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**Jharkhand University of Technology, Ranchi**  
**Diploma 1st Semester Examination, 2024 (NEP-2024)**

Subject : Engineering Mathematics

Subject Code : BSC 101

Time Allowed : 3 Hours

Full Marks : 70

*Answer in your own words.*

*Answer any five questions. Question No. 1 is compulsory.*

*Marks are given in the right margin.*

1. Choose the correct answer in the following:

2×7=14

(i) If  $A$  is a  $2 \times 2$  matrix such that  $|A| = 5$  and  $|A| \neq 0$  then the value of  $|4A|$  is

(a) 20

(b) 25

(c) 80

(d) None of these

(ii) If  $A$  and  $B$  are invertible square matrices of the same order then  $(AB)^{-1} = ?$

(a)  $AB^{-1}$

(b)  $A^{-1}B^{-1}$

(c)  $B^{-1}A$

(d)  $B^{-1}A^{-1}$

(iii) Find the slope of a line whose inclination is  $60^\circ$ .

(a)  $\sqrt{3}$

(b)  $\frac{1}{\sqrt{3}}$

(c) 1

(d) None of these

(iv) The equation of the line that makes intercepts at 2 and  $-3$  on the  $x$ -axis and  $y$ -axis respectively is represented as

(a)  $2x - 3y = 6$

(b)  $x - 2y = 3$

(c)  $3x - 2y = 6$

(d) None of these

(v) If  $\sin x = \frac{1}{6}$  then  $\sin 3x$  can be expressed as

(a)  $\frac{1}{2}$

(b)  $\frac{13}{27}$

(c)  $\frac{12}{27}$

(d) None of these

(vi) The first order derivative of  $\log_3 x$  is

(a)  $\log 3$

(b)  $\frac{1}{x}$

(c)  $\frac{1}{x(\log 3)}$

(d) None of these

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(vii) Find the value of the integral  $\int \frac{\sin 2x}{\sin x} dx$ .

(a)  $2 \sin x + c$

(b)  $2 \cos x + c$

(c)  $\frac{1}{2} \sin x + c$

(d)  $\frac{1}{2} \cos x + c$

2. (a) Prove that  $\begin{vmatrix} 1 & b+c & b^2+c^2 \\ 1 & c+a & c^2+a^2 \\ 1 & a+b & a^2+b^2 \end{vmatrix} = (a-b)(b-c)(c-a)$ .

(b) Solve the system of equations  $x + y + z = 6$ ;  $2x + 3y - z = 5$ ;  $6x - 2y - 3z = -7$  using Cramer's rule. 7+7

3. (a) Find the equation of the line passing through the point  $(-2, -4)$  and perpendicular to the line  $3x - y + 5 = 0$ .

(b) Reduce the equation  $\sqrt{3}x + y + 2 = 0$  to intercept form and find the intercepts on the axes. 7+7

4. (a) Find the values of all trigonometric functions of  $120^\circ$ .

(b) Prove that:  $\cos \alpha + \cos \beta + \cos \gamma + \cos(\alpha + \beta + \gamma) = 4 \cos\left(\frac{\alpha+\beta}{2}\right) \cos\left(\frac{\beta+\gamma}{2}\right) \cos\left(\frac{\gamma+\alpha}{2}\right)$ . 7+7

5. (a) Find the second order derivative of  $e^{2x} \cos 3x + x^4$ .

(b) Obtain the local maxima or local minima of  $f(x) = x^3 - 6x^2 + 9x + 15$ . Also find the local maximum or local minimum values of  $f(x)$ . 7+7

6. (a) Evaluate:  $\int_{-a}^a \sqrt{\frac{a-x}{a+x}} dx$ .

(b) Calculate the area bounded by the parabola  $y^2 = 4ax$  and its latus rectum. 7+7

7. Write short notes on any four: 3.5×4=14

(a) Inverse of a matrix

(b) Collinear points

(c) ASTC diagram

(d) Stationary points

(e) Integration by parts

**Jharkhand University of Technology, Ranchi**  
**Diploma 1st Semester Examination, 2024 (NEP-2024)**

Subject : Engineering Physics

Subject Code : BSC 102

Time Allowed : 3 Hours

Full Marks : 70

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Answer in your own words.

Answer any five questions. Question No. 1 is compulsory.

