



NATIONAL INSTITUTE OF TECHNOLOGY PATNA
Department of Mechanical Engineering
Mid Semester Examination, Jan-June 2025
Exam Session: AN

B. Tech: Semester-II (section-B)

Course Name: Workshop Practice-II

Course Code: ME22105

Maximum Time: 02 Hrs, Date: 5th March 2025

Marks: 30

Instructions:

Attempts All Questions.

- Q.1 (a) Define anvil with suitable diagram. (8)**
- (b) What is an anvil used for ? (3)**
- (c) Top surface of an anvil used in smithy work is made for (2)**
- (i) Mild steel (ii) Cast iron (iii) High carbon steel (iv) Cobalt**
- Q.2 Describe types of hammer with suitable diagram. (8)**
- Q.3 (a) Define swage block with suitable diagram. (6)**
- (b) What is a swage block used for ? (3)**



Roll no.:

NATIONAL INSTITUTE OF TECHNOLOGY PATNA

Department of Mechanical Engineering

Elements of Mechanical Engineering (ME 22101)

Mid Semester Examination, Date: 07-03-2025

(B.Tech.-ME, 2nd Sem., Section A,B & DD)

Time: 03:30 PM – 05:30 PM

Session: Jan-June 2025,

FM: 30

General Instructions:

1. All the questions are compulsory.
2. Please write down the Serial Number of the question before attempting it.
3. Draw neat sketch wherever required.

1. Multiple choice questions.

[1x6=6]

- A. Which of the following is not a type of primary source of energy? (CO-1, BL-2)
- a) Fossil fuel
 - b) Biodiesel
 - c) Solar energy
 - d) Hydro energy
- B. In India, which of the following renewable energy source is used least for the electricity generation? (CO-1, BL-2)
- a) Hydro energy
 - b) Solar energy
 - c) Wind energy
 - d) Nuclear energy
- C. Which of the following is a suitable technique to utilize the solar energy? (CO-1, BL-2)
- a) Flat plate collectors
 - b) Solar tower
 - c) Building design
 - d) All of the above
- D. Which of the following is most suitable place for utilizing maximum wind energy? (CO-1, BL-2)
- a) City
 - b) Coastal area
 - c) Sea
 - d) All of the above
- E. Which of the following is not a mounting of a boiler? (CO-1, BL-2)
- a) Safety valve
 - b) Water level indicator
 - c) Fusible plug
 - d) Air preheater
- F. Choose the correct statement. (CO-1, BL-2)
- a) It is very difficult to inspect and repair the parts of a horizontal boiler
 - b) Locomotive boiler is a water tube boiler.
 - c) A fire tube boiler has a higher rate of steam production.
 - d) Fire tube boilers are generally preferred for low pressure

Sub: ENGINEERING CHEMISTRY

Time: 2 HOURS

CODE: CH22/01

F.M. = 30

BRANCH: B-Tech (ME)

SECTION: B

$$1 + 3\frac{1}{2} + 3 = 7\frac{1}{2}$$

CO1

1. WHY HCV IS GREATER THAN LCV?

THE TEMPERATURE OF 950 g OF WATER INCREASED FROM 25.5°C TO 28.5°C ON BURNING 0.75 g OF SOLID FUEL IN A BOMB CALORIMETER. WATER EQUIVALENT OF CALORIMETER AND LATENT HEAT OF STEAM ARE 400.0 g AND 587 cal/g RESPECTIVELY. IF THE FUEL CONTAINS 0.65% OF HYDROGEN, CALCULATE ITS NET CALORIFIC VALUE.

CALCULATE GROSS AND NET CALORIFIC VALUE OF COAL SAMPLE HAVING THE FOLLOWING COMPOSITION:
 $C = 80\%$, $H = 7\%$, $O = 3\%$, $S = 3.5\%$, $N = 2.1\%$ AND $ASH = 4.4\%$.

$$1 + 3\frac{1}{2} + 3 = 7\frac{1}{2}$$

CO1

Coal \rightarrow Moisture
 Port \rightarrow W₂
 Am \rightarrow W₂
 Am \rightarrow CO
 Am \rightarrow CO₂
 Am \rightarrow N₂
 Am \rightarrow CO₂ + CO + H₂O + H₂

