

Time: 3 Hours

Max Marks: 70

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the Question must be answered at one place

UNIT-I

1. a) Explain the experimental determination of hardness of by EDTA method.
- b) Explain the effect and control of caustic embrittlement in boilers.

Marks	CO1	BTL
8	CO1	L3
6	CO1	L3

(OR)

2. a) How is boiler-feed water softened by ion-exchange method?
- b) Describe the preventive methods for formation of priming and foaming in boiler water.

8	CO1	L2
6	CO1	L3

UNIT-II

3. a) Briefly explain the electronic transitions (UV-Visible) with suitable examples.
- b) State Lambert law, Beer's law and show that $A = \epsilon bc$.

8	CO2	L3
6	CO2	L2

(OR)

4. a) Discuss the different types of stretching and bending vibrations of IR spectroscopy.
- b) Explain batho-chromic and hypso-chromic shifts with suitable examples.

8	CO2	L3
6	CO2	L3

UNIT-III

5. a) Explain the Potentiometric titration of Fe (II) Vs $K_2Cr_2O_7$.
- b) Explain amperometric sensors with example.

8	CO3	L3
6	CO3	L3

(OR)

6. a) Explain the working principles of H_2-O_2 (Hydrogen-Oxygen) fuel cell.
- b) Write the cell reactions for charging and discharging of Lithium ion cell.

8	CO3	L3
6	CO3	L2

UNIT-IV

7. a) Discuss the preparation, properties and applications of Bakelite.
- b) Explain the mechanism of coordination reaction polymerization using Ziegler-Natta catalyst.

8	CO4	L3
6	CO4	L3

(OR)

8. a) Distinguish between thermo and thermosetting plastic with examples.
- b) What are biodegradable polymers? Explain the structure properties and applications of any one biodegradable polymer.

8	CO4	L3
6	CO4	L3

UNIT-V

9. a) What did you understand about super conducting materials? Explain its properties.
- b) Write short notes on principle and mechanism of Super capacitors.

8	CO5	L2
6	CO5	L1

(OR)

10. a) Distinguish between intrinsic and extrinsic semiconductors.
- b) Explain the properties and applications of Graphene nanoparticles.

8	CO5	L3
6	CO5	L3

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		Marks	CO	Blooms Level
<u>UNIT-I</u>				
1.	a) Describe the ion-exchange method for softening of water, with a neat diagram and relevant equations.	8M	CO1	L2
	b) Explain the desalination of brackish water by electrodialysis method	6M	CO1	L2
(OR)				
2.	a) Describe the Estimation of Hardness of water by EDTA method	8M	CO1	L3
	b) Describe priming and foaming and their effects in boiler operation.	6M	CO1	L2
<u>UNIT-II</u>				
3.	a) Discuss the different types of stretching and bending vibrations in IR spectroscopy.	8M	CO2	L2
	b) Explain electronic transitions in UV-Visible spectroscopy	6M	CO2	L2
(OR)				
4.	a) Define chromophore and auxochrome. Explain bathochromic shift (red shift) and hypsochromic shift (blue shift)	8M	CO2	L2
	b) Apply the principle of NMR spectroscopy to explain how different chemical environments of protons in a molecule lead to distinct signals in an NMR spectrum.	6M	CO2	L3
<u>UNIT-III</u>				
5.	a) Describe the construction and working of Li-ion battery	8M	CO3	L2
	b) Derive Nernst's equation giving the EMF of a cell in terms of concentration of reactants and products of cell reaction.	6M	CO3	L2
(OR)				
6.	a) Discuss various factors affecting corrosion	8M	CO3	L2
	b) Explain sacrificial anodic protection with examples.	6M	CO3	L3
<u>UNIT-IV</u>				
7.	a) Discuss the preparation, properties and uses of Nylon-6,6.	8M	CO4	L3
	b) Distinguish between thermoplastics and thermosetting plastics	6M	CO4	L2
(OR)				
8.	a) Describe the fractional distillation of petroleum with neat diagram	8M	CO4	L3
	b) Demonstrate the ultimate analysis of coal and its significance.	6M	CO4	L2
<u>UNIT-V</u>				
9.	a) What is Fibre reinforced composite. Write their engineering applications.	8M	CO5	L2
	b) Define refractories and discuss their properties.	6M	CO5	L2
(OR)				
10.	a) Write the chemical reactions involved in Setting and Hardening of cement.	8M	CO5	L2
	b) Discuss any three properties of lubricants with their importance.	6M	CO5	L2