Marks are given in the right margin.

1. Choose the correct answer in the following:

2×7=14

- (i) The dimensional formulae for Speed is
- (a)  $[M^0L^0T^0]$  (b)  $[M^0L^1T^{-1}]$   
(c)  $[M^1L^1T^1]$  (d) None of these
- (ii) Stoke's formula is related with
- (a) Initial velocity (b) Final velocity  
(c) Terminal velocity (d) Critical velocity
- (iii) Isobaric process is
- (a) No communication of heat (b) Pressure constant  
(c) Volume constant (d) Temperature constant
- (iv) Laser is
- (a) Bichromatic (b) Monochromatic  
(c) Polychromatic (d) None of these
- (v) Unit of stress is
- (a) Newton (b) Joule  
(c)  $N/m^2$  (d) None of these
- (vi) S.I. unit of temperature is \_\_\_\_\_
- (a) Celsius (b) Kelvin  
(c) Newton (d) None of these
- (vii) The physical property of a material that can not returns to its original shape after the stress is removed is known as
- (a) Plasticity (b) Elasticity  
(c) Opacity (d) None of these

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2. (a) Define unit. Also explain fundamental unit and derived unit with examples.  
(b) Briefly discuss Vernier calliper with schematic diagram. 7+7
3. (a) Explain Young's modulus of elasticity, Bulk modulus of elasticity and Modulus of rigidity.  
(b) Explain Newton's law of viscosity. 7+7
4. (a) Briefly explain the modes of heat transfer.  
(b) What are Centigrade scale, Fahrenheit scale and Kelvin scale? 7+7
5. (a) What do you mean by reflection and refraction of light? Explain.  
(b) Derive the relation among velocity, frequency and wavelength. 7+7
6. (a) Explain construction and working of photoelectric cell.  
(b) Calculate the energy of photon of red light in a vacuum with a wavelength of 695nm. 7+7
7. Write short notes on *any four*: 3.5×4=14
- (a) Reynold's number
  - (b) Capillary action
  - (c) Properties of laser
  - (d) X-rays
  - (e) Boyle's law

**Jharkhand University of Technology, Ranchi**  
**Diploma 1st Semester Examination, 2024 (NEP-2024)**

Subject : Engineering Chemistry

Subject Code : BSC103

Time Allowed : 3 Hours

Full Marks : 70

Reg. no. - 24306080037

Pass Marks : 21

*Answer in your own words.*

*Answer five questions in which Question No. 1 is compulsory.*

*The figures in the margin indicate full marks.*

*All questions carry equal marks.*

1. Choose the correct option:

2×7=14

(i) The electronic configuration of  $\text{Cu}^{2+}$  ion is

(a)  $[\text{Ar}] 4s^1 3d^8$

(b)  $[\text{Ar}] 4s^2 3d^{10} 4p^1$

(c)  $[\text{Ar}] 4s^1 3d^{10}$

(d)  $[\text{Ar}] 3d^9$

(ii) Bohr proposed that while revolving in discrete orbits, the electrons

(a) gain energy

(b) lose energy

(c) do not radiate energy

(d) first lose energy and then gain energy

(iii) What is the most difficult atom to ionize?

(a) Hydrogen

(b) Helium

(c) Beryllium

(d) Neon

(iv) Which of the following is a synthetic polymer commonly used in making plastic?

(a) Cellulose

(b) Starch

(c) Protein

(d) Polyethylene

(v) Which of the following is not a type of electrochemical cell?

(a) Voltaic cell

(b) Photovoltaic cell

(c) Electrolytic cell

(d) Fuel Cell

(vi) Which industry causes all three: air, water and land pollution?

