

**CMR COLLEGE OF ENGINEERING & TECHNOLOGY**
(UGC AUTONOMOUS)

B.Tech I Semester Supplementary Examinations December-2025

Course Name: **Linear Algebra and Calculus**

(Common for CE, EEE, ME, ECE, CSE & IT)

Date: 29.12.2025 AN

Time: 3 hours

Max.Marks: 70

(Note: Assume suitable data if necessary)

PART-A

Answer all TEN questions

Each question carries TWO marks.

10x2=20M

1. Define Rank of a matrix 2 M
2. Find the trace of the matrix A. Where $A = \begin{pmatrix} 3 & -6 & 5 \\ 1 & -2 & 9 \\ 5 & 2 & -1 \end{pmatrix}$ 2 M
3. Find the eigen values of the matrix $A = \begin{pmatrix} 4 & 3 \\ 0 & 20 \end{pmatrix}$ 2 M
4. Write any one application of Cayley Hamilton Theorem. 2 M
5. Test for convergence $\sum u_n$ where $u_n = n^2/3^n$. 2 M
6. State D'Alembert's Ratio test. 2 M
7. State Cauchy Mean value theorem. 2 M
8. Define beta function in terms of trigonometric ratios. 2 M
9. Find the first order partial derivatives of $f(x, y) = xy + \sin 2x$. 2 M
10. Define Saddle Point. 2 M

PART-BAnswer the following. Each question carries TEN Marks.5x10=50M

- 11.A). Find P and Q such that the normal form of $A = \begin{pmatrix} 1 & 2 & 3 & -2 \\ 2 & -2 & 1 & 3 \\ 3 & 0 & 4 & 1 \end{pmatrix}$ is PAQ. Hence find the rank of A. 10M

OR

11. B). Solve the following equations by Gauss-Seidal method. 10M
 $10x_1 - 2x_2 - x_3 - x_4 = 3$; $-2x_1 + 10x_2 - x_3 - x_4 = 15$; $-x_1 - x_2 + 10x_3 - 2x_4 = 15$;
 $-x_1 - x_2 - 2x_3 + 10x_4 = -9$ (correct to 3 decimal places)

12. A). Verify Cayley - Hamilton theorem and find the inverse of the matrix $A = \begin{pmatrix} 1 & 1 & 2 \\ 9 & 2 & 0 \\ 5 & 0 & 3 \end{pmatrix}$ 10M

OR

12. B). Reduce the quadratic form $x^2 + y^2 - z^2 + 6xy + 4yz - 2zx$ to the normal form by orthogonal transformation. 10M

13. A). Discuss the convergence $1 - \frac{1}{\sqrt{2}} + \frac{1}{\sqrt{3}} - \frac{1}{\sqrt{4}} + \dots \infty$ 10M

OR

13. B). Test the convergence of the series $1 + \frac{2x}{2!} + \frac{3^2x^2}{3!} + \frac{4^3x^3}{4!} + \dots$ 10M

(P.T.O.)

14. A). i) Verify Rolle's mean value theorem for the function $\log\left(\frac{x^2+ab}{x(a+b)}\right)$ in $[a, b]$, $a > 0$, $b > 0$. 5M
ii) Calculate approximately $\sqrt{85}$ by using Lagrange mean value theorem. 5M

OR

14. B). Prove that $\beta(m, n) = \int_0^{\infty} \frac{x^{m-1}}{(1+x)^{m+n}} dx = \int_0^{\infty} \frac{x^{n-1}}{(1+x)^{m+n}} dx$ 10M

15. A). Prove that $u = x\sqrt{1-y^2} + y\sqrt{1-x^2}$, $v = \sin^{-1}x + \sin^{-1}y$ are functionally dependent. 10M

OR

15. B). i) If $u = \frac{yz}{x}$, $v = \frac{zx}{y}$, $w = \frac{xy}{z}$ then show that $\frac{\partial(u,v,w)}{\partial(x,y,z)} = 4$ 5M
ii) If sum of three variables is a constant, then find the numbers when the product of three numbers are maximum. 5M

