Mid Sem

राष्ट्रीय प्रौद्योगिकी संस्थान पटना

National Institute of Technology Patna

Mid Semester Examination (March 2025)

Session: Jan-June 2025

Department: Electrical Engineering

Programme: B.Tech.(EE)

Semester: 2tnd

Section: B

Course Code: **EE26105**

Course: **Elements of Electrical Engineering-II**

Full Marks: 30

Duration: 2 Hrs

[Answer all the questions. Answer precisely and to the point. Calculator is allowed in this examination]

1.	(a) Point out differences between core type and shell type transformers. (b) What are the losses occurring in a transformer? (c) Calculate emf per turn for a 60 Hz, 230/3300 V, 100 kVA transformer operating with a flux of 30 mWb.	2 (CO1) +2 (CO2) +2 (CO2) =6
2.	(a) Draw the phasor diagram for transformer on No-Load condition and explain the work of each component. (b) Why No-load or Open circuit test is performed on a transformer? Which component of equivalent circuit is calculated by this test?	(1+3) (CO2) +(1+1) (CO2) =6
3.	(a) A shunt generator delivers 90 A at 220 V. The armature and field resistance values are given as 1 Ω and 100 Ω respectively. Calculate the emf generated. (b) Derive the equation of emf generated for a DC generator.	3 (CO3) +3 (CO3) =6
4.	(a) A 4 pole DC shunt generator with a shunt field resistance of 200 Ω and an armature resistance of 1 Ω has 500 wave connected conductors in its armature. The flux per pole is 0.01 Wb. If a load resistance of 15 Ω is connected across the armature terminals and the generator is driven at 1200 rpm. Calculate the voltage across the load terminals. (b) What are the different classes of compound generator?	4 (CO3) +2 (CO3) =6
5.	(a) Draw no-load or open circuit characteristic of separately excited DC generator and explain the nature of the curve very briefly. (b) A 440 Volt motor having an armature resistance of 0.4 Ω takes an armature current of 50 A. The motor is lap connected, has 4 poles, 600 armature conductors and flux per pole in 25 mWb. Calculate (i) the speed and (ii) gross torque developed by the armature.	3 (CO3) +3 (CO3) =6

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NATIONAL INSTITUTE OF TECHNOLOGY PATNA

MID SEMESTER EXAMINATION, Jan-June 2025

B.Tech (EE): IIth Semester (Group A & B)
Course Name: Engineering Graphics
TIME: 2.00 Hrs

DATE: 06/03/2025
Course Code: ME26101
MAX. MARKS: 30

INSTRUCTIONS:

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

		Marks	CO	BL
Q1.	What are the types of line used in the Engineering drawing? Describe with their general applications.	**3**	1	2
Q2.	Divide a straight line into a given number of equal parts say 5.	**3**	1	2
Q3.	Draw a Vernier scale of R.F. =1/25 to read centimeters upto 4 meters and on it, show lengths representing 2.39 m and 0.91 m.	**8**	2	3
Q4.	Construct an Ellipse by Concentric Circles Method.	**8**	2	3
Q5.	Construct a Parabola by Tangent Method.	**8**	2	3

NATIONAL INSTITUTE OF TECHNOLOGY PATNA

Department of Electrical Engineering

Mid Semester Examination (Session: Jan. - June 2025)

B. Tech-EE: 2nd Semester (Section – A and Section – B)

Course Name: Electrical Workshop **Course Code:** EE26106

Time Duration: 2 hours **Full Marks: 20**

Instructions:

1. **All questions are compulsory.**
2. **Draw suitable diagrams, if necessary.**

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

Sl. No.	Questions	CO	BL
Q1.	Identify and describe four common electrical hazards in an electrical workshop. How can these hazards be mitigated through safe work practices? **[Marks: 5]**	CO1	R(L1)
Q2.	What are electrical codes and regulations? Why are they important in ensuring workplace safety? Describe and provide two examples of regulating organizations relevant to electrical safety. **[Marks: 4]**	CO1	U(L2)
Q3.	Draw and explain briefly the construction diagram of an SPST and SPDT switch. Describe the staircase wiring diagram for a three-story building using appropriate electrical switches. **[Marks: 6]**	CO2	A(L3)
Q4.	Draw at least five symbols of various electrical components. Explain the functions of a starter and ballast in a fluorescent lamp with suitable waveforms. **[Marks: 5]**	CO3	U(L2)

NATIONAL INSTITUTE OF TECHNOLOGY PATNA

Mid Semester Examination Jan - June, 2025

B. Tech EE (Section 2) Semester II

Course Name: Engineering Chemistry **Course Code: CH26101**

Maximum Time: 2 hours **Max. Marks: 30**

All questions are compulsory.

