



## NATIONAL INSTITUTE OF TECHNOLOGY PATNA

Department of Chemistry  
Mid Semester Examination July-Dec 2024

Program: B.Tech-CSE, I<sup>st</sup> Year, Section III  
Course Name: Engineering Chemistry  
Maximum Time: 02:00 hrs.

Semester: I<sup>st</sup>  
Course Code: CH14101  
Full Marks: 30

### Instructions:

- All questions are compulsory. Assume if any missing data.
- The Marks related to questions are mentioned on the right-hand side margin.

Questions	Marks
<b>Q.1</b> (a) Draw the molecular energy level diagram for (i) $N_2$ (ii) $O_2$ and (iii) $F_2$ (b) Also give their molecular orbital electronic configuration. (c) Find bond order and predict the magnetic properties of above molecules.	(03) (1.5) (1.5)
<b>Q.2</b> (a) Explain VSEPR theory with the examples of $CH_4$ , $NH_3$ and $H_2O$ . (b) Find contraction in bond angle relative to that of $CH_4$ . (c) Explain the isomerism exhibited by the following coordination complexes; (i) $[Co(NH_3)_5Br]SO_4$ and $[Co(NH_3)_5SO_4]Br$ (ii) $[Cr(H_2O)_6]Cl_3$ , $[Cr(H_2O)_4Cl]Cl_2H_2O$ and $[Cr(H_2O)_4Cl_2]Cl_2H_2O$	(03) (01) (02)
<b>Q.3</b> (a) What are the postulates of Werner's theory of coordination complexes? (b) Give the structures of the following Co(III) amines based on Werner's theory. (i) $CoCl_3 \cdot 6NH_3$ (ii) $CoCl_3 \cdot 5NH_3 \cdot H_2O$ (iii) $CoCl_3 \cdot 5NH_3$ (iv) $CoCl_3 \cdot 4NH_3$ (v) $CoCl_3 \cdot 3NH_3$	(02) (02)
<b>Q.4</b> (c) Also, write the characteristics of the above Co(III) amines. (a) Define crystal field stabilization energy. (b) Calculate its value for the following systems. (i) $d^5$ and $d^8$ low spin octahedral (ii) $d^5$ and $d^8$ high spin octahedral (c) How can you explain the formation of $[Co(NH_3)_6]^{3+}$ and $[CoF_6]^{3-}$ ions on the basis of VBT?	(02) (02) (02)
<b>Q.5</b> (a) Draw the energy profile diagram for the following reactions (i) $SN^1$ and (ii) $SN^2$ (b) Indicate clearly the reactions, transition states activation energies and properties of the above reactions. (c) How would be decide whether the reaction; (i) $CH_3Cl + OH^- \rightleftharpoons CH_3OH + Cl^-$ (ii) $(CH_3)_3CCl + OH^- \rightleftharpoons (CH_3)_3COH + Cl^-$ , proceeds by $SN^1$ or $SN^2$ mechanism?	(02) (02) (02)

# National Institute of Technology Patna

## Department of Chemistry

### Mid Semester Examination

Subject: Workshop Practice-I

Subject Code: ME19101

Date: 25/09/2024

Time: 2 hr

#### Part-A

Answer ALL the questions

(5×2=10)

Q.No	Questions
1. ✓	What are the factors in selection of Materials for Engineering Application?
2. ✓	Write the meaning of BIS specification of steel given by (a) 24 Cr 4 Mo 2 G (b) XT 98 W6 Mo 5 Cr 4 V1.
3. ✓	Write the name and application of four measuring tool.
4. .	Write the composition and application of Bronze and Solder.
5. ✓	Discuss the properties and application of composite material.

#### Part-B

(2×10=20)

Q.No	Questions
6. ✓	Describe ferrous and non-ferrous material. Draw and discuss iron-carbon phase diagram.

Or,

7.	Draw stress strain diagram for mild steel. Describe different type of mechanical and physical properties of material.
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8. ✓	Write the name and effect of different alloying elements in steel.
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Or,

9.	Draw and write the name of five holding, marking and cutting tool.
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**NATIONAL INSTITUTE OF TECHNOLOGY PATNA**  
**MID SEMESTER EXAMINATION, JULY-DECEMBER 2024**

Program: UG & DD Semester: 1<sup>st</sup> Department: HSS  
Course Code: HS12101 (B), HS111101, HS16101 (B), HS19101  
Branch: ME & M&AE and EE & CE&T.  
Course Name: Communicative English  
Full Marks: 22.5 Duration of Examination: 2 Hours

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Instructions:

- Answer all questions.
- Marks for each section has been allotted separately.

