Q.P. Code :12104

[Time: Three Hours] **[Marks:100]**

Please check whether you have got the right question paper.

N.B: 1. All questions are compulsory.
2. All questions carry equal marks.
3. Draw neat, labelled diagrams wherever necessary.

Q.1. A) Fill in the blanks by choosing correct options given in the bracket: **05**

a) In the Goitre disorder there is enlargement of _____ gland.
(Adrenal, thyroid, Pituitary)

b) Smallpox is caused by _____ virus.
(Variola, Varity, Very)

c) pH range of drinking water is _____.
(6.5 to 8.5, 4.5 to 6.5, 8.5 to 9.5)

d) Insulin hormone is secreted by _____ cells of Islet of Langerhans.
(Alpha, Beta, delta)

e) *Neisseria gonorrhea* is a _____ infection.
(Bacterial, viral, protozoal)

B) Match the column and rewrite **05**

I	II
a) Ig A	i. Arteriosclerosis
b) Dengue	ii. *Treponema pallidum*
c) Leprosy	iii. Colostrum
d) Hypertension	iv. *Flaviviridae* family
e) Syphilis	v. MLEC

C) State whether True or False **05**

a) Rickets is caused by deficiency of Vitamin D.
b) Piles are inflamed veins in the stomach area.
c) Water canals are natural water resources.
d) Radiation from cell phone is too weak to heat the biological tissues.
e) Blood pressure lowers during sleep.

D) Answer the following in one sentence: **05**

a) What is “Infantile Pellagra and Nutritional Oedema”.
b) Give full form of PPIP.
c) Explain “Anomolous behavior of water”.
d) What is Psychotherapy.
e) What is Bronchial thermoplasty?

TURN OVER

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Q.P. Code :12104

Q.2 **A)** Discuss causes and consequences of obesity. **10**

OR

A) Describe causes, symptoms, precaution and remedy for Swine flu. **10**

B) Explain **any two** of the following: **10**

a) Dietary recommendation for adult.
b) Causes and symptoms of Flatulence.
c) Symptoms and prevention of Anemia.
d) Causes and remedy for Marasmus.

Q.3 **A)** Explain the concept of water footprint and give its significance. **10**

OR

A) Define health and add a note on psychological and social health. **10**

B) Write short note on **any two** of the following: **10**

a) Small scale water purification methods.
b) Source of fresh water.
c) Polio eradication programmes in India.
d) Radiations risks of mobile phones.

Q.4 Give an detailed account of causes, symptoms, diagnosis, precautions and remedy of the following diseases **(any two)** **20**

a) Asthma
b) Diabetes Type II
c) AIDS
d) Tuberculosis

Q.5 Write short notes on **any four** **20**

a) BMI significance
b) Importance of dietary fibers
c) Aims of First Aid
d) Infections and treatment for Dog bite.
e) Causes and Symptoms of Hepatitis A
f) Oral cancer.

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Q.P. Code : 34026

[Time: Three Hours] **[Marks: 100]**

Please check whether you have got the right question paper.

N.B: 1. All questions are compulsory.
2. All questions carry equal marks
3. Draw neat labelled diagrams wherever necessary.

Q1. A) Fill in the blanks by choosing the correct option given in the bracket **05**

a. _____ is the loss of organisms from a population per unit time.
(Mortality, Natality, Fecundity)
b. _____ is the capacity of a population to increases to its maximum level.
(Biotic potential, population growth, crude density)
c. Ammonia is converted to nitrites and nitrates by _____ present in the soil.
(*Aspergillus, Nitrosmonas, Proteus*)
d. The scientific name of Asiatic lion is _____ .
(*Panthera tigris, Panther pardus, Panthera leopersica*)
e. The coconut lagoon is situated in the state of _____ .
(Kerala, Maharashtra, Andhra Pradesh)

B) Match the Columns **I** and **II** and rewrite **05**

I	II
a) Blue green algae	1) Tiger prawn
b) Rhizobium	2) Arctic tern
c) Anadromous	*3) Maniscrassi*
d) Catadromous	4) Root nodules
e) Indian Pangolin	5) Nostoc

C) State whether **True** or **False** **05**

a. Penicillin was discovered by Watson & Crick.
b. HIV virus is an obligate parasite.
c. The motto for 2011 census was " Our Census, Our Future".
d. Rusty spotted cat is categorized as near threatened in the IUCN Red List.
e. Silent Valley National Park is located in Madhya Pradesh.

D) Answer in **one** sentence **05**

a. Define parasitiodism
b. Define mutualism
c. Define population density
d. What is the full form of UNESCO?
e. Define biopiracy

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Q.P. Code : 34026

Q.2 A) Describe Sigmoid and J-shaped growth pattern. **10**

OR

A) Describe age structure of population & comment on its types.

B) Write short notes on **(any two)** **10**

a. Fecundity
b. Distribution patterns in a population
c. Natality
d. Survivorship curve

Q.3 A) Describe the biotic components of an ecosystem. **10**

OR

A) Describe the impact of temperature on living organisms.

B) Write short notes on **(any two)** **10**

a. Abiotic components in a lentic ecosystem.
b. Water cycle
c. Pyramid of biomass
d. Commensalism

Q .4 Answer the following **(any two)** **20**

a. Describe Jim Corbett National Park with two representative examples.
b. What is ecotourism? Describe ecotourism in Garhwal and Pune region.
c. Describe Bandipur National Park and Wildlife Sanctuary.
d. Explain controversies in patents of any two plants.

Q.5 Write short notes on **(any four)** **20**

a. Life tables
b. Sex ratio in population ecology
c. Sulphur cycle
d. Food chains
e. Threatened species
f. Project Rhinoceros

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3 HRS **100 MARKS**

Note: 1) All questions are compulsory.
2) Use of non- programmable calculator is allowed.
3) Draw figures wherever necessary.
4) Symbols have their usual meanings unless mentioned.

Q.1 (A) Select the correct option 12

i) In case of pure capacitor connected to ac source, phase angle between capacitor voltage and current is _____degrees.
(a) 0 (b) 180
(c) 90 (d) 45

ii) _____ bridge is used to determine frequency of ac source.
(a) De Sauty (b) Wien
(c) Maxwell (d) Hay

iii) In half adder circuit, sum and carry are represented by outputs of _____ and _____ gates respectively.
(a) AND, OR (b) Ex-OR, AND
(c) Ex-OR, OR (d) NAND, NOR

iv) The source delivers maximum power to the load when source resistance is _____.
(a) greater than load (b) less than load
(c) equal to load (d) equal to zero

v) When charge Q is accelerated through a potential difference V, it gains energy _____.
(a)Q.V (b) $Q^2.V$
(c)Q/V (d) Q^2/V

vi) The resultant field between the two coils of Helmholtz coil arrangement is inversely proportional to the _____.
(a) current (b) permeability of free space
(c) number of turns (d) radius

(B) Answer in one sentence : 03

i) Why LCR parallel circuit is called as a rejecter circuit?
ii) Define efficiency of a rectifier.
iii) What is the magnitude of electric field on the equipotential surface?

(C) Fill in the blanks 05

i) The quantity _____ is called as inductive reactance.
ii) The internal resistance of ideal current source is _____.
iii) The sum of half adder is represented by _____ gate.
iv) The ripple factor of bridge rectifier is _____.
v) SI unit of electrostatic potential is _____.

Q.2 (A) Attempt any one 08

i) A sinusoidal voltage is applied across series LR circuit. Show that current lags behind the applied voltage. Draw series relevant phasor diagram.
ii) Derive expression for the instantaneous power dissipated by an ac circuit. Hence define true power and derive expression for it.

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(B) Attempt any one 08

i) Draw a neat labeled diagram of Maxwell LC bridge and find balancing conditions of the bridge.

ii) With the help of circuit diagram determine balancing condition for De Sauty's bridge. State one application of the bridge.

(C) Attempt any one 04

i) In series LCR circuit, resonance occurs at frequency 10 KHz. If R = 10Ω and inductive reactance is 200Ω at resonance. Find the bandwidth of the circuit.

ii) In wien bridge both the resistors and capacitors are of same value. If R= 470Ω and C = 0.1μF, then find the frequency of the ac source used.

Q.3 (A) Attempt any one 08

i) State Thevenin's theorem and explain it in detail.

ii) What are the binary adders? Describe full adder in detail.

(B) Attempt any one 08

i) What is a clipper? What are its types? Explain working of any one type of clipper with the help of diagram.

ii) State and prove De Morgan's laws.

(C) Attempt any one 04

i) Simplify the expression Y = (A+B).(A+C) and design logic circuit for the output using basic gates.

ii) Find the Zener current when Zener diode of voltage 7.2 V is connected across a power supply of 12 V and series resistance of 1 KΩ. The load resistance of 5 KΩ is connected across the Zener.

Q.4 (A) Attempt any one 08

i) Obtain an expression for the potential energy stored in a system of N discrete point charges.

ii) Explain how electric field can be expressed in terms of electric potential. comment on the potential.

(B) Attempt any one 08

i) Derive an expression for the magnetic field at a point at a distance x from a straight current carrying wire of finite length. Modify the result for infinitely long wire.

ii) What is a solenoid? Derive an expression for the magnetic field at a point well inside on the axis of a current carrying air core solenoid.

(C) Attempt any one 04

i) Find the work done in moving a charge of +1e from (2,0)m to (0,2)m along a straight line path joining these two points in electric field
$E = (2xi^{-} - 4yj^{-})$

ii) A circular coil having 30 turns carries a current of 0.5A. If the diameter of the coil is 0.1 m, calculate the magnetic field at the centre of the coil. Given : $\mu_0 = 4\Pi \times 10^{-7}$ N/A^2

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Q.5 Attempt any four 20

i) An ac source specified as V = 200 sin 100t is connected across series CR circuit with C = 1μF and R = 10KΩ. Calculate maximum potential difference across the capacitor.

ii) In a Maxwell LC bridge, when bridge is in the balanced, the following component values were observed. R_2 = 900Ω, R_3 =1000Ω, R_4 = 2700Ω and C = 0.47μF. Determine the value of inductance and the resistance of the coil.

iii) State maximum power transfer theorem. Calculate the maximum power delivered to the load of 1 KΩ by a source with open circuit voltage 5V.

iv) Explain why NAND gate is called as universal building block.

v) State and explain Biot-Savrot law.

vi) A uniformly charged spherical shell of radius R carries a total charge q. Find the electrostatic potential at a point P,(i) outside and (ii) inside the shell.

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3 HRS **100 MARKS**

Note: 1) All questions are compulsory.
2) Use of non- programmable calculator is allowed.
3) Draw figures wherever necessary.
4) Symbols have their usual meanings unless mentioned.