H.T No:

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R18

Course Code: A30008



CMR COLLEGE OF ENGINEERING & TECHNOLOGY
(UGC AUTONOMOUS)

B.Tech I Semester Supplementary Examinations December-2025

Course Name: Engineering Physics

(Common for CE & ME)

Date: 31.12.2025 AN

Time: 3 hours

Max.Marks: 70

(Note: Assume suitable data if necessary)

PART-A

Answer all TEN questions

Each question carries TWO marks.

10x2=20M

- | | | |
|-----|---|-----|
| 1. | What is the difference between natural frequency and driving frequency? | 2 M |
| 2. | Differentiate between transverse and longitudinal waves. | 2 M |
| 3. | State the condition for destructive interference in thin films. | 2 M |
| 4. | Why are the secondary maxima less intense than the principal maxima? | 2 M |
| 5. | Define population inversion in a laser system and how it is achieved. | 2 M |
| 6. | What is the main difference between single-mode and multimode fibers? | 2 M |
| 7. | State the Clausius-Mossotti equation. | 2 M |
| 8. | How are ferrimagnetic materials different from ferromagnetic materials? | 2 M |
| 9. | Define nanoscale and give the size range associated with nanomaterials. | 2 M |
| 10. | Write any four applications of nanomaterials. | 2 M |

PART-B

Answer the following. Each question carries TEN Marks.

5x10=50M

- | | | |
|-----------|--|-----|
| 11.A). | Describe the phase representation of simple harmonic motion. How does the phase angle influence the position and velocity of the oscillator? | 10M |
| OR | | |
| 11.B). | Derive the wave equation for a transverse wave on a string and explain its physical significance. | 10M |
| 12.A). | Discuss in detail Fraunhofer diffraction due to a single slit. Derive the equation for principal maxima. | 10M |
| OR | | |
| 12.B). | What are Newton's rings? Explain how they are formed and derive the formula for the radius of curvature. | 10M |
| 13.A). | Discuss construction and working of the Ruby laser with neat diagrams. | 10M |
| OR | | |
| 13.B). | Discuss step-index and graded-index fibers, focusing on signal transmission in each type. | 10M |
| 14.A). | Outline the different types of polarization mechanisms in dielectric materials. | 10M |
| OR | | |
| 14.B). | Explain the hysteresis curve of ferromagnetic materials based on the domain theory of ferromagnetism. | 10M |
| 15.A). | Why do nanoparticles exhibit different properties. Explain the reasons. | 10M |
| OR | | |
| 15.B). | Explain the working of Transmission Electron Microscopy (TEM). Highlight their importance in analyzing nanoscale structures. | 10M |



CMR COLLEGE OF ENGINEERING & TECHNOLOGY
(UGC AUTONOMOUS)

B.Tech I Semester Supplementary Examinations December-2025

Course Name: Applied Physics

(Common for EEE, CSC, CSM, AID & AIM)

Date: 31.12.2025 AN

Time: 3 hours

Max.Marks: 70

(Note: Assume suitable data if necessary)

PART-A

Answer all TEN questions

Each question carries TWO marks.

10x2=20M

1. State Heisenberg's uncertainty principle. Write its mathematical form. 2 M
2. Write about the concept of electron gas. 2 M
3. Summarize the key features that help in classifying a material in to conductors, semiconductors and insulators. 2 M
4. Explain the law of mass action. 2 M
5. Distinguish Radiative and Non-Radiative recombination. 2 M
6. Explain the breakdown mechanism of a Zener diode under reverse bias with labelled diagram. 2 M
7. Write any four applications of LASER. 2 M
8. Outline optical fiber communication with a neat diagram. 2 M
9. Define Electric susceptibility and polarizability. 2 M
10. Compare Piezo-electric and Ferro-electric materials with examples. 2 M

PART-B

Answer the following. Each question carries TEN Marks.