**Section A**

**Short Answer Questions (6 Marks)**

1. Describe the process of communication and its key elements. Give examples. (2 marks)
2. Explain the concept of non-verbal communication and its significance. Give examples (2 marks)
3. Discuss the role of active listening in effective communication. (2 marks)

**Section B**

**Long Answer Questions (6 Marks)**

4. Analyze the barriers to effective communication and give examples. (3 marks)
5. Describe the different types of listening modes and their applications. (3 marks)

**Section C**

Read the following dialogue and answer the questions that follow (4 marks)

Ravi: Hey, did you hear about the new project we're working on?

Neha: No, I haven't. What's it about?

Ravi: It's a collaboration with our sister company in the UK. We're developing a new software application for their clients.

Neha: That sounds exciting! When do we start working on it?

Ravi: We have a meeting scheduled next week to discuss the project details and timelines. The client wants us to deliver the first phase by the end of this quarter.

Neha: Wow, that's a tight deadline. Do we have enough resources to handle this project along with our existing workload?

Ravi: I've already spoken to the HR manager about hiring a few more developers. We're also planning to outsource some of the testing work to our QA team in India.

Neha: I see. Well, let's hope everything goes smoothly. Keep me posted on the project updates, okay?

Ravi: Sure, no problem. I'll share the meeting notes with you after the discussion next week.

Neha: Great, thanks! I'm looking forward to working on this project.

Questions:

- a) What is the new project about? (1 mark)
- b) What is the deadline for the first phase of the project? (1 mark)
- c) How is the company planning to handle the additional workload? (1 mark)
- d) What will Ravi do after the meeting next week? (1 mark)

### Section D

Read the Passage and answer the questions that follow

(6.5 Marks)

In the bustling city of New York, the Avengers were gearing up for their next big mission. However, there was a problem: they were having a communication crisis! Iron Man, Captain America, and Thor were all in the same room, but instead of discussing their strategy, they were arguing about who was the best superhero.

Iron Man boasted, "I have the coolest gadgets and the best suit! No one can match my technology!"

Captain America replied, "But it's not just about technology! It's about leadership and doing what's right. I stand for justice and honor!"

Thor, swinging his mighty hammer, chimed in, "You both have your strengths, but can you summon lightning? I can! That makes me the most powerful!"

As the argument heated up, Black Widow entered the room and raised her hands. "Friends, this isn't helping! We need to focus on the mission, not who's the best superhero. We have a villain to stop, and we can't do it if we're fighting among ourselves."

Realizing the truth in Black Widow's words, the Avengers paused. They began to communicate more effectively, sharing their strengths and ideas instead of competing. Iron Man suggested using his tech to track the villain, Captain America proposed a tactical plan, and Thor offered to create a distraction with his lightning.

Through open communication and teamwork, the Avengers successfully combined their skills and defeated the villain, saving the day once again. They learned that effective communication is not just about talking but also about listening and working together towards a common goal.

- a) What was the main problem the Avengers faced in the passage? (1.5 marks)
- b) Who intervened to help resolve the argument, and what did they say? (1 mark)
- c) What did the Avengers learn about communication by the end of the passage? (2 marks)
- d) Why is effective communication important for teamwork? (2 marks)

# National Institute of Technology Patna

## Department of Chemistry

End Semester Examination, July-Dec 2024

Subject: Workshop Practice-I

Subject Code: ME19101

Date: 02/12/2024

Time: 3 hr

**Answer ALL the questions**

**(6×3=18)**

### Part-A

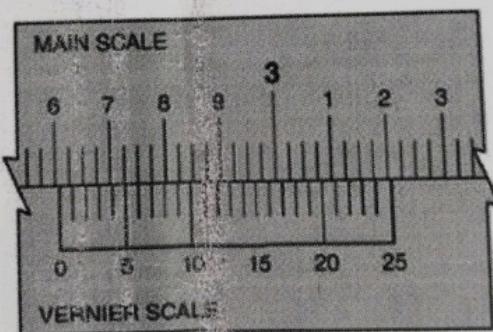
#### Questions

Q.No	Questions
1.	Draw the diagram of double cut half round file and write its part name.
2.	Compare soldering and fusion welding process?
3.	Write the name of different type of file based on number of teeth/cm.
4.	What are the tools used in carpentry shop?
5.	Discuss the application of workshop practice in chemical engineering.
6.	Write the difference between TIG and MIG.

**(7×6=42)**

### Part-B

7.	Define timber. Classify wood and Compare. Discuss five different wood in detail.
8.	Draw and write all the parts name of Vernier calipers. Write the measurement in the following scale if the least count is 0.02mm.



