2022

PHYSICS

PAPER-I

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

Answers may be given either in ***English*** *or in* ***Bengali*** *but all answers must be in one and same language.*

Group-A

Answer *any three* questions.

1. (a) A particle of mass m at rest at $(a, 0, 0)$ is subjected to a force $\vec{F} = -\left(\frac{\alpha}{x^3}\right)\hat{i}$, α is constant. Find the time taken by the particle to reach the origin ($a > 0$, $\alpha > 0$). 10

(b) A body of mass m falls from rest at a height h under gravity through a dense medium of resistive force $F = -kv^2$, where k is constant and v is the speed. Find the kinetic energy when it will hit the ground. 8

(c) Show that if a particle moves in a central force field then its path must be a plane curve. 6

(d) An object at equator is thrown vertically upward with a speed 651·6 km/h. How far from its initial position it will land? 6

(e) A Lagrangian is given by $L = \frac{1}{2}\alpha q^2 - \frac{1}{2}\beta q^2$. α, β constant. Obtain equation of motion. Find the Hamiltonian of the system. 5+5=10

2. (a) Write down the Lorentz transformation equations for a particle moving with velocity $\vec{v}$ along z direction. 4

(b) An event occurs at x = 100 m, y = 10 m, z = 5 m and $t = 10^{-4}$ s in a frame S. Find the coordinates of the event in a frame S' which is moving with velocity $2{\cdot}7 \times 10^8$ m/s with respect to the S along common XX' axis using (i) Gallian transformation, (ii) Lorentz transformation. 4+6=10

(c) Calculate the percentage contraction of a rod moving with a velocity of 0·8c in a direction inclined at 60° to its own length. 8

(d) A particle is rest at origin. A force F starts acting on it at $t = 0$. Show that the speed of the particle at time t is $v = \frac{F.t.c}{\sqrt{m_0^2c^2 + F^2t^2}}$. 8

(e) Determine the S.I. unit of Einstein coefficient A and B. 2+2=4

(f) Determine the ratio of spontaneous to stimulated emission at $T = 10^3 K$ with angular frequency $\omega = 3 \times 10^{15} s^{-1}$. 6

3. (a) State Coulomb's Law and Gauss Law. Among these which Law is more fundamental and why? 3+3+1+3=10

(b) Find the electric field and charge density in a region where the potential is given by $V = a - b\left(x^2 + y^2\right) - c\, ln\left(\sqrt{x^2 + y^2}\right)$ where a, b, c are constant. 4+6=10

(c) A square loop of side a lies in $z = 0$ plane and carries current I. Determine the magnetic field at the center of the loop. 6

(d) Given a magnetic vector potential $\vec{A} = \frac{1}{2}\vec{a} \times \vec{r}$ where a is a constant vector. Find the Magnetic Induction Vector. 6

(e) Two coils of self induction L_1 and L_2 have mutual inductance M. Show from energy consideration that in general $M^2 \leq L_1 L_2$. 8

4. (a) State the Fermat's Principle. Derive the Snell's law using Fermat's Principle. 3+7=10

(b) Two convex lens each of focal length 10 cm and situated 10 cm apart and have common axis an object 2 cm in height is place on the axis at a distance of 15 cm infront of the first lens. Find the position and size of the final image. 6+4=10

(c) Consider a plane convex lens of a material of refractive index 1·5. The convex surface has a radius of curvature 2·5 cm and is face the incident light, center thickness of the lens is 0·6 cm. Construct the System Matrix. 8

(d) What is achromatic doublet? 4

(e) In Young double slit experiment, let β be the fringe width and I_o be the Intensity at the central bright fringe. Calculate the Intensity at a distance x from the central bright fringe. 8

5. (a) For a thermodynamic system the entropy S is related to the internal energy E and volume V by $S = CE^{0.75}V^{0.25}$, C = constant. Find the Gibbs potential. 8

(b) Show that for van der Waals Gas $C_P - C_V = R\left[1 + \frac{2a}{RTV^3}(V - b)\right]$. 8

(c) Define Magnetic Susceptibility of a materials. 4

(d) Calculate the radius of first zone of a zone plate of focal length 0·2 m for a light of wavelength λ = 5000 Å. 4

(e) Red Cadmium line has wavelength 6058Å and Coherence length L = 20 cm. Calculate the line width and Coherence time. 4+4=8

(f) A 40μF capacitor in series with 2 kohm resistor is connected across a 200 volt D.C. source. Determine (i) initial current, (ii) the time constant, (iii) value of the current when time equal to time constant, (iv) energy stored in the capacitor at time 0·04 s. 2+2+2+2=8

6. (a) Define Young Modulus (Y), Bulk Modulus (K) and Rigidity Modulus (n) and show that $Y = \frac{3nK}{n + 3K}$. 3+3+3+8=17

(b) Show that the work done by stretching of a wire is $\frac{1}{2}$ × Young Modulus × (Strain)^2. 7

(c) Two soap bubbles of radius a, b coalesces to form a single bubble of radius c. If the external pressure is B, show that the surface tension is given by $S = \frac{B\left(c^3 - a^3 - b^3\right)}{4\left(a^2 + b^2 - c^2\right)}$. 10

(d) Define coefficient of viscosity. What is the dimension of it? 4+2=6

Group-B

Answer *any two* questions.

7. (a) State the theorems of Parallel and Perpendicular axis as applied to the moment of Inertia. 3+3=6

(b) Find an expression for a moment of Inertia of a solid sphere about a diameter. 10

(c) Obtain an expression for the gravitational self energy of a homogeneous sphere. 8

(d) State the Kepler law of planetary motion. 4

(e) Find the terminal velocity of a oil drop of density 0·95 g/cm^3 and radius 10^{-4} cm fall through the air of density 0·0013 g/cm^3, viscosity of air is 180×10^{-6} C.G.S. and $g = 980\ S^2$. 6

(f) Derive an expression for the equation of continuity of an Ideal fluid of density ρ. 6

8. (a) If a string is plucked at a distance $\frac{l}{4}$ from one end by the amount 'a' then show that the displacement of the string is given by $Y = \sum_{1}^{\infty} \frac{32a}{3n^2\pi^2} \sin\frac{n\pi}{4} \sin\frac{n\pi x}{l} \cos\frac{n\pi Vt}{l}$. 10

(b) A particle is moving in a straight line with Simple Harmonic motion. Its velocity has the value 5 m/s and 4 m/s when the displacement from the center is 2 m and 3 m respectively. Find the length of the path, frequency of oscillation and phase at a displacement 2 m from the center. 4+4+2=10

(c) Define center of mass of a system of particle. Show that the kinetic energy of a system of particle is equal to the kinetic energy of a single particle of mass M situated at the center of mass together with the kinetic energy of the system of particle with this motion relative to the center of mass. 4+8=12

(d) In Newton ring arrangement of source emitting two wavelength $\lambda_1 = 6 \times 10^{-7}$ m and $\lambda_2 = 5{\cdot}9 \times 10^{-7}$ m. It is found that nth dark ring due to λ_1 coincide with $n + 1$ dark ring of λ_2. Find the diameter of the nth ring if the radius of curvature of the lens is 0·9 m. 8

9. (a) Explain the working principle of He-Neon Laser with energy level diagram. 10

(b) Calculate the thickness of half wave plate for sodium light of wavelength 5893 Å. Given $\mu_0 = 1{\cdot}54$ and ratio of velocity of O-ray and E-ray is 1·007. 6

(c) Calculate the change in entropy when 1 g of ice at –10°C is converted into steam at 100°C. (Specific heat of ice 0·5 cal g^{-1} °C, Latent heat of fusion 80 cal/g, Latent heat of vapour 540 cal/g) 10

(d) What is elastic and inelastic collision? Two particles of mass m_1, m_2 travelling along the same line and collide. Find the velocity after collision for perfectly elastic and inelastic collision. 4+5+5=14

10. (a) What is optical activity? Define specific rotation. 3+3

(b) Describe the state of polarization of light wave represented by $E(z,t)=\hat{i}E_0\sin(kz-wt)-\hat{j}E_0\sin(kz-wt)$. 4

(c) A point charge q of mass m is released from rest at a distance a from an infinite grounded conducting plate. Show that the time taken by the charge to hit the plate is $T=\frac{1}{q}\sqrt{2\pi^3\varepsilon_0 ma^3}$. 10

(d) In one dimentional motion of a mass of 10 gm, is acted upon by a restoring force 10 dyne/cm and a resisting force of 2 dynes–sec/cm.

(i) Find whether the motion is aperiodic or oscillatory.

(ii) Find the value of the resisting force which will make the motion critically damped.

(iii) Find the value of the mass for which the given forces will make the motion critically damped. 4+3+3=10

(e) The vector potential $\vec{A}$ due to a magnetic moment $\vec{m}$ at a point $\vec{r}$ is given by $\vec{A}=\frac{\vec{m}\times\vec{r}}{r^3}$. If $\vec{m}$ is directed along z axis find the x component of magnetic field at the point $\vec{r}$. 10

2022

PHYSICS

PAPER-II

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Group-A

Answer *any six* questions.

1. (a) Describe briefly with a diagram the basic principles of Stern-Gerlach experiment.
   (b) In a many-electron atom, the orbital, spin and total angular momentum are denoted by L, S and J. If L = 2, S = 1 and J = 2, find the angle between L and S, using the vector atom model. 7+3=10

2. (a) Prove that $[L^2, L_x] = 0$ where L is the orbital angular momentum and L_x is the x-component of L.
   (b) Using Pauli spin matrix representation, show that the operator
   $$S_x S_y S_z^2 = \frac{\hbar^5}{2^5}\sigma_y .$$
   (c) Prove that $[\sigma_x, \sigma_y] = 2i\sigma_z$. 4+3+3=10

3. (a) The density of copper is 8·96 gm/cc and atomic weight is 63·5 gm. Calculate its Fermi energy. Derive the necessary formula. (Given $h = 6{\cdot}626 \times 10^{-34}$ J-sec)
   (b) Show that the probability that a state ΔE above the Fermi level E_F is filled is equal to the probability that a state ΔE below the Fermi level E_F is empty. (3+4)+3=10

4. (a) A system consists of N particles distributed among four non-degenerate energy states with energies $\epsilon_1 = 0$, $\epsilon_2 = kT$, $\epsilon_3 = 2kT$, $\epsilon_4 = 3kT$, where k is Boltzmann constant and T is absolute temperature. If the total energy of the system is 849 kT, find N.
   (b) What are accessible microstates?
   (c) State Wien's displacement law. Plot the variation of energy density of radiation vs. wavelength for two different temperatures. 5+2+(1+2)=10

5. (a) How does the band theory of solids help to distinguish between metals, insulators and semiconductors?
   (b) Plot the variation of energy, velocity and effective mass of an electron with wave vector "k" according to band theory.
   (c) In a crystalline solid, the energy band structure ($E - k$ relation) for an electron of mass 'm' is given by
   $$E = \frac{\hbar^2 k(2k-3)}{2m}.$$
   Calculate the effective mass of the electron in the crystal. 4+3+3=10

6. (a) Find an expression of Hall coefficient (R_H) in metals.
   (b) Explain analytically why 5-fold rotation axis does not exist in a crystal lattice.
   (c) What is meant by penetration depth in a semiconductor? 4+3+3=10

7. (a) Why does the Coulomb term in semi-emperical binding energy formula
      (i) appear with a negative sign?
      (ii) is directly proportional to square of the atomic number?
      (iii) inversely proportional to one-third power of mass no. (A)?
   (b) Elucidate on the characteristics of the nuclear force. (2+2+2)+4=10

8. (a) Interpret β-decay of neutron in the quark model.
   (b) Find the energy of the photon emitted in the decay $\Sigma^\circ \rightarrow \wedge^\circ + \gamma$.
   Given, mass of $\Sigma^\circ = 1193$ MeV/c^2 and mass of $\wedge^\circ = 1116$ MeV/c^2.
   (c) Which of the following reactions occur?
      (i) $\wedge^\circ \rightarrow \pi^+ + \pi^-$
      (ii) $\pi^- + p \rightarrow n + \pi^\circ$
      (iii) $\pi^+ + p \rightarrow \pi^+ + p + \pi^- + \pi^\circ$ 5+2+3=10

9. (a) Draw the circuit of a $n-p-n$ transistor acting as an amplifier in CE mode. Describe briefly the working of this amplifier.
   (b) A $n-p-n$ transistor in CE mode is used as a simple voltage amplifier with a collector current of 4 mA. The positive terminal of 8 V battery is connected to the collector through a load resistance R_L and to the base through a resistance R_B. The collector-emitter voltage $V_{CE} = 4$V, the base-emitter voltage $V_{BE} = 0{\cdot}6$ V and the current amplification factor $\beta = 100$. Calculate the values of R_L and R_B. (2+4)+4=10

Group-B

Answer *any seven* questions.

10. (a) Explain what is meant by 'expectation value' of a dynamical variable in quantum mechanics.
   (b) The wavefunction of a quantum particle of mass m is given by
   $$\psi(x) = A\sin\pi x, \qquad 0 < x \leq 2.$$
   Calculate the value of of $\langle p_x \rangle$ where p_x is the x-component of momentum of the particle.
   (c) Explain the reason for the apperance of a second order space derivative but a first order time derivative in the Schrödinger equation.
   (d) Determine the transmission coefficent for a quantum particle of mass m, energy $E < V_0$ for a ractangular one-dimensional potential barrier of height V_0 defined by
   $V(x) = V_0, \quad 0 < x < a$
   $= 0, \quad x < 0$ and $x > a$. 3+4+3+10=20

11. (a) Defining the raising and lowering operators for a linear harmonic oscillator of mass 'm' and angular frequency 'ω', as
   $$\hat{a} = \frac{1}{\sqrt{2m\hbar\omega}}\left(\hat{p} + im\omega\hat{x}\right)$$
   and $$\hat{a}^+ = \frac{1}{\sqrt{2m\hbar\omega}}\left(\hat{p} - im\omega\hat{x}\right)$$
   obtain the ground state energy and the lowest eigenket.

(b) Show that if the above linear harmonic oscillator is in ground state, then the probability of finding the particle outside the classical limits is approximately 16%.

(c) Prove that the eigenvalues of Hermitian operators are real. 10+4+6=20

12. (a) State Heisenberg's uncertainty principle and determine the radius of the ground state of hydrogen atom.

(b) Consider the wavefunction

$$\psi(r) = A\left(\frac{r}{r_0}\right)e^{ikr}$$

where A is the normalization constant. Calculate the probability current density if $r = 2r_0$.

(c) Show that for an operator $\hat{A}$ corresponding to a dynamical variable A,

$$\langle A^n \rangle = \langle A \rangle^n.$$

(d) The atomic number of sodium is 11.

(i) Write down the electronic configuration for the ground state of the sodium atom.

(ii) Give the standard spectroscopic notation for ground state of sodium and calculate the Lande-g factor. (2+3)+5+5+(2+3)=20

13. (a) Write down the assumptions of Maxwell-Boltzmann statistics. Apply M-B statistics to obtain an expression for partition function of an ideal monoatomic gas in equilibrium at temperature T.

(b) Obtain an expression for mean energy and molar specific heat at constant volume for the ideal monoatomic gas.

(c) A gas consisting of molecules having mass 'm' and obeying MB statistics is in thermal equilibrium at temperature T. The velocity components of the molecules along x–, y– and z-directions are v_x, v_y and v_z respectively. Calculate the mean value of $(v_x + v_y)^2$. 8+7+5=20

14. (a) Mention the drawbacks of Einstein's theory of specific heat of solids.

(b) Show, analytically, how Debye could provide an improved model for explaning the variation of specific heat of solids at constant volume (C_v) with temperature (T).

(c) If the Debye temperature of a salt be 250 K, calculate how much heat is necessary to increase the temperature of one kilomole of the salt from 10 K to 50 K. 3+12+5=20

15. (a) What is a Wigner-Seitz cell?

(b) The primitive basis vectors of a lattice are $\vec{a} = p\left(\hat{i} + 2\hat{j}\right)$, $\vec{b} = p4\hat{j}$, $\vec{c} = p\hat{k}$. Find the primitive translation vectors in the reciprocal lattice space.

(c) Show that the atomic packing factor in a fcc lattice is 0·74.

(d) Show that the reciprocal lattice corresponding to a bcc lattice is a fcc lattice.

(e) Mo-Kα radiation of wavelength 0·71073Å is incident on a simple cubic crystal. The first order Bragg reflection from (131) plane occurs at an angle of 30°. Calculate the lattice parameters of the crystal. 3+4+5+4+4=20

16. (a) What is Larmor precession? Find an expression for its frequency. Hence find an expression for diamagnetic susceptibility using classical theory.

(b) How does the existence of magnetic domains explain ferromagnetism?

(c) Obtain the relation showing the temperature dependence of spontaneous magnetization in a ferromagnetic substance.

(d) If Curie constant is 3×10^{-2} cgs unit and the critical temperature is 600 K, find the value of Weiss molecular field constant. (1+3+4)+3+6+3=20

17. (a) (i) Draw a curve showing average binding energy per nucleon (B/A) of different nuclides as a function of a mass no. A.

(ii) How would you accout for the observed peaks in the region of low values of A in the above curve?

(iii) What can you conclude about the nature of nuclear force from the near constancy of the binding energy per nucleon?

(b) Discuss evidences on the basis of which the nuclear shell model was proposed.

(c) In the reaction

$$_5B^{11} + {}_2He^4 \rightarrow {}_7N^{14} + {}_0n^1$$

the masses of $_5B^{11}$, $_7N^{14}$, $_2He^4$ nuclei are 11·012 80, 14·00752 and 4·00387 amu respectively. If the incident alpha particle has a kinetic energy of 5·25 MeV towards $_5B^{11}$, which is at rest and the kinetic energy of the resultant product nuclei $_7N^{14}$ and $_0n^1$ are 3·26MeV and 2·139MeV respectively, find the mass of neutron. (4+2+2)+8+4=20

18. (a) Draw the circuit diagram of an integrator using an OPAMP. Obtain an expression of the output voltage.

(b) Design an OP-AMP circuit which gives an output $v_0 = 2v_1 - 3v_2$ where v_1 and v_2 are the two input voltages to the OP-AMP circuit.

(c) Draw energy band diagram for *p-n* junction diode at equilibrium and show how in the case of *p-n* junction diode at equilibrium the potential energy for holes varies with distance from the junction.

(d) The band-gap of a specimen of GaAs is 1·98 eV. Determine the wavelength of the electromagnetic radiation radiated upon direct recombination of holes and electrons in the sample. [Given $h = 6{\cdot}63 \times 10^{-34}$ Joule-sec] (4+4)+5+4+3=20

19. (a) State and explain Barkhausen criteria for sustained oscillation.

(b) Calculate the voltage gain of the negative feedback amplifier with a feedback factor 0·1, if the normal gain of the amplifier is 100.

(c) Sketch the circuit for a NOR gate using diodes and transistors and explain its workings.

(d) Design a logic circuit to implement the following:

$$Y = AB + ABC + \bar{A}B + A\bar{B}C$$

(e) Prove the following Boolean identities:

(i) $A + (B \,.\, C) = (A + B) \cdot (A + C)$

(ii) $(A + B) \cdot \overline{(A.\bar{B})} = B$ 3+3+5+3+(3+3)=20

2022

PSYCHOLOGY

PAPER-I

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Group-A

Answer *any three* questions.