5x10=50M

- 11.A). Develop an expression for energy and wave function of a particle in 1D potential box using Schrodinger's Time Independent Wave Equation. 10M
- OR**
11. B). i) Compare and contrast the Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac statistical-distributions. 6M
ii) Using the Fermi-Dirac distribution, estimate the Fermi energy for electron gas. 4M
12. A). Derive an expression for carrier concentration of N-type semi-conductors. 10M
- OR**
12. B). What is Hall Effect? Obtain an expression for Hall Coefficient and apply it to identify semi-conductors. 10M
13. A). Explain the formation of P-N Junction diode. Analyze its energy level diagram and V-I characteristics under forward and reverse bias. 10M
- OR**
13. B). Explain the construction, working and characterization of Light Emitting Diode. Write any two applications. 10M
14. A). Explain the construction of a He-Ne Laser and examine lasing action with stimulated emission and population inversion with neat & labelled diagrams. 10M
- OR**
14. B). i) Derive an expression for acceptance angle and numerical aperture of an optical fiber. 8M
ii) Differentiate step index and graded index optical fibers. 2M

(P.T.O.)

15. A). Discuss Dipole moment and Displacement vector. Summarize briefly the different types of polarizations. 10M

OR

15. B). Explain the phenomenon of magnetic hysteresis in ferromagnetic materials with the aid of a labeled hysteresis loop. Describe this behavior using the domain theory of ferromagnetism. 10M



CMR COLLEGE OF ENGINEERING & TECHNOLOGY
(UGC AUTONOMOUS)

B.Tech I Semester Supplementary Examinations January-2026

Course Name: Engineering Graphics

(Common for CE & ME)

Date: 02.01.2026 AN

Time: 3 hours

Max.Marks: 60

(Note: Assume suitable data if necessary)

PART-A

Answer all TEN questions

Each question carries ONE mark.

10x1=10M

- | | |
|--|-----|
| 1. Mention the significance of Engineering Drawing. | 1 M |
| 2. Differentiate plain scale and diagonal scale. | 1 M |
| 3. What are the principal planes in orthographic projection? | 1 M |
| 4. A point B is 40 mm above HP and 30 mm in front of VP. Draw its projections. | 1 M |
| 5. Define polyhedra and give two examples. | 1 M |
| 6. Differentiate prisms and pyramids. | 1 M |
| 7. Mention the shape of the curve formed when two cylinders of equal diameter intersect at right angles. | 1 M |
| 8. What do you mean by development of surfaces in engineering drawing? | 1 M |
| 9. Define Isometric scale. | 1 M |
| 10. Compare isometric and orthographic views. | 1 M |

PART-B

Answer the following. Each question carries TEN Marks.

5x10=50M

- 11.A). Draw an ellipse with a distance of the focus from the directrix which is 70 mm and the eccentricity which is $\frac{1}{2}$. Draw a tangent and normal to a point 25 mm below the major axis. 10M

OR

11. B). A coin of 40mm diameter rolls over a horizontal table without slipping. A point on the circumference of the coin is in contact with the table surface in the beginning and after one complete revolution. Draw the path traced by the point. 10M

12. A). The end P of a line 65 mm long is 20 mm above HP and 25 mm in front of VP. The line is parallel to HP and inclined to VP. The length of the front view is observed as 45 mm. Draw the projections of the line and determine the inclination of the line with VP. 10M

OR

12. B). A pentagonal plate of side 25 mm is above HP, one of its sides perpendicular to VP. Draw the projections if the plate is inclined at 45° to HP. The plate is 30 mm above HP. 10M

13. A). A Hexagonal pyramid, side of base 25 mm and axis 55 mm long rests with one of the edges of its base on HP and its axis is inclined at 30° to HP and parallel to VP. Draw its projections. 10M

OR

13. B). A cube of side 25 mm rests on the HP on one of its faces with a vertical face inclined at 35° to the VP. A plane perpendicular to the HP and parallel to the VP cuts the cube 10 mm away from the axis and farther away from the VP. Draw the top view and the sectional front view. 10M

(P.T.O.)