Q.1 (A) Select the correct option 12

i) In an A.C. circuit power is dissipated in ----------.
(a) resistance only (b) capacitance only
(c) inductance only (d) none of these

ii) Wein bridge is mainly used to determine ---------- in terms of known resistance and capacitances.
(a) phase difference (b) frequency
(c) power (d) none of these

iii) The diodes which converts ---------- is called rectifier.
(a) a.c. current to a.c. current (b) d.c. current to d.c. current
(c) d.c. current to a.c. current (d) a.c. current to d.c.

iv) When the load resistance equals the source resistance, ------- will be delivered by a source to a load.
(a) minimum power (b) zero power
(c) maximum power (d) none of these

v) The ---------- gate is also known as inverter which has one input and one output.
(a) NAND (b) EX-OR
(c) NOT (d) AND

vi) The magnetic field is ---------- quantity.
(a) scaler (b) null
(c) vector (d) none of these

(B) Answer in one sentence : 03

i) Define power factor.
ii) What is clipper circuit?
iii) State the Coulomb's law.

(C) Fill in the blanks 05

i) The quantity _____ is called as inductive reactance.
ii) For an ideal constant voltage source, internal resistance is …….. .
iii) $\overline{A \cdot B}$ = ---------.
iv) Zener diode is always connected in ……. bias.
v) Electrostatic energy is stored in ……..

Q.2 (A) Attempt any one 08

i) Show that in a purely resistive AC circuit, emf and current are in a same phase. Represent the emf and current in phasor diagram.
ii) Draw a neat circuit diagram of De Sauty's bridge and obtain its balance condition. Is this condition independent of frequency?

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(B) Attempt any one 08

i) An alternating e.m.f. $E = E_0 \sin \omega t$ is applied to a resistance R and inductance L in series. What will be the impedance, the current and phase difference between applied e.m.f. and the current.

ii) Draw a neat circuit diagram of Hay's bridge and obtain its balance condition. Obtain the expression for unknown inductance

(C) Attempt any one 04

i) A coil of 20 Ω resistance has inductance of 0.2 H is connected in parallel with a condenser of 100 μF capacitance. Calculate the resonant frequency.

ii) In Maxwell's L/C bridge, arm PQ and RS has non-inductive resistance of 600 Ω and 400 Ω respectively. The arm PQ has a non-inductive resistance of 1000 Ω in parallel with a capacitor of capacitance 0.47 μF. The arm PS is an inductive impedance and a.c. source is connected at points P and R. Find the value of resistance and inductance of the arm PS.

Q.3 (A) Attempt any one 08

i) Explain with neat diagram the working of bridge type full wave rectifier.

ii) Explain full adder with its logical circuit and truth table.

(B) Attempt any one 08

i) State and explain Reciprocity theorem with suitable example.

ii) State and explain De-Morgan's theorems using NAND gates and also tabulate the truth tables.

(C) Attempt any one 04

i) Find the value of series resistance connected in series with 6V zener diode produces 140 mA zener current when connected to 20 volt input supply.

ii) If $Y = A\bar{B} + \bar{C}D$, design the logic circuit using basic gates.

Q.4 (A) Attempt any one 08

i) Show that energy stored in continuous charges distribution is $W = \frac{\varepsilon_0}{2} \int_s E^2 \, dv$

ii) State and discuss Biot-Savart's law.

(B) Attempt any one 08

i) State Coulomb's law in vector form. Find the expression for the force between two point charges when their position vectors are given. Discuss limitation of Coulomb's law.

ii) What is a solenoid? Derive an expression for the magnetic field at a point well inside on the axis of a current carrying air-core solenoid.

(C) Attempt any one 04

i) Find the work done in moving a charge of +1e from (2,0)m to (0,2)m along a straight line path joining these two points in electric field
$E = (2x\bar{i} - 4y\bar{j})$

ii) A straight long conductor carries a current of 10A. Calculate the magnetic field at a distance 10 cm from the conductor.

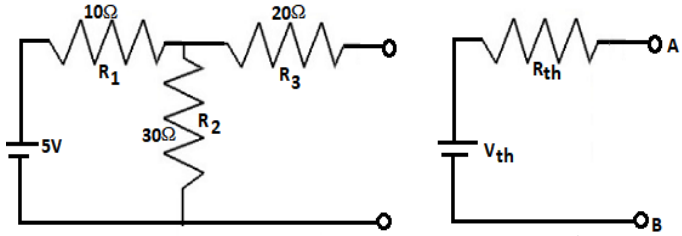
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Q.5 Attempt any four 20

i) State superposition theorem and write basic steps for solving a network using it.

ii) Explain the construction and working of half wave rectifier.

iii) Determine the maximum power that can be delivered to a load by the network shown in figure.



iv) If $Y = A + \bar{B}C$, design the circuit diagram using basic gates.

v) The electrostatic force between two small spheres of charges of magnitudes 0.4μC and 0.8 μC placed at some distance in air is 0.2N.
(i) what is the distance between the spheres.
(ii) what is the force on the second sphere due to first.

vi) A 50 cm long air cored solenoid has 10,000 turns. Its radius is 1.5 cm. If a current of 2A flows through it, calculate the magnetic field within it.

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3 HRS 100 MARKS

Note: 1) All questions are compulsory.
2) Use of non- programmable calculator is allowed.
3) Draw figures wherever necessary.
4) Symbols have their usual meanings unless mentioned.

Q.1 (A) Select the correct option **12**

i) The quantities which require both magnitude and direction for their complete specification are called .....
(a) scalars (b) vectors
(c) polygons (d) None of the above

ii) The vector field V is irrotational if .....
(a) $\nabla \times V = 0$ (b) $\nabla \cdot V = 0$
(c) $V \cdot \nabla = 0$ (d) $V \times \nabla = 0$

iii) The degree of the equation $\left(\frac{d^3y}{dx^3}\right)^2 + x\frac{dy}{dx} = 2y$ is ---------.
(a) 0 (b) 3
(c) 1 (d) 2

iv) In the LR-series circuit has a steady emf E, which is switched on at a time t = 0. The current after a long time will be ----------.
(a) zero (b) $\frac{E}{\sqrt{R^2+L^2}}$
(c) $\frac{E}{L}$ (d) $\frac{E}{R}$

v) Energy is not carried by
(a) Transverse travelling waves (b) Stationary waves
(c) Longitudinal travelling waves (d) Electromagnetic waves

vi) In progressive wave the disturbance propagates with definite .....
(a) velocity (b) displacement
(c) acceleration (d) time

(B) Answer in one sentence : **03**

i) Define unit vectors.
ii) What is differential equation?
iii) Define transverse wave.

(C) Fill in the blanks **05**

i) If higher the frequency of wave, the shorter its ---------.
ii) Time interval during which the oscillation repeats itself is known as .....of oscillations.
iii) .....is the time constant of series LR circuit.
iv) The operator del is known as ---------.
v) For ..... medium group velocity is equal to phase velocity.

Q.2 (A) Attempt any one **08**

i) Define Scalar (DOT) product of two vectors. Write any six properties of Scalar (DOT) product of vectors.
ii) (a) If $\phi(x,y,z) = x^2 - y^2 + 2yz + 2z^2$, find $\nabla\phi$ at (1,-2,1)
(b) if $\vec{r} = x\,\vec{i} + y\,\vec{j} + z\vec{k}$ is the position vector with respect to right handed co-ordinate system, find $\nabla \cdot \vec{r}$.

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(B) Attempt any one **08**

i) If (a) $\phi = ln|\vec{r}|$ and (b) $\phi = \frac{1}{r}$, find $\overrightarrow{\nabla \phi}$.

ii) (a) Find the angle between $\overrightarrow{A} = 2\hat{\imath} + 2\hat{\jmath} - \hat{k}$ and $\overrightarrow{B} = 6\,\hat{\imath} - 3\hat{\jmath} + 2\hat{k}$.
(b) Prove that $\overrightarrow{A} \cdot (\vec{B} + \vec{C}) = \vec{A} \cdot \vec{B} + \vec{C} \cdot \vec{A}$ (distributive law)

(C) Attempt any one **04**

i) Find the relation between $\overrightarrow{A}$ and $\overrightarrow{B}$ if $|\overrightarrow{A} + \overrightarrow{B}| = |\overrightarrow{A} - \overrightarrow{B}|$

ii) If $\phi = x^4 + y^4 + z^4$, determine $\nabla\phi$.

Q.3 (A) Attempt any one **08**

i) Discuss second order homogeneous linear ordinary differential equation with constant coefficients with roots of the equation are real and repeated (equal)

ii) A steady emf is suddenly applied to a circuit consisting of an inductance L and a resistance R in series. Obtain an expression for the growth of current in the circuit and also its decay when the emf withdrawn.

(B) Attempt any one **08**

i) (a) Solve the differential equation $\frac{dy}{dx} + y = e^{-x}$.
(b) Solve the differential equation $\frac{dy}{dx} = \frac{x^2}{e^y}$.

ii) Derive an expression for the growth of charge in the LCR series circuit. A steady emf is connected to the circuit consisting of a resistance R, an inductance L and a capacitor C in series.

(C) Attempt any one **04**

i) Solve the differential equation $\frac{dy}{dx} - kxy = 0$.

ii) A DC voltage of 100V is switched on to a circuit containing a resistance of 10Ω in series with an inductance of 10H. Find the rate of growth of current at the instant when the current is 5A.

Q.4 (A) Attempt any one **08**

i) Obtain an expression for the resultant motion when a particle is subjected simultaneously to two mutually perpendicular Simple Harmonic Motions of identical period and having same center. Give some special cases.

ii) Obtain the expression for the velocity of the transverse wave on a stretched string.

(B) Attempt any one **08**

i) Obtain an expression for the resultant motion when two Simple Harmonic Motions of same period and with same center along the same straight line act simultaneously on a particle. Give some special cases.

ii) Explain the terms phase velocity and group velocity.

(C) Attempt any one **04**

i) Show that the general solution of the wave equation, $\frac{\partial^2 y}{\partial x^2} = \frac{1}{c^2}\left(\frac{\partial^2 y}{\partial t^2}\right)$ can be represented by y = $f_1(x - ct) + f_2(x + ct)$.

ii) Two tuning forks produce Lissajous figures. The figures changes in form of circular figure and after every 0.2 the circular figure occurs. If the frequency of one of the fork is 250 Hz. Find the possible frequencies of the other fork.

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Q.5 Attempt any four **20**

i) Prove that $\vec{A} \times (\vec{B} \times \vec{C}) + \vec{B} \times (\vec{C} \times \vec{A}) + \vec{C} \times (\vec{A} \times \vec{B}) = 0$

ii) Show that the field $\vec{V} = cos\, y\, \hat{\imath} - xsin\, y\, \hat{\jmath} - \cos z\ \hat{k}$ is conservative.

iii) Define the exact differential equation.

iv) A coil of self-inductance 200 H is joined to the terminals of a battery of emf 5 volts through a resistance of 20 Ω. What is the time constant of the circuit? What is the maximum current that is finally established in the circuit?

v) Show that a particle whose potential energy is $\frac{1}{2} Kx^2$, where K is a constant, executes simple harmonic motion.

vi) Distinguish between progressive and stationary waves.