(a) Fertilizer and pesticides

(b) Oil refineries and iron, steel

(c) Oil refineries and caustic soda

(d) Iron, steel and caustic soda

- (vii) Which of the following metal is utilized in trucks, automobile engines, aircraft and missiles?
- (a) Stainless steel (b) Carbon steels  
(c) Magnesium (d) Cast irons
2. (a) Write about the different types of valency with suitable examples.  
(b) Define orbitals. Explain Aufbau Principle for filling up of the orbitals. 7+7
3. (a) Explain Arrhenius Theory of Ionization.  
(b) What is degree of Ionization? Discuss the factors affecting degree of ionization. 7+7
4. (a) What are different types of alloys? Describe the purpose of making alloys.  
(b) Explain the physical properties & applications of Cu and Al. 7+7
5. (a) Define polymers. Compare natural and synthetic rubber with suitable examples.  
(b) Write about the engineering applications of plastic based on their properties. 7+7
6. (a) What do you mean by E-waste? Write about different types of waste.  
(b) Describe air pollution and explain causes and remedial measure of air pollution. 7+7
7. Write short notes on *any four* of the following: 3.5×4=14
- (a) Water Pollution  
(b) Electrolysis  
(c) Gun Metal  
(d) Thermal Insulators  
(e) BOD and COD

**Jharkhand University of Technology, Ranchi**  
**Diploma 1st Semester Examination, 2024 (NEP-2024)**

**Subject : Basics of Electrical Power System**

**Subject Code : EEE101**

**Time Allowed : 3 Hours**

**Full Marks : 70**

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*Answer in your own words.*

*Answer any five questions in which Question No. 1 is compulsory.*

*The figures in the margin indicate full marks.*

*All questions carry equal marks.*

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**I. Multiple Choice Questions:**

2×7=14

- (i) What is the main purpose of the turbine in a hydroelectric power plant?
  - (a) To store water
  - (b) To convert mechanical energy into electrical energy
  - (c) To pump water to higher elevations
  - (d) To regulate water flow in the dam
- (ii) What does the term "water hammer" refer to in a hydroelectric power plant?
  - (a) The impact of water falling on the turbine
  - (b) The sudden increase in pressure in pipes due to rapid changes in water velocity
  - (c) The sound generated by the turbine
  - (d) The pressure of water in the reservoir
- (iii) In a nuclear power plant, what is the function of the reactor?
  - (a) To store nuclear waste
  - (b) To generate steam by harnessing nuclear fission
  - (c) To convert steam into mechanical energy
  - (d) To convert mechanical energy into electrical energy
- (iv) What is the primary function of a solar photovoltaic (PV) module?
  - (a) To store solar energy
  - (b) To convert sunlight into electrical energy
  - (c) To reflect solar radiation
  - (d) To regulate the temperature of the system

- (v) Which of the following is a method of converting biomass to energy?  
 (a) Incineration (b) Photosynthesis  
 (c) Hydrogenation (d) Electrolysis
- (vi) Which of following is calculated as the ratio of the actual demand to the maximum possible demand?  
 (a) Load factor (b) Plant capacity factor  
 (c) Demand factor (d) Diversity factor
- (vii) A blackout in an electric grid can be caused by  
 (a) overload of the system. (b) fault in transmission lines.  
 (c) failure of substations. (d) All of these
2. (a) Explain the various conventional and non-conventional sources of energy and their role in meeting the power demand in India.  
 (b) What factors must be considered when selecting a site for a hydroelectric power plant? Discuss each factor in detail. 7+7
3. (a) Draw a schematic diagram of a nuclear power plant and explain the function of its major components, such as the reactor, steam generator, turbine and cooling system.  
 (b) What are the advantages and disadvantages of gas turbine power plants? Compare them with other conventional power plants in terms of efficiency, fuel consumption and environmental impact. 7+7
4. (a) Explain the photovoltaic effect and how it is used to generate electricity in solar photovoltaic systems.  
 (b) Describe the different types of biogas plants. Explain their construction, working principles and the advantages of each type. 7+7
5. (a) Explain the terms "connected load", "firm power", "cold reserve", "hot reserve" and "spinning reserve". How do these relate to the economics of power generation?  
 (b) Define and explain the concept of the "load curve" in power generation. How is it useful in planning and operating a power plant? 7+7
6. (a) Explain the components and working of an AC transmission and distribution system. Draw a typical single line diagram of the electric supply transmission and distribution system.  
 (b) Explain the concept of "Black Start Restoration". How is it done in the event of a blackout and what are the steps involved? 7+7

7. Write short notes (*any four*):

3.5×4=14

- (a) Primary and Secondary Transmission Lines
  - (b) Radial, Ring Main and Interconnected Distribution Systems
  - (c) Functions of Load Dispatch Centre
  - (d) National Grid and State Grid
  - (e) Functions and Importance of HVDC Transmission
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