14. A). A hexagonal prism, edge of base 20 mm and axis 50 mm long, rests with its base on H.P. such that one of its rectangular faces is parallel to V.P. It is cut by a plane perpendicular to V.P, inclined at 45° to H.P and passing through the right corner of the top face of the prism. Draw the sectional top view and develop the lateral surface of the truncated prism. 10M

OR

14. B). A cylinder of 50mm diameter and 70mm axis is completely penetrated by another of 40mm diameter and 70mm axis horizontally. Both axes intersect & bisect each other. Draw projections showing curves of intersections. 10M

15. A). Draw an isometric view of a cylinder, with a 50mm base diameter and a 70mm long axis when (i) The base is on the HP (ii) when one of the generators is on the HP? 10M

OR

15. B). Draw the isometric view of the object, of which orthographic projections are shown in Fig. 1. (All dimensions are in mm). 10M

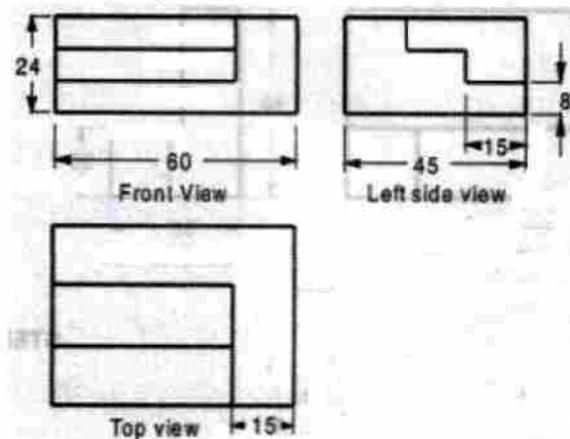


Fig.1



CMR COLLEGE OF ENGINEERING & TECHNOLOGY
(UGC AUTONOMOUS)

B.Tech I Semester Supplementary Examinations January-2026

Course Name: Programming for Problem Solving

(Common for EEE, ECE, CSE, IT, CSC, CSM, CSD, AID & AIM)

Date: 02.01.2026 AN

Time: 3 hours

Max.Marks: 70

(Note: Assume suitable data if necessary)

PART-A

Answer all TEN questions

Each question carries TWO marks.

10x2=20M

- | | | |
|-----|--|-----|
| 1. | Define an algorithm. Give an example. | 2 M |
| 2. | List any four characteristics of a computer. | 2 M |
| 3. | What is the difference between a while loop and a do-while loop? | 2 M |
| 4. | Can you use goto to jump out of a loop? Why or why not? | 2 M |
| 5. | What is a function prototype? Give an example. | 2 M |
| 6. | Define string and write syntax for Strlen(). | 2 M |
| 7. | What is a bit field in C? | 2 M |
| 8. | What is the use of the typedef keyword? | 2 M |
| 9. | List two differences between Bubble Sort and Selection Sort. | 2 M |
| 10. | What is the time complexity of Binary search in the worst case? | 2 M |

PART-B

Answer the following. Each question carries TEN Marks.