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QP CODE : 52351

3 HRS **100 MARKS**

Note: 1) All questions are compulsory.
2) Use of non- programmable calculator is allowed.
3) Draw figures wherever necessary.
4) Symbols have their usual meanings unless mentioned.

Q.1 (A) Select the correct option 12

i) If vectors $2\hat{i} + a\hat{j} + \hat{k}$ and $4\hat{i} - 2\hat{j} - 2\hat{k}$ are perpendicular to each other, then a = _____.

(a) 3 (b) 2 (c) 1 (d) 5

ii) _____ waves do not transmit energy from one point to the other.

(a) Longitudinal (b) Transverse (c) Progressive (d) Stationary

iii) Solution of homogeneous differential equations possesses the property of _____.

(a)Coefficients (b) Dependent variables
(c) Independent variables (d) Superposition

iv) Curl of electrostatic field is _____.

(a) Nonzero (b) constant
(c) zero (d) variable function

v) If force $F = \hat{i}+3\hat{j}-2\hat{k}$ produces displacement $\bar{s} = 4\hat{i}-2\hat{j}+4\hat{k}$, then the work done is ------ unit.

(a) -10 (b) 2 (c) 25 (d) 9

vi) A vector field ($\bar{A}$) is said to be solenoidal if _____.

(a) curl of ($\bar{A}$) = 0 (b) curl of ($\bar{A}$) = 1
(c) Div of ($\bar{A}$) = 0 (d) Div of ($\bar{A}$) = 1

(B) Answer in one sentence : 03

i) What is homogeneous differential equation?
ii) For a non dispersive medium, what will be the relation between between group velocity(v_g) and phase velocity(v_p)?
iii) What is the condition for $\bar{A}$, $\bar{B}$, $\bar{C}$ to be coplanar?

(C) Fill in the blanks 05

i) Time interval during which the oscillation repeats itself is known as……..of oscillations.
ii) For any two non-zero vectors $\bar{A}$ and $\bar{B}$, $|\bar{A}+\bar{B}| = |\bar{A}-\bar{B}|$ only if ----
iii) The _____ in a series LR circuit is the time taken for the current to rise to 63% of its final maximum value.
iv) A differential equation which contains only one independent variable is called as……..differential equation.
v) The principle behind group velocity is the concept of …….packet

Q.2 (A) Attempt any one 08

i) Find the angles made by the vector $\bar{A} = 4\hat{i} - 8\hat{j} + \hat{k}$ with the co-ordinate axes - X-axis and Y-axis. If $\bar{B} = 3\hat{i} + 3\hat{j} + \hat{k}$, find the projection of $\bar{A}$ on $\bar{B}$.

ii) The linear velocity for the circular motion of the particle is $\bar{V} = \bar{\omega} \times \bar{r}$. Assuming ω to be constant, prove that, (a) $\nabla \times \bar{V} = 2\omega$ (b) $\nabla \times \bar{V} = 0$

(B) Attempt any one 08

i) What are scalar and vector triple product and give at least two properties of each.

ii) Explain the operator Del. Define the divergence of a vector field and explain its physical meaning.

(C) Attempt any one 04

i) Prove that $(y^2 - z^2 + 3yz - 2x)\,\hat{i} + (3xz + 2xy)\,\hat{j} + (3xy - 2xz + 2z)\,\hat{k}$ is both solenoidal and irrotational.

ii) If $\Phi = 3y^2x - y^3z^2$; find the gradΦ at a point (1, -1, -2).

Q.3 (A) Attempt any one 08

i) Discuss the general first order linear differential equation with reference to complementary function and particular integral. Obtain its general solution

ii) Derive expression for instantaneous charge on charged capacitor C while discharging through a resistor R. Also find expression for instantaneous voltages across R and C.

(B) Attempt any one 08

i) Set up the differential equation for the motion of an ideal simple pendulum. Solve the differential equation and obtain expression for its periodic time.

ii) $(4x^3 + 6xy + y^2)dx + (3x^2 + 2xy + 2)\,dy = 0$
Is this equation an exact equation? Find the solution.

(C) Attempt any one 04

i) Solve the equation:
$$\frac{dy}{dx} - \frac{y}{x+3} = \frac{2}{x+3}$$

ii) A steady current of 5A is set up in a series LR circuit with inductance of 200mH and resistor of 20Ω. Calculate the current 8 second after the start of decay of current.

Q.4 (A) Attempt any one 08

i) Derive an expression for the resultant motion due to superposition of two mutually perpendicular SHMs having time period in the ratio1:2.

ii) Define particle velocity and wave velocity.
Show that (particle velocity) = – (wave velocity) x (slope of the displacement curve).

(B) Attempt any one 08

i) Obtain an expression for the resultant motion when two SHMs of the same period and with same centre along the same straight line (two collinear SMHs of same period and centre) act simultaneously on a particle. Give some special cases

ii) Derive the expression for the velocity of a simple harmonic wave in a stretched string

(C) Attempt any one 04

i) Two collinear SHMs are given by the equations
$x_1 = 12 \sin(\omega t)$ cm and $x_2 = 5 \cos(\omega t)$ cm .
Find the resultant amplitude of motion and resultant phase constant.

ii) Two tuning forks produce Lissajous figures. The figures changes in form of a circular figure and after every 0.2sec the circular figure occurs. If the frequency of one of the fork is 250 Hz, find the possible frequencies of the other fork.

Q.5 Attempt any four 20

i) A forward travelling wave on string is described by,
$y=0.001 \cos(6.28t + 4x)$
What are the amplitude, frequency, propagation speed and wavelength? All quantities are in SI unit ($\pi = 3.14$)

ii) If $\bar{A} = 4x^2\,\hat{i} - 3yz\,\hat{j} + xz^2\,\hat{k}$, find $\bar{\nabla} \times \bar{A}$ at (1,-1,1)

iii) Distinguish between Progressive and Stationary waves.

iv) Find the area of triangle having vertices A(1,3,2) ,B(2,-1,1) and C(-1,2,3)

v) A Capacitor of 15μF is charged by a battery of emf 5V through a resistor of 1 MΩ. Calculate : a) maximum charge on the capacitor,
b) time taken by the charge to increase to 50% of of the maximum charge.

vi) Write a short note on Lissajous Figures.

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(Time: 3 Hours) **[Total Marks : 100]**

N.B. **1**. All questions are compulsory.

2. Figures to the right indicate marks for respective parts.

3. Use of Calculator is not allowed.

Q.1 Choose correct alternative in each of the following: (20)

i. A linear system of equations may have

(a) No solution (b) Unique solution

(c) infinitely many solutions (d) Any of (a), (b), (c)

ii. A diagonal matrix $D = diag(d_1, d_2, \dots, d_n)$ is invertible if and only if

(a) $d_k \neq 0 \; for \; some \; k$ (b) $d_k = 1 \; for \; some \; k$

(c) $d_k \neq 0 \; for \; all \; k$ (d) $d_k = 1 \; for \; all \; k$

iii. Let A = $\begin{bmatrix} 2 & -1 \\ 3 & -2 \end{bmatrix}$. Then A^n (where n is positive integer) is

(a) I_2 for all n (b) A for all n

(c) I_2 if n is even and A if n is odd (d) None of these

iv. Which of the following is a subspace of $\mathbb{R}^3$ over $\mathbb{R}$?

(a) $\{(x,y,z) \in \mathbb{R}^3 / \; x = -y, z = 2x\}$ (b) $\{(x,y,z) \in \mathbb{R}^3 / \; x = -y + 1, z = 2x\}$

(c) $\{(x,y,z) \in \mathbb{R}^3 / \; x = -y, z = x^2\}$ (d) None of the above

v. S = {(0, 0, 1), (0, 1, 0)} then the linear span of S is

(a) YZ-plane (b) $\mathbb{R}^3$

(c) XY-plane (d) $\mathbb{R}^2$

vi. The singleton set {0} in any real vector space V is

(a) linear independent (b) linear dependent

(c) a basis of the empty set φ (d) none of the above

vii. Which of the following set is a generating set of $\mathbb{R}^3$?

(a) {(1, 2, 0), (0, 1, 1),(-1, 0, 1)} (b) {(1, 2, 1), (2, 4, 2), (-1, 0, 1)}

(c) {(1, 1, 0), (0, 1, 1)} (d) {(-1, 0, 1), (0, 1, 1), (0, 0, 0)}

viii. The dimension of the vector space of all real matrices of order 2×3 is

(a) 5 (b) 6

(c) 13 (d) None of these

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ix. Which of the following is a linear transformation?

(a) $T: \mathbb{R}^2 \rightarrow \mathbb{R}^2$ defined by $T(x, y) = (x + 2, y + 3)$

(b) $T: \mathbb{R}^2 \rightarrow \mathbb{R}^2$ defined by $T(x, y) = (x + y, 3y)$

(c) $T: \mathbb{R}^2 \rightarrow \mathbb{R}^2$ defined by $T(x, y) = (x, y^2)$

(d) None of the above

x. If for a linear transformation $T: \mathbb{R}^7 \rightarrow \mathbb{R}^9$, Rank T = 4 then the nullity of T is

(a) 3 (b) 5

(c) 0 (d) None of these

Q.2 a) Attempt any ONE question from the following: (08)

i. Prove that the homogeneous system $a_1x + b_1y = 0, a_2x + b_2y = 0$ has a non-trivial solution if and only if $a_1b_2 - a_2b_1 = 0$.

ii. Define trace of a square matrix A (Tr(A)) of order n. Show that if A and B are square matrices of order *n* then Tr(A) = Tr(A^T) and Tr(A + B) = Tr(A) + Tr(B).

b) Attempt any TWO questions from the following: (12)

i. For any square matrix A of order n, prove that

(p) A + A^T is symmetric (q) A−A^T is skew symmetric.

ii. Show that the following system of equations has non-trivial solution for all non-zero real numbers *a*, *b* and *c:*

x + ay + (b + c)z = 0, x + by + (c + a)z = 0, x + cy + (a + b)z = 0

iii. If A is a square matrix then prove that

(p) If A^2 = O then I −A is invertible. (q) If A^3 = O then A + I is invertible.

iv. Show that the following system of linear equations is consistent using Gauss elimination method: *x + y + z = 3, x −2y −3z = 1, 2x + 3y + z = 9*

Q.3 a) Attempt any ONE question from the following: (08)

i. Let V be vector space over $\mathbb{R}$ and $V = \{v_1, v_2, \ldots \ldots v_n\}$ be linear independent set V. For $u \in V$, prove that $S \cup \{u\}$ is linear dependent if and only if $u \in L(S)$ where $L(S)$ is linear span of S.