Engineering Physics**(Common to CSE, CSE (AIML), CSE(DS) & IT Branches)****Time: 3 Hours****Max Marks: 70**

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the Question must be answered at one place

		Marks	CO	Blooms Level
<u>UNIT-I</u>				
1.	a) What is Principle of Superposition? Explain Interference in thin films and obtain conditions for bright and dark fringes	8	1	3
	b) Explain colours in thin films	6	1	2
(OR)				
2.	a) Derive the expression for wavelength using grating	9	1	4
	b) How to determine the wavelength of laser	5	1	4
<u>UNIT-II</u>				
3.	a) Obtain Schrodinger's time independent wave equation	8	2	3
	b) Write the physical significance and properties of wave function	6	2	2
(OR)				
4.	a) Distinguish intrinsic and extrinsic semiconductors	6	2	2
	b) What is Hall effect? Derive expression for Hall co-efficient	8	2	3
<u>UNIT-III</u>				
5.	a) Explain various types of polarizations and deduce the relation for electronic polarization	10	3	3
	b) Determine the electric susceptibility at 0° c for a gas whose dielectric constant at 0° c is 1.000041	4	3	4
(OR)				
6.	a) Classify the magnetic materials	10	3	2
	b) Define Magnetic susceptibility and obtain the relation between susceptibility and relative permeability	4	3	3
<u>UNIT-IV</u>				
7.	a) Define unit cell and lattice parameters	4	4	2
	b) With neat sketch elucidate Bravais lattices	10	4	2
(OR)				
8.	a) How do you determine crystal structure using X-ray powder diffraction method	10	4	3
	b) A plane cuts intercepts 2a, 3b, c along the crystallographic axes in a crystal. Determine the Miller indices of plane.	4	4	4
<u>UNIT-V</u>				
9.	a) Define stimulated emission of radiation. Explain construction and working of He-Ne LASER with neat diagrams	8	5	3
	b) Write the characteristics and applications of LASER	6	5	2
(OR)				
10.	a) Explain construction and principle of optical fiber	6	5	2
	b) Classify the optical fibers based on refractive index profile	8	5	3

Time: 3 Hours**Max Marks: 70**

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All parts of the Question must be answered at one place