5x10=50M

- | | | |
|-----------|--|----|
| 11.A). | i) Explain various arithmetic and relational operators in C with examples. | 5M |
| | ii) Describe the data types and symbolic constants used in C. | 5M |
| OR | | |
| 11. B). | i) Explain the logical errors and syntax errors in C programming. Give examples. | 5M |
| | ii) What is type casting? Demonstrate with a C example. | 5M |
| 12. A). | i) Explain nested loops with an example. | 5M |
| | ii) Write a C program using nested loops to print the following pattern: | 5M |
| | <pre> 1 1 2 1 2 3 </pre> | |
| OR | | |
| 12. B). | i) Write a C program to read two 3×3 matrices and display their sum. | 5M |
| | ii) What are multidimensional arrays? Explain with syntax and example? | 5M |
| 13. A). | i) Write a recursive function in C to calculate the factorial of a number? Show its execution for n=4. | 5M |
| | ii) Describe how multi-file programs work in C. Mention the role of header files. | 5M |
| OR | | |
| 13. B). | i) Write a C program to reverse a string without using a library function. | 5M |
| | ii) Describe different storage classes in C with examples. | 5M |

(P.T.O..)

14. A). i) Explain how to pass a pointer to a function. Write a program to find the square of a number using this method. 5M
ii) Write a C program to define a structure for a student (name, roll number, marks) and display its details. 5M

OR

14. B). Explain Dynamic Memory Allocation functions in detail. 10M

15. A). i) 5 2 8 4 1 6 sort these elements using Insertion Sort algorithm. 5M
ii) Compare and analyze the time complexities of all three sorting techniques. 5M

OR

15. B). i) Write a program to read and display content from a text file. 5M
ii) Write a program to count the number of characters, words, and lines in a file. 5M



CMR COLLEGE OF ENGINEERING & TECHNOLOGY
(UGC AUTONOMOUS)

B.Tech I Semester Supplementary Examinations January-2026

Course Name: Engineering Mechanics

(Common for CE & ME)

Date: 05.01.2026 AN

Time: 3 hours

Max.Marks: 70

(Note: Assume suitable data if necessary)

PART-A

Answer all TEN questions

Each question carries TWO marks.

10x2=20M

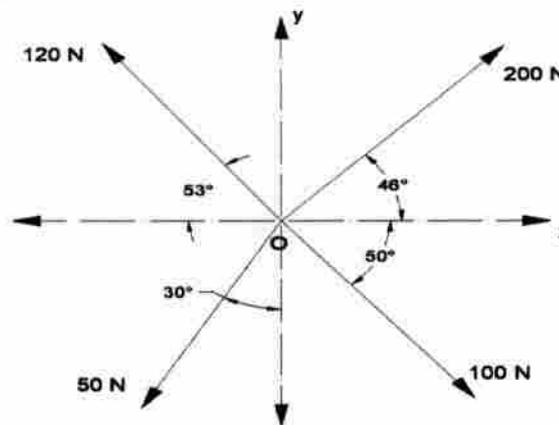
1. State the necessary and sufficient conditions for equilibrium of rigid bodies in two dimensions. 2 M
2. Differentiate between Moment of force and couple. 2 M
3. Define the terms "coefficient of friction" and "angle of friction". 2 M
4. State Pappus theorem. 2 M
5. What is perpendicular axis theorem? 2 M
6. Define mass moment of inertia of a body about an axis. 2 M
7. Define normal and tangential accelerations of a particle. 2 M
8. Write work energy equation for rotating bodies. 2 M
9. Differentiate the kinematics and kinetics. 2 M
10. State the D'Alembert's principle for a particle. 2 M

PART-B

Answer the following. Each question carries TEN Marks.

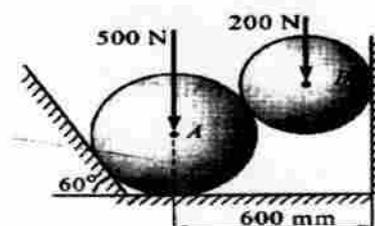
5x10=50M

- 11.A). A system of four forces acting on a body is shown in figure 1. Determine the resultant force and its direction. 10M