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ii. Verify all properties of scalar multiplication of the vector space $M_{2\times3}(\mathbb{R}) = \left\{\begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \end{bmatrix} | a_{ij} \in \mathbb{R}\right\}$, where the operation of matrix addition (+) and scalar multiplication (.) are defined as usual.

b) Attempt any TWO questions from the following: (12)

i. Show that in any vector space the subset of a linear independent set is linear independent.

ii. Prove that the set $W = \{A \in M_2(\mathbb{R}) | AB = BA\}$is a subspace of $M_2(\mathbb{R})$, where $B$is a fixed matrix in $M_2(\mathbb{R})$.

iii. Express $\begin{bmatrix} 2 & 3 \\ 1 & 1 \end{bmatrix}$ as a linear combination of $\begin{bmatrix} 1 & 0 \\ 0 & 2 \end{bmatrix}, \begin{bmatrix} 0 & 3 \\ 1 & 0 \end{bmatrix}, \begin{bmatrix} 0 & 0 \\ 4 & 0 \end{bmatrix}, \begin{bmatrix} -1 & 0 \\ 0 & 1 \end{bmatrix}$

iv. Let u, v and w be linear independent vectors in real vector space V, show that $u + v - 2w, u + v - w$ and $u + v$ are linear dependent.

Q.4 a) Attempt any ONE question from the following: (08)

i. Prove that in a vector space of dimension *n* any set containing *n* + 1 vectors is linear dependent.

ii. Define kernel and image of a linear transformation. If $T: V \to V'$ is a linear transformation, prove that Im(T) is a subspace of V'.

b) Attempt any TWO questions from the following: (12)

i. Prove that the vectors (1,1,0), (1,2,3) and (2,-1,5) form a basis for $\mathbb{R}^3$.

ii. Extend $S = \{(1,0,-1)\}$ to a basis of $\mathbb{R}^3$.

iii. Let $T_1, T_2 : V \to W$be two linear transformations, Prove that $T_1 + T_2 : V \to W$ is also a linear transformation.

iv. State Rank-Nullity theorem and verify it for the linear transformation $T: \mathbb{R}^3 \to \mathbb{R}^3$defined as $T(x, y, z) = (x, y, 0)$.

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Q.5 Attempt any FOUR questions from the following: (20)

a) Find parametric representation for the plane passing through point $P = (1,1,1)$, $Q = (2,1,2), R = (2,2,-3)$

b) Reduce the matrix $\begin{bmatrix} 2 & 1 & 1 \\ 3 & 1 & -1 \\ 5 & 2 & 0 \end{bmatrix}$ to it echelon form.

c) Let S = {(1,0), (0,1)} and T = {(1,1), (1,-1)}. Prove that L(S) = L(T).

d) Show that any two bases of a finite dimensional vector space have the same number of vectors.

e) Find a linear map $T: \mathbb{R}^3 \to \mathbb{R}^2$ such that $T(1,0,1) = (2,3)$, $T(0,1,0) = (0,1)$, $T(0,1,1) = (1,0)$.

f) Find the matrix of the linear transformation $T : \mathbb{R}^2 \to \mathbb{R}^3$ defined by $T(x,y) = (x-2y, 3x+4y, x-6y)$ w.r.t bases {(1,0), (0,1)} of $\mathbb{R}^2$ and {(1,0,0), (0,1,0), (0,0,1)} of $\mathbb{R}^3$.

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(3 Hours) [Total Marks : 100]

N.B. **1**. All questions are compulsory.
2. Figures to the right indicate marks for respective parts
3. Use of Calculator is not allowed.

Q.1 Choose correct alternative in each of the following: (20)

i. If series $\sum a_n$ is convergent then $\lim_{n\to\infty} a_n$ is
(a) 1 (b) 0
(c) 2 (d) 3

ii. The function $y = e^x$ is concave upwards
(a) Only at the origin (b) over negative real numbers only
(c) over positive real numbers only (d) everywhere

iii. If $x^2 + 2xy = y^2$ then $\frac{dy}{dx}$ is
(a) $\frac{x+y}{x-y}$ (b) $\frac{x+y}{y-x}$
(c) $2x + 2y$ (d) $\frac{x+1}{y}$

iv. Which of the following series is convergent?
(a) $\sum_{n=1}^{\infty} \frac{1}{n}$ (b) $\sum_{n=1}^{\infty} n$
(c) $\sum_{n=1}^{\infty} \frac{1}{n^2}$ (d) None of these

v. The function $f(x) = |x - 2|, x \in \mathbb{R}$ *is*
(a) differentiable at x = 2 (b) not differentiable at x = 2
(c) differentiable at any $x \in \mathbb{R}$ (d) none of these

vi. The series $\sum_{n=1}^{\infty} r^n$, $r \in \mathbb{R}$ is
(a) convergent for any $r \in \mathbb{R}$ (b) divergent for any $r \in \mathbb{R}$
(c) convergent if $|r| < 1$ (d) None of these

vii. If a function f is continuous on [a, b], differentiable on (a, b) and let f(a) = f(b). Then
(a) there exists unique $c \in (a, b)$ such that $f'(c) = 0$ (b) there exists $c \in (a, b)$ such that $f'(c) = 0$
(c) there exists $c \in$ (a, b) such that $f(c) = 0$ (d) None of these

viii. The function $y = x^2$ is increasing on
(a) $\mathbb{R}$ (b) $(-\infty, 0)$
(c) $(0, \infty)$ (d) None of these

ix. The Maclaurin series for e^x is given by
(a) $\sum_{n=1}^{\infty} \frac{x^n}{n!}$ (b) $\sum_{n=0}^{\infty} \frac{x^n}{n!}$
(c) $\sum_{n=0}^{\infty} \frac{x^{2n+1}}{(2n+1)!}$ (d) None of these

x. A series $\sum_{n=1}^{\infty} a_n$ of positive terms is convergent when
(a) $\lim_{n\to\infty} \frac{a_n}{a_{n+1}} < 1$ (b) $\lim_{n\to\infty} \frac{a_{n+1}}{a_n} > 1$
(c) $\lim_{n\to\infty} \frac{a_n}{a_{n+1}} > 1$ (d) None of these

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Q.2 a) Attempt any ONE question from the following: (08)

i. If $\sum a_n$ *and* $\sum b_n$ are convergent series then prove that the series $\sum(a_n + b_n)$ and $\sum ca_n$, where c is a real constant, are also convergent.

ii. Let $p \in \mathbb{R}$. Prove that the series $\sum_{n=1}^{\infty} \frac{1}{n^p}$ is convergent if p > 1.

b) Attempt any TWO questions from the following: (12)

i. Check whether the following series are convergent. Clearly state the results used.1. $\sum_{n=0}^{\infty} \frac{5^n}{n!}$ 2. $\sum_{n=1}^{\infty} \left(\frac{3n}{1+9n}\right)^n$

ii. State and prove the Cauchy criterion for convergence of a real series.

iii. Is the series $\sum_{n=1}^{\infty} \frac{7}{2n^2+9n+8}$ convergent? Justify your answer.

iv. By using partial fractions, show that $\sum_{n=0}^{\infty} \frac{1}{(n+1)(n+2)} = 1$.

Q.3 a) Attempt any ONE question from the following: (08)

i. If f: $[a, b] \to \mathbb{R}$ is a continuous function then prove that f is bounded on [a,b].

ii. If f , g : (a, b) $\to$ $\mathbb{R}$ are functions which are differentiable at p ϵ (a, b) then prove that f.g is differentiable at p and (f.g)' (p) = f'(p) g(p) + f(p) g'(p).

b) Attempt any TWO questions from the following: (12)

i. Prove that every differentiable function from $\mathbb{R}$ to $\mathbb{R}$ is continuous. Is the converse true? Justify your answer.

ii. Let $f(x) = x^3 - x$, $x \in \mathbb{R}$. Show that $\exists\ c \in \mathbb{R}$ such that f(c) = -1. State the theorem used.

iii. Find dy/dx for $y = x^3y - 2x^2 - y^2$, where y is a function of x.

iv. Using chain rule , find the derivative of the following : I. $\sqrt{e^x}$ II. $\sin^3 x$.

Q.4 a) Attempt any ONE question from the following: (08)

i. Let (a, b) be an open interval in $\mathbb{R}$ and function $f : (a, b) \to \mathbb{R}$ be differentiable on (a, b) except possibly at $c \in (a, b)$. If $f'(x) > 0$ $\forall\ x \in (a, c)$ and $f'(x) < 0\ \forall\ x \in (c, b)$ then prove that $f(x) \leq f(c)$ $\forall\ x \in (a, b)$.

ii. State and prove the Taylor's theorem with Lagrange's form of remainder.

b) Attempt any TWO questions from the following: (12)

i. Show that Rolle's theorem is applicable to function $f: [-1,2] \to \mathbb{R}$ defined by $f(x) = x^3 - 2x^2 - x + 2$. Further find the point of local extremum for f in interval $[-1,2]$.

ii. State the L'Hospital's rule for an indeterminate form. Further find $\lim_{x \to \frac{\pi}{2}} \frac{\tan 3x}{\tan x}$.

iii. Define point of inflection of a function. State derivative test to determine a concave upwards function. Show that $x = 0$ is the point of inflection for function $f(x) = x^3\ \forall\ x \in \mathbb{R}$.

iv. If $f'(x) = 0\ \forall\ x \in \mathbb{R}$ then prove that function f is constant on $\mathbb{R}$. Further find function $g: \mathbb{R} \to \mathbb{R}$ satisfying $g''(x) = 0\ \forall x \in \mathbb{R}$ and $g'(0) = 3$, $g(0) = 5$.

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Q.5 Attempt any FOUR questions from the following: (20)

a) Find $\sum_{n=1}^{\infty} x_n$ and $\sum_{n=1}^{\infty} y_n$ if both these series are convergent and $\sum_{n=1}^{\infty}(3x_n - 11y_n) = 5$ and $\sum_{n=1}^{\infty}(-11x_n + 3y_n) = 4$.

b) Discuss convergence of series $\sum_{n=1}^{\infty} \frac{(-1)^{n+1}}{n}$. Clearly state the results used.

c) State the intermediate value theorem. Hence show that there is $c \in [-1, 1]$ such that $4c^4 + 50c^3 + 2c^2 + c + 1 = 0$.

d) Find $\frac{d^3y}{dx^3}$ for function $y = (3x + 11)^6 \sin(5x + 2)$.

e) Determine intervals where polynomial $x^3 - \frac{9}{2}x^2 - 84x$ is increasing or decreasing.

f) Derive the Maclaurin series for function $cosx$.

