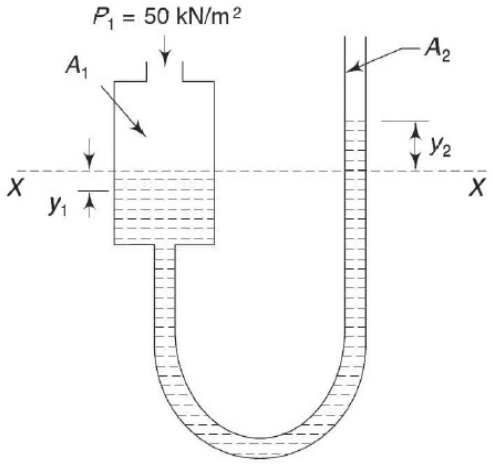
(B) A rotameter is calibrated for metering a liquid of density 1000kg/m^3 and has a scale ranging from 1 to 100 lit/min. It is intended to use this meter for measuring the flow of gas of density 1.25 kg/m^3 with a flow range between 20 and 2000 lit/min. Determine the density of the new float, if the original one has a density of 2000 kg/m^3. The shape and volume of both floats are assumed to be the same. **[8]**

Que-3 (A) Describe the working principle of the McLeod gauge with relevant diagram and highlighting its key components and mechanisms involved in pressure measurement. **[8]**

(B) A McLeod gauge has volume of bulb, capillary and tube down to its opening equal to 90 cm^3. The capillary has the diameter of 1 mm. Calculate the pressure indicated by a reading of 3 cm on the capillary tube. **[8]**

Que-4 (A) Define Absolute Pressure, Gauge Pressure, and Vacuum Pressure. Explain the mathematical relationship between them using Atmospheric Pressure as the reference point. Under what specific condition is "Vacuum Pressure" used? **[6]**

(B) A mercury manometer of the type shown in figure below is to have a float in the left-hand chamber. An electromechanical transducer is used to measure the motion of the fluid. The float motion is 5 mm for a gauge pressure of 50 kN/m^2. If the diameter of the float chamber is 40 mm, **[10]**



find the required diameter for the right-hand chamber. For mercury, density ρ = 13600 kg/m^3. Assume that the other end of the manometer is open to the atmosphere.

Que-5 (A) With the help of clear and labeled diagram, explain the working principle and operation of a thermal conductivity gauge or Pirani gauge. **[6]**

(B) A mercury in steel thermometer employs a Bourdon pressure gauge which has a range of 0-6 MPa for the pointer from 0 to 270^{0}C. In the temperature calibration process the pointer movement was set to 0^0 rotation at 0^{0}C and the instrument indicate 250^0 rotation corresponding to 200^{0}C. Determine i) the sensitivity of the instrument in rad/^{0}C. ii) the error due to ambient temperature rise of 16^{0}C, if the thermometer bulb has 8 times that of combined volume of capillary and Bourdon tube iii) the error in the observed temperature values if the bulb is raised by 60 cm from calibration elevation. Take the density of mercury as 13.546 gm/ cm^3 or 13,546 kg/ m^3. **[10]**

Que-6 (A) Discuss the operation of radiation pyrometer with relevant sketch. **[10]**

(B) The power radiated from a hot piece of metal was measured by radiation pyrometer and temperature was determined as 820^{o}C assuming a surface emissivity of 0.75. Later, it was found that the accurate value of emissivity was 0.69. Find the error in the temperature determination. **[6]**

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

ALIAH UNIVERSITY

Electrical Engineering Department

Odd (Autumn) Semester Examination 2025-26 (Reg/Supple)

Subject: Optimization Technique (EENPGPE01)

Year: 1st Semester: I

Time: 3 hrs Full Marks: 80

INSTRUCTIONS: **1. Answer any EIGHT questions.**

2. Clearly mention the Question No. in the left margin of the answer sheet.
3. Write answers neatly as practicable as possible.
4. All part of a question should be answered at one place.
5. Acronyms & symbols have their usual meaning unless otherwise specified.
6. Make suitable assumptions wherever necessary.
7. **Use of graph paper is mandatory for question no. 8. For clarity, utilization of the full graph paper is must.**