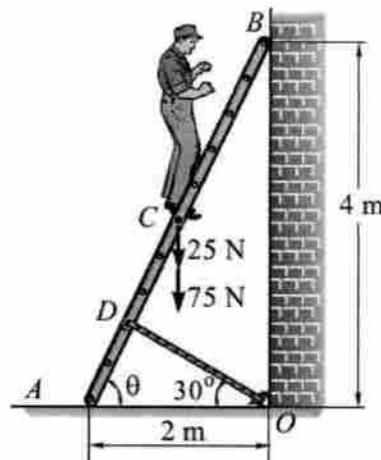
OR

11. B). Two spheres, A and B, are resting in a smooth trough as shown in figure. Draw the free body diagrams of A and B showing all the forces acting on them, both in magnitude and direction. Radius of spheres A and B are 250 mm and 200 mm, respectively. 10M



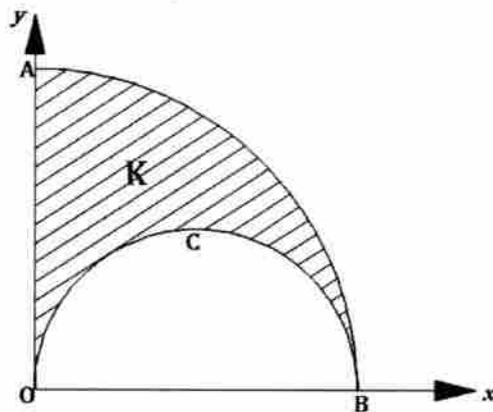
(P.T.O..)

12. A). A man weighing 72 N stands on the middle rung of a 25 N ladder resting on smooth floor and against a wall. The ladder is prevented from slipping by a string OD. Find the tension in string and reactions at A and B as shown in the figure. 10M

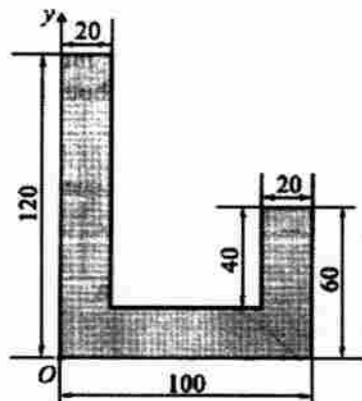


OR

12. B). Find the coordinates of the centroid of the shaded area K shown in figure. The curve OAB is a quarter circle with radius 200 mm, and OCB is a semicircle of radius 100 mm. 10M



13. A). For the given shaded area shown in figure. Find moment of inertia about the reference axes i.e., Ox and Oy axis. All dimensions are in mm. 10M



OR

13. B). Derive an equation for mass moment of inertia of circular plate of radius 'R' and thickness 't' about its diameter. 10M

(P.T.O.)

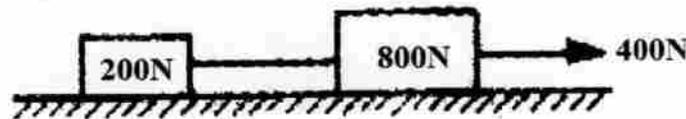
14. A). A motorist is travelling at 90 kmph, when he observed a traffic light 250 m ahead of him 10M
turns red. The traffic light is timed to stay red for 12 sec. If the motorist wishes to pass the
light without stopping, just at it turns green, determine: a) the required uniform
deceleration of the motor and b) speed of the motor as it passes the traffic light.

OR

14. B). State the work-energy principle and conservation of mechanical energy for a rigid body 10M
motion.
15. A). A body weighing 20 N is projected up a 20° inclined plane with a velocity of 12 m/s, 10M
coefficient of friction is 0.15. Find the maximum distance the body will move up the
inclined plane.

OR

15. B). Two weights 800 N and 200 N are connected by a thread and they move along a rough 10M
horizontal plane under the action of a force of 400N applied to the 800 N weight as shown
in figure. The coefficient of friction between the sliding surface of the weights and the
plane is 0.3. Using Alembert's principle, determine the acceleration of the weight and
tension in the Thread.