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QP Code : 04014

(2½ Hours) **[Total Marks : 75**

N.B. : (1) **All** questions are **compulsory**.
(2) **Figures** to the **right** indicate **full** marks

1. (a) Choose the correct alternative (any **eight**) :- **(08)**
   (i) _____ means the integration of national economy with the world economy.
   (Liberalisation, Privatisation, Globalisation)
   (ii) Maximum number of farmers' suicides have occured in the state of _____.
   (Madhya Pradesh, Andhra Pradesh, Maharashtra)
   (iii) Right to Freedom is enumerated in Article _____ of Indian constitution.
   (17, 18, 19)
   (iv) _____ is the study of all living systems in relation to their envireonment.
   (Ecology, Biology, Physiology)
   (v) Human Rights are _____.
   (absolute, inalienable, revocable)
   (vi) The General Assembly adopted UDHR on 10th December, _____.
   (1945, 1948, 1950)
   (vii) Working with the farmers by corporate firms and sharing the profit is known as _____.
   (Contract farming, Corporate farming, Private farming)
   (viii) Acid Rain is one of the harmful effects of _____pollution.
   (Air, Water, Noise)
   (xi) _____ is a term used to describe positive stress.
   (Eustress, Distress, Hyperstress)
   (x) Hassels of everyday life are _____ stressors.
   (Individual, Organisational, Background)

   (b) State whether the following statements are **True** or **False** (any **seven**) : **(07)**
   (i) Progressive elimination of government control over economic activities is known as liberalisation.
   (ii) Globalisation has resulted in increase of ratio of contractual workers to total workers.
   (iii) Article 22 of Indian constitution abolishes untouchability.
   (iv) Articles 3-16 of UDHR proclaim economic, social and cultural rights.
   (v) Prejudice leads to in formation of stereotypes.
   (vi) Freedom of speech and expression is an absolute right.
   (vii) Primary producers are small living beings such as bacteria, insects and fungi in the ecosystem.
   (viii) Public participation is one of the guiding prinicples of sustainable development.
   (ix) Lack of civic amenities is an individual stressor.
   (x) Choice between two negative altermatives is known as approach-approach conflict.

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2. Explain the benefits and limitations of economic liberalisation in India. **(15)**

OR

2. 'Globalisation and privatisation have provided innumerable employment oppurtanities in India'. Discuss.

3. Define 'Human Rights' and discuss the origin and evolution of human rights from ancient to modern period. **(15)**

OR

3. Discuss the characteristics of Fundamental Rights enshrined in our Constitution and examine the constitutional provisions which guarantee Right to Constitutional Remedies.

4. Examine the various factors responsible for environmental degradation. **(15)**

OR

4. Explain the concept of socialization and examine how the agents of socialization play an important role in the development of individual.

5. Explain the various types of conflict and elaborate the startegies for coping with conflicts. **(15)**

OR

5. Write short notes on (any **three**) :–
   (a) Causes of Migration
   (b) Significance of UDHR
   (c) Components of suitainable development
   (d) Maslow's theory of self-actualization
   (e) Causes of Stress.

(मराठीरूपांतर)

(२$^{१}/_{२}$ तास) **(एकूण गुण : ७५**

सूचना : (१) **सर्व** प्रश्न **अनिवार्य** आहेत.
(२) **उजवी**कडील अंक **पूर्ण** गुण दर्शवतात.
(३) **आवश्यकता** वाटल्यास **इंग्रजी** प्रश्नपत्रिका पहावी.

१. (अ) योग्य पर्याय लिहा (कोणतेही **आठ**) :– **(८)**

(१) जागतिक अर्थव्यवस्थेशी राष्ट्रीय अर्थव्यवस्थेच्या होणाऱ्या एकत्रिकरणाच्या प्रक्रियेला –––––––– म्हणतात.
(उदारीकरण, खाजगीकरण, जागतिकीकरण)

(२) शेतकऱ्यांच्या सर्वात जास्त आत्महत्या –––––– या राज्यात झाल्या आहेत.
(मध्य प्रदेश, आंध्र प्रदेश, महाराष्ट्र)

(३) भारतीय राज्यघटनेत स्वातंत्र्याचा हक्क कलम –––––– मध्ये अनुस्यूत आहे.
(१७, १८, १९)

(४) सर्व जीवांचा त्यांच्या पर्यावरणाशी असलेल्या संबंधाचा अभ्यास म्हणजे ––––––.
(पर्यावरणशास्त्र, जीवशास्त्र, शरीरशास्त्र)

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(५) मानवी हक्क –––––––– आहेत.
(अमर्यादित, अतूट, काढून घेता येण्या जोगे)

(६) आमसभेने मानवी हक्क जाहीरनामा १० डिसेंबर ––––– रोजी संमत केला.
(१९४५, १९४८, १९५०)

(७) शेतकऱ्यांच्या सहकार्याने उद्योगधंद्यांनी केलेली शेती आणि त्यातून मिळालेला नफा वाटून घेण्याच्या पद्धतीला –––––––– म्हणतात.
(कंत्राटी शेती, उद्योगी शेती, खाजगी शेती)

(८) आम्लवर्षा हा ––––– प्रदुषणाचा घातक परिणाम आहे.
(हवा, पाणी, ध्वनी)

(९) सकारात्मक ताणाला ––––––– हे नाव आहे.
(युस्ट्रेस, निराशा, अतीतणाव)

(१०) दैनंदिन जीवनातल्या समस्यांना –––––––– ताणकारक असे म्हणतात.
(वयक्तिक, संघटनात्मक, पार्श्व)

(ब) खालील विधाने **चूक** की **बरोबर** ते लिहा (कोणतेही **सात**) :– **(७)**

(१) आर्थिक व्यवहारांवरचे सरकारी नियंत्रण टप्प्याटप्प्याने कमी होण्याला उदारीकरण म्हणतात.

(२) जागतिकीकरणामूळे कंत्राटी कामगारांच्या प्रमणात (एकूण कामगारवर्गाच्या संदर्भात) वाढ झाली आहे.

(३) राज्यघटनेच्या कलम २२ अनुसार अस्पृश्यतेचे निर्मूलन झाले आहे.

(४) मानवी हक्क जाहीरनाम्याच्या कलम ३ ते १६ मध्ये आर्थिक, सामाजिक आणि सांस्कृतिक हक्क अनुस्यूत आहेत.

(५) पूर्वग्रहांचे पर्यावसन चाकोरीबद्ध विचारात होते.

(६) अभिव्यक्ती स्वातंत्र्य हा अमर्यादित हक्क आहे.

(७) जिवाणू, कीटक आणि बुरशी हे पर्यावरणातील प्राथमिक उत्पादक आहेत.

(८) लोकसहभाग हे शाश्वत विकासाचे एक महत्त्वाचे तत्त्व आहे.

(९) नागरी सुविधांच्या अभावामुळे वयक्तिक ताण निर्माण होतो.

(१०) दोन नकारात्मक पर्यायांमधील निवड हा दृष्टिकोन–दृष्टिकोन–संघर्ष आहे.

२. भारतात आर्थिक उदारीकरणाचे फायदे आणि मर्यादा स्पष्ट करा. **(१५)**

किंवा

२. 'जागतिकीकरण आणि खाजगीकरणामुळे भारतात रोजगाराच्या भरपूर संधी उपलब्ध झाल्या आहेत.' चर्चा करा.

३. 'मानवी हक्कांची' व्याख्या करून त्यांच्या, प्राचीन ते आधुनिक काळापर्यंतच्या उत्क्रांतीची चर्चा करा. **(१५)**

किंवा

३. भारतीय राज्यघटनेतील मूलभूत हक्कांच्या वैशिष्ट्यांची चर्चा करा आणि घटनात्मक संरक्षणाच्या हक्काचे परीक्षण करा.

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४. पर्यावरण ऱ्हासाला कारणीभूत असलेल्या वेगवेगळ्या कारणांचे परीक्षण करा. **(१५)**

किंवा

४. सामाजिकीकरण ही संकल्पना स्पष्ट करा. व्यक्तीच्या विकासात सामाजिकीकरणाचे घटक काय भूमिका बजावतात ते स्पष्ट करा.

५. संघर्षाचे प्रकार स्पष्ट करा आणि संघर्षांना सामारे जाण्यासाठी करायच्या युक्त्यांची चर्चा करा. **(१५)**

किंवा

५. थोडक्यात टीपा लिहा (कोणत्याही **तीन**) :-

(अ) स्थलांतराची कारणे

(ब) मानवी हक्क जाहीरनाम्याचे महत्त्व

(क) शाश्वत विकासाचे घटक

(ड) मॅस्लॉचा आत्मपूर्वीचा सिद्धांत

(क) ताणाची कारणे.

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[Time: Three Hours] **[Marks: 100]**

Please check whether you have got the right question paper

NB: 1.All questions are compulsory.
2. Answers to the same questions must be written together.
3. Figures to the right indicate full marks.
4. The use of log table/ non programmable calculator is allowed.

Q 1 (A) Select the correct option and complete the following statements**(Any twelve)** **(12)**

i) The H^+ ion concentration in water at 25^0C is _____.
a) 7 b) 10^{-14} c) 10^{-7}

ii) The pH of 0.05M H_2SO_4 is _____.
a) 1 b) 2 c) 4

iii) The pH of Sea water is _____.
a) 7.5 b) 8.5 c) 8.0

iv) Amorphous solids have solid state properties, but they do not posses_____.
a) specific volume b) orderly arrangement c) density

v) _____is the axial distances and axial angles for rhombohedral system?
a) $a = b = c, \alpha = \beta = \gamma \neq 90°$
b) $a = b \neq c, \alpha = \beta = \gamma = 90°$
c) $a \neq b \neq c, \alpha = \beta = \gamma = 90°$

vi) Electromagnetic waves travel_____.
a) without medium
b) with medium
c) with medium and without medium

vii) If steric number of the central atom is five then the arrangement of electron pairs around the central atom is_____.
a) trigonal planar b) pentagonal bipyramidal
c) trigonal bipyramidal

viii) The electrostatic forces of attraction between oppositively charge ions are called as_____.
a) covalent bonds b) ionic bonds c) metallic bonds

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ix) Covalent bond is formed when two electrons in a molecule is _____.

a) shared equally by both the atoms.
b) not shared equally by both the atoms.
c) are transformed from one atom to another atom.

x) The bond angle in SF_6 is _____.

a) 120^o b) 90^o c) 180^o

xi) Iodine is insoluble in water, the solutions of iodine is prepared by using _____

a) KI b) NH_4I c) NaCl

xii) Strong oxidizing agent in the electrochemical series is _____.

a) Li b) F_2 c) H_2

xiii) Thiophene is _____.

a) antiaromatic b) aromatic c) non-aromatic

xiv) In nitration of benzene nitric acid is used along with _____.

a) hydrochloric acid b) sulphuric acid c) phosphoric acid

xv) _____is a meta directing group.

a) –OH b) $–NH_2$ c) $–NO_2$

xvi) Transannular strain is in _____conformation of cyclohexane.

a) chair form b) boat form c) half chair form

xvii) Aromatic compound is _____ than anti aromatic compound.

a) less stable b) more stable c) equally stable

xviii) Planar cyclo-octatetraene is_____.

a) aromatic b) antiaromatic c) non aromatic

(B) State whether the following statements are True or False **(3)**
(Any Three)

i) Ionic equilibria is established in aqueous solutions of all electrolytes.

ii) All electromagnetic waves travel through a vacuum at the same speed.

iii) Polarizability of LiCl is more than NaCl.

iv) The number of lone pairs in HF molecule is one.

v) Resonance energy of benzene is 36 kcal / mol.

vi) According to Huckels rule monocyclic ring which have eight pi electrons show aromaticity.