Ques no	Statement of the question	Marks
1	(i) Determine the nature of the matrix: $A=\begin{bmatrix} -2 & 1 & -5 \\ 5 & 0 & -1 \\ -4 & 4 & -2 \end{bmatrix}$	5
	(ii) Comment, whether Kuhn-Tucker (KT) condition can be applied to minimize $f=x_1^2+6x_2^2-2x_3^2-x_1x_2+6x_2x_3$ subject to some inequality constraints or not.	5
2	State the necessary and sufficient conditions for unconstrained single-variable optimization problem.	4
	The profit per acre of a firm 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 value of x_1 and x_2 to maximize the profit.	6
3	Starting from the point (0,0), show two steps of iteration of the steepest descent method for finding the minimum point of the function: $f(x_1,x_2)=x_1-2x_2+7x_1x_2+2x_1^2+3x_2^2$	10
4	Starting from the point (0, 0), show one iteration of the BFGS method for finding the minimum point of the function: $f(x_1,x_2)=x_1-2x_2+3x_1x_2+x_1^2+4x_2^2$	10
5	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
6	Solve the following Linear Programming Problem (LPP) by regular simplex method: Maximize $Z=5x_1+7x_2$ Subject to $x_1+x_2\le 4$ $3x_1+8x_2\le 24$ $10x_1+7x_2\le 35$	10

$x_1, x_2 \geq 0$

7 Express the following system of operation in positive variables x_1, x_2, x_3 and x_4 in canonical form with respect to x_1, x_2 and x_4 and hence, obtain a basic solution. Perform one pivot operation to find a solution with basic variables x_1, x_2 and x_3. 10

$$\begin{bmatrix} 2 & 3 & -2 & 4 \\ 2 & 3 & 3 & -1 \\ 1 & -2 & 3 & 1 \end{bmatrix} . \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{bmatrix} = \begin{bmatrix} 8 \\ 11 \\ 0 \end{bmatrix}$$

8 Consider the following function $f = 3x_1 + 2x_2$ 10

Subject to: $8x_1 + x_2 \geq 8$

$2x_1 + x_2 \geq 6$

$x_1 + 3x_2 \geq 6$

$x_1 + 6x_2 \geq 12$

$x_1, x_2 \geq 0$

(i) Show graphically the feasible region.

(ii) Examine, whether (1, 3) represents a feasible solution or not

(iii) Find the minimum value of the function

9 (i) Show that the optimization of $f(x_1, x_2)$ subject to $g(x_1, x_2) = 0$, the following condition $\frac{\partial f}{\partial x_1} - \frac{\partial f / \partial x_2}{\partial g / \partial x_2} . \frac{\partial g}{\partial x_1} = 0$ must be satisfied at the extreme points. 5

(ii) Find the maxima and minima if any of the function $f(x) = 4x^3 - 18x^2 + 27x - 7$ 5

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

Aliah University

Odd (Autumn) Semester Examination, 2025-26

Subject: System Identification and Estimation ; Code: EENPGPC02

M-Tech 1st Semester Examination

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

Answer any five questions (5×16=80)

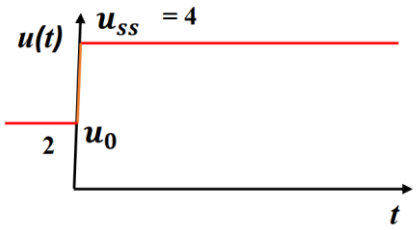
1. (a) What do you mean by a model of a system? Explain different types of models. **[6]**