		<u>UNIT-I</u>	Marks	CO	BTL
1.	a)	Explain desalination of Brackish water by the reverse osmosis method with a neat sketch.	8	1	2
	b)	Explain the determination of total hardness of water by EDTA method	6	1	2
		(OR)			
2.	a)	Explain Ion-Exchange method for water softening with neat diagram and relevant equations.	8	1	2
	b)	Explain formation of priming and foaming and their drawbacks in boilers.	6	1	2
		<u>UNIT-II</u>			
3.	a)	Discuss the different types of stretching and bending vibrations in IR spectroscopy.	8	2	2
	b)	Explain the principle of NMR Spectroscopy.	6	2	3
		(OR)			
4.	a)	Illustrate the components of UV-Visible Spectrophotometer with neat diagram.	8	2	2
	b)	Describe the different types of electronic transitions observed in UV-Visible spectroscopy. Arrange them in order of increasing wavelength and justify your answer.	6	2	3
		<u>UNIT-III</u>			
5.	a)	Derive an expression for Electrode potential by the Nernst equation	8	3	2
	b)	Explain the construction, working and application of Lithium ion battery	6	3	2
		(OR)			
6.	a)	Explain the mechanism of Wet corrosion taking iron metal as example.	8	3	2
	b)	Explain sacrificial anodic protection method for the protection of underground pipelines from corrosion using.	6	3	3
		<u>UNIT-IV</u>			
7.	a)	Explain the proximate analysis of coal.	8	4	2
	b)	Explain the Preparation and applications of Nylon 6,6	6	4	2
		(OR)			
8.	a)	What is calorific value of fuels. Differentiate HCV from LCV	6	4	2
	b)	Distinguish between thermoplastics and thermosetting plastics	8	4	4
		<u>UNIT-V</u>			
9.	a)	Write the chemical reactions involved in setting and hardening of cement.	8	5	2
	b)	Discuss the importance of lubricants in reducing friction and wear, with reference to thick film and thin film lubrication mechanisms.	6	5	3
		(OR)			
10.	a)	Classify Fibre reinforced composite and also mention their engineering applications.	8	5	4
	b)	Explain any six properties of refractories.	6	5	2

Time: 3 Hours

Max Marks: 70

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the Question must be answered at one place

		Marks	CO	Blooms Level
<u>UNIT-I</u>				
1.	a) Draw and explain the molecular orbital energy level diagram of N ₂ .	8M	1	2
	b) Explain π molecular orbitals of Benzene with neat sketch.	6M	1	2
(OR)				
2.	a) Interpret the shape and geometry of CH ₄ and H ₂ O with help of VSEPR theory.	8M	1	2
	b) Summarise salient features of Molecular orbital theory. Illustrate the MO diagram of CO molecule.	6M	1	2
<u>UNIT-II</u>				
3.	a) Explain about various types of absorption and intensity shifts in UV - visible spectroscopy with examples	8M	2	2
	b) Illustrate the components of IR Spectrophotometer with neat diagram.	6M	2	2
(OR)				
4.	a) Explain about different types of stretching and bending vibrations in IR spectroscopy	8M	2	2
	b) Explain (i) Chemical Shift (ii) Coupling constant	6M	2	2
<u>UNIT-III</u>				
5.	a) Derive Nernst's equation for electrode potential and cell potential.	8M	3	2
	b) Explain the working principle of H ₂ -O ₂ Fuel cell with reactions.	6M	3	2
(OR)				
6.	a) Explain the principle and working of conductometric titrations of weak acid against strong base	8M	3	2
	b) Outline working principle of potentiometric titrations with suitable example	6M	3	2
<u>UNIT-IV</u>				
7.	a) Explain the mechanism of free radical addition polymerisation.	8M	4	2
	b) Distinguish thermoplastics from thermosetting plastics	6M	4	4
(OR)				
8.	a) Explain conducting polymers. Discuss the mechanism of conduction and applications polyacetylene.	8M	4	2
	b) Explain the Preparation, properties and applications of Bakelite	6M	4	2
<u>UNIT-V</u>				
9.	a) Illustrate the principle and mechanism of super capacitors and mention their industrial applications.	8M	5	2
	b) Distinguish intrinsic and extrinsic semiconductors.	6M	5	4
(OR)				
10.	a) Explain the properties and applications of Fullerenes.	8M	5	2
	b) Classify Nano materials based on dimension	6M	5	4

Time: 3 Hours**Max Marks: 70**

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the Question must be answered at one place