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(C) Match the following columns**(Any Five)** **(5)**

Column A		Column B	
(i)	The pH of Human blood	(a)	Edge
(ii)	Intersection of two adjacent faces in a crystal	(b)	Oxidation
(iii)	Decrease of oxidation number	(c)	Staggered form
(iv)	Iodimetry	(d)	Less stable
(v)	Chair conformation	(e)	Interfacial angle
(vi)	Antiaromatic compound	(f)	Free iodine solution
		(g)	7.3
		(h)	Reduction

Q. 2 Attempt any Four of the following

(A) Explain the use of Hendersons equation for the measurement of pH of an acidic buffer solution. **(5)**

(B) Calculate the pH of 0.1M solution of ammonia. **(5)**
[Given, $K_b = 1.77 \times 10^{-5}$].

(C) What is degree of ionization? Discuss the factors that affect the degree of ionization. **(5)**

(D) Determine the wavelength and energy of the microwave radiation emitted **(5)**
a) by a microwave oven of frequency 2.45×10^9 Hz and
b) by a cordless phone of frequency 5.8×10^9 Hz.
[Given: $c = 3 \times 10^8$ m/s: $h = 6.626 \times 10^{-34}$ Js].

(E) Explain the different types of interaction between radiation and matter. **(5)**

(F) Define Unit cell. State the three laws of crystallography. **(5)**

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Q. 3 **Attempt any Four of the following**

(A) What is isoelectronic principle ? Explain it with suitable examples. **(5)**

(B) Explain the effect of lone pair of electron in the geometry of molecule by giving suitable example. **(5)**

(C) What is steric number ? Calculate the steric number of the following molecules: **(5)**

a) CO_2 and b) NH_3

(D) Draw the Lewis dot structure of the following: **(5)**

a) BCl_3 and b) H_2O

(E) Balance the following reaction with stepwise explanation: **(5)**

$$CrO_4^{2-} + SO_3^{2-} \rightarrow Cr(OH)_4^- + SO_4^{2-}$$

(in Basic medium)

(F) Discuss redox stability is water with example. **(5)**

Q. 4 **Attempt any Four of the following**

(A) Explain sulphonation of benzene with mechanism. **(5)**

(B) What are the criteria which must be satisfied for the compound to be aromatic? **(5)**

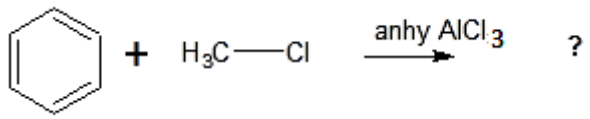
(C) Draw the conformations of cyclohexane. Give the relative stabilities of these conformations ? **(5)**

(D) Which of the following are aromatic, antiaromatic or non aromatic. Justify: **(5)**

a) cyclobutadiene b) pyrrole c) pyridine

(E) Explain why cyclopropane is less stable than cyclopentane. **(5)**

(F) Complete the following reaction? Give its name and mechanism. **(5)**



Q 5 **Attempt any Four of the following**

(A) Calculate the pH of a solution which contains 0.2 mol sodium acetate and 0.1 mol acetic acid per dm^3. [Given : K_a for the acid is 1.8×10^{-5}]. **(5)**

(B) Define axis of symmetry. Draw the different axis of symmetry of a cubic crystal. **(5)**

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(C)	i)	Find out the oxidation number of Cr in $K_2Cr_2O_7$ and K_2CrO_4 .	**(2)**
	ii)	What are disproportionation reactions? Explain the disproportionation reaction of Cu^+ to Cu^{2+} and Cu^0.	**(3)**
(D)		Explain the titration curve of reaction between Fe(II) and Ce(IV) solution.	**(5)**
(E)	i)	What is flipping of cyclohexane?	**(3)**
	ii)	Explain steric strain.	**(2)**
(F)		State Hammond's Postulate. How does it help to identify the structure of transition states?	**(5)**

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[Time: Three Hours] **[Marks: 100]**

Please check whether you have got the right question paper

NB: 1.All questions are compulsory.
2. Answers to the same questions must be written together.
3. Figures to the right indicate full marks.
4. The use of log table/ non programmable calculator is allowed.

Q.1 (A) Select the correct option and complete the following statements**(Any twelve)** **(12)**

i) The pH of Milk is _____.
a) 5.6 b) 6.5 c) 7.5

ii) _____ is an example of basic buffer.
a) $NH_4OH + NH_4Cl$ b) $CH_3COOH + CH_3COONa$
c) $NH_4OH + NaCl$

iii) The pH of 0.001 M HCl is _____.
a) 0.001 b) 3 c) 0.1

iv) _____ among these has the shortest wavelength.
a) Radio waves b) Infrared waves c) Ultraviolet waves

v) Repeatable entity of a crystal structure is known as_____.
a) crystal b) lattice c) unit cell

vi) Amorphous solids are _____.
a) super cooled liquids
b) substances with definite melting points
c) possess anisotropy

vii) The number of bond pairs in silicon tetrachloride molecule is_____.
a) 4 b) 0 c) 2

viii) Number of electrons in valence shell of carbon in methane is_____.
a) 4 b) 8 c) 6

ix) The Steric number for CO_2 molecule is_____.
a) 4 b) 2 c) 8

x) The bond angle in $HgCl_2$ is _____.
a) 120^o b) 90^o c) 180^o

xi) A graphical plot of potential vs pH of an electrochemical system is _____.
a) Frost b) Latimer c) Pourbaix

xii) Indicator used in the titration involving the use of Iodine solution is_____.
a) $KMnO_4$ b) starch c) methyl orange

xiii) The bond angle in planar cyclohexane is _____.
a) 60^0 b) 120^o c) 109^o

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xiv) _____ is used as a catalyst in halogenation of benzene.
a) $FeCl_3$ b) $FeCl_2$ c) $LiAlH_4$

xv) Cl has _____ inductive effect.
a) electron attracting b) electron repelling c) none

xvi) Anthracene has _____pi electrons
a) 6 b) 10 c)14

xvii) Phenanthrene is_____.
a) aromatic b) antiaromatic c) non aromatic

xviii) Electron withdrawing groups have _____effect on aromatic ring in electrophilic substitution.
a) activating b) deactivating c) none

(B) State whether the following statements are True or False **(3)**
(Any Three)

i) In an infinitely dilute solution, a weak electrolyte is completely dissociated.
ii) The energy of visible light is lesser than the infrared rays.
iii) ClF_3 is T-shaped molecule.
iv) The number of lone pairs in $BeCl_2$ molecule is one.
v) Cyclopentadiene is Antiaromatic.
vi) The energy of transition state is higher than that of intermediate.

(C) Match the following columns**(Any Five)** **(5)**

Column A		**Column B**	
(i)	pH of gastric juice	(a)	32
(ii)	Elements of symmetry of cubic crystal	(b)	reduction
(iii)	Decrease in oxidation number	(c)	m-directing group
(iv)	self indicator	(d)	2.0
(v)	$–NO_2$	(e)	axial bonds become equatorial
(vi)	Flipping of cyclohexane	(f)	23
		(g)	$KMnO_4$
		(h)	phenolphthalein

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Q.2 Attempt any Four of the following

(A) Explain the use of Henderson equation for the measurement of pH of a basic buffer solution? **(5)**

(B) A buffer solution of pH 4.5 is to be prepared by using acetic acid and sodium acetate. Calculate the ratio of [salt] : [acid] that must be used.[Given: Ka = 1.8×10^{-5}] **(5)**

(C) Define the term Degree of ionization.What are the factors which affect the degree of ionization? **(5)**

(D) The lowest frequency of electromagnetic radiation used for communication purposes is at 76 Hz. Calculate the **(5)**

a) wavelength
b) frequency in m^{-1} and
c) energy of the electromagnetic radiation.

[Given: c=3×10^{8} m/s: h =6.626×10^{-34}Js]

(E) Define crystallography and interfacial angle. Explain the law of constancy of interfacial angles. **(5)**

(F) What are the seven crystal systems? Give the unit parameters (length and angels) of any three-crystal system. **(5)**

Q.3 Attempt any Four of the following

(A) Define the following terms:- **(5)**

a) polarizability b) ionic bond
c) metallic bond d) covalent bond

(B) Draw Lewis dot structures for the following molecule/ions. **(5)**

a) BF_3 b) NH_4^+

(C) Explain isoelectronic principle.Give any two of its applications. **(5)**

(D) Give a brief account of Sidwick-Powell theory.On the basis of this theory predict the shape of the following molecules. **(5)**

a) BeH_2 b) BCl_3

(E) Balance the following redox reaction with stepwise explanation: **(5)**

$$Fe^{2+} + MnO_4^- + H^+ \rightarrow Mn^{2+} + Fe^{3+} + H_2O$$

(in acidic medium)

(F) i) Calculate the E system for titration of $10.0cm^3$ of 0.1M Fe^{2+} with a standard solution of Ce^{4+} in presence of 0.1 M Sulphuric acid, on addition of **(5)**

a) $5.0cm^3$ and b) 11.0 cm^3 of 0.1M Ce^{4+} solution at 298 K

$E^0_{(Pt/\ Fe^{3+},\ Fe^{2+})}$=0.771V, $E^0_{(Pt/\ Ce^{4+},\ Ce^{3+})}$ = 1.44V

Q.4 (A) i) Explain Nitration of Benzene with mechanism ? **(3)**

ii) Explain Baeyer's strain theory ? **(2)**

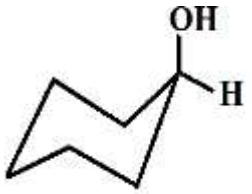
(B) Explain Huckel's Rule of aromaticity? Discuss aromaticity of **(5)**

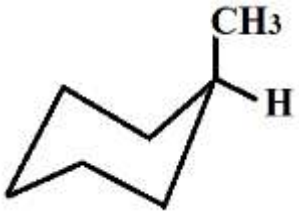
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napthalene and anthracene.