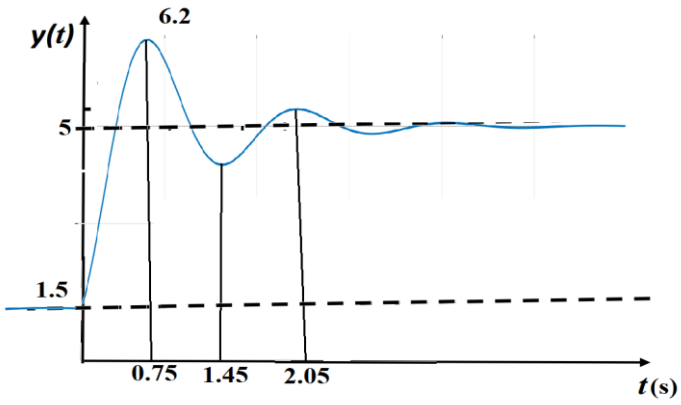
(b) What do mean by system identification? Write down the system identification procedure. **[8]**

(c) What do you by non-parametric method of system identification. **[2]**

2. (a) Write and explain the steps required to identify the model of a 2nd order system from its step response. **[7]**

(b) The input $u(t)$ and output $y(t)$ waveforms of a system are given below. Estimate the transfer function of the system. **[9]**





3. (a) Show that Wiener–Hopf's relationship has filter property. **[4]**

(b) Explain how impulse response can be identified using Wiener–Hopf's relationship. **[6]**

(c) Explain how transfer function can be identified using power spectra. **[6]**

4. (a) Prove that the estimated vector parameter $\boldsymbol{\theta} = (\boldsymbol{\varphi}^T\boldsymbol{\varphi})^{-1}\boldsymbol{\varphi}^T\mathbf{y}$ [where $\boldsymbol{\varphi}$ is regression vector and **y** is the output] using least-squares estimation technique. **[8]**

(b) Estimate the values of the unknown parameters of the linear model $y(t) = a + bt$ using linear regression and least-squares estimation technique. The experimental data are given in Table 1. **[8]**

Table 1

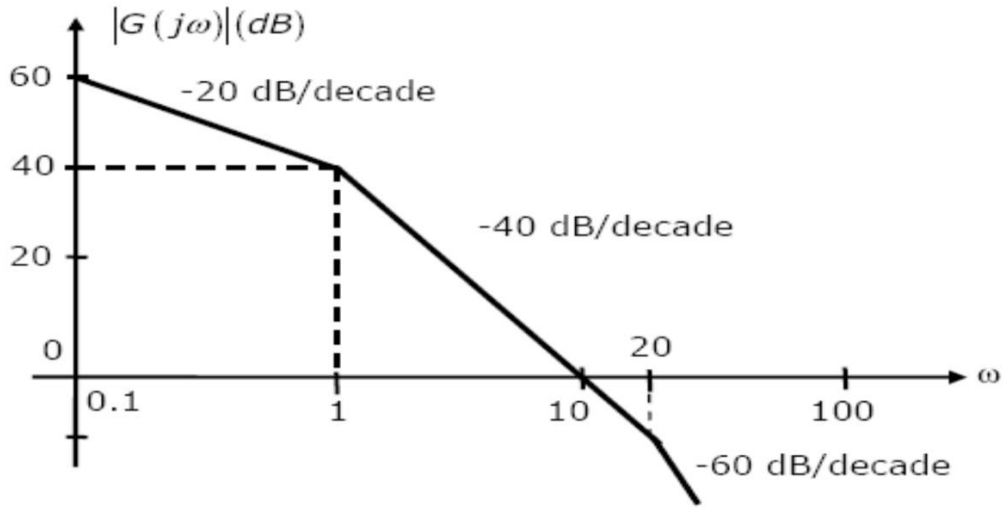
t (s)	**1**	**5**
y (m)	5	10

5. (a) Derive the autoregressive moving average exogenous (ARMAX) and autoregressive exogenous (ARX) model structures. Write the difference between finite impulse response (FIR), autoregressive exogenous (ARX) and autoregressive moving average exogenous (ARMAX) model structures. **[8]**