1. Define Psychology. Discuss the Experimental and Survey Methods as used in the discipline of Psychology. Discuss the application of Psychology in the field of work and education. (2+18+20)=40

2. Discuss the determinants of Attention. Differentiate between Fluctuation of Attention and Selectivity of Attention. How Attention differs from Perception? Discuss the monocular cues of Depth Perception. (10+10+10+10)=40

3. Discuss the Atkinson-Shiffrin's Model of Memory. Differentiate between STM and LTM, Echoic and Iconic Memory. Illustrate on Procedural Memory. (10+20+10)=40

4. Define Intelligence. Discuss Spiritual and Artificial Intelligence. Discuss Gardner's Theory of Intelligence. (2+20+18)=40

5. Distinguish between Intrinsic and Extrinsic Motivation. Which is Psychologically more significant in work life? Justify. Discuss Maslow and Mcclelland's theory of Motivation. (10+10+20)=40

6. Discuss in detail Piaget's theory of Cognitive Development. 40

Group-B

Answer *any two* questions.

7. 'Emotional Intelligence is as important as General Intelligence'– Justify. 40

8. Discuss the Role of Prejudice and Stereotypes in Cross-Cultural Interaction. 40

9. 'Is exploring students' career interests still a necessity?'— What is your opinion? 40

10. 'Human value is a global challenge'— Narrate. 40

2022

PSYCHOLOGY

PAPER-II

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The figures in the margin indicate marks for each question.

Group-A

Answer *any three* questions.

1. Define personality. Discuss in detail Erikson's stages of personality development. 5+35=40

2. (a) Discuss the characteristics of a sound psychological test.

   (b) Discuss the steps of test construction. 20+20=40

3. (a) Write on the DSM 5's classification of Mental Disorders.

   (b) Discuss the different types of Schizophrenia with the symptoms. 20+20=40

4. Discuss in detail client-centered therapy and its applications. 40

5. Discuss the uses of Job Analysis. Discuss the steps of Job Analysis. Write on Interview as a method of Job Analysis. 10+15+15=40

6. Define Leadership. Discuss the characteristics of a good leader. Write on transactional and transformational leadership. 5+10+25=40

7. Discuss the psychological factors behind crime and delinquency. 20+20=40

Group-B

Answer *any two* questions.

8. 'Individual is a product of Nature and Nurture'—Justify. 40

9. Write on the Role of Technology in the Teaching Learning Method. 40

10. Differentiate between Parametric and Non-parametric sampling. Write on the different non-parametric sampling methods. Give examples with suitability for their applications. 10+30=40

2022

PHYSIOLOGY

PAPER-I

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Group-A

Answer *any six* questions.

1. (a) Distinguish between Isotonic and Isoosmotic solution.
   (b) What is buffer? Give example.
   (c) Derive Henderson-Hesselbalch equation of buffer system and explain its significance.
   (d) State the importance of alkali reserve in plasma. 4+(2+2)+(6+2)+4=20

2. (a) What do you mean by osmotic pressure? State its physiological importance.
   (b) What is osmotic work?
   (c) What do you mean by hypotonic, isotonic and hypertonic solution?
   (d) What will happens if red blood cells (RBC) are placed in pure water? (4+4)+2+(2+2+2)+4=20

3. (a) Define glycolysis and why this name is so appropriate?
   (b) Why glycogen but not glucose is the natural storage form?
   (c) Calculate the total energetics of glycolytic pathway of one molecule of glucose.
   (d) Write the significance of Rapoport-Leubering cycle (R-L cycle). (2+2)+4+6+6=20

4. (a) Describe the general amino acid pool.
   (b) What are glycogenic and ketogenic amino acids? Give example each of them.
   (c) State the differences between hexokinase and glucokinase.
   (d) Distinguish between proteoglycan and glycoprotein.
   (e) What is mutarotation? 4+(4+2)+(2+2)+(2+2)+2=20

5. (a) State briefly the role of lipoproteins in lipid transport mechanism.
   (b) What do you mean by 'reverse cholesterol transport'?
   (c) How do phospholipids are different from triglycerides?
   (d) Discuss the triacylglycerol synthesis through glycerophosphate pathway. 6+4+4+6=20

6. (a) Distinguish between transamination and deamination reaction.
   (b) Describe the role of pyridoxal phosphate in transamination reaction.
   (c) What is glycosidic bond? State its significance in the formation of sugar. 6+6+(4+4)=20

7. (a) Explain why disaccharide lactose exhibits reducing property but sucrose does not.
   (b) What are the differences between starch and glycogen?
   (c) Why is glucose also called dextrose?
   (d) What do you mean by epimer and enantiomer?
   (e) "Glucose and galactose are epimers of each other"— explain with reasons.
   (f) What is a 'recemic' mixture? 4+4+2+4+4+2=20

8. (a) How many molecule of ATP are required to activate one molecule of fatty acid?
   (b) Why ATP is called as a high energy compound?
   (c) Name the substrate which produce acetyl CoA.
   (d) Name the ketone bodies produced in the body.
   (e) Describe the formation and fate of ketone bodies in human body. 4+4+2+3+(4+3)=20

9. (a) Distinguish between nucleoside and nucleotide.
   (b) Write the differences between DNA and RNA.
   (c) What do you mean by good and bad cholesterol and why they are called so?
   (d) What do you mean by fatty liver?
   (e) State the physiological importance of cholesterol in the human body. 4+4+(2+4)+2+4=20

10. (a) Why the consumption of raw egg cause biotin deficiency?
    (b) Discuss the function of Vitamin K in blood coagulation.
    (c) Why deficiency of Vitamin C leads to anemia?
    (d) Describe the role of sodium in our body.
    (e) What do you mean by adult consumption unit (ACU)? 4+4+4+4+4=20

Group-B

Answer *any four* questions.

11. (a) What is immunity?
    (b) Describe the typical structure of immunoglobulin.
    (c) Write the difference between acquired immunity and innate immunity.
    (d) What is plasma cell?
    (e) What are the functions of natural killer cells (NK Cells)? 2+6+6+2+4=20

12. (a) What is called Polycythemia?
    (b) What are the cardiovascular complication that can arise due to Polycythemia?
    (c) What is the significance of biconcave structure of erythrocyte?
    (d) What do you mean by haemophielia?
    (e) Write the chemical structure of haemoglobin. 2+6+4+4+4=20

13. (a) Describe the physiological basis of ABO blood group system.
    (b) Why blood do not clot in the vascular system?
    (c) What is erythroblastosis foetalis?
    (d) Discuss the hazard of blood transfusion. 8+2+4+6=20

14. (a) Describe the structure and functions of intercalated disc.
    (b) Discuss the origin and significance of ECG waves.
    (c) Describe the ionic basis of rhythmicity properties of the heart.
    (d) What do you mean by myocardial infarction? 4+6+6+4=20

15. (a) Describe the role of chloride shift in the transport of CO_2 from tissue to lungs.
    (b) What is Bohr effect?
    (c) Define hypoxia. Classify hypoxia.
    (d) What do you mean by physiological dead space? 6+4+(2+4)+4=20

16. (a) State the differences between cortical and juxta medullary nephron.
    (b) Describe the structural peculiarities of the epithelial cells in human renal tubule.
    (c) Describe the forces involve in glomerular ultrafiltration.
    (d) Discuss the non-excretory functions of kidney. 4+5+5+6=20

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PHYSIOLOGY

PAPER-II

Time Allowed — 3 Hours *Full Marks — 200*

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*Answers may be given either in **English** or in **Bengali** but all answers must be in one and the same language.*

Group-A

Answer *any six* questions.

1. (a) Describe the EM structure of skeletal muscle sarcomere with a neat diagram.
   (b) What is the function of dihydropyridine (DHP) and raynodine receptors during EC coupling?
   (c) What is calsequestrin? (6+4)+6+4=20

2. (a) What are the differences between monosynaptic and disynaptic reflex?
   (b) What do you mean by spatial and temporal summation?
   (c) Distinguish between apolar and unipolar neurone.
   (d) What are the Nissl substances? State their functions. 6+6+4+(2+2)=20

3. (a) State the recent advancement in the mechanism of long term memory.
   (b) Describe the origin and outflow of parasympathetic efferent fiber passing through vagus and glossopharyngeal nerve.
   (c) What do you mean by geniculate ganglion? 10+8+2=20

4. (a) Describe the neural pathways carrying unconscious kinesthetic impulses from periphery to brain with neat diagram.
   (b) State briefly the differences between somatic and autonomic reflex arc.
   (c) Describe the thermal changes that takes place in the skeletal muscle during contraction. 8+6+6=20

5. (a) Describe with neat diagram the ultrastructure of neuromuscular junction.
   (b) Describe the role of syntexin and synaptobravin proteins during the neuromuscular transmission.
   (c) What do you mean by neurotransmitter and neuromodulator substances? (6+4)+(3+3)+(2+2)=20

6. (a) List the different layers of human retina.

   (b) When light falls on the retina, on which layer it falls first?

   (c) Describe briefly the process of accommodation of eye.

   (d) What are the differences between fluent and non-fluent aphasia? 5+2+7+(3+3)=20

7. (a) What do you mean by condensation and rarefaction in sound wave?

   (b) Describe how the mechanical sound wave is converted into electrical neural signal with diagramatic explanation of tip link mediated mechanism.

   (c) What is Weber-Flechner law? 4+12+4=20

8. (a) In what respect does a special sensation differ from general sense?

   (b) Describe the process of olfactory transduction.

   (c) What do you mean by odorus binding protein (OBP)?

   (d) What do you know about primary taste modalities? 5+7+4+4=20

9. (a) Describe with suitable diagram the histological structure of skin.

   (b) Discuss the physical process in the regulation of body temperature.

   (c) What do you mean by insensible perspiration?

   (d) What is Sebum? 6+8+4+2=20

10. (a) What is physical fitness?

    (b) Discuss the assesment of physical fitness by modified Harvard step test method.

    (c) What do you mean by warm up and cool down process?

    (d) What do you understand by static work and dynamic work? 4+6+4+6=20

Group-B

Answer *any four* questions.

11. (a) Describe the histology of adenohypophysis.

    (b) What do you understand by hypothalamic neurosecretory substances (HNSS)? State briefly their functions on the anterior pituitary.

    (c) Describe how the posterior pituitary hormone acts on milk ejection in lactating mother.

    (d) What are the functions of oxytocin in male body? 6+(4+4)+4+2=20

12. (a) Mention two important functions of calcium in human body.

    (b) Write the name and origin of hormones which regulate the calcium level in blood. Give a brief account of their role in calcium homeostasis in blood.

    (c) What is the normal blood calcium level in human body?

    (d) What is reverse T_3 (rT_3)? 2+(2+4+8)+2+2=20

13. (a) Discuss the role of insulin in the maintenance of normal blood sugar level.

    (b) What are type-I and type-II diabetes mellitus?

    (c) Describe the role of ADH in osmoregulation. 10+4+6=20

14. (a) What are the active principles of adrenal cortex?

    (b) Discuss the role of glucocorticoids on inflamation and immunological processes.

    (c) How does the thyroid gland accumulate iodide required for thyroid hormone biosynthesis?

    (d) Why the action of growth hormone on growth is inhibited after attainment of a particular age? 4+(3+3)+6+4=20

15. (a) Describe the role of Leydig Cells and Sertoli Cells in spermatogenesis process.

    (b) Describe the physiological changes of ovary and uterus during menstrual cycle.

    (c) Describe with suitable diagram the microscopic structure of spermatozoa. 8+8+4=20

16. (a) Discuss the goiter and anemia control program implemented by Govt. of India.

    (b) What do you mean by 0-db (zero decibel) sound?

    (c) Describe the effect of sound pollution in human body and its preventive measure. (5+5)+2+(4+4)=20

2022

POLITICAL SCIENCE

PAPER-I

Time Allowed — 3 Hours *Full Marks — 200*

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Group-A

Answer question *No. 1* and *any two* from the rest.

1. Discuss Plato's theory of Justice. How is it different from modern notions of justice? 20+20=40

2. What is Power? What are the different kinds and forms of power? Differentiate between the Class Theory of Power and the Elite Theory of Power. 10+10+10=30

3. What is Civil Society? Discuss its features. What are the views of John Louce and Antonio Gramsci on civil society? 10+10+10=30

4. What is Liberty? Distinguish between negative and positive liberty. What is Marx's views on liberty? 10+10+10=30

Group-B

Answer question *No.5* and *any two* from the rest.

5. Analyse the role of the Constituent Assembly and its Vision of the Future India. 40

6. Discuss the role of the Prime Minister of India vis-a-vis 15+15=30
   (a) The President
   (b) The Cabinet

7. Discuss the main features of the 73rd Constitution Amendment Act. What are the issues ahead in its proper implementation/functioning? 15+15=30

8. Discuss the origins of Trade Unions in India. How has it evolved in the post-independence period? 15+15=30

2022

POLITICAL SCIENCE

PAPER-II

Time Allowed — 3 Hours *Full Marks — 200*

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*Answers may be given either in **English** or in **Bengali** or in **Nepali** but all answers must be in one and same language.*

Group-A

Answer Question *No.1* and *any two* from the rest.

1. Answer *any five* from the following: 8×5=40

   (a) What is the SMART Cities Mission?

   (b) Evaluate the Sarva Shiksha Abhiyan Mission.

   (c) Describe the functioning of the NITI Aayog.

   (d) What is the District Good Governance Index?

   (e) Evaluate the functioning of the Jal Jeevan Mission till date.

   (f) What is the PM Garib Kalyan Anna Yojana?

   (g) What is the Ayush Mission?

2. Analyse Man Weber's theory of bureaucracy. 30

3. What is Decision Making? What are its bases? What problems are involved in decision making? Discuss Mary Parker Follett's contribution to decision making. 30

4. What is development administration? How is it related to politics especially in low-income countries? Discuss, in this context, the Riggsian Model. 30

Group-B

Answer Question *No.5* and *any two* from the rest.

5. Answer *any five* from the following: 8×5=40

   (a) Evaluate India's G20 Leadership till date.

   (b) What is the BIMSTEC Summit? Discuss its major aims and objectives.

   (c) What is the Paris Club? How does it function?

(d) Discuss the role of the Shanghai Co-operation Organisation (SCO).

(e) What is the FIPIC Summit?

(f) What is the Indo-Pacific Economic Framework (IPEF)?

(g) Analyse the performance of the 14th BRICS Virtual Summit.

6. Discuss the terms 'Collective Security' and 'Balance of Power' with examples. What are the major similarities and differences between them? 30

7. What is globalization in international relations? What were its phases? Discuss its major dimensions— political, economic, cultural and social. 30

8. Analyse Indo-US relations in the last ten years. 30

2022

MANAGEMENT

PAPER-I

Time Allowed — 3 Hours *Full Marks — 200*

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Group-A

Answer any three *questions.*

1. (a) Discuss Fayol's Emphasis on the Universality of Management Practices.

   (b) Briefly explain Interpersonal behabiour approach and Emperical or Case approach to Management Analysis. 20+(10+10)=40

2. (a) What are the commonly used Decision Making Process? State and illustrate 4-such processes.

   (b) Delphi technique and Brain storming — are important ways of Decision Making— explain with examples. 20+20=40

3. (a) What basic principles are to be considered for 'Process of Delegation'?

   (b) Draw an organisation structure of Decentralised Product based. 20+20=40

4. (a) Briefly discuss 'Conclusion of Hawthorne Investigation on working environments' — from management practices.

   (b) McGregor's theory of 'X' and theory of 'Y'.— Discuss criticism of the theory. 20+20=40

5. (a) What are the quality characteristic of a products? How TQM is implented in an organisation?

   (b) Explain the main pillars of Supply Chain Management. New trends to supply chain after Covid — what are the changes you observed? (10+10)+(10+10)=40

Group-B

Answer *any two* questions.

6. (a) How group behaviour differs from Individual? — Explain how a manager can tackle group to motivate for adopting a change in the organisation.

   (b) What are the qualities you, as a manager, will consider for selecting a group leader? What are the probable effects of wrong selection of a group leader in the organisation? 20+20=40

7. (a) What types of leadership styles might be useful in (i) Public Sector organisation (ii) Private Sector organisation? — Justify answer reference to theories and examples.

   (b) Fiedler's contingency model of leadership — explain by drawing a graph of group performance with leadership (leader member relation). 20+20=40

8. (a) What are the basic steps in Control Process? — Discuss importance and short commings of control.

   (b) What are the essential conditions for applying 'budgetary control'? 20+20=40

9. Explain *any two*: 20+20=40

   (a) Re-engineering Process

   (b) TQM vs. TPM

   (c) Ohio State Model of leadership

   (d) Delegation vs. Decentralisation

2022

MANAGEMENT

PAPER-II

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

Answers may be given either in ***English*** *or in* ***Bengali*** *but all answers must be in one and same language.*

Answer five *questions.*

1. (a) Define Product. What are the levels of product relation to customer value hierarchy? — Explain with example.

   (b) State Product classifications. 10+20+10=40

2. (a) Illustrate set of all products that a particular seller offers for sale to buyers (Product Mix) — Give example of such Product Mix offered by a producer to its customers.

   (b) Briefly discuss on 'Market-Channels'. What are the major channel functions? 20+(10+10)=40

3. (a) What are the steps to follow for Working Capital Management?

   (b) BCG Matrix helps to take business strategies to design Re-engineering.— Explain. 20+20=40

4. (a) What changes are made to implement Human Resource Management for Personal Management Concept?

   (b) How a HR Manager identifies training need of employees?

   (c) Recruitment need is a policy or a requirement for fulfilling need of business. 15+15+10=40

5. (a) Define 'Activity' and 'Event' in relation to network analysis. Explain with diagram.

   (b) Find the project duration time, critical path of a network, drawn from the following data: (Duration in days)

Activity	Duration	Interdepending
A	2	—
B	3	—
C	2	—
D	3	B
E	4	C
F	2	A
G	3	F
H	2	D
I	2	G
J	3	E, H, I

15+25=40

6. (a) In supply chain, distribution cost is prime important factor, the location of plants and warehouses and its capacities are determining distribution costs. Following are plant vs. warehouse distribution unit costs and its capacity are tabulated. Find out least Cost Schedule and minimum Total Cost.

Plant	Warehouse				Capacity
	1	2	3	4	
A	7	2	4	5	100
B	3	1	5	2	75
C	6	9	7	4	80
Capacity:	70	90	45	50	255 / 255

(b) Briefly state how objective functions are derived with help of Linear Programme (LP) when capacity of each machine centre, unit time to produce on each centre and profit per unit of two products are given. What product mix (no. of units of each product) to be produced with objective to achieve maximum profit? (You can assume all datas) 30+10=40

7. (a) Discuss 'ADKAR' model of 'Change', in perspective of organisational change.

(b) How a manufacturing company responds to its quality complain with the help of 'Service Quality Model'? 20+20=40

8. Write short notes on *any four*: 10×4=40

(a) SWOT Analysis

(b) 7P's of Marketing

(c) ERP

(d) MRP II

(e) Bull Whip Effect

(f) Meta Market

2022

MEDICAL SCIENCE

PAPER-I

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

*Answers may be given either in **English** or in **Bengali** but all answers must be in one and same language.*

1. Answer *any four* of the following: 10×4=40

   (a) Enumerate the small muscles of hand and mention their functions.

   (b) Describe the anatomy of conducting system of heart and briefly mention the function of SA Node.

   (c) What are the pathophysiologic mechanisms of Bronchial Asthma?

   (d) How oxygen is carried by Hemoglobin from lungs to peripheral tissues?

   (e) Microbiological diagnosis of Dengue infection.

   (f) Causative organism of COVID Pandemic. What was the main clinical problem in COVID 19?

2. Answer *any four* of the following: 10×4=40

   (a) Common causes of Hypokalemia.

   (b) Describe a neuromuscular junction and name diseases resulting from neuromuscular junction dysfunction.

   (c) Draw and describe the visual pathway.