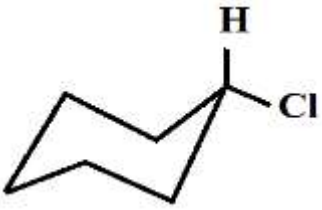
(C) i) Which of the following has substituent on axial bonds? **(3)**

a) b)





c)



ii) Explain antiaromaticity with suitable examples? **(2)**

(D) State Hammond's Postulate. Explain how it is possible to identify the structure of Transition States. **(5)**

(E) Explain Steric strain and Pitzer strain ? **(5)**

(F) What are activated aromatic rings and deactivated aromatic rings? **(5)**

Q.5 Attempt any Four of the following

(A) Derive the expression for ionic product of water. **(5)**

(B) Define wavelength and frequency. Give three characteristics of electromagnetic radiation. **(5)**

(C) i) Find out the oxidation number of S in $Na_2S_2O_3$ and H_2SO_4. **(2)**

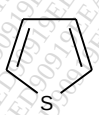
ii) What are disproportionation reactions? Explain the disproportionation reaction of Cu^+ to Cu^{2+} and Cu^0. **(3)**

(D) Explain Frost diagram for manganese ion in various oxidation states. **(5)**

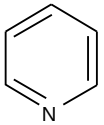
(E) Draw the chair conformation and boat conformation of cyclohexane. Explain the structures of chair conformations and boat conformation? **(5)**

(F) Which of the following are aromatic, antiaromatic or non aromatic. Justify **(5)**

a) **b)** **c)**







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(Time: Three Hours) **(Marks: 100)**

Please check whether you have got the right question paper.

N.B: 1. All questions are compulsory.
2. Answers to the same questions must be written together.
3. Figures to the right indicate full marks.
4. The use of log table/non-programmable calculators is allowed.

Q.1 A. Select the correct option and complete the following sentences (**any twelve**): **12**

i) The van-der Waal's constant 'a' is expressed in the unit---------.
a) $atm.lit^{-2}.mol^{-2}$ b) $atm.lit.mol^{-1}$ c) $atm.lit^{-1}.mol^{-1}$

ii) The velocity for which the fraction of molecule is maximum is called -------.
a) maximum velocity b) most probable velocity
c) minimum velocity

iii) Entropy of the medium -------- when salt is dissolved in water.
a) increases b) decreases c) remains constant.

iv) If the pressure and absolute temperature of the 3 litre of a gas are doubled its volume will be --------.
a) 2L b) 3L c) 6L

v) The value of equilibrium constant depends on---------.
a) temperature b) pressure c) concentration of reactants

vi) A gas which follows all assumptions of kinetic theory of gases is called ----- gas.
a) non-ideal b) ideal c) real

vii) Cations have_____ charges.
a) positive b) negative c) neutral

viii) Reddish brown gas_____.
a) chlorine b) bromine c) iodine

ix) The evolution of CO_2 can be detected by _____
a) lime water b) starch water c) plain water

x) HSO_4^- is an example of_____.
a) conjugated acid b) conjugated base c) amphiprotic ion

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xi) Acidic and basic character in non aqueous solvent is not explained by _____
a) Arrhenius concept b) Lowry Bronsted concept
c) Lewis concept

xii) Cu+ is toxic when present in the body at concentration of _____ mg/kg of body weight.
a) 5 b) 10 c) 15

xiii) Bromination of propane gives _____ .
a) 1-bromopropane as major product
b) 2-bromopropane as major product
c) equal quantities of 1-bromopropane and 2-bromopropane as product

xiv) The product of Wurtz reaction is _____ .
a) higher alkane b) lower alkane c) lower alkene

xv) The products of ozonolysis of 2-butene are _____ .
a) 2 molecules of CH_3CHO
b) 2 molecules of CH_3COCH_3
c) 1molecule of CH_3CHO and 1 molecule of CH_3COCH_3

xvi) Oxymercuration-demercuration is a method for _____ of an alkene.
a) hydrogenation b) hydration c) hydroxylation

xvii) The ease of dehydration of alcohols is _____ .
a) $3^\circ > 2^\circ > 1^\circ$ b) $2^\circ > 3^\circ > 1^\circ$ c) $1^\circ > 2^\circ > 3^\circ$

xviii) Hydroxylation of alkenes using OsO_4 is a _____ addition.
a) anti b) trans c) syn

B. State whether the following statements are true or false (**any three**). **3**

i) At equilibrium free energy does not changes.
ii) The free path is the distance travelled by the molecule before collision.
iii) According to Pearson, Class 'a' metal ions are hard acids.
iv) Sulphur dioxide is basic in nature.
v) Addition of HBr to propene in absence of peroxides follows Anti-Markownikoff rule.
vi) Relative reactivities of halogens is $I_2 > Br_2 > Cl_2$.

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C. Match the following columns (**any five**): **5**

i) Avogadro law	a) carbocation
ii) Gibbs free energy	b) hard acid
iii) $Co(SCN)_4^{-2}$	c) carbanion
iv) I^-	d) $V \alpha n$
v) E_1 mechanism	e) blue complex
vi) E_1cB mechanism	f) state function
	g) carbon free radical
	h) soft base

Q. 2 Answer **any four** of the following:

A. Define Joule-Thompson effect. Show that Joule Thompson effect is isoenthalpic. **5**

B. Explain the deviation of gases from ideal behaviour using van-der Waal's equation. **5**

C. The free energy change for a reaction at 300 K is -67KJ, the enthalpy change is -42KJ. Calculate the entropy change of the reaction. What will be ΔG of the reaction at 350K? **5**

D. What is meant by equilibrium constant? Derive the relation between K_p and K_c. **5**

E. Derive Van-der Waal's equation. **5**

F. For a reaction $CO_{(g)} + 2H_{2(g)} \longleftrightarrow CH_3OH_{(g)}$, calculate the value of K_c and K_p at 327 ^oC. The equilibrium concentration of H_2, $CO_{(g)}$, and $CH_3OH_{(g)}$ are 0.06mol.dm^{-3}, 0.02 mol.dm^{-3} and 0.02 mol.dm^{-3} respectively. (Given: R=8.314 J.K^{-1}.mol^{-1}). **5**

Q.3 Answer **any four** of the following:

A. How will you detect the presence of ions in the given sample using reagent paper sulphites, sulphides and Ni^{+2}. **5**

B. Explain the term precipitation equilibria in qualitative analysis. **5**

C. What is ionic strength? Discuss it's relation with activity of ions. **5**

D. Explain classification of substances of acids and bases of solvent system. **5**

E. What are the different types of Lewis acids and bases? Give examples. **5**

F. What are the limitations of Bronsted-Lowry concept? **5**

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Q. 4 Answer **any four** of the following:

A. What is a β-elimination? Explain E_2 mechanism with a suitable example. **5**

B. i) How would you prepare methyl iodide from methane? Why is the yield of the reaction low and how can it be increased? **3**

ii) Explain the reactivity-selectivity principle as applied to halogenation of alkanes. **2**

C. Write a reaction to show the action of 20% H_2SO_4 on 2-methyl-2-butanol. Predict the major and minor products. Give reasons for your answer. **5**

D. Give stepwise reactions for the hydroboration-oxidation of ethane. Name the rule according to which addition takes place. **5**

E. Explain why :- **5**

i. Terminal alkynes are weakly acidic in nature.

ii. Tertiary alkyl halides prefer to undergo E_1 mechanism as compared to primary alkyl halides.

F. Write short notes on the following: **5**

i. Diels Alder reaction

ii. Peroxide effect

Q.5 Answer **any four** of the following:

A. State Le-Chatelier principle. How does it explain the effect of change of variables on the equilibrium? **5**

B. 11.0 g of CO_2 occupied 1.5dm^3 at 298K. Calculate the pressure exerted by the gas using ideal gas equation and Van-der Waal's equation. **5**

Given: R=8.314 Nm K^{-1} mol^{-1}, a = 0.3640 Nm^4 mol^{-2}, b = 4.267 x10^{-5} m^3 mol^{-1}, molar mass of CO_2 = 44.

C. What are dry and wet test? Explain. **5**

D. Calculate the pH of solution when 10 cm^3 of 0.1M NaOH added to 0.1M HCl, using following stages of titration. **5**

a) 5.0 cm^3 of NaOH added

b) 9.9 cm^3 of NaOH added

E. What is a conjugated diene? Explain 1,2- and 1,4- addition reactions to conjugated dienes with a suitable example. **5**

F. Explain the mechanism of oxymercuration-demercuration reaction. **5**

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(Time: 3 Hours) (Marks: 100)

Please check whether you have got the right question paper.

1) All the Questions are compulsory.
2) Figures to the right indicate full marks.
3) The use of log table /programmable calculator is allowed.
4) Answers for the same question should be written together.

Q.1A) Select the correct option and complete the following sentences **12**
(**Attempt any twelve)**

i) Molar volume of NH_3 gas at NTP is _____.
a) $22.083dm^3$ b) $22.084dm^3$ c) $22.4dm^3$

ii) The second law thermodynamics introduces concept of_____.
a) free energy b) enthalpy c) entropy

iii) The compressibility factor is expressed by equation _____.
a) PV = ZnRT b) PV = RT c) Z =PV

iv) The mass of 22400 cm^3 of CO_2 (C =12,O=16)gas at NTP will be _____.
a) 4.4g b) 8.5g c) 44g

v) For the reaction C_2H_4 (g) + H_2(g) $\rightleftharpoons$ C_2H_6(g) _____.
a) Kp = Kc b) Kp = Kc /RT c) Kp = Kc RT

vi) When salt dissolves in water, entropy _____.
a) decreases b) increases c) remains constant

vii) Carbon dioxide, and sulphur dioxide are_____ gases.
a) acidic b) basic c) neutral

viii) The colour of the bromine gas is _____.
a) reddish brown b) yellow c) black

ix) Ions with negative charges are called _____.
a) anion b) cation c) mixture

x) According to Lowry- Bronsted concept base is _____.
a) protophilic b) protogenic c) both a & b

xi) _____ is the Bronstead base
a) S^{2-} b) Cl^- c) Al^{3+}

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xii) _____ is the hard acid
a) Co^{3+} b) NO_2^- c) SCN^-

xiii) Bromination of propane gives _____as a major product.
a) n-propyl bromide b) iso-propyl bromide c) 1,2-dibromopropane

xiv) Reaction intermediate in E_1 reaction is _____.
a) carbocation b) carbanion c) carbon free radical

xv) More polar solvents favours _____reaction.
a) E_1 b) E_2 c) E_{1cB}

xvi) Diels-Alder reaction is an example of _____reaction
a) addition b) cyclo-addition c) substitution

xvii) sp hybridized carbon is more _____than sp^2 or sp^3 hybridized carbon atom.
a) acidic b) basic c) neutral

xviii) Catalytic hydrogenation of alkenes is _____addition.
a) cis b) trans c) anti

B) State whether the following sentences are **true** or **false**. **(Attempt any three)** **3**

i) Reaction between NaOH and HCl is reversible.
ii) Entropy is an extensive property.
iii) Ammonium chloride and ammonium hydroxide have uncommon ions.
iv) To maintain constant pH a buffer mixture is used.
v) Hydroxylation of alkene by OsO_4 is stereospecific reaction.
vi) Alkenes undergo addition reactions.