Sr. No.	Question	Marks	CO	BL
1	(a) What is the purpose of pelletization of biomass?	1	CO1	L2
	(b) Mention the characteristics of a good fuel.	4	CO1	L1
2	(a) Define Knocking.	1	CO1	L1
	(b) Compare proximate vs ultimate analysis of coal.	2	CO1	L1
	(c) 1.56 g of the coal was Kjeldahlized and NH_3 gas thus evolved was absorbed in 50 ml of 0.1 N H_2SO_4. After absorption, the excess acid required 6.25 ml of 0.1 N NaOH for exact neutralization. Calculate the percentage of Nitrogen in the coal sample.	2	CO1	L4
3	(i) A dilute solution of $AgNO_3$ has an equivalent conductivity of 115.3 $ohm^{-1}cm^2\ eq^{-1}$ and the transport number of silver ion is 0.47. Calculate the ionic conductance and ionic mobilities of silver and nitrate ions.	2	CO2	L4
	(ii) Explain how does the conductance of the solution change when a weak acid is titrated with a strong base.	3	CO2	L2
4	Explain the principle and working of the glass electrode.	5	CO2	L2
5	A 0.2 g sample containing copper is analyzed iodometrically. Copper II is reduced to copper I by iodide; CuI precipitates: $2Cu^{2+} + 4I^- \rightarrow 2CuI + I_2$ What is the percent copper in the sample if 20 ml of 0.1 M $Na_2S_2O_3$ is required for titration of the liberated I_2?	5	CO2	L4
6	Calculate the volume of air required for complete combustion of 1 m^3 of a gaseous fuel having the composition CO = 46 %, CH_4 = 10 %, H_2 = 40 %, C_2H_2 = 2 %, N_2 = 1% and the remaining being CO_2.	5	CO2	L4

NATIONAL INSTITUTE OF TECHNOLOGY PATNA

DEPARTMENT OF MATHEMATICS

MID-SEMESTER EXAMINATION - MARCH 2025

COURSE: ENGINEERING MATHEMATICS

TIME: 2 HOUR

CODE: MA26101

MAXIMUM MARKS: $5 \times 6 = 30$

ANSWER ALL QUESTIONS

1. (a) Find the inverse of the matrix

$$A = \begin{pmatrix} 2 & 1 & 3 \\ 1 & 0 & 1 \\ 2 & 1 & 1 \end{pmatrix}$$

by applying elementary row operations and verify that result.

(b) Consider the linear system of equations

$$2x_1 + 3x_2 + 5x_3 = 9$$
$$7x_1 + 3x_2 - 2x_3 = 8$$
$$2x_1 + 3x_2 + \alpha x_3 = \beta.$$

Find the value of α and β for which the system has (i) a unique solution; (ii) infinitely many solution and (iii) no solution.

[CO. 1]

2. (a) Prove that the solution set W of a homogeneous system of equations $AX = 0$ in n unknowns is a subspace of F^n.

(b) Determine whether the set $W = \{(a_1, a_2, a_3) \in \mathbb{R}^3 : a_1 - 4a_2 - a_3 = 0\}$ is a subspace of $\mathbb{R}^3$ under the operations of addition and scalar multiplication defined on $\mathbb{R}^3$. Justify your answers. If W is a subspace, then determine the basis and dimension of W.

[CO. 1]

3. Let $T : \mathbb{R}^3 \to \mathbb{R}^3$ be defined by $T(x, y, z) = (2x + y - 2z, 2x + 3y - 4z, x + y - z)$. Find all eigenvalues of T, and find a basis of each eigenspace. Is T diagonalizable? If so, find the basis S of $\mathbb{R}^3$ that diagonalizes T, and find its diagonal representation D. [CO. 1]

4. Consider the vector space $P(t)$ with inner product $\langle f, g \rangle = \int_0^1 f(t)g(t)dt$. Apply Gram-Schmidt algorithm to the set $\{1, t, t^2\}$ to obtain an orthogonal set $\{f_0, f_1, f_2\}$ with integer coefficients. [CO. 1]

5. (a) Test the convergence of the series

$$1 + \frac{1}{2}.\frac{1}{3} + \frac{1.3}{2.4}.\frac{1}{5} + \frac{1.3.5}{2.4.6}.\frac{1}{7} + \cdots\cdots$$

(b) Show that the series $\sum \frac{1}{n^p}$ converges if $p > 1$, and diverges if $p \leq 1$.

[CO. 2]

6. (a) Prove that $\lim_{x \to 5} \frac{1}{x} = \frac{1}{5}$, by definition.

(b) Use $\epsilon - \delta$ definition to show that the function defined by

$$f(x) = \begin{cases} x \sin \frac{1}{x}, & x \neq 0; \\ 0, & x = 0. \end{cases}$$

is continuous at $x = 0$.

[CO. 2]

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NATIONAL INSTITUTE OF TECHNOLOGY PATNA
Department of Electronics and Communication Engineering
MID SEMESTER EXAMINATION, Jan-June 2025

B. Tech-EE: Semester-III
Course Name: Electronics Workshop
Maximum Time: 2 Hours

Date of Exam: 07.03.25 (EV)
Course Code: EC26105
Max. Marks: 30

Instruction:

- Attempt all the questions.
- The Marks, CO (Course Outcome) and BL (Bloom's Level) related to questions are mentioned on the right-hand side margin.

		Marks	CO	BL
1.	(a) Why silicon? (b) Why analog? (c) Draw the pin diagram of IC LM317? (d) Why BJT is not preferred for IC Design? (e) What is the relationship between α, β, and γ of the BJT? (f) A BJT transistor has β=59 and $I_b = 10\mu A$, and a leakage current of 10nA; find its collector current?	6	CO1	R, U, P, A, E
2.	Draw and elaborate the block diagram and working of Cathode Ray Oscilloscope (CRO) and Digital storage Oscilloscope (DSO) in detail.	6	CO1	R, U, P
3.	Explain the working principle of the following diode and write their applications: (a) Zener Diode (b) Photo Diode (c) Varactor Diode	6	CO1	R, U, P, A
4.	Describe the soldering and de-soldering process in terms of usage and limitations and also write the function of each component used in the soldering and de-soldering process.	6	CO1	U, P, A, E
5.	Explain the working principle of NPN-type BJT and N-channel MOSFET and draw their equivalent circuit diagram (low frequency).	6	CO1	U, A, E

END