National Institute of Technology Patna
Department of Mathematics
Mid Semester Examination : March 2025

Course Name: **Engineering Mathematics – II** Course Code: MA28101/MA211101
Program: Applied Physics··· & MAE **(MA28101 & MA211101)**
Duration: 2 Hrs Full Marks: $5 \times 6 = 30$

Answer All The Questions

1. (a) Show that for the function $f(z) = u + iv$ the C-R equation can be written as

$$\frac{1}{2}\left(\frac{\partial}{\partial x} + i\frac{\partial}{\partial y}\right) f = 0.$$

(b) Find an analytic function f whose real part is

$$u(x, y) = \sinh x \sin y.$$

[CO.3]

2. (a) Find all the singularities and their types of the following functions.

$$(i) f(z) = \exp\left(\frac{1}{z-3}\right), \quad (ii) f(z) = cosec\left(\frac{\pi}{z}\right)$$

(b) Find the Laurent expansion of

$$f(z) = \frac{z^2 - z + 1}{z(z^2 - 3z + 2)}$$

in the region $|z + 1| > 3$.

[CO.3]

3. (a) Evaluate

$$\oint_C \frac{e^z}{z-2} dz$$

if C is (i) the circle $|z| = 3$, (ii) the circle $|z| = 1$.

(b) Let $a > e$. Then using Rouche's theorem prove that the equation $e^z = az^n$ has n roots inside the circle $|z| = 1$.

[CO.3]

4. (a) Discuss for what values of m, the improper integral $\int_0^1 \frac{x^{m-1}}{1+x} dx$ converges and diverges.

(b) Evaluate $\int_0^{\pi/2} \sqrt{\tan x} dx$.

[CO.1]

5. (a) Prove that $\int_0^1 \int_x^{1/x} \frac{y^2}{(x+y)^2\sqrt{1+y^2}} dy dx = (2\sqrt{2} - 1)/2$.

(b) Evaluate the integral

$$\iiint x^\alpha y^\beta z^\gamma (1 - x - y - z)^\lambda dx dy dz$$

over the tetrahedron formed by the coordinate planes and the plane $x + y + z = 1$.

[CO.1]

***** All the Best *****

24U016

NATIONAL INSTITUTE OF TECHNOLOGY PATNA

Department of Chemical Science & Technology

MID SEMESTER EXAMINATION, MARCH 2025

B. Tech: Semester-II, MAE, APME & MCT

Course Name: Engineering Chemistry; Course Code: CH211101, CH28101 & CH27101

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

Instruction:

1. Attempt All questions.
2. Assume any suitable data, if necessary.

		Marks	CO	BL
1. a).	Write the different types of gaseous fuels and their properties and applications.	4	CO2	L4
b).	Calorific value is an important property of solid fuels. Explain. Calculate the HCV and LCV of a coal specimen from the following data per kg of coal: Carbon: 70%, Hydrogen: 8%, Oxygen: 10%, Sulfur: 3%, and the remaining ash.	4	CO3	L5
c).	Correlate the working principle of solar cells as an alternative non-renewable energy.	2	CO3	L4
d).	Write the reactions involved in the combustion of fuels by radical mechanism pathways.	2	CO3	L5
e).	Distinguish between octane number and cetane number. What happens if I mix with 91 octane and 98 octane? What happens if petrol is put in a diesel car? Explain Briefly.	3	CO5	L5
2. a).	How can the transport no be determined by applying Kohlrauschs's law? Explore the coulometer and explain its role in determining transport no.	4	CO3	L4
b)	The molar conductance at infinite dilution for sodium acetate and HCl at 30°C is 91.0 $X10^{-4}$ and 426.16$X10^{-4}$ S m^2 mol^{-1}, respectively. Also H+ ion in HCl, t_+ is 0.821, and for CH_3COO^- ion in CH_3COONa, t_- is 0.556. Assuming $t_\pm = t°_\pm$. Calculate the $\Lambda°_m$ for CH3COOH.	3	CO3	L4
c).	Correlate the molar conductance of dilution with (i) ionic mobility and (ii) ionic conductance.	2	CO2	L4
d).	Deduce the asymmetric effect of Debye-Hückel's theory of strong electrolytes.	3	CO3	L5
e).	Write and explain calomel electrodes working principle and their properties.	3	CO3	L5

NATIONAL INSTITUTE OF TECHNOLGY PATNA

Department of Computer Science & Engineering

MID SEMESTER EXAMINATION, JAN-JUNE 2025

B. Tech: Mechatronics Engineering | Semester-II

Course Name: Problem Solving using C | Course Code: CS211102

Maximum Time: 2 hours | Max. Marks: 30

Instruction:

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

	Questions	Marks	CO	BL
Q1	Analyze the given programs and write their outputs. Assume all these programs contains all necessary header files.	10 (2*5)	CO1-CO5	Understanding and Analysing

(i)

```
int main(){
        int main = 3;
        printf("%d", main);
        return 0;
      }
```

(ii)

```
int main(){
  printf(10+ "MECHATRONICS ENGINEERING");
     return 0;
}
```

(iii)

```
int main() {
        signed char chr;
        chr = 128;
         printf("%d\n", chr);
         return 0;  }
```

(iv)

```
void reverse(int i);
 int main()  {
      reverse(1);
 }
     void reverse(int i)
      {if (i > 5){
                return ;}
        printf("%d ", i);
        return reverse((i++, i));
      }
```

	(v)
	int Hi(){
	static int num = 16;
	return num--;
	}
	int main()
	{
	for(Hi(); Hi(); Hi())
	printf("%d ", Hi());
	return 0;
	}			

