

Code No: 152AB

R18

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech I Year II Semester Examinations, May - 2019

CHEMISTRY

(Common to CE, ME, ECE, EIE, MCT, MMT, AE, MIE, PTM)

Time: 3 hours

Max. Marks: 75

Note: This question paper contains two parts A and B.

Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART- A

(25 Marks)

- 1.a) What are the differences between atomic and molecular orbitals? [2]
- b) What is Calgon? Write the reaction involved in Calgon conditioning. [2]
- c) Define standard electrode potentials. [2]
- d) Write the reaction involved in the addition of HBr to Propene in the presence of peroxide. [2]
- e) Explain why CO_2 is IR active. [2]
- f) What do you understand by Linear combination of atomic orbitals? [3]
- g) What is the significance of breakpoint chlorination in the treatment of municipal water? [3]
- h) Why galvanised sheets are not advised in making utensils? [3]
- i) Define Enantiomers, and give example. [3]
- j) Give any two selection rules for rotational spectroscopy. [3]

PART-B

(50 Marks)

- 2.a) Draw the molecular orbital diagram O_2 molecule and predict the magnetic behaviour of it.
 - b) Discuss the salient features of Crystal field theory and explain the crystal field splitting of transition metal ion d-orbitals in square planar geometries. [5+5]
- OR
- 3.a) Explain the band structure of solids. Discuss how the doping influences the conductance of them.
 - b) Draw neatly, the molecular orbital diagrams of Butadiene and Benzene. [5+5]
- 4.a) Explain how brackish water can be desalinated by reverse osmosis method with the help of a diagram.
 - b) A sample of water on analysis contains 4.2 mg/L of magnesium bicarbonate, 12.0 mg/L of magnesium sulphate, 16.2 mg/L of calcium bicarbonate, 22 mg/L of calcium chloride and 13.6 mg/L of calcium sulphate. Calculate the total, permanent and temporary hardness of the sample and express them in degree Clark and degree French. [5+5]
- OR
- 5.a) Explain Ion exchange method for softening water.
 - b) What are the specifications of potable water? [5+5]

- 6.a) What is electrochemical series? Explain its applications with suitable examples.
b) What is Cathodic protection? Explain sacrificial anode method? [5+5]

OR

- 7.a) How pH of a solution is determined by Glass electrode? Discuss.
b) Write a detailed note on electroless plating of Nickel. [5+5]

- 8.a) Explain the Markownikoff's rule with suitable example. Why this rule is failed during the addition of HBr in the presence of a peroxide?
b) Write the synthetic methods for Paracetamol and Aspirin. Give their pharmaceutical applications. [5+5]

OR

- 9.a) What are Conformational isomers? Discuss them with special reference to n-Butane. Give the potential energy diagram for the conformers.
b) Explain the mechanism of S_N1 and S_N2 reactions. [5+5]

- 10.a) Describe various modes of electronic transitions when a molecule absorbs in UV-Visible region.
b) Explain the principle involved in NMR spectroscopy. [5+5]

OR

- 11.a) Write a note on Chemical Shift.
b) Give an account of various fundamental vibrations. [5+5]

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech I Year II Semester Examinations, May - 2019

APPLIED PHYSICS
(Common to EEE, CSE, IT)

Time: 3 hours

Max. Marks: 75

Note: This question paper contains two parts A and B.

Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART- A

(25 Marks)

- 1.a) What is Photo-electric effect. Give the Einstein's equation. [2]
- b) What are donors and acceptors? Give two examples of each. [2]
- c) What are direct and Indirect band gap semiconductors [2]
- d) Explain Population Inversion and how is it achieved? [2]
- e) State the Faraday's Law. [2]
- f) Give the Born's interpretation of wave function. [3]
- g) Explain the concept of Hall effect. [3]
- h) Give three differences between semiconductor laser and LED. [3]
- i) Explain the construction of optical fiber. [3]
- j) Derive the relation between \vec{B} , \vec{H} and \vec{M} [3]

PART-B

(50 Marks)

- 2.a) Derive an expression for the wavelength λ of the matter waves.
- b) Describe a experiment to verify the existence of matter waves.
- c) For an electron in a one-dimensional infinite potential well of width 1Å , calculate the energy separation between the two lowest energy levels and also calculate the frequency and wavelength of the photon corresponding to a transition between these two levels. [10]