   (d) What are the important features of hanging?

   (e) Enumerate X-linked diseases and describe one of them.

   (f) Define Jaundice. What are the types of jaundice?

3. Answer *any four* of the following: 10×4=40

   (a) Enumerate Ketone Bodies. How it is produced within human body?

   (b) Common causes of Hemorrhagic cerebrovascular Accident. What is subdural hematoma?

   (c) What are the parts of a Nephron? How to prevent Glomerular injury?

   (d) What is autoimmunity? Enumerate autoimmune disorders.

   (e) What is Anemia? Common types of Anemia and their causes.

   (f) What are the impacts of environmental pollution?

4. Answer *any four* of the following: 10×4=40

   (a) What is Brain Death? What are precautions before organ harvesting before organ transplantation.

   (b) What are the common features of Paraquet Poisoning?

   (c) Describe the impact of obesity and over weight on human body.

   (d) What are the diseases diagnosed by simple Routine Urine and Blood Examination (Peripheral Smear)?

   (e) What are the types of steroid used for treatment purpose? What are different routes of administration?

   (f) What are the significance of sleep and wakefulness in human health?

5. Answer *any four* of the following: 10×4=40

   (a) What is hypertension? Name few anti-hypertensive drugs and their side effects.

   (b) Common causes of Acid Peptic Disorder. What are the side effects of prolonge 'Prazole' use?

   (c) Define Rape. What are the medicolegal examination necessary for the lady?

   (d) Name the organism causing Tuberculosis. What is XDR Tuberculosis?

   (e) What are the functions of Neutrophil in blood? Common causes of Neutrophilia.

   (f) How Thyroid Hormone is synthesized in human body?

2022

MEDICAL SCIENCE

PAPER-II

Time Allowed — 3 Hours *Full Marks — 200*

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*Answers may be given either in **English** or in **Bengali** but all answers must be in one and the same language.*

1. Write short notes on *any four* of the following: 10×4=40

   (a) Angina

   (b) Leukemoid Reaction

   (c) Lepra Reaction

   (d) Coma in Diabetic Patient

   (e) Renal Involvement in SLE

   (f) PCR

2. Outline the Management of *any four* of the following: 10×4=40

   (a) Acid Peptic Disorder

   (b) Dengue Shock Syndrome

   (c) Status Epilepticus

   (d) Acute Severe Asthma

   (e) Myxoedema Coma

   (f) APLA Crisis (Syndrome)

3. Briefly explain *any four* of the following: 10×4=40

   (a) Hepatitis C Transmission and Disease out of it

   (b) Amoebic Liver Abscess – Clinical Feature

   (c) Do's and Dont's in Burn

   (d) Snake Bite Management in Periphery

   (e) Blood Component Transfusion

   (f) Adult Vaccination

   (g) Hypertension in Pregnancy

4. Differentiate between (*any four* of the following): 10×4=40

   (a) Epidemic and Endemic

   (b) Antenatal Case and Postnatal Case

   (c) Inflamatory Bowel Disease and Irritable Bowel Syndrome

   (d) Active and Passive imunisation

   (e) Hemiplegia and Hemiparesis

   (f) Hot vs. Cold Nodule of Thyroid

5. Enumerate *any eight* of the following: 5×8=40

   (a) Migraine

   (b) Choledocholithiasis

   (c) Complete Heart Block

   (d) DOTs Therapy and Drugs used in the Protocol

   (e) Acute Respiratory Infection in a Child

   (f) Artificial Intelligence and Health Care

   (g) Episodic Weakness

   (h) REM Sleep

   (i) Obstructive Sleep Apnoea

   (j) Hodgkins Lymphoma

   (k) Use of Condoms

   (l) Post Exposure Prophylaxis in Dog Bite

   (m) Alopecia — Common Causes

2022

PHILOSOPHY

PAPER-I

Time Allowed — 3 Hours *Full Marks — 200*

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Answer *any five* questions taking at least two from each group.

Group-A

1. What is the Cartesian Method? How did Descartes apply it to arrive at his principle 'Cogito ergo sum'? 20+20=40

2. 'To be is to be perceived'— How does Berkeley establish this thesis? Does it lead to solipsism? — Discuss. 40

3. Discuss critically following Kant 'How are synthetic-apriari judgements possible'. 40

4. What is the verification theory of meaning? Discuss in detail. 40

Group-B

5. Explain the Jaina doctrine of Anekāntavāda. Discuss in this context the relation between Anekāntavāda and Syādvāda. 40

6. What according to the Naiyāyikas the difference between determinate and indeterminate (savikalpaka and nirvikalpaka) perception? Explain critically. 40

7. Discuss according the Sānkhya school the nature of Puruṣa. How can the existence of plurality of Puruṣa be established? 20+20=40

8. Write short notes on *any two* of the following: 20×2=40

   (a) Cārvāka theory of self

   (b) Aṣtāṅgika-mārga

   (c) Māyā after Śaṅkara

   (d) Practical Vedānta (Swāmi Vivekānanda)

2022

PHILOSOPHY

PAPER-II

Time Allowed — 3 Hours *Full Marks — 200*

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Group-A

Answer *any three* questions.

1. Explain in detail Liberal Democracy. What are the demerits of Liberal Democracy? 25+15=40

2. Explain and examine Gandhi's views on social change. 40

3. Distinguish between subconscious and unconscious levels of mind. What are the arguments in favour of the unconscious? 20+20=40

4. What is secularism? Analyse the concept of secularism in the Indian context. 20+20=40

5. Write short notes on *any two* of the following: 20×2=40
   (a) Dualism
   (b) Behaviourism
   (c) Concept of mind (citta) after the yoga system of Philosophy.

Group-B

Answer *any two* questions.

6. What according to Aristotle, is virtue? Critically discuss his views on virtue ethics. 20+20=40

7. Critically discuss Paul Taylor's concept of bio-centric ethics. 40

8. Explain and examine the causal and ontological arguments for the existence of God after Descartes. 40

2022

SOCIOLOGY

PAPER-I

Time Allowed — 3 Hours *Full Marks — 200*

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Group-A

Answer *any three* questions.

1. 'The Sociological perspective often challenges common sense'. Discuss the nature and scope of sociology in the light of a review of the preceding statement. 40

2. (a) Illustrate what is meant by Emile Durkheim's concept of Social fact and mention the features of social fact.

   (b) Show how he relates forms of social solidarity with types of societies. 20+20=40

3. (a) What is meant by Talcott Parsons by Social System and its functional prerequisites?

   (b) Mention the pattern variables noted by him.

   (c) How far do his ideas explain social reality across the globe? 15+15+10=40

4. (a) Show the relationship of personality and socialization.

   (b) Critically examine the impact of

      (i) Anticipatory socialization and of

      (ii) Oversocialization as suggested by Dennis Wrongs 'Over-socialized conception of man's on personality. 20+10+10=40

5. Write short notes on: 20+20=40

   (a) Karl Marx's idea of class struggle

   (b) The relative importance of primary groups and secondary groups in life in modern societies

Group-B

Answer *any two* questions.

6. (a) Briefly delineate the features of survey method highlighting the importance of random sampling in it.

   (b) What are its advantages and points of weakness? 20+20=40

7. How far does education help social mobility of the currently less privileged people and ensure their equality with those who are more favourably placed in society? 40

8. (a) Examine the place of religion in modern society.

   (b) Write in short on the consequences of spread of digital technology in a country like India.

20+20=40

2022

SOCIOLOGY

PAPER-II

Time Allowed — 3 Hours *Full Marks — 200*

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Group-A

Answer *any three* questions.

1. (a) Explain the nature of unity and diversity in the Indian society and culture.

   (b) Examine whether and how far the proposed Uniform Civil Code would farther or hinder the harmonisation of the two. 30+10=40

2. Discuss briefly the major points of contribution of A.R. Desai to the understanding of Indian Society and culture. 40

3. Comment on the processes noted by M.N. Srinivas in bringing about social change in modern India. 40

4. (a) Discuss, in brief, the nature of kinship and marriage in India.

   (b) Show how important and effective they are in modern India. 30+10=40

5. Assess the prospect and problems of industrialisation of India with special reference to West Bengal. 40

Group-B

Answer *any two* questions.

6. (a) Show the connection between Ecology and Environment.

   (b) Analyse the nature of crisis to environment and ecology which is faced in India and the world.

   (c) Give a short description of any one of the environmental/ecological movements that have occurred in Independent India. 5+20+15=40

7. (a) Explain how empowerment of women is connected with their status in society.

   (b) Attempt a brief review of the existing programmes initiated by the state of West Bengal in this realm. 10+30=40

8. Write short notes on: 20+20=40

   (a) B. R. Ambedkar and the Dalits

   (b) Measures adopted and to be adopted in relation to persons above 60 years of age in the society and policy in view of their increasing number in the population of India.

2022

STATISTICS

PAPER-I

Time Allowed — 3 Hours *Full Marks — 200*

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Group-A

Answer *any four* questions.

1. (a) Give the axiomatic definition of probability. Show that conditional probability satisfies all the axioms.

   (b) Suppose X is distributed with PDF,

   $$f(x)=\frac{1}{2\beta}e^{-|x-\theta|/\beta},\ -\infty<x<\infty.$$

   Show that $P\{|X-\theta|>a+b\,||X-\theta|>a\}$ does not depend on a for any $a, b>0$. 18+12=30

2. Suppose a random variable X has the following PDF,

   $$f(x)=ae^{\left(-x^2-bx\right)},\ -\infty<x<\infty$$

   for constants a (>0) and b.

   (a) If $E(X)=-3/2$, find a and b.

   (b) Obtain the second, third and fourth central moments of X. 15+15=30

3. If $(X,Y)\sim N_2(0,0,1,1,\rho)$,

   (a) show that $\text{correlation}\left(X^2,Y^2\right)=\left\{\text{correlation}\left(X,Y\right)\right\}^2$.

   (b) find $E\left(e^{\frac{1}{2}XY}\right)$. 18+12=30

4. Suppose $X_2\sim N(0,\text{variance}=5)$ and

   $$X_1=1+2X_2-X_2^2/10^3.$$

   (a) Find $\text{Var}(X_1)$ and $\text{Cov}(X_1, X_2)$.

   (b) Find an upper bound of $\left\{\text{Cov}\left(X_1,X_2\right)\right\}^2$ and compare with the actual value. Comment on the results. 12+15+3=30

5. (a) State and prove Neymar-Fisher Factorization theorem for discrete families of distributions.
   (b) Suppose a N(unknown) faced regular die is thrown 17 times independently. If X_k is the outcome of the kth throw, find a sufficient statistic for N, $k = 1, 2, ..., 17$. 18+12=30

6. (a) Find a most powerful size α test for testing
   $H_0 : X \sim N(0, \text{variance} = 1/2)$ ag
   $H_1 : X \sim$ Cauchy (0, 1).
   (b) State and prove Neymar-Pearson Fundamental Lemma. 18+12=30

Group-B

Answer *any two* questions.

7. (a) Define Sampling Frame and Sampling Design with examples.
   (b) Describe the advantages of sample surveys over the census.
   (c) How do you select a simple random sample of 11 households from a list of 112 households in a village without replacement? Describe any two methods. 8+12+20=40

8. (a) Distinguish between stratified random sampling and two stage sampling procedures.
   (b) Under a linear systematic sampling procedure, propose an unbiased estimator of population mean. Also find its variance.
   (c) What is ratio estimator? Find its exact bias. How do you estimate population mean using ratio estimation? Is such an estimator unbiased? 8+12+20=40

9. (a) Describe three basic principles of experimental design.
   (b) What is confounding in the context of factorial designs? Distinguish between partial and complete confounding through examples.
   (c) Consider the one-way ANOVA model

$$y_{ij} = \mu + \alpha_i + e_{ij},\ i = 1, \cdots, p;\ j = 1, \cdots, n_i$$

with $\sum_{i=1}^{p} n_i \alpha_i = 0$.

Define SSA $= \sum_{i=1}^{p} n_i \left(\bar{y}_{io} - \bar{y}_{oo}\right)^2$

SSE $= \sum_{i,j} \left(y_{ij} - \bar{y}_{io}\right)^2$, where

$$\bar{y}_{io} = \frac{1}{n_i} \sum_{j=1}^{n_i} y_{ij},\ \bar{y}_{oo} = \sum_{i=1}^{p} n_i \bar{y}_{io} \Big/ \sum_{i=1}^{p} n_i .$$

If e_{ij}'s are *iid* normal random variables with mean zero and variance σ^2, derive E(SSA) and E(SSE). 12+8+20=40

2022

STATISTICS

PAPER-II

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

*Answers may be given either in **English** or in **Bengali** but all answers must be in one and the same language.*

Group-A

1. Answer *any ten* questions: 10×10=100

(a) Describe control charts for fraction defectives.

(b) Distinguish between chance and assignable causes of variation with examples.

(c) What are the functions of Central Statistical Office (CSO)?

(d) Define Crude Death Rate (CDR). Discuss its merits and demerits.

(e) Minimize $z = 20x_1 + 10x_2$ by finding the extreme points of the feasible space. Subject to the restrictions:

$$x_1 + 2x_2 \leq 40$$
$$3x_1 + x_2 \geq 30$$
$$4x_1 + 3x_2 \geq 60$$
$$x_1 \geq 0,\ x_2 \geq 0.$$

(f) What is exponential smoothing method of forecasting? Why is it called exponentially weighted moving average method?

(g) What is a life table? What are its uses? Write down the assumptions required for the construction of life tables.

(h) What do you mean by cost of living index numbers? What are its uses?

(i) What is homogeneity error in the measurement of price index numbers? How is it controlled?

(j) Distinguish between acceptance rejection and acceptance rectification type sampling plans.

(k) What are the different tests for index numbers? Does Laspeyre's price index satisfy all these tests?

(l) Distinguish between Neonatal and Perinatal mortality rates.

(m) How National Income is estimated in India through production approach?

(n) Describe moving average method of trend determination.

(o) Describe main functions of West Bengal Bureau of Applied Economics and Statistics.

Group-B

Answer *any five* questions.

2. (a) Define natural tolerance limits and give its applications.

   (b) Construct the range chart for process control. 8+12=20

3. (a) Define GRR and NRR. What happens if NRR = GRR?

   (b) Define TFR. If in some region number of female births is exactly one third of the total number of births, deduce a relation between GRR and TFR under appropriate conditions. 8+12=20

4. (a) Describe a sequential sampling plan, when observations are classified either defective or non-defective. Derive the boundaries explicity taking type I and type II error probabilities as α and β, respectively.

   (b) Derive an approximate expression of oc-function corresponding to the plan described (a) above. 10+10=20

5. (a) Describe a double sampling plan for attributes. Derive the explicit expression of the oc function for the above plan.

   (b) Derive the expression of ASN clearly for the plan given in 5 (a) above under appropriate conditions. 12+8=20

6. (a) Define "reliability". If an item has a random lifetime x, define its reliability function for a mission time of t. If x has the PDF, $f(x) = xe^{-x}, x > 0$, find the reliability function for mission time t.

   (b) Define "failure rate". Establish a relation between failure rate and reliability function. How do you derive the PDF of a lifetime random variable from given failure rate? 10+10=20

7. (a) Distinguish between "autoregressive" and "moving average" processes. Show that under certain conditions (to be stated by you), an AR (1) process can be expressed as an MA (∞) process.

   (b) Derive the correlogram of a stationary AR (2) process. 8+12=20

8. (a) Deduce the following relations:

   (i) $T_x = \frac{1}{2} l_x + \sum_{t=1}^{\infty} l_{x+t}$

   (ii) $p_x = \frac{e_x}{1 + e_{x+1}}$

   With usual notations.

   (b) Show that ratio of Laspeyre's price and quantity index is proportional to the ratio of Paasche's price and quantity index. 12+8=20

9. (a) If $x_1 = 2, x_2 = 3, x_3 = 1$ is a feasible solution to the following LPP,

$$\begin{aligned} \text{Maximize} \quad & Z = x_1 + 2x_2 + 4x_3 \\ \text{Subject to:} \quad & 2x_1 + x_2 + 4x_3 = 11 \\ & 3x_1 + x_2 + 5x_3 = 14, \\ & x_1 \geq 0, x_2 \geq 0, x_3 \geq 0, \end{aligned}$$

find a basic feasible solution.

(b) A businessman has the option of investing his money in two plans. Plan A guarantees that each rupee invested will earn seventy paise a year, hence while plan B guarantees that each rupee invested will earn two rupees two years hence. In plan B, only investments for periods that are multiples of two years are allowed. How should he invest ten thousand rupees in order to maximize the earnings at the end of 3 years? Formulate this problem as an LP problem. 12+8=20

2022

BENGALI

PAPER-I

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

(উত্তর সাধু বা চলিত যে কোনো একটি ভাষারীতিতে হওয়া বাঞ্ছনীয়।)

'ক' বিভাগ

(*যে কোনো একটি* প্রশ্নের উত্তর লিখুন।) ৫০×১=৫০

১। (ক) ভারতীয় আর্যভাষার যুগবিভাগ করে, প্রাচীন ভারতীয় আর্যভাষার ধ্বনিতাত্ত্বিক ও রূপতাত্ত্বিক বৈশিষ্ট্যগুলি আলোচনা করুন। ১০+১৫+২৫=৫০

(খ) বাংলাভাষার ক্ষেত্রে সাধু ও চলিত রূপের বিবর্তনের ইতিহাসটি উদাহরণসহ আলোচনা করে, উভয় রূপের ভাষাতাত্ত্বিক পার্থক্য নির্দেশ করুন। ২০+৩০=৫০

'খ' বিভাগ

(*যে কোনো দুটি* প্রশ্নের উত্তর লিখুন।) ৫০×২=১০০

২। চর্যাপদের দার্শনিক তত্ত্বের সংক্ষিপ্ত পরিচয় দিয়ে-এর কাব্যমূল্য নির্ধারণ করুন।

৩। মধ্যযুগের বাংলা সাহিত্যে অনুবাদের ধারার পরিচয় দিয়ে কবি কৃত্তিবাসের কবি কৃতিত্ব সম্পর্কে আলোচনা করুন।

৪। উনিশ শতকে বাংলা গদ্যের বিকাশে দেবেন্দ্রনাথ ঠাকুর ও অক্ষয়কুমার দত্তের অবদান সম্পর্কে আলোচনা করুন।

৫। বাংলা নাট্যসাহিত্যে দ্বিজেন্দ্রলাল রায়ের অবদানের বিষয়টি বিশ্লেষণ করুন।

'গ' বিভাগ

(*যে কোনো একটি* প্রশ্নের উত্তর লিখুন।) ৫০×১=৫০

৬। বাংলা উপন্যাসের ধারায় শরৎচন্দ্র চট্টোপাধ্যায়ের অবদান নিয়ে আলোচনা করুন।

৭। মানিক বন্দ্যোপাধ্যায়ের উপন্যাসে কীভাবে বৈজ্ঞানিক দৃষ্টিভঙ্গি ও মার্কসীয় চেতনা প্রতিফলিত হয়েছে তা আলোচনা করুন।

৮। সৎ, নিপীড়িত মানুষের যন্ত্রণার কথা মহাশ্বেতা দেবীর সাহিত্যে কীভাবে উঠে এসেছে তা বিশ্লেষণ করুন।

2022

BENGALI

PAPER-II

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

(উত্তর সাধু বা চলিত যে কোনো একটি ভাষারীতিতে হওয়া বাঞ্ছনীয়।)

'ক' বিভাগ

(*যে কোনো তিনটি* প্রশ্নের উত্তর লিখুন।) ৪০×৩=১২০

১। মাথুর কাকে বলে? বৈষ্ণব পদাবলীতে এই পর্যায়ের পদকর্তাদের মধ্যে কোন্ কবি শ্রেষ্ঠত্বের দাবী রাখেন তা উপযুক্ত পদ বিশ্লেষণের দ্বারা বিচার করুন।

২। চণ্ডীমঙ্গল কাব্যের কালকেতুর উপাখ্যানে কবি মুকুন্দরাম চক্রবর্তী নারী চরিত্র অঙ্কনে যে জীবনবোধের পরিচয় দিয়েছেন তা আলোচনা করুন।

৩। "আখ্যায়িকাটি নিজে না বলিয়া উপন্যাসের চরিত্রগুলিকে বক্তার আসনে বসাইয়াছেন"—'রজনী' উপন্যাসের ক্ষেত্রে বঙ্কিমচন্দ্রের এই উপস্থাপনার কৌশল কতখানি সফল হয়েছে তা বিচার করুন।

৪। 'বঙ্গদেশের কৃষক' রচনায় বঙ্কিমচন্দ্র জমিদারদের যে অত্যাচারের পরিচয় দিয়েছেন তা আলোচনা করুন, প্রসঙ্গত জমিদারদের পক্ষে বঙ্কিমচন্দ্রের বক্তব্যগুলি বিশ্লেষণ করুন।

৫। 'পুনশ্চ' কাব্যগ্রন্থে কাহিনিমূলক কবিতাগুলি বিশ্লেষণ করে দেখান রবীন্দ্রনাথের কোন্ বিশেষ দৃষ্টিভঙ্গি কীভাবে এই কবিতাগুলিতে রূপ লাভ করেছে।

'খ' বিভাগ

(*যে কোনো দুটি* প্রশ্নের উত্তর লিখুন।) ৪০×২=৮০

৬। "গৃহ ও দাহ দুইই অচলার।" মন্তব্যটির পক্ষে অথবা বিপক্ষে যুক্তিসহ আলোচনা করুন।

৭। 'শাশ্বতী' কবিতাটির একটি রসগ্রাহী আলোচনা করুন।

৮। 'ফসিল' গল্পে সুবোধ ঘোষ যে শ্রেণিচেতনার পরিচয় দিয়েছেন তা উপযুক্ত প্রসঙ্গ উল্লেখ করে আলোচনা করুন।

৯। "রাজনৈতিক সংগ্রামের বিষয়ে লেখা হলেও শেষ পর্যন্ত মানুষের চিরন্তন সম্পর্কগুলোই 'জাগরী' উপন্যাসে প্রধান হয়ে উঠেছে।"—মন্তব্যটি যুক্তসহ বিচার করুন।

2022

ENGLISH

PAPER-I

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

The figures in the margin indicate marks for each question.