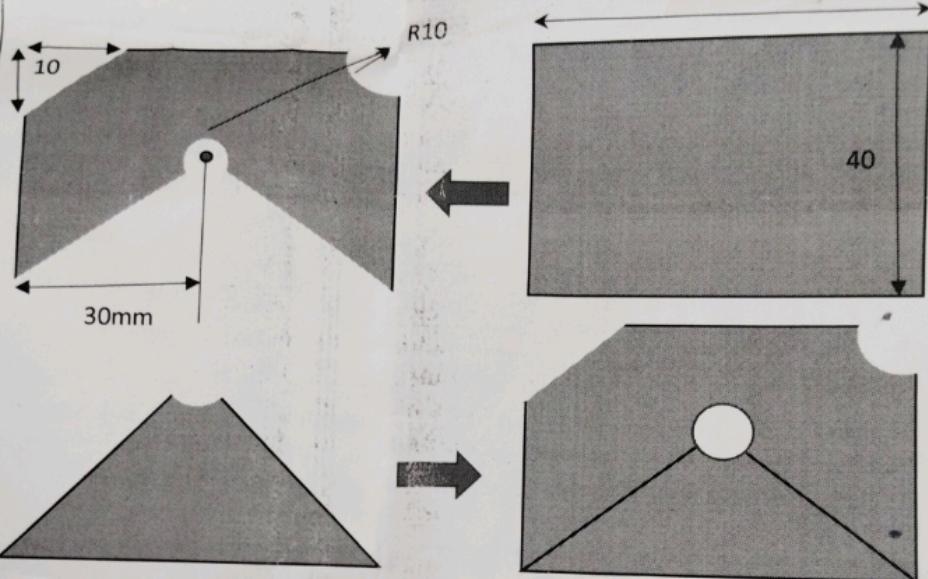
9.	Draw schematic diagram of arc welding. Discuss the functions of flux in metal arc welding. Write the name of different types of material used in flux coating for different purposes.
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10.

The resistance spot welding of two 1.55 mm thick metal sheets is performed using welding current of 10000 A for 0.30 s. The contact resistance at the interface of the metal sheets is 0.0001  $\Omega$ . The volume of weld nugget formed after welding is  $70 \text{ mm}^3$ . Considering the heat required to melt unit volume of metal is  $15 \text{ J/mm}^3$ . Find the thermal efficiency of the welding process.

List the name of tools used and discuss the sequence of operations to make following fitting job in workshop. 60

11.



All the dimensions are in mm.

12.

A welding operation is being performed with voltage = 30 V and current = 100 A. The cross-sectional area of the weld bead is  $20 \text{ mm}^2$ . The work-piece and filler are of titanium for which the specific energy of melting is  $14 \text{ J/mm}^3$ . Assuming a thermal efficiency of the welding process 70%, find the welding speed (in mm/s).

13.

In a direct current arc welding process, the power source has an open circuit voltage of 100 V and short circuit current of 1000 A. Assume a linear relationship between voltage and current. The arc voltage ( $V$ ) varies with the arc length ( $l$ ) as  $V=10+5l$ , where  $V$  is in volts and  $l$  is in mm. Find the maximum available arc power during the process in kVA.

  
**NATIONAL INSTITUTE OF TECHNOLOGY PATNA**  
**END SEMESTER EXAMINATION, JULY-DEC 2024**

Program: B. Tech Semester: 1 Department: HSS

Course Code: HS12101 (B) & HS11101, HS16101 (B), HS19101

Branch: ME & MEA and EE & Chem Tech.

Course Name: Communicative English

Full Marks: 45

Duration of Examination: 3 Hours

**Section A**

Short Answer Questions. Each question carries one mark.

10M

1. Create a new word by combining the prefix "bio-" with a suitable root word and define its meaning.
2. Form a noun from the verb "to educate" and use it in a sentence.
3. Give the antonyms of the words: optimist, expand.
4. Give synonyms of the words: identical, creek.
5. Give two sentences using the homophones "bare" and "bear" correctly, highlighting their meanings.
6. Differentiate between "affect" and "effect" by giving their meaning and using each correctly in a sentence.
7. What is the one-word substitution for
  - a) a person who studies insects
  - b) a platform for speakers or conductors
8. Use the following phrasal verbs in a sentence:
  - a) Carry out
  - b) Put off
9. Give the meaning of the following idioms and use it in a sentence:
  - a) Through thick and thin
  - b) Bite the bullet
10. From the following list of names, identify which one is an eponym and briefly explain its significance:
  - a) Ohm
  - b) Einstein
  - c) Curie
  - d) Gravity

**Section B**

Answer the following Questions. Each question carries one mark.

7 M

✓ 1 Rewrite the following sentence to improve clarity:  
"The engineer who was late to the meeting because of traffic he missed the important discussion."

✓ 2 Which of the following sentences is grammatically correct?  
a) The list of items are on the table.  
b) The group of students were excited about the trip.  
c) The team is winning the championship.  
d) The data were analyzed carefully.