OR

- 3.a) Explain Heisenberg's Uncertainty principle.
- b) Using the Heisenberg's Uncertainty principle explain why electron cannot exist in the nucleus of radius 10^{-14}m .
- c) Show that the particle trapped in a potential box possesses discrete energy levels. [10]
- 4.a) What are intrinsic and extrinsic semiconductors?
- b) Distinguish between N-type and P-type semiconductors with an example.
- c) A rectangular plate of a semiconductor has dimensions 2.0 cm along y direction, 1.0 mm along z-direction. Hall probes are attached on its two surfaces parallel to x z plane and a magnetic field of 1.0 tesla is applied along z-direction. A current of 3.0 mA is set up along the x direction. Calculate the hall voltage measured by the probes, if the hall coefficient of the material is $3.66 \times 10^{-4}\text{ m}^3/\text{C}$. Also, calculate the charge carrier concentration. [10]

OR

- 5.a) The conductivity of N-type Germanium semiconductor is $39 \Omega^{-1}\text{m}^{-1}$. If the mobility of electrons in Germanium is $0.39 \text{ m}^2\text{V}^{-1}\text{s}^{-1}$, then find the concentration of the donor atoms.
- b) Define Fermi level. Where does a Fermi level exist in a Intrinsic semiconductor, P-type semiconductor and N- type semiconductor at moderate temperature?
- c) Explain the working for a Common Base PNP transistor with a suitable circuit diagram. [10]

- 6.a) What is a photodetector? Explain the principle of photodetection in semiconductors.
- b) When 3×10^{11} photons each with wavelength of $0.85 \mu\text{m}$ are incident on a photodiode, on average 1.2×10^{11} electrons are generated. Determine the quantum efficiency and responsivity.
- c) What is a solar cell? Explain with a neat diagram. Define the efficiency and fill factor. [10]

OR

- 7.a) Explain the construction and working of a LED.
- b) What are the major differences between PIN and Avalanche photodiode?
- c) A silicon photodiode has quantum efficiency of 65% with photon energy $1.5 \times 10^{-19} \text{ J}$. Its band gap energy is 0.67 eV . Calculate:
i) Responsivity (R)
ii) Incident power required to obtain a photo current $2.5 \mu\text{A}$ (P_0)? [10]

- 8.a) Explain the construction, principle and working of Ruby laser.
- b) A He-Ne gas laser of wavelength 6328 \AA has an output power of 2.3 mW . How many photons are emitted each minute when it is operated?
- c) Explain about the different modes that are propagated through step-index and graded-index fiber? [10]

OR

- 9.a) Elaborate the various applications of laser in the field of medicine and military.
- b) Discuss the concept of Acceptance angle and Acceptance cone of a fiber. Derive a relation between acceptance angle and the refractive indices of core and cladding materials.
- c) The numerical aperture of an optical fiber is 0.5 and core refractive index 1.54 . i) Find refractive index of cladding; ii) Calculate the change in core cladding refractive index per unit refractive index of the core. [10]
- 10.a) What is dielectric polarization? Describe briefly types of polarizations.
- b) Derive Clausius-Mosotti relation for a cubic dielectric structure.
- c) Write notes on ferroelectricity and piezoelectricity. [10]

OR

- 11.a) Derive a relation between electric polarization and electric susceptibility of the dielectric medium.
- b) Describe dielectric displacement, dielectric loss, dielectric strength.
- c) Describe the Hysteresis loop of ferromagnets. How can it be used to distinguish between hard and soft magnetic materials? [10]

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R16

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech I Year II Semester Examinations, May - 2019

MATHEMATICS-II

(Common to EEE, ECE, CSE, EIE, IT, ETM)

Time: 3 hours

Max. Marks: 75

Note: This question paper contains two parts A and B.

Part A is compulsory which carries 25 marks. Answer all questions in Part A.

Part B consists of 5 Units. Answer any one full question from each unit.

Each question carries 10 marks and may have a, b, c as sub questions.

PART- A

(25 Marks)

- 1.a) Find $L^{-1}\left(\frac{1}{(s-2)^2}\right)$. [2]
- b) Define Unit step function and find its Laplace transform. [3]
- c) Evaluate $\Gamma\left(-\frac{3}{2}\right)$. [2]
- d) Evaluate $\int_0^1 x^5(1-x)^6 dx$. [3]
- e) Using triple integral, find the volume of a rectangular box whose length is 6 ft, breadth is 5 ft and height is 4 ft. [2]
- f) Evaluate $\int_0^2 \int_0^x (x+y^2) dy dx$. [3]
- g) Define solenoidal vector. [2]
- h) Prove that \vec{r} is an irrotational where $\vec{r} = x\vec{i} + y\vec{j} + z\vec{k}$. [3]
- i) State Stokes theorem. [2]
- j) Evaluate $\iiint_V \text{div} \vec{f} dx dy dz$ where V is the volume of the sphere whose radius is 'a' units and $\vec{f} = x\vec{i} + y\vec{j} + z\vec{k}$. [3]

PART-B

(50 Marks)