Group-A

1. Write an essay on *any one* of the following topics: 40×1=40
   (a) Connecting cultures through the power of language
   (b) Psychological approach in literature
   (c) E-literary texts and contexts
   (d) Contemporary Indian English Poetry

Group-B

2. Answer *any two* of the following questions: 40×2=80
   (a) Consider *Edward II* as a play of the irony of kingship.
   (b) Explain how the 'carpe diem' theme is expressed in Andrew Marvell's 'To His Coy Mistress'.
   (c) What message Shelley want to convey in 'Ode to the West Wind'?
   (d) How does John Keats suggest that the nightingale's realm may simply be an illusory way of alleviating human suffering?
   (e) Critically evaluate the toilet scene of Belinda in *The Rape of the Lock.*
   (f) What is Browning's attitude to life as revealed in the poem 'The Last Ride Together'?

Group-C

3. Answer *any two* of the following questions: 40×2=80
   (a) Why do you think *Pride and Prejudice* has such moving force for so many readers?
   (b) Explain irony in the title of the novel *Great Expectations.*
   (c) How might the novel, *Frankenstein* be read as a commentary on scientific progress?
   (d) Discuss the relationship between gender and power in *Wuthering Heights.*

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2022

ENGLISH

PAPER-II

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

The figures in the margin indicate marks for each question.

Group-A

1. Critically evaluate the following poem: 50×1=50

How difficult it is to leave
the home, one it is fixed to
your name, your roles, your bed.

All small and big things are
remembered, and stored
in the heart's mystery

A slow act of withdrawal, renewing
Itself each day's end the same way
as on the previous day, you move on

The choice is difficult
when mind is amorphous
spaces are not defined

It's an open game you play
like seasons and rivers flowing
deep in uncertain hearts.

You play 'Home'.
Your kids imitate you.
Life grows on trees, green faces.

Group-B

2. Answer *any one* question from the following: 50×1=50

(a) What is the historical context of 'Easter, 1916'? What features of modernist poetry can be found in the poem, 'Easter, 1916'?

(b) Consider 'An introduction' by Kamala Das as a confessional poem.

(c) Comment on the significance of the title of the poem, 'The Love Song of J. Alfred Prufrock'.

(d) What is the theme of the poem, 'In memory of W.B. Yeats' by W.H. Auden? Give an over view of the symbols used in the poem.

3. Answer *any one* of the following: 50×1=50

(a) Explain Beckett's play, *Waiting for Godot* as a tragicomedy.

(b) Describe the relationship between Jimmy and his wife, Alison in *Look Back in Anger.*

(c) "The main theme of 'Mirror' by Sylvia Plath is self-reflection." — Comment with proper textual references.

(d) What role does the poet see for himself with regard to his country in 'To India My Native Land'?

Group-C

4. Answer *any one* of the following: 50×1=50

(a) What is Raja Rao's style in *Kanthapura*? Discuss subalternity in the novel.

(b) *The Rainbow* is a bitter condemnation of the industrial society. Is this true? Discuss with references to the text.

(c) How is *The Shadow Lines* a post-colonial novel?

(d) What is the narrator's point of view and what values are important to the narrator in *Things Fall Apart*?

2022

HINDI

PAPER-I

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

The figures in the margin indicate marks for each question.

Group-A

1. भाषा की परिभाषा बतलाते हुए भाषा अनुकरण और पारोल का अन्तर स्पष्ट कीजिए। 30

अथवा,

भाषा की परिवर्तनशीलता और परिवर्तन के कारण पर प्रकाश डालिए।

2. देवनागरी लिपि की विशेषताओं का उल्लेख कीजिए। 30

अथवा,

मानक हिन्दी की व्याकरणिक संरचना का विवेचन कीजिए।

Group-B

3. आदिकाल की सामान्य प्रवृत्तियों पर प्रकाश डालिए। 30

अथवा,

सूफ़ी काव्यधारा की विशेषता बतलाते हुए जायसी के योगदान का मूल्यांकन कीजिए।

4. रीतिबद्ध काव्यधारा का अर्थ बतलाते हुए सिद्ध कीजिए कि केशव का आचार्य के नाते जितना महत्व है उनका कवि के नाते नहीं — अपने शब्दों में उत्तर दीजिए। 30

अथवा,

प्रयोगवादी काव्यधारा की विशेषताएँ उदाहरण सहित बतलाइए।

5. हिन्दी नाटक के उद्‌भव और विकास पर अपने विचार व्यक्त कीजिए। 30

अथवा,

हिन्दी कहानी के विकास में कथाकार प्रेमचन्द के योगदान का मूल्यांकन अपने शब्दों में कीजिए।

6. निम्नलिखित में से किन्हीं *दो* प्रश्नों के उत्तर संक्षेप में लिखिए: 25×2=50

(क) चन्दवरदाई

(ख) मीराबाई

(ग) मैथिलीशरण गुप्त

(घ) लक्ष्मी नारायण लाल

(ङ) चित्रा मुद्‌गल

2022

HINDI

PAPER-II

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

The figures in the margin indicate marks for each question.

All questions carry equal marks.

Group-A

(निम्नलिखित में से किन्हीं *तीन* प्रश्नों के उत्तर लिखिए।) 40×3=120

1. कबीर की सामाजिक चेतना पर उदाहरण सहित प्रकाश डालिए।
2. विनय पत्रिका के आधार पर तुलसी की भक्ति भावना का मूल्यांकन कीजिए।
3. कामायनी की प्रमुख पात्र श्रद्धा का चरित्र-चित्रण कीजिए।
4. निराला प्रगतिशील चेतना के कवि है : —सोदाहरण विवेचना कीजिए।
5. 'असाध्य वीणा' में बौद्धिक चिंतन और सांस्कृतिक अस्मिता का समन्वय है : —इस कथन को स्पष्ट कीजिए।
6. सर्वेश्वर दयाल सक्सेना की काव्यगत विशेषताओं का वर्णन कीजिए।

Group-B

(निम्नलिखित में से किन्हीं *दो* प्रश्नों के उत्तर लिखिए।) 40×2=80

7. 'अंधेर नगरी' नाटक की सोद्देश्यता पर प्रकाश डालिए।
8. पठित कहानियों के आधार पर प्रेमचन्द की कहानी-कला की विशेषताएँ बतलाइए।
9. ध्रुवस्वामिनी की चारित्रिक विशेषताओं का वर्णन कीजिए।
10. देवदारू निबंध की तात्विक समीक्षा कीजिए।

2022
PERSIAN
PAPER-I

Time Allowed—3 Hours *Full Marks—200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.
Answer may be given either in ***English*** *or* ***Persian*** *unless otherwise mentioned in the question.*

Group—A

Attempt *any two* of the following questions: 25×2 = 50

1. Discuss the origin and development of Pahlavi Language. 25

2. Briefly describe the difference between Dialect and Language. 25

3. Write notes on *any three* of the following: 25

   (a) Old Perisan

   (b) Avestan language

   (c) Huzwarish

   (d) Evolution of Modern Persian

Group —B

Attempt *any four* of the following questions: 10×4=40

4. Give the opposite number of *any five* of the following: 2×5

   غنی – انبیاء – دینار – مندر – فضلاء – مواقع – نتائج – فکر

5. Illustrate with example *any two* of the following: 5×2

   اسم نکره – صفتِ نسبتی – اسم فاعل – ضمیر

6. Explain the formation of *any five* of the following: 2×5=10

ارجمند – آئینه – دولتکده – ریگستان – آفتاب – بوستان

7. Give the uses of الف or ی. 10

8. Form words with *any five* of the following: 2×5

آسمان – گلدسته – خساره – سلامت – احترام – گلشن – باغیچه – طفل

Group–C

9. Translate the follwing passage into English: 30

آشنای من با افکار گاندی وقتی شرع شد که در دبیرستان کتابی دربارهٔ او ازیک نویسندهٔ فرانسوی خواندم. کتاب "خردمندی گاندی" (Sangesse de Gandhi) نام داشت و درمن چنان تاثیر کرد که فصلی از آن برای روز نامهٔ دبیرستان ترجمه کردم. ازهمان زمان حس کردم. واین اعتقاد بعدًا درمن راسخ شد که گاندی مردیست که در قرن بیستم از مشرق زمین پر خاسته و تمّدنی آورده است که نه تنها رقیب تمدن مغرب زمین است بلکه چارهٔ نقصها و مفاسد ان است. از قسمتهای که هنوز از آن کتاب به یادم مانده است یکی این بود که نویسندهٔ فرانسوی یه گاندی گفته بود "عقیدهٔ شما درباره این گفتهٔ اروپای که وقت طلاست چلیست؟" گاندی جواب داده بود" وقت گرامی تر ازآن و طلایی ارزش تر از آن که بتوان این دورا باهم سنجید".

اجازه می خواهم نخست به اختصار و قایع مهم زندگی مردی را که امروز به احترام روز تولد او اینجا گردآمیده یم. ذکر کنم و بعد از آن به اختصار اشاره ای به تعلیمات او وارزش این تعلیمیات برای بشرِامروزه کنم.

10. Translate into Persian, the passage given below: 30

Maulana Jalaluddin Md. Balkhi commonly known as Maulana Rum or Maulana Rumi has universally been recognised as one of the greatest Persian Sufi poets the world has ever produced. A mystic par-excellence he was the pioneer of the Melvi (our master) or Melvi order of Darvishes generally known as Whirling Order Darvishes of Turkey. It is also known as Jalaliya order after the name of its founder Maulana Jalaluddin .

Maulana Jalaluddin was born according to the author of Manaqib-ul-Arfin at Balkh presently in Afghanistan, in 604 A.H./1207 A.D. and died in the capital city , Qeniya in 672 A.H./1293 A.D. at the age of 68 years.

Rumi is considered as one of the best Masnavi writers of Persian. He composed Masnavi in his 50's, Masnavi-e-Rumi is the magnum opus of spiritual ascension, sufistic philosophy, intelectual edification and intense human declacation.

11. Define *any three* of the following and give suitable examples. 10×3=30

کنایه - حسنِ طلب - غلو - لف ونشر - مجاز مرسل - تلمیح

12. Scan *any two* of the following verses and give name of the metere. 10×2=20

(الف) پدم گفتی و دُرسفتی بپاو خوش بخوان حافظ
جواب تلخ می زیبد لب لعلِ شکر خارا

(ب) بسیار سفر باید تا پخته شود خامی
صوفی نشود صَفی تا در نکشد جامی

(ج) گر دل و دست بحر و کان باشد
دل ودست خد ایگان باشد

2022
PERSIAN
PAPER-II

Time Allowed—3 Hours *Full Marks—200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.
The figures in the margin indicate marks for each question.
Answer may be given either in ***English*** *or in* ***Persian*** *unless otherwise mentioned in the question.*

Group-A

Attempt *any four* of the following questions:

1. Describe the different views regarding the origin of Persian poetry. 25

2. Define Qasida. Describe in brief the history of the origin and development of Qasida writing in Persian. 25

3. Estimate the contribution of the Seljuq period to the historical literature in Persian. 25

4. Describe the chief characteristics of the poetry of Saib Tabrezi. 25

5. What is the literary importance of the Chahar Maqala of Nezami Uruzi Samarqandi. 25

6. Show your acquaintance of Parveen Itesami and comment her poetry. 25

Group-B

7. Explain *any four* of the following: 10×4=40

(الف) ای چهـــرۂ زیبـــــای تـــو رشک بتـــــانِ آرزی
هـر چـنـد و صـفـت مـی کـنم درحسن ز ان بـالاتری

(ب) مـرا در مـنـزلِ جـانـان چـه امن و عیـش چون هردم
جـرس فـریـاد مـی دارد کـه بـرنـدید مـحـمـلـهـا

(ج) هـــر سـوخـتـــه جـانـی کـــه بـــه کشمیـر در آیـد
گـر مـرغ کبـاب اسـت کـــه بـابـال وپـری آیـد

(د) تواضع از همه کس زیبای نماید وازدوست زیبا تر زیرا که پیرایئے بزرگی تواضع است۔

(ہ) خلافت انسان را بدوچیز منوط است۔ یکی حکمت بالغه که عبادت است۔ از کمال علمی۔ دوم قدرت فاجله که عبارت است از کمال علمی۔

8. Write short notes in Persian on *any four* of the following: 15×4=60

یـمیـائی سـعـادت - اخـلاق مـحسـنـی - راحته الصدر -چـهار مقاله -عـمر خیّام - پروین اعتصامی - نظام الملک طوسی- رضا علی - وحشت-امیر خسرو -

2022

SANSKRIT

PAPER-I

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

*Answer may be written either in **English** or in **Bengali** or in **Sanskrit**, but all answers must be in one and the same language, unless otherwise specified.*

Group-A

1. What do you mean by Indo-European family of languages? Discuss its different branches briefly. 30

Or,

Write an informative note on phonetic laws with special reference to Grimm's Law and Grossman's Law. 30

2. Define and illustrate *any two* of the following: 10×2=20
   (a) Epenthesis
   (b) Dissimilation
   (c) Subjunctive
   (d) Ablaut

Group-B

3. Explain *any two* of the following rules in Sanskrit: 10×2=20
   (a) कर्तुरीप्सिततमं कर्म
   (b) स्पृहेरीप्सितः
   (c) ध्रुवमपायेऽपादानम्
4. Account for the case-endings in *any five* of the underlined words by citing the relevant rules of Pāṇini in each case: 4×5=20
   (a) शिशुः *शय्याम्* अधिशेते।
   (b) *श्रमेण* अलम्।
   (c) मोदकः *शिशुभ्यो* रोचते।
   (d) *मातुः* निलीयते कृष्णः।
   (e) *पयसः* पानं शिशुना।
   (f) केशेषु चमरीं हन्ति।

5. Name and expound the Samāsa or compound in *any five* of the following: 4×5=20

   (a) कृष्णसर्पः

   (b) अपदिशम्

   (c) नखभिन्नः

   (d) भूतबलिः

   (e) शिरश्छेदः

   (f) वनेचरः

   (g) केशाकेशि

6. Justify *any two* of the following in Sanskrit: 10×2=20

   (a) प्रदीयतां दाशरथाय मैथिली।

   (b) व्याददते पिपीलिकाः पतङ्गस्य मुखम्।

   (c) न च न स्वीकृतमर्थगौरवम्।

   (d) त्रिलोकनाथः पितृसद्भगोचरः।

Group-C

7. Translate into English or Vernacular *any two* of the following: 10×2=20

   (a) अग्निर्होता कविक्रतुः
   सत्यश्चित्रश्रवस्तमः
   देवो देवेभिरागमत्।।

   (b) अद्या देवा उदिता सूर्यस्य
   निरंहसः पिपृता निरवद्यात्।
   तन्नो मित्रो वरुणो मामहन्ता-
   मदितिः सिन्धुः पृथिवी उत द्यौः।।

   (c) यो हत्वाहिमरिणात सप्त सिन्धून्
   यो गा उदाजदपधा बलस्य।
   यो अश्मनोरन्तरग्निं जजान
   संवृक् समत्सु स जनास इन्द्रः।।

Group-D

(Answer *any one* of the following.)

8. Translate into Sanskrit from English : 10×3=30

   (a) Today in the morning getting up from the bed, I went to walk in the garden near the bank of the lake.

   (b) Life is war. There are ups and downs. Happiness and misery revolve like a wheel.

   (c) Then the sun set. Gradually appeared the night. The traveller lost his way in the forest covered with darkness.