(b) Explain how the parameters of finite impulse response (FIR) model structure can be estimated using linear regression and least square estimation technique. **[8]**

6. (a) When is closed-loop identification technique used? Write the different methods of closed-loop identification technique. Write short note on any one method. **[8]**

(b) The asymptotic Bode magnitude plot of a system is shown in the figure below. Determine the transfer function of the system. **[8]**



---------× ----------

Aliah University
Electrical Engineering Department
M.Tech. Odd (Autumn) Sem Examination, 2025 (Regular+ supplementary)
Subject: Advanced Control Engineering Code: EENPGPC01

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.

Group-A

Qn. No	Answer any two questions (5x2=10)	Marks
1. a.	What are the advantages of the state space technique? Construct a state space model for the armature-controlled DC motor system.	**2+6**
b.	Write the solution of the homogeneous linear time-varying system given in the equation. $$\dot{x}(t) = A(t)x(t)$$	**2**
2. a.	Obtain the diagonal form of the given matrix for the system matrix given below: $$A = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -6 & -11 & -6 \end{bmatrix}$$	**5**
b.	Derive the similarity transformation matrix from the state and output equations of the state space model in the continuous domain.	**5**
3.	Write the advantages of adaptive control. Write two differences between adaptive control and conventional control. Draw the block diagram of model reference adaptive control (MRAC). Briefly describe it.	**2+3+5**

Group-B

Qn. No	Answer any five questions (5x12=60)	Marks
4. a.	Find the state transition matrix using Cayley-Hamilton theorem for the following state equation	**6**

$$\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\end{bmatrix} = \begin{bmatrix}0 & 1\\ -2 & -3\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix} + \begin{bmatrix}0\\ 1\end{bmatrix}u \text{ and } y = \begin{bmatrix}1 & 0\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix}$$

b. State and prove any three properties of the state transition matrix for the linear time-invariant system. **6**

5. Find out the eigen value, eigen vector, and transfer function for the state space model given below: **12**

$$\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\end{bmatrix} = \begin{bmatrix}0 & 1\\ -12 & -7\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix} + \begin{bmatrix}0\\ 1\end{bmatrix}u$$

$$\begin{bmatrix}y_1\\ y_2\end{bmatrix} = \begin{bmatrix}12 & 1\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix}$$

6. a. What is zero order holding (ZOH) device? Determine the pulse transfer function of ZOH. **4**

b. Derive the dual phase variable form of the state model from the given transfer function: **8**

$$\frac{Y(s)}{U(s)} = \frac{0.4s^2 + 1.4s + 0.8}{s^3 + 0.3s^2 + 1.7s + 0.2}$$

Draw the simulation diagram.

7. a. Determine the transfer function matrix for a multi-input and multi-output system **7**

$$\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\end{bmatrix} = \begin{bmatrix}0 & 3\\ -2 & -5\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix} + \begin{bmatrix}1 & 1\\ 1 & 1\end{bmatrix}\begin{bmatrix}u_1\\ u_2\end{bmatrix}$$

$$\begin{bmatrix}y_1\\ y_2\end{bmatrix} = \begin{bmatrix}2 & 1\\ 1 & 0\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix}$$

b. Write the steps for the design of a state feedback controller for a linear time-invariant system. **5**

8. a. Write the state and output equations for a discrete-time control system and derive the pulse transfer function from these two equations. **6**

b. Obtain the canonical form of the given pulse transfer function **6**

$$\frac{Y(z)}{U(z)} = \frac{z + 8}{z^2 + 5z + 3}$$

9. a. State and explain Lyapunov's theorem on global asymptotic stability and instability for a linear system. **6**

b. What is an equilibrium point? Is $Q(x) = x_1^2 + 4x_2^2 + 2x_1x_2 - 6x_2x_3 - x_1x_3$ a-positive definite? **6**