H.T No:

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R18

Course Code: A30313



CMR COLLEGE OF ENGINEERING & TECHNOLOGY
(UGC AUTONOMOUS)

B.Tech I Semester Supplementary Examinations January-2026

Course Name: Engineering Drawing

(Common for EEE, CSC, CSM, AID & AIM)

Date: 05.01.2026 AN

Time: 3 hours

Max.Marks: 60

(Note: Assume suitable data if necessary)

PART-A

Answer all TEN questions

Each question carries ONE mark.

10x1=10M

- | | | |
|-----|--|-----|
| 1. | How significant is Engineering Drawing to engineers? | 1 M |
| 2. | Recall the dimensions of A1, A2, A3 and A4 drawing sheets. | 1 M |
| 3. | When is a projection called orthographic projection? | 1 M |
| 4. | What is the principle of First angle projection? | 1 M |
| 5. | What are solids of revolution? | 1 M |
| 6. | What is a polyhedra? | 1 M |
| 7. | What is an isometric scale? | 1 M |
| 8. | Compare isometric view with isometric projection. | 1 M |
| 9. | What is an orthographic view? | 1 M |
| 10. | How many views are drawn in isometric projection to represent the three dimensions of an object? | 1 M |

PART-B

Answer the following. Each question carries TEN Marks.

5x10=50M

- | | | |
|-----------|---|-----|
| 11.A). | Construct an ellipse with distance of focus from the directrix of 50 mm and eccentricity $\frac{1}{4}$. Draw the tangent and normal to the curve at a distance of 35mm from directrix. | 10M |
| OR | | |
| 11. B). | Construct a parabola with the distance of the focus from directrix being 50mm. Draw the tangent and normal to the curve at a point 30mm from the directrix. | 10M |
| 12. A). | A line PQ of 75mm length has its end 'P' at 10mm above H.P and 20mm in front of V.P. Its front view and top view measures 50mm and 60mm respectively. Draw the projections of the line and determine its inclinations with H.P and V.P. | 10M |
| OR | | |
| 12. B). | A regular hexagonal plane of 30mm side has a corner at 20mm from V.P and 50mm from H.P. Its surface makes an angle of 45° to V.P and perpendicular to H.P. Draw the projections of the plane. | 10M |
| 13. A). | Draw the projections of a hexagonal prism of base 20mm side and axis 60mm long, when its resting on one of its corners of the base on H.P. The axis of the solid is inclined at 30° to H.P. | 10M |
| OR | | |
| 13. B). | Draw the projections of hexagonal pyramid with side of base 30mm and axis 70mm long which is resting with a slant face on H.P such that, the axis is parallel to V.P. | 10M |

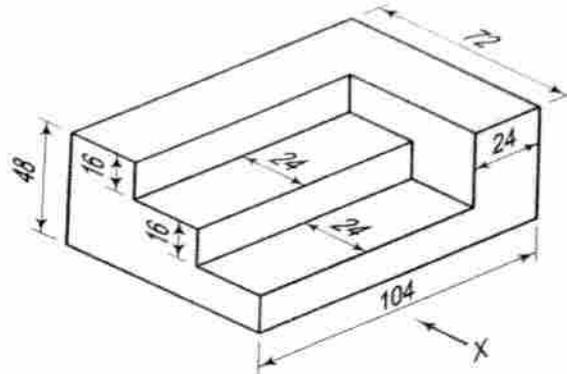
(P.T.O.)