9. Translate into English from Sanskrit: 15×2=30

(a) सूखस्य मूलं धर्मः। धर्मस्य मूलमर्थः। अधनस्य बुद्धिर्न विद्यते। हितमपि अधनस्य वाक्यं न शृणोति लोकः।

(b) वयमधुनातनास्तरुणाः भाविदिनानां भारतीयाः भवामः। सत्यम्, साधुत्वम्, आत्मसंयमः, शुचित्वम्, सौजन्यम्-इत्यादिगुणानमनुशीलनम् अस्माभिः करणीयम्।

Group-E

10. Write a paragraph on *any one* of the following topics in Sanskrit: 20×1=20

(a) जननी जन्मभूमिश्च स्वर्गादपि गरीयसी

(b) जनजीवने विज्ञानस्य प्रभावः

(c) तव प्रियः ग्रन्थः

2022

SANSKRIT

PAPER-II

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

Answers may be given either in ***English*** *or in* ***Bengali*** *or in* ***Sanskrit*** *but all answers must be in one and the same language.*

Answer question No.1 *and* 2 *and* any three *of the rest.*

1. What is meant by the term "Secular Hymns"? Mention the source of these hymns. Give an account of any such hymn in details. 8+6+26=40

Or,

Analyse the term 'Upaniṣaḍ' and mention the source of the Upaniṣaḍs. Write a note on the fundamental doctrines of the Upaniṣaḍs. 10+5+25=40

2. Write a note on the different schools of Buddhism, and specially discuss about Ālayavijñānavada. 20+20=40

Or,

Who is the propounder of Sāṁkhya philosophy? Mention the Saṁkhya texts and commentaries. Discuss about Prakṛti and Puruṣa theory. 2+8+30=40

3. Write a comprehensive note on the influence of the Rāmāyaṇa on Indian life and literature. 40

4. Discuss about Bhāsa problem in detail. 40

5. Describe in details the three dramas composed by Kālidāsa. 40

6. Evaluate the contribution of post-Kālidāsa poets in Sanskrit poetics. 40

7. Name the eight sectors of Āyurveda. Critically estimate the value of the texts Carakasaṁhita and Sushrutasamhita. 40

8. Estimate the value of Daṇḍin's Daśakumāracarita as a prose romance. 40

2022
URDU
PAPER-I

Time Allowed : 3 Hours *Full Marks: 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to prescribed number shall be valued and the remaining ones ignored.
Answer should be written in ***Urdu****.*

Group: A

1. وسطی ہند آریائی زبانوں سے متعلق اپنی واقفیت کا اظہار کیجیے۔ 30

یا

محمود شیرانی کا لسانی نظریہ ''پنجاب میں اردو'' کا تنقیدی جائزہ لیجیے۔

2. عادل شاہی دور میں اردو زبان وادب کے سمت ورفتار کا جائزہ لیجیے۔ 30

یا

فورٹ ولیم کالج کی نثری خدمات کا جائزہ لیجیے۔

Group: B

3. غالب کو بحیثیت غزل گو پیش کیجیے۔ 30

یا

اختر الایمان کی نظم نگاری کا تنقیدی جائزہ لیجیے۔

4. شہریار کو بحیثیت نظم نگار پیش کیجئے۔ 30

یا

قصیدے کے فنی لوازم سے اپنی واقفیت کا اظہار کیجئے۔

5. کسی دو پر نوٹ لکھئے: 10×2=20

(الف) نظم تنہائی

(ب) سرسید تحریک

(ج) لکھنو اسکول

6. ''سودا کا رتبہ قصائد میں ظہوری کے برابر ہے۔'' 30

اس قول کی تائید میں اپنے خیالات کا اظہار کیجئے۔

یا

مثنوی ''سحر البیان'' کا تنقیدی جائزہ لیجئے۔

7. درج ذیل اشعار میں سے کسی تین کی ناقدانہ تشریح کیجئے۔ 5×3=15

(الف) ہنگامہ گرم کن جو دلِ ناصبور تھا
پیدا ہر ایک بالے سے شور شور تھا

(ب) شوق ہر رنگ رقیب سروساماں نکلا
قیس تصویر کے پردے میں بھی عریاں نکلا

(ج) تھا مستعار حسن سے اس کے جو نور تھا
خورشید میں بھی اس ہی کا ذرّہ ظہور تھا

(د) کاو کاو سخت جانی ہائے تنہائی، نہ پوچھ
صبح کرنا شام کا لانا ہے جوئے شیر کا

8. درج ذیل مرثیہ کا مرکزی خیال واضح کیجئے . 15

کس شیر کی آمد ہے کہ رن کانپ رہا ہے
رستم کا جگر زیر کفن کانپ رہا ہے
ہر قصر سلاطین زمن کانپ رہا ہے
سب ایک طرف چرخ کہن کانپ رہا ہے

2022
URDU
PAPER-II

Time Allowed : 3 Hours *Full Marks: 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to prescribed number shall be valued and the remaining ones ignored.

Answer should be written in ***Urdu.***

Group: A

1. درج ذیل سوالات میں سے کسی چار کے جواب تحریر کیجئے۔ 30×4=120

(i) ''باغ و بہار'' کی روشنی میں میر امن دہلوی کی اسلوب نگارش کا تنقیدی جائزہ لیجئے۔

(ii) مختصر افسانے کا آغاز وارتقاء کا جائزہ لیجئے۔

(iii) مولانا ابوالکلام آزاد کی مکتوب نگاری کا تنقیدی جائزہ لیجئے۔

(iv) راجندر سنگھ بیدی کی افسانہ نگاری کا تنقیدی جائزہ لیجئے۔

(v) آغا حشر کاشمیری بحیثیت ڈراما نگار پیش کیجئے۔

(vi) سرسید احمد خان کا مقالہ ''رسم ورواج'' کا خلاصہ پیش کیجئے۔

(vii) منٹو بحیثیت افسانہ نگار پیش کیجئے۔

Group: B

2. درج ذیل سوالات میں سے کسی دو کے جواب تحریر کیجئے: 20×2=40

(i) مولانا الطاف حسین حالی کے تنقیدی تصورات کا جائزہ لیجئے۔

(ii) مارکسی تنقید کسے کہتے ہیں؟ بحث کیجئے۔

(iii) ''اردو تنقید پر ایک نظر'' کا تجزیاتی مطالعہ پیش کیجئے۔

(iv) سید احتشام حسین کی تنقیدی بصیرت کا جائزہ لیجئے۔

Group: C

3. درج ذیل عنوانات میں سے کسی ایک پر مضمون لکھئے: 40

(i) مغربی بنگال میں اردو شاعری آزادی کے بعد

(ii) ترقی پسند تحریک

(iii) اردو ادب میں جدیدیت

(iv) عبدالرزاق ملیح آبادی بحیثیت صحافی

2022

AGRICULTURE

PAPER-I

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

Answers may be given either in ***English*** *or in* ***Bengali*** *but all answers must be in one and same language.*

Group-A

Answer *any three* questions.

1. Define intercropping as compared to pure cropping. State the advantages of intercropping. What is suitable cropping system? State the soil and water management in cropping system. 10+10+10+10=40

2. (a) Describe the factors and process of soil formation.
   (b) Describe in details, about the problem of soils and their management. (10+10)+20=40

3. (a) Describe different methods of cultivation of improved varieties of rice.
   (b) Discuss about macro-nutrients and their functions. 20+20=40

4. Differentiate between a weed and crop. Discuss the special characteristics of weed. Classify weeds based on ontogeny, origin and morphology with example. Discuss weed management in transplanted rice and potato crop. 10+10+10+10=40

5. (a) Write in brief, the factors affecting water use efficiency.
   (b) Mention the strategies that increase water use efficiency.
   (c) Give a schematic diagram of methods of irrigation.
   (d) Mention the different parameter which are considered for judging the suitability of water for irrigation. 10+10+10+10=40

6. (a) "All weeds are plants but all plants are not weeds." — Discuss with suitable example.
   (b) Discuss why it is easier to control weeds in winter and summer rice than Autumn rice.
   (c) State why preventive methods of weeds management is always better than control.
   (d) Discuss why chemical method of weed management is gaining importance day by day than other methods of weed management. 10+10+10+10=40

Group-B

Answer *any two* questions.

7. Writes notes on *any four* : 10×4=40
   (a) Global warming
   (b) Precision farming
   (c) Geographic Information System (GIS)

(d) Acid soil

(e) Dryland farming

(f) Biofertilizers

8. (a) Describe the principle and methods of agriculture extension.

(b) Describe the role of Krishi Vigyan Kendra in transfer of technology for rural development. 20+20=40

9. (a) What is the difference between fertility and productivity?

(b) Write note on Acid sulphate soil.

(c) Write notes on different agro climatic zones of India.

(d) Discuss about mixed cropping in India. 5+5+20+10=40

2022

AGRICULTURE

PAPER-II

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

Answers may be given either in ***English*** *or in* ***Bengali*** *but all answers must be in one and same language.*

Group-A

Answer *any three* questions.

1. (a) Membrane play an important role in various function of living plant cell. Explain it with diagram and example.
   (b) Discuss in details about photosynthesis of the plant. 20+20=40

2. Write notes on *any five* : 8×5=40
   (a) Cell
   (b) Cell Membrane
   (c) Mitochrondia
   (d) Chloroplast
   (e) Synaptonemal Complex
   (f) Cell theory
   (g) Ribosome
   (h) Vacuole

3. (a) Define seed.
   (b) Briefly describe the role of quality of seed in crop production.
   (c) Discuss about various seed quality characters.
   (d) Describe in brief about seed certification. 5+15+10+10=40

4. (a) What is allopolyploid? How does it occur in nature and how can you induce allopolyploid? Discuss the role of allopolyploid in plant evolution and limitation of it in crop inprovement. 2+3+3+12=20
   (b) What are the common aneuploids for locating genes of chromosome? Give a brief description of the techniques using suitable diagram. 20

5. (a) What is TPS? What are the advantages of using TPS? How can TPS be grown in plain area? 2+6+12=20
   (b) How do the seeds deteriorate? What are the symbols of deteriorated seeds? How it is possible to maintain genetic purity of seeds? What are the agronomic techniques adopted to maintain genetic purity of seeds? 5+5+5+5=20

6. Describe the standard method of cultivation of Mango with special reference to soil type, climatic condition, fertilizer requirements, irrigation and management practices. 40

Group-B

Answer *any two* questions.

7. Write short notes on *any five* :
   (a) GM crops
   (b) Important medicinal plants of West Bengal and their uses
   (c) Certified seeds
   (d) Pest Management
   (e) Indexing of tuber
   (f) Quarantine
   (g) Heritability

8. Write the variety of tube-rose in the plains of West Bengal. Write their cultivation with special reference to land preparation, fertilizer requirement, inter cultural operation, irrigation and stick management. 5+10+10+10+5=40

9. Write in brief (*any four*) :
   (a) Hill reaction
   (b) Nutritional Security
   (c) Role of light as a biological agent
   (d) Tripple fusion
   (e) Neurospora
   (f) Post-harvest technology

2022

ANIMAL HUSBANDRY AND VETERINARY SCIENCE

PAPER-I

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

Answers may be given either in ***English*** *or in* ***Bengali*** *but all answers must be in one and same language.*

Group-A

Answer *any three* questions.

1. (a) Write down the Animal Husbandry Programme for rural development.

   (b) Define the social group. Write down about type of social group and its their function.

   10+5+15+10=40

2. (a) Define Puberty. Write down the factors in details causing the infertility.

   (b) Write down the composition of Semen and how to preserve the Semen.

   (c) Write in details the advantage of Artificial Insemination. 15+15+10=40

3. (a) Write the partition of feed energy in animals and strategies used to methane emission from ruminants.

   (b) Define feed additives used in poultry diet.

   (c) Write benefits and limitation of microbials in animal feed. 10+15+15=40

4. (a) What are the objectives of green forder conservation?

   (b) Write in details about the crops suitable for silage and step in silage making in field condition.

   (c) Discuss the feeding strategies with emphasis on early lactation for high producing dairy cows. 10+15+15=40

Group-B

Answer *any four* questions.

5. (a) Describe silent contribution of Mendel's Principles of inheritance.

   (b) Briefly discuss the Mendel law of Independent Assortment with suitable example.

   (c) How do you view the contribution of G. J. Mendel in understanding the mechanism of inheritance?

   (d) Write the method of selection of dairy animals.

   (e) Write important breed of sheep. 10+10+10+10=40

6. Attempt *any four* questions:

   (a) Write important poultry breed in India.

   (b) Write difference between inbreeding and outbreeding in animal husbandry.

   (c) Write the major and trace minerals and their sources.

   (d) Write down the grading of eggs.

   (e) Write negative feedback mechanism of hormonal regulation. 10+10+10+10=40

2022

ANIMAL HUSBANDRY AND VETERINARY SCIENCE

PAPER-II

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

Answers may be given either in ***English*** *or in* ***Bengali*** *but all answers must be in one and same language.*

Group-A

Answer Question No. 1 *and* any two *from the rest.*

1. Answer *any ten* from the following: 6×10=60

   (a) Draw and describe the air sac of fowl.

   (b) Write the difference between endotoxin and exotoxin.

   (c) Write the full form of TCA, write in details about TCA.

   (d) Write the blood supply of head and gives the all branches with suitable diagrams.

   (e) Write the glycogen metabolism in muscle.

   (f) How we can conserve wildlife? Write the types of wildlife conservation.

   (g) Draw and describe the laryngeal cartilage of ox.

   (h) Write the pathological stages of pneumonia in goat.

   (i) Write the causes of diarrhoea and treatment of ox.

   (j) Write the symptom of B.Q. with specific treatment of cattle.

   (k) Write the different type of hernia.

2. Draw and describe formation, branching, course, distribution pattern of lumbo-sacral plexus in dog. 20+20=40

3. Write etiology, pathogenesis, clinical findings, diagnosis and treatment of Brucellosis. 3+7+10+10+10=40

4. (a) Differentiate between organophosphorus and organochlorine poisioning in animal. Discuss the treatment in both insecticide poisoning of calves.

   (b) Write down the layers of Retina. Describe in details about lamies of eye. (10+10)+(10+10)=40

Group-B

Attempt *any two* questions.

5. (a) Draw the bacterial growth curve.
   (b) Write the function of liver.
   (c) Write in details etiology, symptoms, diagnosis and treatment of Rabies. 10+10+10=30

6. Write in details etiology, pathogenesis, symptom and treatment of Tryponsomisis. 10+10+10=30

7. Write short on the following: 6×5=30
   (a) Ligament of liver
   (b) Milk fever and treatment
   (c) Snake bite poisioning and treatment
   (d) Dignosis of Tympany and clinical finding
   (e) Fever

2022

ANTHROPOLOGY

PAPER-I

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

*Answers may be given either in **English** or in **Bengali** but all answers must be in one and same language.*

Group-A

Answer *any three* questions.

1. (a) Briefly discuss the Neutral theory of molecular evolution.
   (b) What are the different types of molecular evolution?
   (c) Discuss the basis of neutral theory of molecular evolution. 10+10+10=30

2. (a) Write in brief the definition, aims and scopes of Development Anthropology.
   (b) What are the specific role of the anthropologists in the implementation of the development plans?
   (c) Discuss in brief the role of anthropologists in the Tribal-Rural Development programmes. (4+3+3)+10+10=30

3. (a) Write in brief on 'Cave art' and 'Home art' in upper palaeolithic period.
   (b) Discuss briefly the methods of cave art.
   (c) What were the motives of prehistoric human behind art as explained by prehistorians? (5+5)+10+10=30

4. (a) Discuss briefly questionnaire and schedule used in collection of data.
   (b) Write the advantages and disadvantages of the case-study Technique.
   (c) Write in brief about t-test and chi-square test with examples. (5+5)+(5+5)+(5+5)=30

Group-B

Answer *any three* questions.

5. (a) What do you mean by human growth and development? Write the different stages of human growth.
   (b) Discuss in brief, different factors which affect the growth and development.
   (c) Write about different methods of growth study. (5+5)+10+10=30

6. (a) Discuss in brief Lower Palaeolithic culture of Narmada valley.
   (b) Write a note on chopper-chopping culture found in Indian sub-continent. 15+15=30

7. (a) Discuss aim and scopes of Ecological Anthropology.
   (b) Write the methods of study Ecological Anthropology.
   (c) Write a note on culture ecology. 10+10+10=30

8. (a) Write the distribution of Archaic Homo Sapiens worldwide.
   (b) Write in brief anatomical features of Archaic Homo Sapiens.
   (c) Discuss phylogenetic relationship and taxonomic issues of Archaic Homo Sapiens. 10+10+10=30

Group-C

9. Write short notes on *any two* of the following: 10×2=20
   (a) Prepared core technique of tool making
   (b) Kula exchange system
   (c) DNA finger printing
   (d) Quasi participant observation

2022

ANTHROPOLOGY

PAPER-II

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

*Answers may be given either in **English** or in **Bengali** but all answers must be in one and same language.*

Group-A

Answer *any three* questions.

1. (a) Write in brief, an integrated approach of Anthropology and Folklore in understanding human society and cultural traditions.
   (b) Discuss on folkloric elements of West Bengal.
   (c) Write in brief on folklore and identity. 10+15+15=40

2. (a) Write a brief account on chalcolithic culture of Eastern India with mentioning chronology, salient features and distribution.
   (b) Discuss how chalcolithic culture developed to Iron Age culture in India and mention salient features of second urbanisation in India. (5+5+5+5)+20=40

3. (a) Write in brief, about anthrometry which are used to study the variation of Indian population.
   (b) What genetic markers are used to study emergence of man in India and contemporary variation of different ethnic groups. 20+20=40

4. (a) Discuss in brief, Hominin fossil findings from Narmada Valley with its salient features.
   (b) Write briefly the status of Narmada Man in the study of evolutionary history of human in South Asia with its phylogenetic controversy. 20+20=40

5. Write short notes on *any two* of the following: 20×2=40
   (a) Linguistic elements of Indian population
   (b) Role of Anthropology in development
   (c) Tribal movement
   (d) Mesolithic culture of India

Group-B

Answer *any two* questions.

6. (a) Discuss the phases of development and major trends of Anthropology in India.
   (b) Write the contribution of S.C. Roy and M.N. Srinivas in the foundation of Indian Anthropology. 20+20=40

7. (a) Discuss briefly theoritical understanding of structure of Indian civilization as proposed by R. Redfield and N. K. Bose.

   (b) Write in brief about Tribe-peasant and Tribe-caste continuum with suitable examples. 20+(10+10)=40

8. (a) Discuss in brief, the distribution of early Acheulian culture of India with salient features.

   (b) Write in brief, the Middle Palaeolithic culture of India with focus on chronology, distribution of sites and tool typology. 20+20=40

9. (a) Discuss briefly the development of village studies in India and its significance.

   (b) Write briefly different concepts developed through village studies in India. 20+20=40

2022

BOTANY

PAPER-I

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

*Answers may be given either in **English** or in **Bengali** or in **Nepali** but all answers must be in one and same language.*

Group-A

Answer *any four* of the following.

1. Write brief notes on *any four* of the following: 10×4=40
   (a) Mycotoxins with special reference to *Aflatoxins*
   (b) Sporopollenin—structure and function
   (c) Auxospore formation in Centrales and Pennales
   (d) Anamorphic fungi and parasexuality
   (e) Pathotoxins—definition, criteria and examples
   (f) Bryophytes in plant succession and pollution monitoring

2. Answer *any four* of the following: 10×4=40
   (a) Description and Phyllogenetic importance of Progymnosperms
   (b) Chemical structure and difference between gram(+) and gram(–) bacteria
   (c) Types of mycorrhiza and its role in agriculture and forestry
   (d) Telome concept and its significance in the origin of different groups of Pteridophytes
   (e) Application of genetic recombination in medicine and industry
   (f) Diagramatic representation of disease cycle of Late blight of potato and its control methods

3. Explain *any four* of the following: 10×4=40
   (a) Post fertilization changes in angiosperms
   (b) Salient features of Orchidaceae with special reference to floral structure and advanced features
   (c) In situ and ex situ biodiversity conservation
   (d) Adaptive anatomical features of Hydrophytes and Xerophytes
   (e) Define endemism with examples. Briefly discuss the vegetation of Eastern Himalaya's.
   (f) Types of vascular bundles in plants

4. Comment on *any four* of the following: 10×4=40
   (a) Types of stomata with examples and diagram
   (b) Organization of shoot apex with special reference to histogen and tunica-corpus concept

(c) Monophylletic, polyphylletic and paraphylletic groups in taxonomy

(d) Apospory and apogamy

(e) Algal toxins

(f) Ultrastructure of flagella and its differences with pili

5. Discuss *any four* of the following: 10×4=40

(a) Types of endosperm development with example

(b) Hydrosere concept

(c) Phytoremediation— types and examples

(d) Define '*Red Data Book*'. Write a note on importance of Indian Herberia and Botanical Gardens.

(e) Describe the various types of fruits with example.

(f) Name the origin, composition and uses of (i) Agaragar, (ii) Algin and (iii) Carrageenan.

Group-B

Answer *any two* questions.

6. (a) Discuss the origin of heterospory with examples. How heterospory led to seed habit in plants?