10. a. Construct the state model for a system characterized by the differential equation $6\ddot{y}(t) + 11\dot{y}(t) + 6y(t) = u(t)$. **6**

b. Define and evaluate Kalman's controllability test for the system model obtained from the differential equation given in question no. 10.a. **6**

----------x----------

SEMESTER EXAMINATION: AUTUMN 2025

PGAUCO1: ELEMENTARY ARABIC AND ISLAMIC STUDIES

ARABIC- ISLAMIC STUDIES /PG/I/I

Full Marks: 80 **Time: 3:00 Hrs.**

ARABIC

Q. 1. Attempt any five questions from the following: **5x2=10**

a) How many elements are there in a Language and what are they?

b) How many skills are there in a language and what are they?

c) Define the definite article in Arabic with two examples.

d) Identify the following words whether they are Noun (اسم) or Verb (فعل).

الكتاب ، مسجد، أحمد، درس، دخل، ذهب

e) Identify the gender whether they are masculine or feminine.

ذاهب ، ذاهبة ، ناصر ، ناصرة ، مجتهد، مجتهدة

f) How many vowels are there in Arabic? Write them.

g) What is the grammatical function of "ال" in Arabic?

h) Differentiate between طالب and الطالب.

Q. 2. Attempt any three question from the following: **10x3 =30**

a) Explain the parts of speech of Arabic language, write all of them withexamples.

b) Define (Noun)اسم and (Verb) فعل with suitable examples.

c) Write the importance and opportunities of the Arabic language.

e) Explain معرفة (Definite Noun) and نكرة (Indefinite Noun) in Arabic grammar.Give suitable examples.

f) Explain the basic structure of nominal (الجملة الاسمية) and verbal (الجملة الفعلية) sentences in Arabic with examples.

ISLAMIC STUDIES

Q.1) Attempt any five questions from the following: **5x2=10**

a) Write two social benefits of Zakāh.

b) Write two points about the importance of fasting in Islam.

c) Name the five pillars of Islam and explain any one of them briefly.

d) State two reasons why *Ṣalāh* is considered the pillar of religion.

e) Mention two contributions of Prophet Muhammad ﷺ to humanity

f) What happens to society if *Zakāh* is properly given?

g) Arrange in correct order: *Ṣalāh, Shahādah, Zakāh* (according to the pillars of Islam).

h) Explain briefly the importance of "the Farewell Sermon".

Q.2. Attempt any three questions from the following: **10x3=30**

a. Describe the five pillars of Islam.

b. Discuss the concept of Tawhid and write its kinds with brief explanation.

c. Write a short note about the life of the Prophet Muhammad (PBUH).

d. What do you know about Zakat? Write in details.

e) Explain the importance of Tawḥīd in Islam.
How does it influence a Muslim's belief and actions?

f) Write a detailed account of the Farewell Sermon of Prophet Muhammad ﷺ and its message for humanity.

==00==

Pedagogy Studies

Subject Code: UCEPGAU02

Semester-I

Autumn Semester Examination-2025

Time: 3 hours **Full Marks: 80**

Answer the questions in your own words. Follow the instructions & word limits while answering. Numbers in the right-hand margin indicate marks.

1. Answer any <u>ten</u> questions from the following: (Word limit: 50) **2×10=20**

a) Mention any two sources for reviewing related literature in research.
b) What does it mean by the term 'hypothesis' in research?
c) Give one example of hidden curriculum in schools and its impact on students.
d) Write any four differences between formative assessment and summative assessment.
e) State two features that distinguish experimental research design from other research designs.
f) Why research dissemination encourages the researcher's credibility?
g) State two objectives of research according to NEP-2020.
h) Mention any two examples of pedagogical practices.
i) State any two objectives of professional development in the 21st century.
j) Mention any two barriers a teacher faces while teaching in large classes.
k) Write any two aims of pedagogy in the teaching–learning process.
l) What do you mean by peer support among teachers?
m) What is meant by community support in education?
n) What is meant by "body of evidence" in pedagogical research?
o) Mention any two ways in which teacher education practicum supports effective pedagogy.