	<u>UNIT-I</u>	Marks	CO	Blooms Level
1. a)	Discuss interference of light in thin films by reflection and express the conditions for which the film appears bright and dark in reflected light.	10M	1	2
b)	Newton rings are observed in reflected light of wavelength $5900\text{\AA}$. The diameter of 10 th dark ring is 0.5cm. Assess the radius of curvature of lens used.	4M	1	3
	(OR)			
2. a)	Deduce the expression for resultant intensity in Fraunhofer diffraction due to single slit and discuss the position of principal maximum.	10M	1	5
b)	Explain the polarization of light by reflection with a neat diagram.	4M	1	2
	<u>UNIT-II</u>			
3. a)	Define packing fraction. Evaluate and compare packing fractions of SC and BCC structures.	8M	2	3
b)	What is Bragg's law.	6M	2	1
	(OR)			
4. a)	What are Miller indices? Illustrate the plane with Miller indices (1,0,0) in cubic crystal.	6M	2	3
b)	Demonstrate the Powder method for determining crystal structure.	8M	2	2
	<u>UNIT-III</u>			
5. a)	Determine the expression for internal field in a solid dielectric material by Lorentz method.	8M	3	5
b)	Deduce Clausius-Mossotti equation.	6M	3	5
	(OR)			
6. a)	Define Magnetic susceptibility and permeability.	4M	3	1
b)	Explain the hysteresis loop with neat illustration and compare soft and hard magnetic materials.	10M	3	2
	<u>UNIT-IV</u>			
7. a)	What is the significance of wave function? List its properties.	6M	4	1
b)	Discuss de Broglie wave length of dual nature of matter waves and explain Heisenberg uncertainty principle.	8M	4	2
	(OR)			
8. a)	List the merits and demerits of classical free electron theory.	6M	4	1
b)	Determine the equation for electrical conductivity based on quantum free electron theory.	8M	4	5
	<u>UNIT-V</u>			
9. a)	Explain the classification of solids with energy band diagrams.	6M	5	2
b)	Deduce the expression for density of electrons in conduction band of an intrinsic semiconductor.	8M	5	5
	(OR)			
10. a)	Discuss drift and diffusion currents.	6M	5	2
b)	Explain Hall effect and list its applications.	8M	5	2

Time: 3 Hours**Max Marks: 60**

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the Question must be answered at one place

UNIT-I

1. a) In an area the underground water contains hardness causing Impurities, how can be determined the amount of hardness present in the water by using EDTA solution with titration process, Discuss. 6M
 - b) The ground water has the following impurities per 1 L of water calculate the temporary and permanent hardness of water 4M
 $\text{CaSO}_4 = 6.8\text{ppm}$; $\text{CaCl}_2 = 11.1\text{ppm}$; $\text{Mg}(\text{HCO}_3)_2 = 7.3\text{ppm}$; $\text{MgSO}_4 = 12.0\text{ppm}$
- (OR)**
2. a) For Laboratory purpose the water should be deionized, How the given water can be deionized by Ion Exchange process Explain with neat sketch. 6M
 - b) What happens when Sufficient amount of chlorine is not added in the disinfection process? Discuss 4M

UNIT-II

3. a) What is meant by finger print region? Why it so called? Explain with examples 6M
 - b) Give the difference between Auxochrome and chromophore 4M
- (OR)**
4. a) Discuss the principle of NMR spectroscopy and Explain the role of NMR in identifying the equivalent and non-equivalent Hydrogens. 6M
 - b) Explain The term Couple constant with examples 4M

UNIT-III

5. a) Distinguish between Addition Polymerization and Condensed polymerization 6M
 - b) How a Thermoplastic articles can be fabricated using Injection moulding 4M
- (OR)**
6. a) Explain the preparation and Engineering applications of Bakelite 6M
 - b) How can the base plastic properties can be enhanced by adding additives. Illustrate 4M

UNIT-IV

7. a) Discuss the addition mechanism of Isobutene reaction with HBr 6M
 - b) Give the products 4M
 - i. When $\text{CH}_3\text{CH}_2\text{Br}$ reacts with aqueous KOH
 - ii. When $\text{CH}_3\text{CH}_2\text{Br}$ reacts with alcoholic KOH
- (OR)**
8. a) What is pinacol pinacolone rearrangement? Explain the reaction with mechanism 6M
 - b) Distinguish between SN_1 and SN_2 reactions 4M