(b) Briefly describe the bacterial genome structure. What are plasmids? Mention its role in Biotechnology. (5+5)+(4+2+4)=20

7. (a) Describe the structural features and evolutionary significance of *Williumsonia oldhamia*.

(b) What are mechanical tissues in plants? Discuss the principles of distribution of mechanical tissues in plants. (6+4)+(5+5)=20

8. (a) Describe the ultrastructure and chemical composition of plant cell wall.

(b) Describe the salient features of the family Fabaceae. Name at least four economically important genera of the family. Distinguish the sub-families in accordance to Bentham & Hookers system of classification. (5+5)+(4+2+4)=20

2022

BOTANY

PAPER-II

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

Answers may be given either in ***English*** *or in* ***Bengali*** *or in* ***Nepali*** *but all answers must be in one and the same language.*

Answer any five *questions.* 40×5=200

1. Answer *any four* from the following:

(a) Describe in brief:

(i) Principles of enzyme action (Fishers and Koshland model)

(ii) Michaelis-Menten equation of enzyme Kinetics

(iii) Allosteric enzyme regulation 4+3+3=10

(b) Distinguish between:

(i) Functions of Ethylene and Abscisic acid

(ii) Symbiotic and non-symbiotic N_2-fixation

(iii) DNA and c-DNA 3+4+3=10

(c) Answer in brief:

(i) Sex-linked inheritance

(ii) Application of R-DNA technology and its social ethics

(iii) Oxidative Pentose-Phosphate Pathway 3+3+4=10

(d) Explain with diagram:

(i) C_4-pathway and crop productivity

(ii) Semiconservative replication of DNA

(iii) Maintenance of germplasm 4+3+3=10

(e) Justify:

(i) Triplet nature of genetic code

(ii) Asymmetric structure of plasma membrane

(iii) Pericentric inversion 4+3+3=10

2. Answer *any four* from the following:

(a) Write short notes on: 5×2=10

(i) Restriction enzymes

(ii) ELISA

(b) Explain:

(i) Universal nature of genetic code

(ii) Stress physiology 5+5=10

(c) Compare:

(i) *nif* gene and *nod* gene

(ii) Mass selection and pure line selection

(iii) Allosteric and covalently modulated enzyme regulation 3+3+4=10

(d) What are *phytochromes*? Discuss the various roles of phytochromes in flowering and plant growth. 2+4+4=10

(e) (i) Describe the structure and functions of endoplasmic reticulum.

(ii) Discuss the origin of allopolyploids and their importance. (3+2)+(4+1)=10

3. Answer *any four* from the following:

(a) Describe only with diagram/flow chart:

(i) Opening and closing mechanism of stomata

(ii) TCA-cycle with enzymes 5+5=10

(b) (i) Classification of enzymes according to IUBMB

(ii) Describe the process of biosynthesis of cytokinin. 5+5=10

(c) Compare the following:

(i) Compound and electron microscopy

(ii) Linkage and crossing-over 5+5=10

(d) Discuss in brief:

(i) Photoperiodism and plant types

(ii) Prokaryotic cellular types 5+5=10

(e) Write a brief account of Darwinism and mutation theory of de Vries. 7+3=10

4. Answer *any four* from the following: 10×4=40

(a) Explain in brief:

(i) Hybridization technique

(ii) Hardy-Weinberg equilibrium 5+5=10

(b) Define with example—holoenzyme, apoenzyme, co-factor, co-enzyme and prosthetic group. 2×5=10

(c) Define blotting. Briefly discuss Southern, Northern and Western blotting. 1+9=10

(d) Distinguish between:

(i) Mitotic and meiotic metaphase

(ii) Chromosomal mutation and gene mutation 5+5=10

(e) (i) Role of bacteria as an alternative source of Nitrogen fertilizer

(ii) Cell cycle control 5+5=10

5. Answer *any four* from the following: 10×4=40

(a) Write notes on:

(i) Nucleosome model

(ii) Structure and function of ribosome 5+5=10

(b) Answer the following: 2×5=10

(i) Define ribozymes.

(ii) What technique is employed to separate isozymes?

(iii) Distinguish between DNA and RNA.

(iv) What are phospho-lipids? Where do they occur in plants?

(v) What bonds are associated with formation of protein structure?

(c) Explain in brief:

(i) Ethylene as plant growth regulator

(ii) Z-scheme 5+5=10

(d) Distinguish between C_3 and C_4 pathway. Cite examples of C_3 and C_4 plants. 8+2=10

(e) Explain briefly with examples.

(i) Transgenic plants

(ii) PCR technique 5+5=10

6. Answer *any four* from the following: 10×4=40

(a) Define micropropagation with examples. Briefly discuss the different gene transfer methods. 4+6=10

(b) Distinguish between transcription and translation. Name the various types of RNA-polymerase with function. What is reverse transcriptase? 2+6+2=10

(c) Distinguish between: 2×5=10

(i) Split gene and overlapping gene

(ii) Anaphase Chromosome of Meiosis I and II

(iii) Omega 3 and Omega 6 fatty acids

(iv) Homeotic gene and Caretaker gene

(v) Auto and allopolyploids

(d) Write notes on:

(i) Techniques of sexual hybridization

(ii) Role of intercalating agents on DNA-mutation 5+5=10

(e) Find out mean, standard deviation, mean deviation, co-efficient of variation and standard error from the given sample:

Class value	Frequency
48	8
50	32
52	75
54	52
56	28
58	5

2×5=10

7. Answer *any four* from the following: 10×4=40

(a) (i) Briefly describe the Lac-operon concept.

(ii) Write a note on embryo culture and its importance. 5+5=10

(b) Define chromosomal aberration. Briefly discuss deletion, duplication, translocation and inversion. 2×5=10

(c) Describe the structure and function of dinitrogenase complex. Write a note on ETS of dinitrogenase. 6+4=10

(d) Write notes on:

(i) Visible and UV-visible spectrophotometry and its significance.

(ii) Biochemical reactions of 'Calvin's Cycle' and stoichiometry. 5+5=10

(e) Discuss the overdominance hypothesis of Heterosis. Give an outline of different techniques of Emasculation in hybridization. Write a note on cytoplasmic male sterility. 4+4+2=10

2022

CHEMISTRY

PAPER-I

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

*Answers may be given either in **English** or in **Bengali** but all answers must be in one and the same language.*

Section-I

This Section comprises 15 questions in three Groups.

Answer *any ten* questions taking *at least three* questions from each Group.

Group-A

1. How the four Quantum Numbers signify the state of an electron in H atom? 4

2. ICl_2^- is linear but NH_2^- is bent.— Justify. 4

3. Among the following which is stronger base $(H_3Si)_2O$, $(H_3C)_2O$? Explain. 4

4. Aqueous solution of $SbCl_3$ turns turbid. — Explain. 4

5. E^O values for Zn^{+2}/Zn and Ag^+/Ag half cells are –0·763 V and +0·799 V respectively. Calculate the E^O_{cell} value in Volt. 4

Group-B

6. Explain why the distance between two successive hkl planes for a cubic system cannot be $a/\sqrt{7}$ where a is the length of the edge of the cube. 4

7. Calculate the ratio of final to initial wall collision frequency for an ideal gas if pressure is doubled at constant density. 4

8. Calculate the inlet pressure required to maintain a flow rate of $9{\cdot}5\times10^5$ Lh^{-1} of nitrogen at 293 K flowing through a pipe of length 8.50 m and diameter 1·00 cm. The pressure of the gas as it leaves the tube is 1·00 bar. The volume of the gas is measured at that pressure. Given $\eta = 1{\cdot}76 \times 10^{-5}$ kg m^{-1} s^{-1} at 293 K. 4

9. Does the equilibrium constant depend on the stoichiometry of the chemical reaction? "Kp is independent of pressure at constant temperature for all gaseous reaction" — Justify or contradict. 2+2=4

Group-B

3. (a) Write down the Maxwell function for distribution of molecular speeds in three dimensions in the case of an ideal gas, explaining the terms involved. Draw the distribution curves, on the same graph, for two gases of molar mass M_1 and M_2 ($M_2 = 2M_1$) at the same temperature T. Estimate the ratio of the most probable speeds in two cases. 2+2+2=6

(b) One mole of an ideal gas is expanded adiabatically but irreversibly from V_1 to V_2 and no work is done.

(i) Does the temperature of the gas change?

(ii) What is ΔS for the gas and the surroundings? 4

(c) Write down the van der Waal's equation in the virial form. Hence deduce the expression for the Boyle temperature from the second virial coefficient. 4

(d) N_2 and O_2 combine at a given temperature to produce NO. At equilibrium, the yield of NO is x% by volume. If $x = \sqrt{Kab} - \frac{K(a+b)}{4}$ where K is the equilibrium constant of the reaction at the given temperature and 'a' and 'b' are the volume percentages of N_2 and O_2 respectively in the initial pure mixture, what should be the initial composition of the reaction mixture in order that maximum yield of NO is ensured? 6

(e) Why is it difficult to blow a balloon initially, but becomes easier afterwards? (Consider the balloon as a bubble).

Find the change in surface energy when two identical Hg droplets of diameter 1·5 mm merge isothermally to form one drop. [γ of Hg = 490 dyne cm^{-1}] 2+3=5

(f) For the ideal gas reaction $PCl_5\,(g) \rightleftharpoons PCl_3\,(g) + Cl_2\,(g)$, state with reasons, how the equilibrium is affected when each of the following changes is made in the above equilibrium mixture at 25°C.

(i) He(g) is added at constant T and V.

(ii) He(g) is added at constant T and P. 2+3=5

(g) What do you mean by residual entropy? 3

(h) Al crystallises with a face centered cubic lattice. The inter ionic distance (shortest) in a unit cell of Aluminium is 2.86Å. Calculate the density of Al. (Atomic weight of Al = 27).

Show that in an orthorhombic unit cell, the separation of the *hkl* planes will be reduced by a factor of 'n' if all three Miller indices are multiplied by that factor.

Although NaCl and KCl have same crystalline structures, reflection from (111) planes is present in NaCl crystal but that is missing in KCl crystal. — Explain. 2+2+3=7

4. (a) Represent graphically (by P-V curve) the behaviour of a typical van der Waals' gas at three different temperatures T >> Tc, T = Tc and T < Tc. Justify that the condition

$\left(\frac{\partial P}{\partial V}\right)_T = \left(\frac{\partial^2 P}{\partial V^2}\right) = 0$ serve to give the critical constants. 5

(b) For the process H_2O (liquid) $\rightarrow$ H_2O (vapour), $\Delta H_{vap} = 40{\cdot}52$ kJ mol^{-1} at 100°C and 1 atm pressure. Assuming ideal behavior of the vapour phase, calculate w, ΔU, ΔS and ΔG for the process. 5

(c) "Joule-Thompson experiment is an isenthalpic process" — Justify or criticize the statement.

Prove that: $\mu_{JT} = \frac{1}{C_P}\left[T\left(\frac{\partial V}{\partial T}\right)_P - V\right]$

where μ_{JT} is the Joule-Thompson coefficient. Hence explain 'inversion temperature'.

2+3+2=7

(d) What is the highest order that can be observed in Bragg's reflection from a crystal of interplanar distance 2Å by X-ray having wavelength 100 pm?

From the following data, determine the type of cubic lattice to which the system belong: Edge length 286 pm, Density 7·86 g cm^{-3}, Molar mass 55·85 g mol^{-1}. 3+4=7

(e) Show that according to the simple kinetic molecular theory of gases, the viscosity coefficient is

(i) independent of pressure. Give a physical explanation of why this should be so.

(ii) directly proportional to average velocity of a definite amount of gas at definite temperature. 4+3=7

(f) State whether each of the following properties increases or decreases as intermolecular attraction increases:

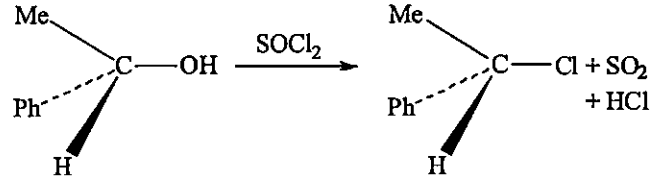
Surface tension of a liquid, Viscosity of a liquid, Viscosity of a gas.

The limb of a vertical U-tube having internal dimensions of 1 mm and 2 mm respectively, is partially filled with a liquid. What is the difference in levels of the liquid? 3+3=6

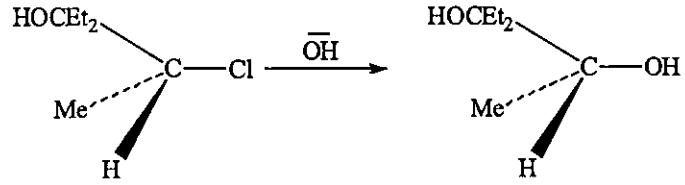
(g) The value of Kp for the reaction $NH_3(g) \rightleftharpoons \frac{3}{2}H_2(g) + \frac{1}{2}N_2(g)$ is $1{\cdot}36 \times 10^{-3}$ at 298 K. Determine the corresponding value of K_c. 3

(d) Suggest the mechanism of the following reactions: 5×2=10

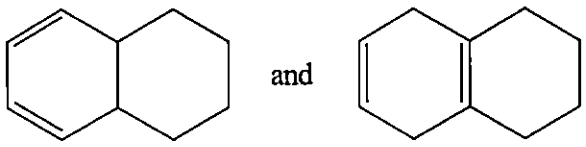
(i)



(ii)



(e) How would you distinguish between the two compounds by UV spectroscopic studies? 3



(I) (II)

2022

CHEMISTRY

PAPER-II

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

Answers may be given either in ***English*** *or in* ***Bengali*** *but all answers must be in one and same language.*

Section-I

This Section comprises 15 questions in three Groups. Answer *any ten* questions taking *at least three* questions from each Group.

Group-A

1. Write down the IUPAC name of Zeise's Salt. Do you expect any rotation in ethylene molecule of Zeise's Salt without hampering the stability of the complex? If possible explain it. 1+1+2=4

2. Metal deficiency and metal excess both may exert harmful effects — Explain with example. 2+2=4

3. $[Co\ F_6]^{3-}$ and $[Ni\ F_6]^{2-}$ ions both have weak field F^- ion as ligand, yet $[Co\ F_6]^{3-}$ is paramagnetic and $[Ni\ F_6]^{2-}$ is diamagnetic— Explain. 2+2=4

4. Draw all the optical and geometrical isomers of $[Co(en)_2\ Cl_2]^+$. (en = 1, 2-diaminoethane) 4

5. How ferrocene is prepared? What is the oxidation state of Fe in ferrocene? 3+1=4

Group-B

6. Derive Clausius-Clapeyron equation thermodynamically for liquid-vapour equilibrium. 4

7. For a 10°C rise in temperature the rate constant doubles for reaction I, trebles for reaction II. If the two reactions have comparable pre-exponential factors, what is the ratio of their activation energies? 4

8. Adsorption of gas on a solid surface is an exothermic process. Justify. Write down four differences between physisorption and chemisorption. 2+2=4

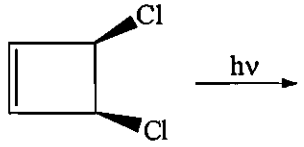
9. The number of the degrees of freedom for a system of a mixture of $H_2(g)$, $O_2(g)$ and $H_2O(g)$ may be either 4 or 2— Comment. 4

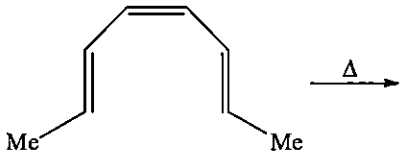
10. What is photostationary state? How does this differ from the equilibrium state? 4

Group-C

11. Although the –OH group is not bulky, *cis* 1, 4-cyclohexane diol exist preferably in twist boat conformation — Explain. 4

12. Predict the product(s) of the following reactions and explain. 4

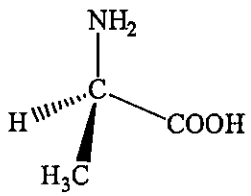
(i) 

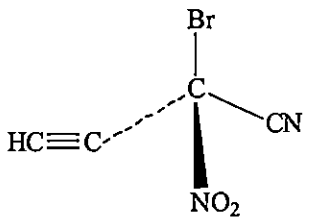
(ii) 

13. Carry out the mechanism of the following reaction: 4

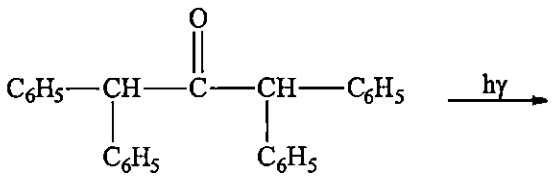
$$2CH_3CHO \underset{}{\overset{(-)}{\underset{OH}{\rightleftharpoons}}} CH_3—CH(OH)CH_2CHO$$

14. Assign description of the following molecules: 4

(i) 

(ii) 

15. Complete the following Norish Type I reaction with explanation (mechanism): 4



Section-II

This Section comprises *six* questions in three Groups. Answer *any four* questions taking *at least one* question from each Group.