✓ 3 Convert the following active voice sentence to passive voice:  
"The technician repaired the machine."

✓ 4 Convert this direct speech into indirect speech:  
"She said, 'I will finish my project tomorrow.'

✓ 5 Identify and correct the punctuation error in this sentence:  
"My favorite subjects are mathematics physics and chemistry."

✓ 6 Identify the error in this sentence:  
"Each of the students have submitted their assignments on time."

✓ 7 Choose the correct modal verb to complete this sentence:  
"You \_\_\_\_\_ (must/can) submit your application by Friday if you want to be considered for the scholarship."

### Section C

Answer the following questions.

8 M

✓ 1 Differentiate between voiced and voiceless consonants by providing three examples for each category. (4 marks)

✓ 2 What is communication skill and why is it important for everyday life? Discuss the types. (4 marks)

### Section D

Long Answer Questions.

20 M

✓ 1 Explain Johari Window and its application within an organization. (10 marks)  
OR

2. Explain the Eisenhower Matrix Technique of Time Management. How can you utilize this technique in your everyday life? (10 marks)

✓ 3 Write a job application for a job posting you saw on LinkedIn regarding post of a Robotics Engineer at McKinsey. Follow the proper format. (10 marks)  
OR

4. What is a resume? Discuss all the important features of a resume. (10 marks)

NATIONAL INSTITUTE OF TECHNOLOGY PATNA

DEPARTMENT OF MATHEMATICS

END-SEMESTER EXAMINATION : DECEMBER 2024

ENGINEERING MATHEMATICS - I

COURSE CODE: MA19101

TIME: 3 HOURS

MAXIMUM MARKS:  $6 \times 10 = 60$

Answer any 5 questions

✓ (a) Reduce the following matrix into normal form.

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

Hence find its rank.

✓ (b) Determine whether the set

$$S = \{-1 - x + x^2, 2 + x - 2x^2, 1 - 2x + 4x^2\}$$

is a basis for  $P_2(R)$ .

[3+3=6 marks] [CO.1]

✓ 2. Determine the eigenvalues and eigenvectors of the matrix

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

State Cayley-Hamilton's theorem. Verify Cayley-Hamilton theorem for the given matrix  $A$ . Hence deduce  $A^{-1}$ .

[3+3=6 marks] [CO.1]

✓ 3. Check the convergence of the series

$$1 + \frac{2.x}{2!} + \frac{3^2.x^2}{3!} + \frac{4^3.x^3}{4!} + \dots \quad \text{for } x > 0.$$

[6 marks] [CO.2]

4. Show that the function

$$f(x, y) = \begin{cases} xy \frac{x^2 - y^2}{x^2 + y^2}, & \text{when } x^2 + y^2 \neq 0; \\ 0, & \text{when } x = 0, y = 0 \end{cases}$$

is continuous and possesses first partial derivatives at  $(0,0)$ . Test the differentiability of the function at  $(0,0)$ .

[6 marks] [CO.2]

✓ 5. Let  $V$  is a function of  $x$  and  $y$ , and if,  $x = u \cos \alpha - v \sin \alpha$  and  $y = u \sin \alpha + v \cos \alpha$ , where  $\alpha$  is a constant, show that

$$\left( \frac{\partial V}{\partial x} \right)^2 + \left( \frac{\partial V}{\partial y} \right)^2 = \left( \frac{\partial V}{\partial u} \right)^2 + \left( \frac{\partial V}{\partial v} \right)^2.$$

[6 marks] [CO.2]

6/ If  $V = \cos^{-1} \frac{x+y}{x^{1/2} + y^{1/2}}$ , then show that

$$x \frac{\partial V}{\partial x} + y \frac{\partial V}{\partial y} + \frac{1}{2} \cot V = 0.$$

[6 marks] [CO.2]

7/ Find the extremum value of the function

$$f(x, y, z) = (x + y + z)^3 - 3(x + y + z) - 24xyz + a^3.$$

[6 marks] [CO.2]

8. Solve the differential equation

(a)  $(y^4 + 2y)dx + (xy^3 + 2y^4 - 4x)dy = 0.$

(b)  $\frac{dy}{dx} + \frac{y}{x} \log y = \frac{y}{x^2} (\log y)^2.$

[3+3=6 marks] [CO.3]

9. (a) Use the method of variation of parameter to solve the differential equation  $y'' + 4y = 4 \tan 2x$ .

(b) Solve the differential equation  $(D^2 - 2D + 3)y = \cos x + x^2$ .

10. Solve the simultaneous differential equations

[3+3=6 marks] [CO.3]

$$\begin{aligned} \frac{dx}{dt} + x &= y + e^t \\ \frac{dy}{dt} + y &= x + e^t. \end{aligned}$$

[6 marks] [CO.3]

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