2. Answer any <u>eight</u> questions from the following: (Word limit:150) **5×8=40**

a) What is meant by curriculum? Mention the steps involved in curriculum construction. (2+3)
b) Write briefly key concepts and educational implications of behaviourism (Skinner) and cognitivism (Piaget). (2 + 2)
c) What are the characteristics of scientific research questions?
d) Compare pedagogy and andragogy in terms of learner characteristics, motivation for learning, pace of learning, social system, and learning activities.
e) What is meant by in service teacher education? Mention its objectives. (2+3)
f) Discuss the importance of professional development and follow-up support for teachers.
g) Analyse the impact of large class sizes on teaching–learning processes.
h) Discuss how peer support promotes professional growth among teachers.
i) Discuss the concept of the Theory of Change in education and its relevance to pedagogical reform.

j) Examine the influence of teachers' attitudes and beliefs on the implementation of pedagogical approaches in the classroom.

k) What is meant by evidence-based pedagogical practices? Explain their importance in improving classroom learning. (2+3)

3. Answer any <u>two</u> questions from the following: (Word limit:300) 10×2=20

a) What are the major aims of research methodology? Explain the sequential steps involved in conducting research. (3+7)

b) Discuss the four components of teacher education. Write down the key differences between pedagogical practices in formal and informal classroom in developing countries. (4+6)

c) Discuss how teacher education, curriculum design and guidance materials collectively support in effective teaching.

.....

Aliah University

Dept. of Electrical Engineering

M. TECH. (POWER SYSTEM & CONTROL SYSTEM), **SEM. - III**

End Term Examination Question Paper, (Regular/Supplementary), **2025**

SUBJECT NAME: **SENSOR AND DEVICES**

SUBJECT CODE: **EENPGPE18**

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 wherever applicable.
7. **Acronyms & symbols** have their usual meaning.

Answer any five

Que-1 (A) Discuss the theoretical operation of 'Shape Memory Polymers' (SMP). How do 'Light Activated Polymers' (LAP) function within this category, and what specific stimulus allows them to be controlled remotely without physical contact? **[4+4]**

(B) Explain the working principle of 'Soft Actuators,' specifically focusing on the conversion of microscopic molecular changes to macroscopic deformations. Why are these theoretically preferred for tasks involving fragile objects compared to rigid actuators? **[4+4]**

Que-2 (A) Define the mechanical characteristics of 'Stiffness' and 'Compliance' in actuators. Using these concepts, explain why hydraulic systems are theoretically considered 'stiff' while pneumatic systems are considered 'compliant'. **[5]**

(B) While often used interchangeably in casual conversation, 'accuracy' and 'precision' have distinct theoretical definitions in sensor characteristics. Explain the difference between the two, using the 'principle of repeatability' to define precision. **[5]**

(C) Explain the fundamental operating principle of a Passive Infrared (PIR) sensor. Why is it called 'Passive' and how does it utilize the property of reflection to detect the motion of humans or animals? **[6]**

Que-3 (A) In the context of the IoT Network Layer, distinguish between IPv4 and IPv6 addressing schemes. Why has IPv6 become the successor to IPv4, and what is the difference in address bit-length between the two? **[4+4]**

(B) Theoretically differentiate between Infrastructure-as-a-Service (IaaS) and Platform-as-a-Service (PaaS) regarding what the user is responsible for managing versus what the cloud provider manages. **[8]**

Que-4 (A) Describe the structural composition of a Wireless Sensor Network (WSN). What are the distinct responsibilities of End-nodes, Routers and the Coordinator within this network topology? **[4+6]**

(B) Analyze the architectural differences between IoT Level-1 and IoT Level-2. How does the location of data storage and the complexity of the analysis differ between these two levels? **[6]**