Group-A

1. (a) Find out 'n' in

(i) $Fe_3(CO)_n$

(ii) $Co_4(CO)_n$

(iii) $Fe_4(CO)_n$ 2+2+2=6

(b) Using trans effect phenomenon prepare all possible stereoisomers of $Pt(Cl)(NH_3)(P_y)Br$ starting from $P + Cl_4^{2-}$ 2+2+2=6

(c) Identify the compounds A, B and C in the following reaction: 2+2+2=6

$$(\eta^5 - C_5H_5)_2\,Fe \xrightarrow[AlCl_3\ (anhydrous)]{CH_3COCl} A$$

$$\xrightarrow{n.BuLi} B$$

$$\xrightarrow[CH_3COOH]{HCHO + Me_2NH} C$$

(d) Why is the change from deoxyhaemoglobin to oxy-form accompanied by a decrease in the observed magnetic moment? 3+3=6

(e) Evaluate the ground state term for Cr^{+3}. 4

(f) Account the carbonyl streching frequency (in cm^{-1}) of the following: 6

CO	$[V(CO)_6]^-$	$[Cr(CO)_6]$	$[Mn(CO)_6]^+$
2143	1860	2000	2090

(g) Using CFSE indicate whather $MnCr_2O_4$ is normal or inverted spined? 6

2. (a) What are fluxional molecules? Give one example. 3+1=4

(b) What are the different modes of finding in carbonyls? Describe with examples, also comment on the CO streching frequencies in those binding mode. 3+3+3=9

(c) Draw the active site structure of Ferrodoxins and comment on the magnetic property during electron transfer process. 2+4=6

(d) How can you incorporate $-NH_2$ group in Ferrocene? Explain why ferrocene is unreactive towards iodine where as cobaltocene is readily decolorizes the colour of iodine solution. 3+3=6

(e) Aqueous solution of Co (II) is pale pink in colour, but when excess conc HCl is added to it, solution become intensely blue — explain. 4

(f) Define hapticity of an organometallic ligand. Indicate various modes of binding of cyclopentadiene taking proper examples. 2+3=5

(g) Name any two of each major elements and trace elements. Name two biological function of Mg^{2+}. 2+2+2=6

Group-B

3. (a) Give a schematic plot of the energy profile diagrams for an exothermic reaction carried out in absence and presence of a catalyst. Hence explain how a catalyst takes part in the reaction. 5

(b) 100 g of a 1 : 1 (by weight) mixture of water and phenol is taken at 40°C. It shows two layers:

(i) phenol (9.2%) in water and

(ii) water (35%) in phenol. Find the amount of the two layers. Also mark the above three % values of phenol (w/w) in proper T-wt % of phenol diagram. Assume CST = 66°C, weight % of phenol at CST = 33%. 7

(c) For a simultaneous set of reactions $A \xrightarrow{k_1} B$; $A \xrightarrow{k_2} C$

Show that:

(i) $[B] / [C] = k_1/k_2$ at any time t, where $0 < t < t_{eqm}$

(ii) If $k_1/k_2 = 2$, plot [A], [B], [C] on the same graph as functions of time, assuming that $[B]_0 = [C]_0 = 0$. 4+4=8

(d) Derive Langmuir adsorption isotherm, mentioning the assumptions involved. Suggest a suitable linear plot for its varification. In the Langmuir model of absorption of a gas on solid if rate constant of adsorption is equal to that of descorption at 1 atm pressure, the surface is 50% covered. Justify/criticise. 5+5+5=15

(e) The photochemical decomposition of HI proceeds by the following mechanism:

$HI + h\nu \longrightarrow H + I$

$H + HI \xrightarrow{k_2} H_2 + I$

$I + I \xrightarrow{k_2} I_2$

Derive an expression for $-\frac{d[HI]}{dt}$ and hence calculate the quantum yield (φ). 5

4. (a) Show that the following experimental observations follow the above kinetic features of the photochemical decomposition of gaseous HI. Absorption of 3.07×10^9 ergs of energy (light of wavelength 2537 Å) decomposes 1.30×10^{-3} moles of HI. One Einstein = $1.196 \times 10^8 / \lambda$ ergs $mole^{-1}$. 6

(b) Establish how the frequency factor of a bimolecular reaction is related to $\Delta S^{\#}$. If the activation energy for the gaseous reaction $H_2 + I_2 \longrightarrow 2HI$ is 167 kJ and the ΔH for the reaction is – 8.2k What is the activation energy for the decomposition of HI? 5+5=10

(c) Draw the phase diagram for water system and find the number of degrees of freedom at the triple point of water. 4+2=6

(d) Give examples of three model systems where the energy gap between successive levels (i) remains the same, (ii) decreases and (iii) increases. 3

(e) The reaction $2A \leftrightarrow A_2$ occurs photochemically. The different steps in the reaction system are,

(i) $A \xrightarrow{h\nu} A^*$

(ii) $A^* + A \xrightarrow{k_2} A_2$

(iii) $A^* \xrightarrow{k_3} A + h\nu'$

(iv) $A_2 \xrightarrow{k_4} 2A$

Applying the steady state concept of A^*, show that at photostationary equilibrium,

$$[A_2] = \frac{I_a}{K_4\left\{1+\frac{k_3}{k_2[A]}\right\}}$$

Also show that $[A_2]$ is independent of A when A is present in large excess. 6+2=8

(f) A heteronuclear diatomic molecule of reduced mass 1.63×10^{-24}g absorbs at 2880 cm^{-1}. Calculate the force constant assuming harmonic oscillator model. 4

(g) Methyl acetate was hydrolysed to acetic acid and methanol using 1 (N) HCl as catalyst. Aliquots of equal volume were removed at intervals and titrated with a solution of NaOH.

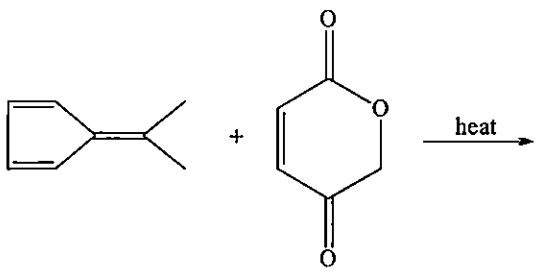
Time (min)	0	5	15	∞
NaOH (cm^3)	24.0	27.0	31.4	40.0

Show that it is a first order reaction and evaluate the average life period of the reaction, in minutes. 3

Group-C

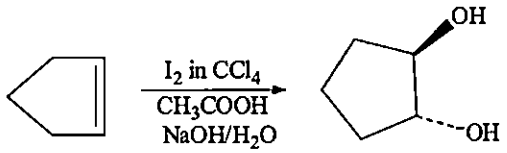
5. (a) Draw the different conformers and their energy diagram of n-butane. 5

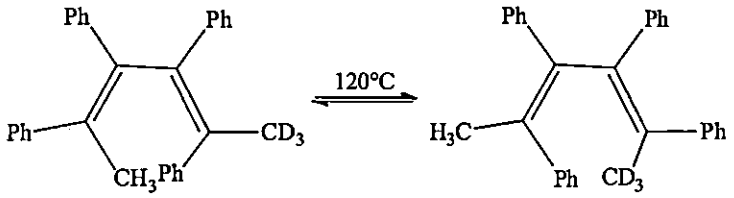
(b) Identify the product(s) of the following reaction and predict the major product with proper explanation. 5



(c) $LiAlH_4$ reduction of R-Benzoin gives meso hydrobenzoin as the major product. Applying Cram's rule to rationalise the observation. 10

(d) Suggest the mechanism of the following transformation: 5×2=10

(i) 

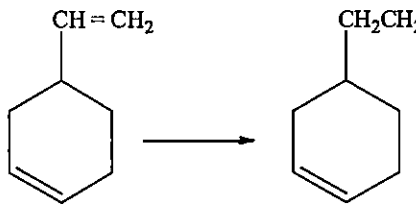
(ii) 

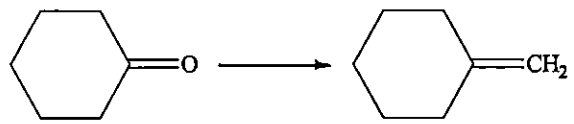
(e) Synthesis 5×2=10

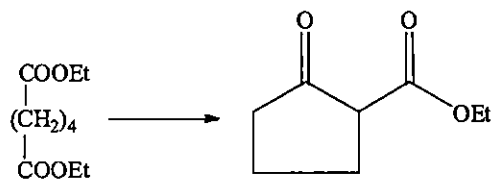
(i) Cinnamic acid through Perkin reaction.

(ii) 3-hydroxy-2-Butanone through acyloin condensation.

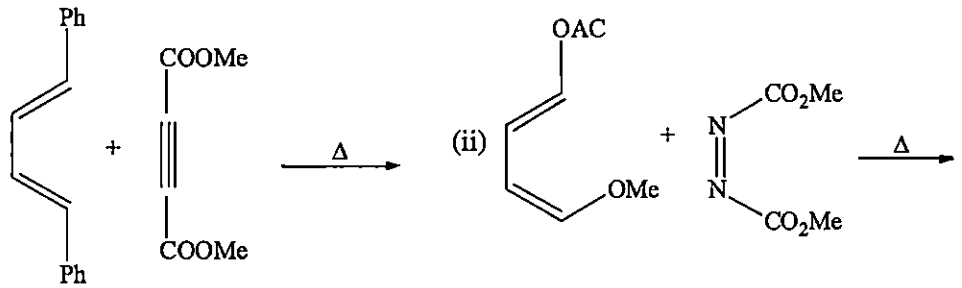
6. (a) How would you accomplish the following transformation? 5×3=15

(i) 

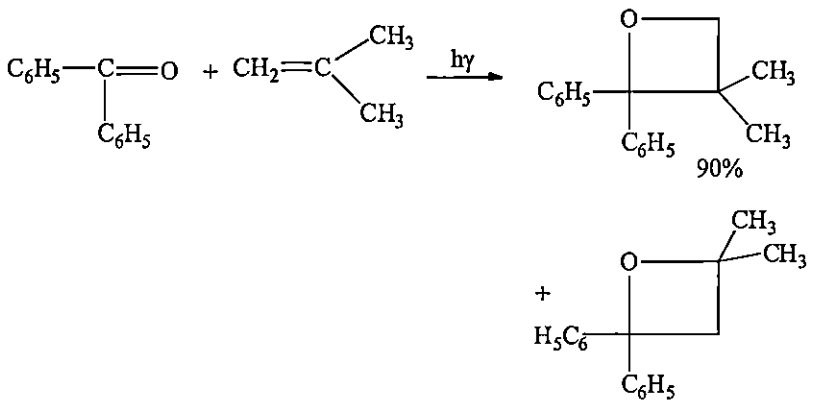
(ii) 

(iii) 

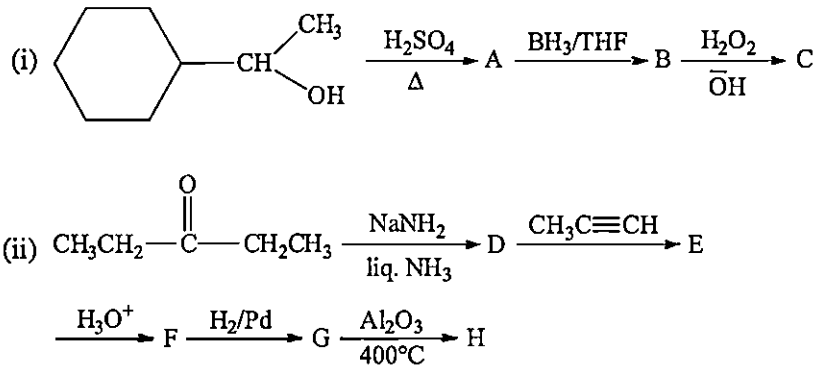
(b) Give the stereochemistry of the product of the given reactions. 5×2=10



(c) Suggest the mechanism of the following Paternobuchi photo reaction. 6



(d) Identify A – H. 2×3=6



(e) Draw the Fischer Projection formula of the following molecules: 3

(i) S–Lactic acid

(ii) R–2-Butanol

2022

COMMERCE AND ACCOUNTANCY

PAPER-I

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

*Answers may be given either in **English** or in **Bengali** but all answers must be in one and the same language.*

Answer one question each from the following five groups.

Group-A

1. From the following Trial Balance of ABC and the additional information, prepare a Trading and Profit and Loss Account for the year ending on 31st December, 2021 and a Balance Sheet as at that date:

Dr. Cr.

Particulars	(₹)	Particulars	(₹)
Machinery	1,24,900	Provision for Debtors	4,100
Buildings	8,72,560	Capital	1,48,900
Salaries & Wages	34,800	Provision for Depreciation on Machinery	23,000
Sales Ledger Balance	1,64,800	Provision for Depreciation on Building	1,12,700
Purchases	1,10,800	Purchase Ledger Balance	1,42,600
Return	4,100	Sales	6,86,220
Carriage Inward	5,900	Return	5,230
Carriage Outward	6,300	Bad debt Recovery	1,800
Bad debt	6,900	Bills Payable	6,900
Due from Consignee	1,800	Bank Overdraft	3,12,500
Depreciation on Machinery & Building	11,600	Goods sent on consignment	6,400
Bills Receivables	13,000	Consignment Profit	1,300
Freight on Purchase	3,600		
Freight on Sales	5,700		
Provision on Creditors	1,500		
Drawings	20,800		
Bank	23,900		
Advertisement	6,090		
Commission to Purchase Manager	6,100		
Commission to Sales Manager	7;900		
Octroi	4,500		
Income Tax	4,700		
Consignment Stock	3,500		
Sundry Expenses	5,900		
	14,51,650		14,51,650

(vii) The notes to Balance Sheet relating to share capital includes the following:

	Share Capital	(₹)	(₹)
(a)	Subscribed and fully paid-up		
	18,000 equity shares of ₹ 10 each		1,80,000
(b)	Subscribed but not fully paid-up		
	6,000 equity shares of ₹ 10 each	60,000	
	(less) calls-in-arrear @ ₹ 3 per share	18,000	
			42,000
			2,22,000

After forfeiting the shares on which the call money is outstanding, they were re-issued at ₹ 5 per share, ₹ 7 paid-up and the other fully paid-up shares were reduced to ₹ 7 per share paid-up. [2+2+2+3+3+3+5=20]

(b) Equity Liabilities & Assets of ABC Ltd. as on 31/3/21 are as follows:

		(₹)
I.	Equity and Liabilities	
	1. Shareholder's Fund:	
	(a) Share Capital:	
	8,00,000 Equity shares of ₹ 10 each	80,00,000
	(b) Reserves and Surplus:	
	(i) Securities Premium Account	8,00,000
	(ii) General Reserve	72,00,000
	2. Non-Current Liabilities:	
	Secured Loan: 13% Debentures	40,00,000
	3. Current Liabilities	40,00,000
		2,40,00,000
II.	Assets:	
	1. Non-Current Assets:	
	Fixed Assets	80,00,000
	2. Current Assets:	
	(a) Stock-in Trade	48,00,000
	(b) Sundry Debtors	40,00,000
	(c) Bank Balance	72,00,000
		2,40,00,000

It was decided at the meeting of the shareholders:

(a) to buyback 20% of the equity shares @ ₹ 12 per share;

(b) to utilize the general reserve for buy back of shares;

(c) to utilize securities premium reserve for premium payable on buyback of shares.

Pass the Journal entries and draw up the Balance Sheet after the above transactions have been given effect to. [8+12=20]

4. (a) ABC Ltd. issued 30,000 equity shares of ₹ 10 each at a premium ₹ 10 per share payable as follows:

On application: ₹ 3 per share; on allotment: ₹ 13 per share (including premium); on call: ₹ 4 per share.

Applications were received for 50,000 shares. Excess application money was refunded by the company in due time.

Mr. P, the holder of 2500 shares failed to pay the allotment money on his subsequent failure to pay the call money, the shares were forfeited. Later on the forfeited shares were re-issued at par.

Show the Journal entries and Cash Book entries in the books of ABC Ltd. Show all the workings. [15+15=30]

(b) (i) Explain the objectives and benefits of buy back of shares.

(ii) Explain the rationale behind re-issue of shares. [5+5=10]

Group-C

5. (a) ABC toys manufacture 1000 pices of toys when working at normal capacity. It incurs the cost of ₹ 16 in manufacturing one unit. The details of this cost is given below:

Direct Material — ₹ 7·5; Direct Labour — ₹ 2;

Variable Overheads — ₹ 2·5; Variable selling & administrative expenses — ₹ 0·50.

Fixed Cost — ₹ 4; Sale Price — ₹ 20; Variable selling and administrative expenses are not included in the cost of ₹ 16.

During the next 3 months, only 500 units can be produced and sold. Management plans to close down the factory estimating that the fixed manufacturing cost can be reduced to ₹ 2,000 for the quarter.

When the plant is operating, the fixed overhead costs are incurred at a uniform rate throughout the year. Additional cost of plant shut down for the three months is estimated at ₹ 2,800.

Should the plant be shut down for three months? Calculate the shut down point for three months in units of products. 15

(b) The following data is of PQR manufacturing company:

Costs	Variable cost (% of Sales)	Fixed cost (₹)
Direct material	23·8	
Direct labour	18·4	
Factory overheads	21·6	37,980
Distribution expenses	4·1	11,680
General & administrative expenses	11·1	13,340

Budgeted sales for the next year are ₹ 3,70,000.

Calculate the following:

(i) The sales required to break even.

(ii) Profit at the budgeted sales volume.

(iii) The profit if actual sales increase by 5% from the budgeted sales.

(iv) If there is drop by 10% from the budget sales in terms of actual sales, what will be the new profit? [15]

Additional Information:

(a) X Ltd. acquired its interest in Y Ltd. On 1st January, 2020. When the balance to the General Reserve Account of Y Ltd. was ₹ 1,80,000.

(b) The Balance to the Profit & Loss Account of Y Ltd. as on 31st December, 2020 was arrived at as under—

		(₹)
Balance on 1/1/20		40,000
Current Profit (including dividends)		2,04,000
		2,44,000
Less. Transfer to General Reserve	20,000	
Proposed Dividend	84,000	
		1,04,000
Balance as on 31/12/20		1,40,000

(c) Balance to the Profit & Loss Account of Y Ltd. as on 1/1/2020 was after providing for dividends on Preference shares and 10% dividends on Equity shares for the year ended 31st December, 2019. These dividends were paid in cash by Y Ltd. in May 2020.

(d) No entries have been made in the books of X Ltd. for debenture interest due as for proposed dividends of Y Ltd. for the year ended 31/12/20.

(e) Mutual Indebtedness of ₹ 24,000 is reflected in the balance shown in the Balance Sheet.

(f) Y Ltd. in October 2020 issued fully paid up bonus shares in the ratio of one share for every four shares held by utilizing the general reserve. This was not recorded in the books of both the companies.

(g) Dividend paid by Y Ltd. for 2019 was created to Profit & Loss Account of X Ltd. instead of crediting to investments in subsidiary Company Account.

(h) X Ltd. acquired both the Equity Shares and Preference Shares of Y Ltd. on 1st January, 2020.

From the above information prepare the consolidated Balance Sheet of X Ltd. and its subsidiary Y Ltd. as at 31/12/2020. Show all the workings as a part of your answer. [40]

10. Write short notes on the following: [5×8=40]

(a) Input Tax Credit

(b) Idle Time and its impact on Labour Variances

(c) Machine Hour Rate

(d) Unrealised Profit on stock in case of Holding Company and its calculation

(e) Deductions under section 80C

(f) Deductions under section 80G

(g) Primary and Secondary Distribution in Overheads

(h) Suspense Account.

2022

COMMERCE AND ACCOUNTANCY

PAPER-II

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

Answers may be given either in ***English*** *or in* ***Bengali*** *but all answers must be in one and the same language.*

Group-A

Answer *Question No. 1* and *any one* from the rest.

1. (a) Explain the structure of the Indian Financial System in detail, thereby describing each component.

   (b) Describe the role of financial intermediaries in the economic development.

   (c) Explain the functions of SEBI in the context of financial system. 16+16+8=40

2. (a) (i) Differentiate between primary and secondary market.

   (ii) Describe the concept and functioning of all money market.

   (b) Explain the role of NABARD in the development of the economy, highlighting its functions. 16+16=32

3. (a) (i) Explain the methods of trading securities in the stock exchange.

   (ii) Explain the concept and functioning of a DEMAT account.

   (b) What are the causes of price fluctuations in the stock exchange?

   (c) Explain the recent trends in the Indian Money Market. 16+8+8=32

4. (a) Explain the role and functions of the Reserve Bank of India.

   (b) What is the need and function of discount houses?

   (c) What are the functions of Commercial Banks? 16+8+8=32

Group-B

Answer *any two* questions.

5. (a) Define contract.

   (b) Explain the various rules regarding offer and acceptance.

   (c) Explain the concept of void and voidable agreements as per Indian Contract Act, 1872. 4+16+12=32

6. (a) Explain the composition and jurisdiction of District Forum.
   (b) Differentiate between State Commission and National Commission.
   (c) Define:
      (i) Unfair trade practices
      (ii) Dispute 16+8+8=32

7. (a) Explain the structure and components of the Memorandum and Articles of Association as per Companies Act, 2013.
   (b) Explain the steps in the process of promotion and incorporation of a company as per Companies Act, 2013.
   (c) What are the role and functions of Directors as per Companies Act, 2013? 12+12+8=32

8. (a) Explain the concept and need for collective bargaining as per Industrial Disputes Act, 1947.
   (b) Describe the causes of Industrial Disputes.
   (c) What are the consequences of ultra vires acts of the company? 16+8+8=32

Group-C

Answer *any one* question.

9. (a) What are the provisions of the Companies Act, 2013 regarding appointment , re-appointment and removal of a Company Auditor?
   (b) Explain the various types of Audit Report highlighting the key features of each type.
   (c) Can a statutory auditor of a company depend completely on the report of the internal auditor? Justify your answer focussing on the responsibilities of the statutory auditor. 16+8+8=32

10. (a) How would you do the annual financial audit of an NGO? Focus on the key areas you will audit and the detailed plan of the audit.
   (b) Explain the preconditions to an audit of a company.
   (c) Explain the concept of Audit Working Papers. What are the two specific types of files maintained as Audit Working Papers? What are the components of these files? 16+8+8=32

Group-D

Answer *any one* question.