UNIT-V

9. a) Discuss any mechanism of wet Corrosion in the aqueous medium. 6M
 - b) Enumerate the Environmental factors effecting corrosion 4M
- (OR)**
10. a) Sacrificial Anodic Protection can use in protecting underground pipe lines? Explain with neat sketch 6M
 - b) Where Tinning coatings are more suitable Why? Explain 4M

UNIT-VI

11. a) Illustrate the principles of Green Chemistry 6M
 - b) Discuss the working of Solar Cell 4M
- (OR)**
12. a) Explain the construction and working of Lead acid batteries 6M
 - b) How a battery is different from super capacitor 4M

**ENGINEERING PHYSICS
(MECHANICAL ENGINEERING)****Time: 3 Hours****Max Marks: 60**

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the Question must be answered at one place

UNIT-I

1. a) Derive the differential equation of a damped harmonic oscillator and explain its solution qualitatively. 8
 - b) What is a damped harmonic oscillator? 2
- (OR)**
2. a) Explain the concept of Quality Factor (Q-factor) and derive its expression. 8
 - b) What is the significance of the Quality Factor? 2

UNIT-II

3. a) Explain the formation of Newton's rings under reflected light with a neat diagram and derive the expression for the diameter of the n th dark ring. 7
 - b) The wavelength of light used in a Newton's rings experiment is 589 nm and the radius of curvature of the lens is 1.2 m. Calculate the diameter of the 20th dark ring. 3
- (OR)**
4. a) Derive the expression for the intensity distribution in Fraunhofer diffraction due to a single slit. 7
 - b) State the conditions required to observe Fraunhofer diffraction. 3

UNIT-III

5. a) Explain the construction and working of a Ruby laser with a neat diagram. Give advantages and applications. 8
 - b) State any two characteristics of laser light. 2
- (OR)**
6. a) Distinguish between spontaneous emission and stimulated emission. 6
 - b) Explain the concept of population inversion and its importance in laser action. 4

UNIT-IV

7. a) Explain Acceptance Angle, Acceptance Cone and Numerical Aperture? 7
 - b) Explain the Total Internal Reflection with a neat diagram. 3
- (OR)**
8. a) Differentiate between Step Index Fiber and Graded Index Fiber. 6
 - b) Explain & Draw the Communication system Block Diagram in Optical fiber. 4

UNIT-V

9. a) Explain the structure of the Body-Centered Cubic (BCC) crystal and derive expressions for atomic radius, coordination number, and packing fraction. 8
 - b) What is a unit cell? 2
- (OR)**

10. a) Describe the seven crystal systems and explain the fourteen Bravais lattices with suitable sketches. 7
- b) Explain the structure of a Simple Cubic (SC) crystal. 3

UNIT-VI

11. a) Differentiate between Type-I and Type-II superconductors. 6
 - b) Explain Weiss theory of ferromagnetism. 4
- (OR)**
12. a) Compare soft magnetic and hard magnetic materials. 6
 - b) Explain the hysteresis curve and define retentivity, coercivity, and hysteresis loss. 4

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the Question must be answered at one place

UNIT-I

1. a) With a neat diagram, explain interference in a plane parallel thin film due to reflected light and derive the conditions for maxima and minima. 8
b) What are the conditions required for sustained interference? 2

(OR)

2. a) Explain Fraunhofer diffraction due to a single slit with a neat diagram and derive the expression for the intensity distribution. 7
b) Distinguish between diffraction and interference. 3

UNIT-II

3. a) Explain Einstein's theory of absorption, spontaneous emission, and stimulated emission, and discuss the significance of Einstein coefficients. 8
b) State any two characteristics of laser light. 2

(OR)

4. a) Explain the construction, working of the Helium-Neon laser. 8
b) What is population inversion? 2