14. A). Draw the isometric projections of a square prism with side of base 40mm and length of axis 60mm when its axis is (i) vertical and (ii) horizontal. 10M

OR

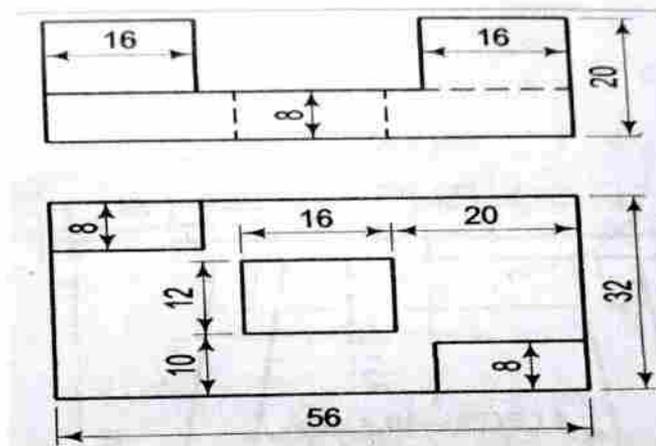
14. B). Draw the isometric view of a pentagonal pyramid with side of the base 20mm and axis 70mm long. The pyramid is resting on its base on H.P. with an edge of the base parallel to V.P. 10M

15. A). Draw the i) front view ii) top view and iii) side view of the below figure. 10M



OR

15. B). Draw the isometric view of the two views of a component shown below 10M





CMR COLLEGE OF ENGINEERING & TECHNOLOGY
(UGC AUTONOMOUS)

B.Tech I Semester Supplementary Examinations January-2026

Course Name: Engineering Chemistry

(Common for ECE, CSE, IT & CSD)

Date: 05.01.2026 AN

Time: 3 hours

Max.Marks: 70

(Note: Assume suitable data if necessary)

PART-A

Answer all TEN questions

Each question carries TWO marks.

10x2=20M

1. The O₂ molecule is paramagnetic. Explain through the Molecular Orbital theory. 2 M
2. Write the salient features of the Crystal Field Theory. 2 M
3. Write the anodic and cathodic reactions of a lead-acid battery. 2 M
4. Explain waterline corrosion with an example. 2 M
5. On the basis of IR spectroscopy, how do you differentiate between 1-butyne and 2-butyne? 2 M
6. What are the possible electronic transitions when energy is absorbed by a molecule in the UV region? 2 M
7. Differentiate between scale and sludge. 2 M
8. What is the main advantage of the reverse osmosis process over ion exchange? Explain. 2 M
9. Why do S_N1 reactions occur with retention of configuration? 2 M
10. Draw the structure of paracetamol and mention its main application. 2 M

PART-B

Answer the following. Each question carries TEN Marks.

5x10=50M

- 11.A). With the help of a Molecular Orbital diagram, explain why hydrogen forms diatomic molecules while helium remains monoatomic. 10M
- OR**
11. B). Both [Co(NH₃)₆]³⁺ and [CoF₆]³⁻ are octahedral complexes. Use crystal field theory and predict the magnetic nature of the two complexes. 10M
12. A). What are fuel cells? Mention any five advantages and limitations of fuel cells. 10M
- OR**
12. B). (i) What is electroless plating? Explain the principle involved. Mention its advantages. 5M
(ii) Describe the method of electroless plating of nickel. 5M
13. A). Predict the number of ¹H NMR signals, multiplicity, and splitting pattern of signals for: 10M
(i) Cl₂-CH₂-CH₂-CH₃ (ii) Cl-CH₂-CH₂-CH₂-Cl.
- OR**
13. B). (i) Explain the principle of NMR spectroscopy. 5M
(ii) What is meant by the term chemical shift? How does it arise, and how is it measured? 5M
14. A). With a neat diagram, explain the ion-exchange process of water purification. Discuss the merits and demerits of this process. 10M
- OR**
14. B). (i) What do you mean by the hardness of water? How is it classified? 5M
(ii) Mention the disadvantages of using hard water for domestic purposes. 5M

(P.T.O..)

15. A). The reaction of alkyl chloride with aqueous KOH leads to the formation of alcohols, whereas alkenes are formed as major products in the presence of alcoholic KOH. Explain with suitable examples. 10M

OR

15. B). (i) Draw all the possible stereoisomers of 2,3-butanediol and comment on their optical activity. 7M

(ii) Assign R/S configuration to the stereoisomers drawn. 3M