- 2.a) Find the Laplace transform of $(\sin t + \cos t)^2$
- b) Find the inverse Laplace transform of $\frac{1}{(s^2+1)(s+1)}$. [5+5]
3. Solve $y'' + 2y' + 5y = e^{-t}$, $y(0) = 1$, $y'(0) = 1$ using Laplace transform. OR [10]
- 4.a) Evaluate $\int_0^{\infty} e^{-x/3} x^3 dx$.
- b) Evaluate $\int_0^1 \frac{x dx}{\sqrt{1-x^4}}$. [5+5]
- OR

5.a) Evaluate $\int_0^{\infty} e^{-x^3} x^7 dx$.

b) Evaluate $\int_0^1 \frac{x^2 dx}{\sqrt{1-x^4}}$. [5+5]

6.a) Evaluate $\int_0^2 \int_{\sqrt{2x-x^2}}^{\sqrt{2x-x^2}} (x^2+y^2) dx dy$ by changing to polar coordinates.

b) Evaluate $\iint_R y dx dy$ where R is the region bounded by the parabola $y^2 = 4x$ and $x^2 = 4y$. [5+5]

7.a) Evaluate $\iiint_{x^2+y^2+z^2=a^2} xy^2 z dx dy dz$ taken through the positive octant of the sphere. OR

b) Evaluate $\int_0^a \int_0^{x+y} \int_0^{x+y+z} e^{x+y+z} dx dy dz$. [5+5]

8.a) Find the directional derivative to the surface $f(x,y,z) = xyz - 4$, at the point $(1, -1, 2)$ along $\vec{i} + \vec{j} + \vec{k}$.

b) A butterfly is located at $(2, -1, 3)$ and desires to fly towards fragrance surface $f(x,y,z) = x^2 + yz^2$. Along which direction should it fly to get fragrance at the earliest? [5+5]

OR

9.a) Show that $\nabla^2 r^n = n(n+1)r^{n-2}$ where $\vec{r} = x\vec{i} + y\vec{j} + z\vec{k}$ and $|\vec{r}|^2 = r^2$.

b) Prove that $\nabla \left(\frac{1}{r} \right) = -\frac{\vec{r}}{r^3}$ where $\vec{r} = x\vec{i} + y\vec{j} + z\vec{k}$ and $|\vec{r}|^2 = r^2$. [5+5]

10. Verify Greens theorem for $\oint_C (y - \sin x) dx + \cos x dy$ where C is the triangle enclosed by the lines $y=0, x=\frac{\pi}{2}$ and $\pi y=2x$. [10]

OR

11. Verify Stokes theorem for a vector field defined by $\vec{F} = -y^3 \vec{i} + x^3 \vec{j}$ in the region $x^2 + y^2 \leq 1, z=0$. [10]

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B.Tech I Year II Semester Examinations, May - 2019

APPLIED PHYSICS

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Time: 3 hours

Max. Marks: 75

Note: This question paper contains two parts A and B.

Part A is compulsory which carries 25 marks. Answer all questions in Part A.

Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART- A

(25 Marks)

- 1.a) Define stress, strain and write their units.
- b) Define Poisson's ratio.
- c) What is the Sabine's formula? Explain
- d) What is acoustic quieting?
- e) What is Piezoelectric effect?
- f) What are the properties of ultrasonics?
- g) Explain dielectric constant & electrical susceptibility.
- h) Distinguish between Ferro-electricity and Piezoelectricity.
- i) What is Bohr magneton?
- j) Explain ferromagnetism.

[2]
[3]
[2]
[3]
[2]
[3]
[2]
[3]
[2]
[3]

PART-B

(50 Marks)

2. What is the Torsional pendulum? Explain how it is used to determine the rigidity modulus of a given wire. [10]
OR
3. Derive the relation between three modules of elasticity. [10]
4. Explain various factors affecting architectural acoustics and their remedies. [10]
OR
- 5.a) What are the requisites for good acoustics?
b) Describe the method of measurement of sound absorption coefficient. [4+6]
6. Explain how the ultrasonic waves produced with the help of piezoelectric method. [10]
OR
7. Describe in detail applications of ultrasonic waves [10]

8.a) Explain the electronic polarizability in atoms and obtain an expression for electronic polarizability in terms of the radius of the atom.

b) The radius of a gaseous atom is 0.062nm. Calculate the electronic polarizability of the gas and its relative permittivity. Given that the number of atoms of the gas is 2.7×10^{25} per m^3 . [8+2]

OR

9.a) Explain in detail the structure of BaTiO_3 and write its applications.

b) Derive an expression for ionic polarizability in an ionic solid. [5+5]

10.a) Explain the origin of magnetic moment and also explain classification of magnetic materials.

b) Describe Hysteresis behavior of ferromagnetic material. [5+5]

OR

11.a) Describe the properties of superconductors.

b) What are important applications of superconductors? Explain in detail. [4+6]