UNIT-III

5. a) Compare Step Index Fibers and Graded Index Fibers with neat diagrams. 7
b) Calculate the Numerical Aperture of an optical fiber with core refractive index 1.48 and cladding refractive index 1.46. 3

(OR)

6. a) Explain Acceptance Angle and Numerical Aperture, and discuss their importance in optical communication. 8
b) Mention any two applications of optical fibers. 2

UNIT-IV

7. a) Derive the time-independent Schrödinger wave equation? Give physical significance of wave function. 8
b) State de Broglie's hypothesis. 2

(OR)

8. a) Derive the expression for the normalized wave function and energy eigenvalues of a particle in a one-dimensional potential box. 8
b) State Heisenberg's Uncertainty Principle. 2

UNIT-V

9. a) State and derive the Biot-Savart law for the magnetic field due to a current element. 7
b) A long straight conductor carries a current of 10 A. Find the magnetic field at a point 5 cm from the conductor. 3

(OR)

10. a) Using Gauss's law, derive the electric field due to (a) an infinite line charge and (b) an infinite plane sheet of charge. 8
b) State Lenz's law. 2

UNIT-VI

11. a) Explain the Hall effect with a neat diagram and derive the expression for the Hall coefficient. 7
b) A semiconductor has a carrier concentration of $5 \times 10^{21} \text{ m}^{-3}$. Calculate the Hall coefficient. 3

(OR)

12. a) Discuss the dependence of the Fermi level on carrier concentration and temperature in intrinsic and extrinsic semiconductors. 7
b) Distinguish between n-type and p-type semiconductors. 3

Answer ONE Question from each Unit

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All parts of the Question must be answered at one place

UNIT-I

1. a) Discuss the theory of Fraunhofer diffraction due to N slits and derive the conditions for principal maxima and minima. Using this obtain intensity distribution curve. 9M
- b) Find the highest order that can be seen with a grating having 15000 lines per inch. The wavelength of light used is 600 nm. 3M

(OR)

2. a) Give the analytical treatment of interference of light and hence obtain the condition for maximum and minimum intensity by using Young's double slit experiment. 9M
- b) Two slits separated by a distance of 0.2 mm are illuminated by a monochromatic light of wavelength 550 nm. Calculate the fringe width on a screen at distance of 1 m from the slits. 3M

UNIT-II

3. a) What is an optical fiber? Explain its construction and principle with a neat diagram. 9M
- b) Explain three applications of optical fiber 3M

(OR)

4. a) What is angle of Acceptance? Derive an expression for angle of acceptance of an optical fiber in terms of refractive indices of core and cladding 9M
- b) Calculate the refractive indices of core & cladding of an optical fiber with a numerical aperture of 0.33 and their fractional differences of refractive indices being 0.02. 3M

UNIT-III

5. a) Give de Broglie theory of matter waves. Derive an expression for the de Broglie wavelength of matter wave. 9M
- b) Calculate de Broglie wave length of an electron whose kinetic energy is 50eV. Rest mass of the electron is 9.1×10^{-31} kg and $h = 6.63 \times 10^{-34}$ J-s. 3M

(OR)

6. a) Show that energies of a particle in 1-Dimensional a potential box are quantized. 9M
- b) What is the lowest energy that a neutron (mass 1.67×10^{-27} kg) can have if confined to move along the edge of an impenetrable box of length 10-14 meter? $h = 6.63 \times 10^{-34}$ J-s. 3M

UNIT-IV

7. a) State and proof gauss law in electrostatics. 9M
- b) State Biot and Savart law 3M

(OR)

8. a) Write Maxwell's equations differential and integral form 8M
- b) State ampere's Law 4M

UNIT-V

9. a) Derive an expression for electron concentration for an intrinsic semiconductor. 10M
- b) What is fermi energy? 2M

(OR)

10. a) Discuss the effect of dopants on the Fermi Level in extrinsic semiconductor. 6M
- b) Differentiate between N-type and P-type semiconductor. 6M