Q2	Write a C Program to check whether a user-given number is Prime or Not using Recursion.	5	CO1, CO2, CO3	Apply
Q3	Write a C Program to find the HCF of two user given numbers.	5	CO1, CO2, CO3	Apply
Q4	Write a C program that takes two strings of equal length from the user and replaces all characters in the second string that are present in the first string with the symbol *	5	CO3, CO4, CO5	Apply
Q5	Write a C program that takes an array of n numbers from the user and arranges those numbers in descending order	5	CO3, CO4	Apply

National Institute of Technology Patna

Department of Mechatronics and Automation Engineering

Mid Semester Examination

Subject: Fundamentals of Machine Tools — Subject Code: MAE21101
Date: 10/03/2025 — Time: 2 hr
Branch: Mechatronics and Automation Engineering — Total Marks: 30
Batch: 2024-28 — Semester: II

Part-A — **Answer ALL the questions** — **(5×3=15)**

Q.No	Questions
1.	Discuss machine tools and its application in the industry ?
2.	Draw the velocity triangle. Write the sine law relationship among all the velocities.
3.	Discuss distribution of heat in metal cutting.
4.	Compare different types of chip.
5.	Write the name and application of any three lathe and drill machine.

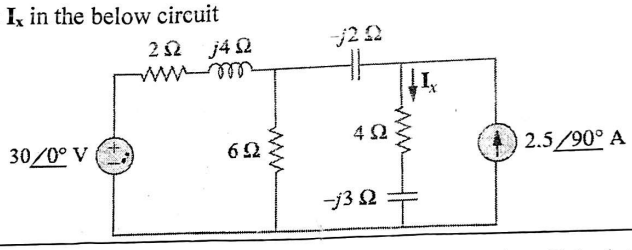
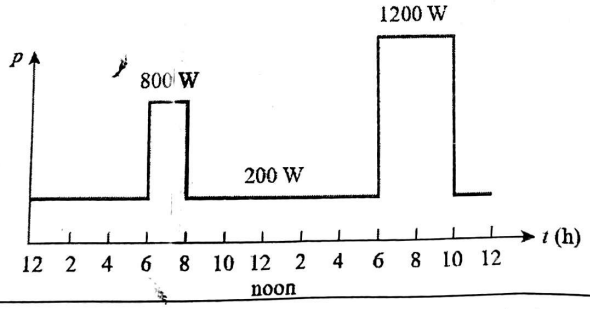
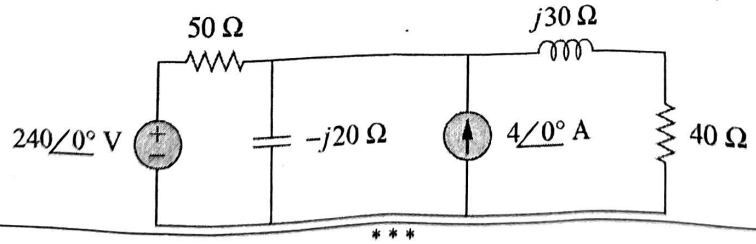
Part-B — **(3×5=15)**

Q.No	Questions
6.	Draw and discuss the parts of bench lathe machine. Also discuss five lathe machine operation.
	Or,
7.	The following data from the orthogonal cutting test is available: Rake angle =10°, chip thickness ratio = 0.35, uncut chip thickness = 0.51, width of cut = 3 mm, yield shear stress of work material = 285 N/mm2, Mean friction coefficient on tool face = 0.65. Determine the (i) Cutting force (ii) Radial force (iii) Normal force on tool and (iv) Shear force on the tool.
8.	A generalized Taylor's tool life equation was obtained for HSS tool; $$V = \frac{C}{T^{0.3} \times f^{0.6} \times d^{0.3}}$$ A 60 min tool life was obtained using the following cutting parameters, V = 40 m/min, f = 0.25 mm, d = 2.00 mm. Compute the tool life if cutting speed, feed and depth of cut are increased by 25% where V-cutting speed, f = feed, d = depth of cut.
	Or,
9.	Derive formula for shear angle using Merchant's circle analysis. Also derive the formula of different forces.
10	Discuss the types of tool wear. Also discuss different type of tool wear mechanism.
	Or,
11	Draw and discuss the parts of bench drill machine. Also discuss different type of operation performed on drill machine.

NATIONAL INSTITUTE OF TECHNOLOGY PATNA
DEPARTMENT OF ELECTRICAL ENGINEERING
Mid Semester Examination, Session: Jan-June 2025

Program: B. Tech. | **Semester:** 2 — **Department:** Mechatronics and Automation Engineering (MAE)
Course Code: EE211106 — **Full Marks:** 30
Course Name: Electrical Workshop — **Duration of Examination:** 2 hours
Date: 5th March 2025

Important Instruction: • Answer all questions • Each question must be answered at one place only

Q. No.	Questions	Marks
1.	Write a short note on the following: a) 'Pole' and 'Throw' in mechanical switches b) Double Pole Double Throw (DPDT) switch c) Single Pole Double Throw (SPDT) switch d) Selector switch e) Rocker switch	2×5 = 10
2.	a) What is switch? Why do we need switches? Briefly explain characteristics of an ideal switches. b) What is 'normally open (NO)' and 'normally closed (NC)' switches? Write applications of NO and NC switches.	2.5×2 = 5
4.	Find phasor current $\mathbf{I_x}$ in the below circuit 	5
5.	The below figure shows the power consumption of a household in one day. Calculate: a) The total energy consumed in kWh b) The average power per hour 	5
6.	Calculate the reactive power absorbed by the inductor and the capacitor in the given circuit. 	5

* * *