2. DISTINGUISH BETWEEN OCTANE NUMBER AND CETANE NUMBER.

CALCULATE $C, H, N, S\%$ FROM THE FOLLOWING OBSERVATION FOR A SAMPLE OF COAL:
 (i) 2.1 g OF THE COAL IS BURNT IN COMBUSTION TUBE. THE INCREASE IN WEIGHT OF ANHYDROUS $CaCl_2$ IS 0.53 g AND INCREASE IN WEIGHT OF KOH IS 5.73 g.
 (ii) 0.75 g OF COAL IN KJELDAHL'S EXPERIMENT RELEASED NH_3 , WHICH IS PASSED IN 50 ml 0.12 (N) HCl. THE HCl REQUIRES 35 ml OF 0.12 (N) NaOH TO NEUTRALISE IN BACK TITRATION.

(iii) WASHING OF BOMB POT WHEN 1.9 g OF THE COAL SAMPLE IN BOMB CALORIMETER EXPERIMENT IS TREATED WITH $BaCl_2$ SOLUTION TO GIVE 0.41 g $BaSO_4$.

2.3 g OF AIR DRIED COAL SAMPLE WAS TAKEN IN SILICA CRUCIBLE. AFTER HEATING IN AN ELECTRIC AIR OVEN AT 110°C FOR ONE HOUR, THE RESIDUE WEIGHED 2.2 g. THE RESIDUE WAS THEN IGNITED AT 750°C TO A CONSTANT WEIGHT OF 0.245 g.

IN ANOTHER EXPERIMENT 1.1 g OF SAME COAL SAMPLE WAS HEATED IN A SILICA CRUCIBLE COVERED WITH A VENTED LID AT A TEMPERATURE OF $925 \pm 20^\circ C$ FOR EXACTLY SEVEN MINUTES. AFTER COOLING, THE WEIGHT OF RESIDUE WAS FOUND TO BE 0.725 g. CALCULATE % OF FIXED CARBON.

$$2 + 2 + 2 + 1\frac{1}{2} = 7\frac{1}{2}$$

CO2

3. WRITE THREE APPLICATIONS OF KOHLRAUSCH'S LAW WITH EXAMPLE.

THE MOLAR CONDUCTANCE AT INFINITE DILUTION OF $Al_2(SO_4)_3$ IS $858 \text{ ohm}^{-1} \text{ cm}^2 \text{ mol}^{-1}$. CALCULATE MOLAR IONIC CONDUCTANCE OF Al^{3+} ION, GIVEN THAT $\Lambda^\infty(SO_4^{2-}) = 160 \text{ ohm}^{-1} \text{ cm}^2 \text{ mol}^{-1}$.

THE RESISTANCE OF AN $(\frac{N}{10})$ KCl SOLUTION IS 295 OHM. CALCULATE THE SPECIFIC CONDUCTANCE AND EQUIVALENT CONDUCTANCE OF THE SOLUTION IF THE ELECTRODES IN THE CELL ARE 4 cm APART AND EACH HAVING AN AREA OF 7.0 sq cm .

5.39 g OF A MIXTURE OF $FeSO_4 \cdot 7H_2O$ AND ANHYDROUS FERRIC SULPHATE REQUIRES 80 ml OF 0.125 (N) PERMANGANATE SOLUTION FOR COMPLETE CONVERSION TO THE FERRIC SULPHATE. CALCULATE THE INDIVIDUAL WEIGHT OF EACH COMPONENT IN THE ORIGINAL MIXTURE.

$$5 + 7\frac{1}{2} = 12\frac{1}{2}$$

P.T.O.

1

✓ (a) EXPLAIN WERNER THEORY.

$$2+3+1\frac{1}{2}+1=7\frac{1}{2} \quad \boxed{CO3}$$

✓ (b) DRAW MO DIAGRAM OF He_2^+ , H_2^- & O_2 AND CALCULATE THEIR BOND ORDER -

✓ (c) WHY BOND ANGLE OF H_2O IS 105° (APPROX) NOT $109^\circ 28'$?

✓ (d) WHAT ARE LIMITATIONS OF VALENCE BOND THEORY. CO₂,

NATIONAL INSTITUTE OF TECHNOLOGY PATNA

Department of Computer Science and Engineering

MID SEMESTER EXAMINATION, Jan-June 2025

B.Tech. ME, 2nd Semester

Course Code: CS22101

Course Name: Fundamentals of information Technology

Max. Marks: 30

Max. Time: 2 hours

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.