C) Match the following **(attempt any five)**. **5**

i) Boyles law	a) Second order reaction
ii) n is zero	b) Toxic
iii) Fe^{+3}	c) KOH
iv) As	d) $V \alpha 1/P$
v) Alkene hydroxylation	e) $k_4 Fe(CN)_6$
vi) E_1 reaction	f) Kp = Kc
	g) $KMnO_4$
	h) First order reaction

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Q.2 Attempt **any four** of the following.

A) State and explain Joule Thomson's effect. **5**

B) Derive van der Waals equation for pressure correction. **5**

C) Calculate the pressure exerted by 1mol of NH_3 in $30dm^3$ at 300K using a)ideal gas equation b) van der Waals equation. The value of van der Waals constant 'a' and 'b' for NH_3 are $a=0.5563Nm^4mol^{-2}$ and $b=6.38x10^5\ m^3\ mol^{-1}$ ($R=8.314JK^{-1}mol^{-1}$ **5**

D) What are Kp and Kc ? Obtain relationship between them. **5**

E) State the Le-Chateliers principle and discuss its application. **5**

F) Explain entropy of a system. For the reaction $N_2(g) + 3H_2(g) === 2NH_3(g)$ standard free energy at 298K is -103.25 KJ. Calculate equilibrium constant for the reaction at same temperature ($R=8.314JK^{-1}mol^{-1}$). **5**

Q.3 Attempt **any four** of the following.

A) Write short note on use of complexes forming ability in qualitative analysis with any one example. **5**

B) What do you mean by qualitative analysis? What are the types of it on the basis of weight of sample? **5**

C) How will you prepare starch iodide paper and lead acetate reagent papers? **5**

D) Explain Arrhenius concept of acids and bases. **5**

E) What is Pearson's concept of hard soft acids and bases? **5**

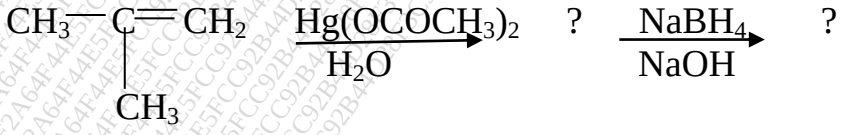
F) Give any three advantages and limitations of Lewis concept of acids and bases. **5**

Q.4 Attempt **any four** of the following.

A) i) Explain Wurtz-Fittig reaction with examples. **3**

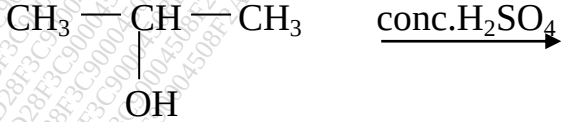
ii) Explain : Iodination of alkanes is difficult. **2**

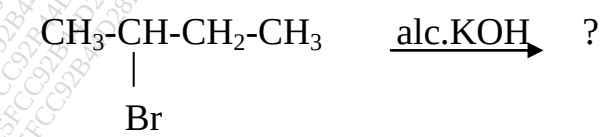
B) Complete the following reaction and give its mechanism **5**



C) i) State and explain Hofmann elimination with suitable example. **3**

ii) Complete the following reactions **2**





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D) i) How does acetylene converted into following compounds? **3**
a) Acetaldehyde b) Vinyl chloride
ii) Give ozonolysis products of 2-methyl propene. **2**

E) Explain the mechanism of hydroboration-oxidation of alkene with suitable example. **5**

F) Explain the mechanism of E_2- elimination reaction with energy profile diagram. **5**

Q.5 Attempt **any four** of the following.

A) State and explain the law of mass action. What is the significance of equilibrium constant? **5**

B) Explain the assumptions of kinetic theory of gases **5**

C) Calculate the solubility in pure water of silver chloride whose solubility product is 1.1×10^{-10} at 298 K. **5**

D) What are the different types of titrations on the basis of reaction involved? **5**

E) How are metal acetylides prepared? How is sodium acetylide converted to propyne and 1- butyne ? **5**

F) Explain the mechanism of 1,2 and 1,4- addition of Br_2 to 1,3-butadiene. **5**

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Q. P. Code: 52073

[Time: Three Hours] **[Marks. 100]**

Please check whether you have got the right question paper.

N.B: i) All questions are compulsory
ii) Figures to the right indicate full marks
iii) Draw neat and labeled diagrams whenever necessary

Q.1 A. Choose the **correct option** from the following: **10**

a) Cells surrounding the guard cell are called_____ cells.
i) accessory ii) subsidiary iii) motor iii) bulliform

b) _____ is a complex permanent tissue.
i) Parenchyma ii) Xylem iii) Collenchyma iv) Sclerenchyma

c) Cotton fibre is the part of_____ tissue system.
i) Epidermal ii) Vascular iii) Ground iv) Meristematic

d) _____ are unicellular structures present on epidermis.
i) Glandular hairs ii) Scales iii) Ramentum iv) Dendroid hairs

e) _____ is the essential pigment for photosynthesis.
i) Anthocyanin ii) Carotene iii) Chlorophyll iv) Xanthophyll

f) During photosynthesis the final product of Calvin cycle is_____ .
i) Pyruvate ii) PGA iii) RuBP iv) Glyceraldehyde

g) Plants during non-cyclic Photophosphorylation produce _____.
i) ATP ii) NADPH iii) NADPH and ATP iv) NADH and ATP

h) _____ part of *Zingiber officinale* is of medicinal importance.
i) Roots ii) Dried rhizome iii) Leaves iv) Entire plant

i) _____ are the constituents of the basic molecular structure of the cell.
i) Primary metabolites ii) Secondary metabolites
iii) Alkaloids iv) Lectins

j) Turmeric powder is prepared from_____ of *Curcuma longa.*
i) Root ii) Leaf iii) Rhizome iv) Bark

Q 1. B. Answer the following in **one sentence**: **10**

a) Write any two functions of parenchyma tissue.
b) Write any two active constituents of *Aloe*.
c) Name any two energy rich metabolites
d) How many NADPH &ATP molecules are required to fix one CO_2 molecule in Calvin cycle?
e) State the functions of medullary rays.

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Q.2 Answer **any two** from the following: **20**

a) Describe T.S. of young Dicot stem.
b) Explain the anatomy of monocot root.
c) Explain the structure and functions of simple permanent tissues.
d) Describe various epidermal appendages.

Q.3 Answer **any two** from the following: **20**

a) Explain Calvin pathway in C_3 plants.
b) Describe the process of fixation of carbon dioxide in C_4 plants.
c) Describe the role of plant pigments involved in photosynthesis.
d) Describe the process of Non-cyclic photophosphorylation.

Q.4 Answer **any two** from the following: **20**

a) What are secondary metabolites? Give types and functions of secondary metabolites?
b) What is medicinal botany? Add a note on active constituents & uses of Turmeric and Ginger.
c) Give an account of botanical name, family, active constituents and uses of Sandalwood and Tulsi.
d) What are the components of grandma's pouch? State the botanical name, family, source, active constituents and medicinal uses of Adulsa.

Q.5 Write short notes on **(any four)**: **20**

a) Structure of Vascular bundles in monocot stem
b) Phloem tissue
c) Schematic representation of CAM pathway
d) Active constituents of *Aloe*
e) Primary metabolites
f) Nature & role of light in photosynthesis

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Q.P. Code :32379

[Time: Three Hours] **[Marks:100]**

Please check whether you have got the right question paper.

N.B: 1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Draw neat and labelled diagrams wherever necessary.

Q.1 A) Choose the **correct option** from the following: 10

a. Ramentum of *Nephrolepis* is _____.
i) Unicellular ii) Multicellular iii) Bicellular iv) Tricellular

b. In *Nephrolepis*, the vascular bundle with xylem in the centre, surrounded by phloem is called _____.
i) Centripetal ii) Amphicribal iii) Centrifugal iv) Leptocentric

c. *Nephrolepis* is _____ plant.
i) heterosporous ii) homosporous iii) bisporous iv) tetrasporous

d. The stem of female plant of *Cycas* shows _____ growth.
i) Sympodial ii) Monopodial iii) Centripodial iv) Multipodial

e. _____ is absent in xylem of Gymnosperms.
i) Parenchyma ii) Vessels iii) Trachieds iv) Fibres

f. Vascular bundles of *Cycas* rachis are arranged in _____ form.
i) Circular ii) Elongated iii) Elliptical iv) Horse – shoe

g. Multicostate convergent reticulate venation is found in _____
i) Banana ii) Mango iii) *Ficus* *iv) Zizypus*

h. _____stipules are found in *Hibiscus rosa-sinensis*.
i) Adnate ii) Interpetiolar iii) Free lateral iv) Intrapetiolar

i. Monadelphous stamens are found in _____ family.
i) Amaryllidaceae ii) Malvaceae iii) Cruciferae iv) Asteraceae

j. Capitulum inflorescence is found in _____
i) *Hibiscus* ii) *Helianthus annus* iii) *Centella* iv) *Vinca*

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Q.P. Code :32379

Q.1 B) Answer the following in **one sentence**: 10

a) Define chemotaxis.
b) What is Indusium?
c) Mention the functions of scale leaves of *Cycas*.
d) State the method of germination of *Cycas* seed.
e) What are stipules?

Q.2 Answer **any two** from the following: 20

a) Describe external morphology of *Nephrolepis* sporophyte.
b) Explain sexual reproduction of *Nephrolepis*.
c) Describe advanced types of steles giving suitable examples.
d) Describe internal structure of *Nephrolepis* rachis.

Q.3 Answer **any two** from the following: 20

a) Describe T.S. of *Cycas* leaflet. Add a note on its xerophytic adaptations.
b) Give detailed account of megasporophyll of *Cycas*.
c) Describe secondary growth in *Cycas* root.
d) Give an account of economic importance of gymnosperms.

Q.4 Answer **any two** from the following: 20

a) Give classification, distinguishing characters, two plants of economic importance and floral formula of family Amaryllidaceae.
b) Describe various types of cymose inflorescence.
c) Describe different types of leaf venations.
d) Explain various types of leaf modifications.

Q.5 Write short notes on **(any four)**: 20

a) Prothallus of *Nephrolepis.*
b) Sporangium of *Nephrolepis.*
c) Coralloid roots of *Cycas.*
d) Phyllotaxy.
e) Distinguishing characters of Malvaceae.
f) Systematic position of *Cycas* with reasons.

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