Que-5 (A) Discuss the key enabling technologies for smart lighting in home automation. How do solid-state lighting solutions (like LEDs) achieve energy savings compared to traditional lighting, specifically regarding their interaction with ambient conditions? **[4+4]**

(B) In the context of forest fire detection systems, explain how Artificial Neural Networks (ANN) are theoretically applied to the data collected by sensor nodes. What specific environmental attributes are fused to detect a fire? **[8]**

Que-6 (A) Define a Smart Grid in terms of data communication. Explain the stability challenge that arises when integrating distributed Renewable Energy Systems (like solar and wind) into a grid originally designed for centralized generation. **[4+4]**

(B) Explain the concept of Structural Health Monitoring (SHM) within a smart city infrastructure. What specific physical parameters do the sensor networks typically monitor in structures like bridges and what is the theoretical goal of analyzing this data? **[8]**

Que-7 (A) According to the Boston Consulting Group, there are nine principal technologies that constitute Industry 4.0. List these technologies and explain how their convergence facilitates the creation of a 'Smart Industry'. **[8]**

(B) Trace the evolution of manufacturing through the four industrial revolutions. Distinguish the Third Industrial Revolution from the Fourth Industrial Revolution, explaining how the latter takes digital technology to a 'new level'. **[4+4]**

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

"PG" 3rd SEMESTER EXAMINATION – JANUARY, 2026
(REGULAR)
RESEARCH METHODOLOGY & IPR
MENPGPR02

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

Group-A (answer all) **(1 x 10 = 10)**

1. Research which portrays characteristics of a situation is called:
   A. Diagnostic B. Analytical
   C. Descriptive D. Historical
2. Research that tests causal relationship between variables is:
   A. Descriptive B. Exploratory
   C. Hypothesis-testing D. Historical
3. Research based on numerical measurement is called:
   A. Qualitative B. Quantitative
   C. Conceptual D. Descriptive
4. Simulation research involves:
   A. Field study B. Artificial environment
   C. Historical analysis D. Case study
5. Scientific method relies mainly on:
   A. Faith B. Authority
   C. Empirical evidence D. Ethics
6. Scientific predictions are generally:
   A. Absolute B. Deterministic
   C. Probabilistic D. Imaginary
7. Hypothesis primarily helps in:
   A. Writing report B. Guiding the direction of research
   C. Data entry D. Sampling
8. Review of literature helps mainly in:
   A. Writing conclusions B. Formulating the problem precisely
   C. Data tabulation D. Error analysis
9. Randomized Block Design is mainly used to control:
   A. Independent variable B. Dependent variable
   C. Extraneous variable D. Sampling error
10. A good research design should minimize:
    A. Reliability B. Sample size
    C. Bias D. Accuracy

Group-B (answer any FIVE) **(5 x 14 = 70)**

1. (a) Define the term Research with any one standard definition.
   (b) Explain the Objectives of Research with examples.
   (c) Discuss the Motivation in Research. [2+6+6]

2. (a) Distinguish between Descriptive and Analytical Research.
   (b) Explain Applied and Fundamental Research with examples.
   (c) Write a short note on Quantitative and Qualitative Research. [5+5+4]

3. (a) Explain the meaning of Research Methods.
   (b) Explain the scientific method of research and discuss its basic postulates.
   (c) Differentiate between Research Methods and Research Methodology. [2+6+6]

4. (a) Explain the meaning and significance of a Research design.
   (b) Explain any four major steps of the research process. [7+7]

5. (a) Empirical research in India in particular creates so many problems for the researchers". State the problems that are usually faced by such researchers.
   (b) Explain criteria of good research. [9+5]

6. (a) Discuss components of a good research problem.
   (b) What is the necessity of defining a research problem? Explain. [7+7]

7. What is research problem? Define the main issues which should receive the attention of the researcher in formulating the research problem. Give suitable examples to elucidate your points. [14]

========== END ==========