S.N.	Questions	Marks	CO	BL
1.	Define a computer and explain its key characteristics. Discuss the evolution of computers and briefly explain each generation.	3+3	CO1	Remember
2.	Explain the role of Input/ Output devices in a computer system. Name and describe any three input devices, including their functions. Also Differentiate between Impact Printers and Non-Impact Printers, giving at least one example of each.	2+2+2	CO2	Understand
3.	Memory hierarchy plays a crucial role in determining a computer system's performance. a) Explain the concept of memory hierarchy with a well-labeled diagram. b) Differentiate between cache memory, primary memory (RAM) in terms of speed, cost, and storage capacity.	3+3	CO2	Understand
4.	A hard disk has the following parameters: • Seek Time = 8 ms • Rotational Speed = 7200 RPM • Data Transfer Rate = 100 MB/s • Data Size = 19 MB Computing the following: a) Rotational Latency b) Total Disk Access Time	3+3	CO2	Apply
5	a) Convert the following : • $(162.2342)_{10}$ to Octal • $(1101.101)_2$ to Decimal • $(1243)_8$ to $(---)_{16}$ b) Perform the following binary operations: ✓ $(1011)_2 + (1101)_2$ ✓ $(10110)_2 - (1101)_2$ • $(3562)_8 - (1734)_8$	6	CO2	Apply

All the best

$$\begin{aligned}
 1011 &\rightarrow 1 \times (2)^3 + 0 \times (2)^2 + 1 \times (2)^1 + 1 \times (2)^0 = 8 + 0 + 2 + 1 = 11 \\
 1101 &\rightarrow 1 \times (2)^3 + 1 \times (2)^2 + 0 \times (2)^1 + 1 \times (2)^0 = 8 + 4 + 0 + 1 = 13
 \end{aligned}$$

$$\begin{array}{r}
 1011 \\
 1101 \\
 \hline
 1000
 \end{array}$$

$$\begin{array}{r}
 1000 \\
 1011 \\
 \hline
 16+8=24
 \end{array}$$

$$\begin{aligned}
 13+11 &= 24 \\
 10110 &\rightarrow 1 \times (2)^4 + 0 \times (2)^3 + 1 \times (2)^2 + 1 \times (2)^1 + 0 \times (2)^0 = 16 + 0 + 4 + 2 = 22 \\
 1101 &\rightarrow 1 \times (2)^3 + 1 \times (2)^2 + 0 \times (2)^1 + 1 \times (2)^0 = 8 + 4 + 0 + 1 = 13 \\
 \hline
 01001
 \end{aligned}$$

9

3562
1734

1828

National Institute of Technology Patna

Department of Mathematics

MID-SEM-EXAMINATION: 11th March, 2025

Course Name: **Engineering Mathematics-I**

Course Code: MA22101

Program: B.Tech (Mechanical)

Full Marks:30

Duration: 2 Hrs.

ANSWER ALL QUESTIONS

1. Let $A = \begin{bmatrix} 1 & -6 & -4 \\ 0 & 4 & 2 \\ 0 & -6 & -3 \end{bmatrix}$. Find the eigenvalues and eigenvectors of A and check its diagonalizability. [3+2M]

2. If G be the linear transformation on \mathbb{R}^3 defined by $G(x, y, z) = (2y + z, x - 4y, 3x)$. Find the matrix representation of G relative to the basis $S = \{(1, 1, 1), (1, 1, 0), (1, 0, 0)\}$. [5M]

3. Let $A = \begin{bmatrix} 3 & 1 & 1 \\ -1 & 5 & -1 \\ 1 & 1 & 3 \end{bmatrix}$. Using Cayley-Hamilton theorem, find A^{-1} and A^4 . [2+3M]

4. Let $A = \begin{bmatrix} 1 & 1 & 1 & -1 \\ 2 & 0 & 1 & 1 \\ 2 & 2 & 2 & -2 \end{bmatrix}$. Find the basis and dimension of the null space of the matrix A . [4+1M]

5. Let V be a vector space over a field F and S be a non-empty subset of V . Prove that linear span of S is the smallest subspace of V . [3+2M]

6. Show that the following equation is exact and solve it.

$$(y^4 + 4x^3y + 3x)dx + (x^4 + 4xy^3 + y + 1)dy = 0.$$

[5M]

*****ALL THE BEST*****

$$\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$$

$$\frac{44}{444}$$

4/2/22