11. (a) Explain Maslow's Need Hierarchy Theory.
   (b) Differentiate between McGregor's theory X and theory Y.
   (c) Is there any similarity between Herzberg's Motivation Theory and Maslow's Need Hierarchy Theory? Justify your answer. 16+8+8=32

12. (a) Explain Fiedler's Situational Theory of Leadership.
   (b) Explain the Managerial Grid with an appropriate diagram, thereby bringing out the key features of each of the styles of leadership as per the Managerial Grid. 16+16=32

2022

COMPUTER SCIENCE

PAPER-I

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

*Answers may be given either in **English** or in **Bengali** but all answers must be in one and same language.*

Answer *any five* questions.

1. (a) Suppose you have to give Rs. N to your friend. You have enough numbers of 500, 200, 100, 50, 20, 10 rupee notes each at your disposal. Your goal is to give Rs. N to your friend with minimum number of notes. For example, Rs. 600 can be changed 1 using three Rs. 200 notes as well as using one Rs. 500 note and one Rs. 100 note. However, the later one uses minimum number of notes.
   (i) Either prove correctness or provide counter example of the following greedy strategy: keep picking highest denomination as much as you can!
   (ii) Provide a set of denominations for which the above greedy strategy will fail.

   (b) There is a sequence of n activities $a_1, a_2, ..., a_n$ with corresponding utilities $u_1, u_2, ..., u_n$. You wish to perform all these n activities according to this sequence within k days. If you perform the activities from a_i to a_j for some $1 \le i \le j \le$ non the j-th day, then your utility U_i for the j-th day is $\max\{u_l : i \le l \le j\}$. Your total utility is $\sum_{l=1}^{k} U_l$. Design a greedy algorithm to find the sequence of activities you will perform on every day which maximizes your total utility.

   (c) A string s is called a sub-sequence of another string 't', if 's' can be obtained from 't' by deleting some symbols from s. Design a dynamic programming-based algorithm that finds the longest common sub-sequence of two input strings.

   (d) Design a dynamic programming-based algorithm that finds a subset of a set of integers (given as an array of integers as input) that has the maximum sum of its elements. 10+10+10+10=40

2. (a) Let $G = (V, E)$ be a connected, weighted graph. Let T and T' be two MSTs of G and $\alpha \in R$ then show that, the number of edges in T of weight α is the same as the numbers of edges in T' of weight α.

   (b) Let $G = (V, E)$ be a connected, weighted graph, $v \in V$ be any vertex, and e be an edge with minimum weight among all the edges that incident on v. Prove that there exists a MST which includes the edge e.

   (c) Let G be a connected, weighted graph. Prove that, if all edge weights in G are distinct, then G has exactly one MST.

   (d) Prove that an infinite graph with a finite number of edges (i.e., a graph with a finite number of edges and an infinite number of vertices) must have an infinite number of isolated vertices.

   (e) Consider the following properties of an undirected graph G with n vertices.
   (i) G is connected.
   (ii) G is acyclic.
   (iii) G has $n - 1$ edges.

Prove that if G satisfies any two of the above three properties, then G also satisfies the third property, i,e.,

(i) if G satisfies properties (a) and (b), then G satisfies property (c),

(ii) if G satisfies properties (a) and (c), then G satisfies property (b),

(iii) if G satisfies properties (b) and (c), then G satisfies property (a).

As you must know, graphs satisfying these three properties are called trees. 15+5+5+5+10=40

3. (a) You are given an unsorted array $A = A[1...n]$ containing n distinct integers. Design an algorithm that outputs the smallest k elements in array A. The running time of your algorithm should be $O(n + k\log n)$. Give pseudocode and discuss running time.

(b) Write Merge sort algorithm. Let A and B be two sequences of n integers each. Given an integer m, describe an $O(n\log n)$ time algorithm for determining if there is an integer a in A and b in B such that $m = a + b$.

(c) Define a Circular Queue. Implement Insert and Delete operations on it using the link list.

(d) Write a program that counts the number of leaves of a binary tree. Use an example to demonstrate your solution. 10+10+10+10=40

4. (a) Construct a DFA for the language $L = \{w \mid w \in (a + b)^*\}$ such that $N_a(w) \bmod 3 = 0$ and $N_a(b) \bmod 5 = 0$.

(b) What is Instantaneous Description in a Pushdown Automata (PDA)? Construct a PDA for the language $L = \{ww^F \mid w \in (0, 1)^*\}$.

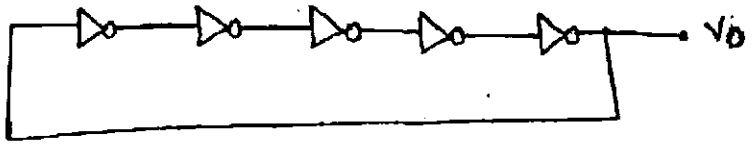
(c) What is a Lamda transition in Turing Machine? Construct a Turing Machine model for the addition of two numbers represented in unary notation. 10+(5+10)+(5+10)=40

5. (a) What is meant by isomorphic Boolean algebra? Give examples.

(b) What will be the simplified version of the Boolean expression $(x + y)(x + y') + ((xy') + x')'$?

(c) Compare and contrast the concepts of prime implicants and minterms in terms of their applications in Boolean algebra. Provide an example of a Boolean function where there are no essential prime implicants. What will be the maximum number of prime implicants for an n-variable Boolean function?

(d) For the ring oscillator shown in the figure, the propagation delay of each inverter is 100 pico sec. What is the fundamental frequency of the oscillator output?

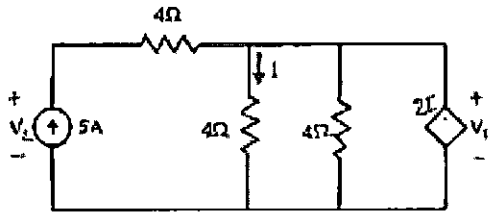


(e) Convert $59{\cdot}72_{10}$ to BCD. What will be the range of values that can be represented with 8 bit 2's compliment form? What will be the 8 bit 2's compliment form of the number – 14?

(f) Use the quine McCluskey method of minimization and find the expression for the function. $F(A, B, C, D) = ? m(0, 1, 2, 3, 5, 7, 8, 9, 11, 14)$. 3+5+8+4+6+14=40

6. (a) State and explain, (i) the Maximum Power Transfer theorem, (ii) Parallel RLC resonant circuit.

   (b) In the given circuit, what will be the values of V_1 and V_2?

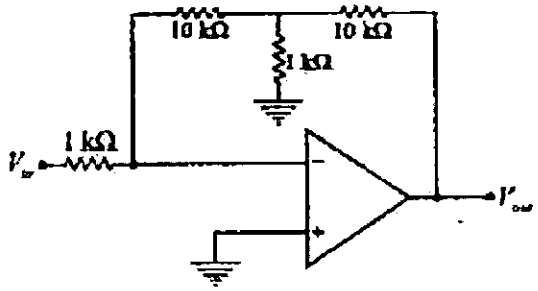


   (c) Discuss the concept of impedance parameters and admittance parameters in 2-port networks. How are they related to S-parameters?

   (d) Write the differences between npn and pnp transistor. Explain early effect in BJT. What is the significance of the common-mode rejection ratio (CMRR) in op-amps?

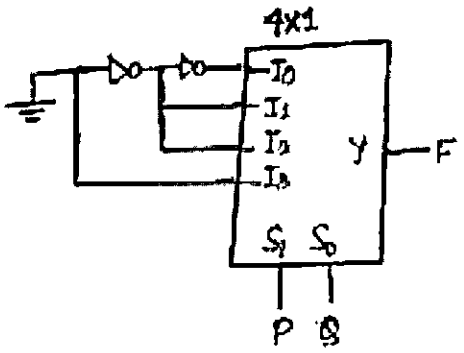
   (e) Assuming the operational amplifier to be ideal, the gain Vout/Vin for the circuit shown in the given figure is

10+5+10+7+8=40



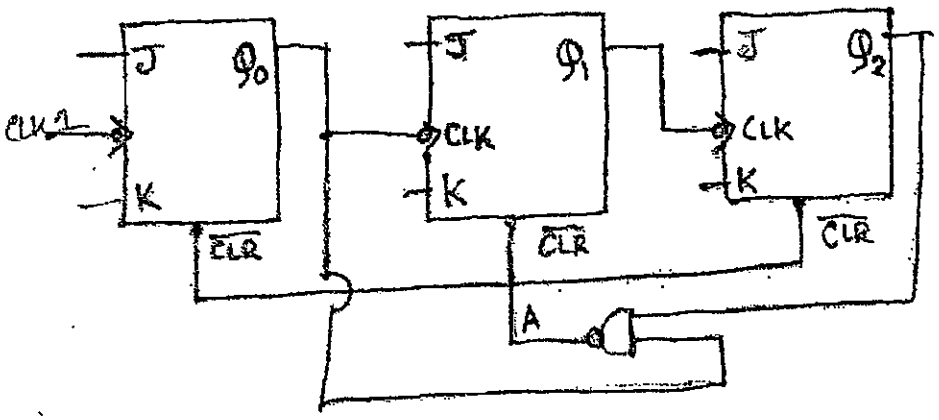
7. (a) What is a Full Adder? Write its truth table and characteristics equation and also implement full adder circuit using decoder.

   (b) The minimized logic function implemented by the circuit below is (ground implies a logic "0").



   (c) Give the block diagram, truth table, characteristics table, characteristics equation of JK flip flop. What is race around condition and how we can overcome this?

(d) The riple counter shown in figure is made up of negative edge triggered J-K Flip Flops. The signals levels at J and K inputs of all the flip-flops are maintained at logic 1. Assume all the outputs are cleared just prior to applying the clock signal. What will be the module number of the circuit? Explain briefly.



(e) Why are ADC used? For a 12-bit ADC with voltage range 0-5 V, what will be the resolution? 10+5+10+10+5=40

8. Answer *any four* of the following: 10×4=40

(a) CDMA

(b) Newton-Raphson method

(c) OPAmp as a differentiator

(d) Ring counter

(e) Priority Queue using Heap

(f) Dijkstra's shortest path algorithm

2022

COMPUTER SCIENCE

PAPER-II

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

*Answers may be given either in **English** or in **Bengali** but all answers must be in one and the same language.*

Question No.-8 *is compulsory and answer* any 6 *questions from the rest.*

1. (a) What is a compiler? Explain the different phases of a compiler in detail. Differentiate token, pattern and lexeme. Define operator precedence grammar. Define triples, indirect triples and quadruples. Define loop unrolling with an example.

   (b) Construct SLR(1) for the following grammar:

   E-->E+T/T

   T-->TF/F

   F-->F*/a/b

   (c) Check whether the grammar is LALR(1) but not SLR(1).

   S-->Aa/bAc/dc/bda

   A-->d (10+10+10)=30

2. (a) What do you mean by a process? Draw a process state transition diagram and define its states in brief. What is a Deadlock? What are the necessary conditions for a deadlock to occur? How is it detected? What is the critical section problem? What are its various solutions?

   (b) Consider a machine with 64 MB of physical memory and a 32-bit virtual address space. If the page size is 4 KB, what is the approximate size of the page table?

   (c) Suppose the time to service a page fault is on average 10 milliseconds, while a memory access takes 1 microsecond. Then a 99·99% hit ratio results is an average memory access time of 'x' micro sec. Find x.

   (d) Consider a disk system with 100 cylinders. The requests to access the cylinders occur in the following sequence:

   4, 34, 10, 7, 19, 73, 2, 15, 6, 20

   Assuming that the head is currently at cylinder 50, what is the time taken to satisfy all requests if it takes 1 ms to move from one cylinder to the adjacent one and the shortest seek time first policy is used? (15+5+5+5)=30

3. (a) Define primary key, foreign key, candidate key and super key. What is normalization? And what explains different normalization forms? What are the advantages of RDBMS? What is a different type of index? Explain three levels of data abstraction.

   (b) What is a relationship and what are their types? What is the difference between DELETE, TRUNCATE and DROP commands? What is Self-Join and Cross-Join? What is a View? What is a Cursor? What is a Stored Procedure? What are the advantages and disadvantages of the Stored Procedure?

   (c) What is a Transaction? What are ACID properties? Explain the following:
   (i) Unrepeatable read problem, (ii) Lost update problem. (10+15+5)=30

4. (a) What is meant by Structured Programming? Briefly describe the main features of OOPs. What is Compile time Polymorphism and how is it different from Runtime Polymorphism?

   (b) How much memory does a class occupy? Is it always necessary to create objects from class? What is a constructor? How is an abstract class different from an interface? What is meant by Garbage Collection in the OOPs world?

   (c) What is Coupling in OOP and why is it important? What is a *finally* block? What is the use of 'finalize'? What is Diamond problem in Inheritance? What is the significance of a virtual destructor? (10+10+10)=30

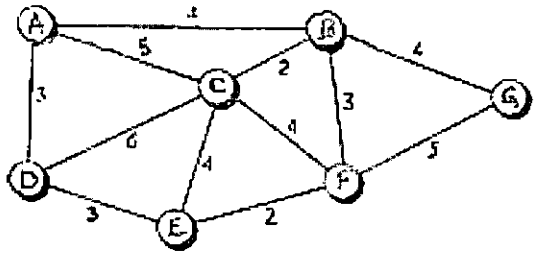
5. (a) What are the different addressing modes typically supported by microprocessors and how do they affect the programming process?

   (b) What are the various interrupts in 8086? Explain each type with a suitable example. What is the significance of RISC and CIS architectures in microprocessors?

   (c) What is stack pointer in a microprocessor? What is the position of the Stack Pointer after the PUSH and POP instruction? A microprocessor has a clock speed of 2·5 GHz. Calculate the time taken by the microprocessor to execute a program consisting of 5,00,000 instructions. Assume each instruction takes one clock cycle to execute. (8+10+12)=30

6. (a) Explain the purpose of DNS and how it resolves domain names to IP addresses. In a block of addresses, the IP address of one host is 182.44.82.16/26. What is the first address (network address) and the last address (limited broadcast address) in this block?

   (b) Describe Distance Vector Routing Protocol briefly. Use Dijkstra's algorithm to find the shortest path tree and the forwarding table for node A in the Figure.



   (c) What is CSMA/CD and how does it work to avoid collisions in an Ethernet network?
   (10+14+6)=30

7. (a) Explain the role of caches in a computer system and how they improve memory access efficiency. Compare the different cache mapping techniques. A computer has a 256 KByte, 4-way set associative, write-back data cache with a block size of 32 Bytes. The processor sends 32-bit addresses to the cache controller. Each cache tag directory entry contains, in addition to the address tag, 2 valid bits, 1 modified bit and 1 replacement bit. What is the number of bits in the tag field of an address?

   (b) Explain RAM, ROM, EPROM and EEPROM.

   (c) Write a short note on USB. A RAM chip has a capacity of 1024 words of 8 bits each (1K × 8). What is the number of 2 × 4 decoders needed with enable line needed to construct a 16K × 16 RAM from 1K × 8 RAM? (14+8+8)=30

8. Write short notes on (*any two*): 10×2=20

   (a) Operator overloading and overriding

   (b) TCP vs. UDP

   (c) Instruction Set Architecture in Microprocessors

   (d) Process Control Block in OS

   (e) Assembler, Loader, Linker

2022

ECONOMICS

PAPER-I

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

Answers may be given either in ***English*** *or in* ***Bengali*** *but all answers must be in one and same language.*

Answer *any five* questions taking at least *two* from each group.

Group-A

1. (a) Distinguish between substitution effect and income effect of a price change.

   (b) When would you get normal shaped demand curve for a commodity? Explain your answer in terms of the two effects mentioned above. 20+20=40

2. (a) Explain the relation between the short run and the long run AC and MC curves with the help of appropriate diagrams.

   (b) When would you find the average product and the marginal product of a variable input are dependent on factor proportions? 20+20=40

3. (a) Define Pareto optimality. Derive the Pareto optimality conditions for consumption and production and the overall Pareto optimality.

   (b) Competitive equilibria are Pareto optimal—Do you agree? Justify. (5+20)+15=40

4. (a) Distinguish between the value added method and the total expenditure method of measuring national income of a country. Why do the two methods give identical measurement?

   (b) Derive the Keynesian investment multiplier and the Balanced Budget multiplier in a closed economy IS-LM model of macroeconomy. 20+20=40

5. (a) What is meant by involuntary unemployment? Explain this phenomenon in terms of the aggregate demand—aggregate supply diagrams.

   (b) Explain the Golden Rule of Accumulation. 25+15=40

Group-B

6. (a) Distinguish between the doctrine of Absolute advantage and of comparative advantage as the basis of trade between nations.

   (b) How can you derive the two components of gains from international trade? With the help of a diagram, show what will be the gains from trade in the following cases :

   (i) When the factors are immobile across different sectors;

   (ii) When two commodities are consumed in fixed proportion? (10+10)+(8+12)=40

7. (a) Discuss the impact of income tax on work effort and savings.
   (b) What are the types of public debt? Discuss how the burden of internal debt can be determined.
   (c) Distinguish between a public good and a private good. 20+14+6=40

8. (a) Distinguish between physical definition and price definition of factor abundance.
   (b) State the assumptions behind the factor price equalization theorem. What does the theorem state? Discuss.
   (c) Distinguish between import tariff and import quota. 10+20+10

9. (a) In the two Variable Classical Regression Model, how would you derive R^2? Explain its significance.
   (b) If each value of a variable x is multiplied by 2, what shall be the value of its Arithmetic Mean and Variance?
   (c) What is meant by normal distribution? 18+12+10=40

10. Write notes on (*any two*): 20+20=40
   (a) Expenditure switching policy for BOP management
   (b) Objectives of fiscal policy
   (c) Cournot model of duopoly
   (d) Fiscal Deficit

2022

ECONOMICS

PAPER-II

Time Allowed — 3 Hours *Full Marks — 200*

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Answers may be given either in ***English*** *or in* ***Bengali*** *but all answers must be in one and same language.*

Answer *any five* questions taking at least *two* from each group.

Group-A

1. (a) Is 'trade' an 'engine' of growth? Explain your answer with reference to impact of foreign trade on the economic development of a developing country.

   (b) Explain rural-urban migration of labour on the basis of Harris-Todaro model. 20+20=40

2. (a) Discuss the planning versus market debate in the context of economic development of nations.

   (b) Does economic development harm the natural environment? Argue your case. 25+15=40

3. What is the link between poverty and inequality? Has the world experienced more income inequality between persons and less incidence of poverty? If so, explain. 15+25=40

4. What are the underlying assumptions of the Lewis model of development? Does the model provide a satisfactory framework for analysing the process of economic development of a nation endowed with surplus labour? Give reasons. 40

5. Write notes on (*any two*) : 20+20=40

   (a) Demographic transition

   (b) Capability approach to development

   (c) Technical change and economic development

   (d) Globalization

Group-B

6. (a) What factors caused commercialization of agriculture in British India?

   (b) Write a note on economic drain. 25+15=40

7. (a) Briefly discuss the land tenure system prevailing in British India.

   (b) What reforms in the system were conducted in independent India? 20+20=40

8. Analyse the impacts of Green Revolution on the Indian economy. 40

9. What were the justifications for introducing economic reforms in India in June 1991? Explain carefully. 40

10. Has the economy of the state of West Bengal moved from dependence on agriculture to one of service-led growth? Answer in terms of behaviour of sectoral changes that look place during the last fifty years. 40

2022

ELECTRICAL ENGINEERING

PAPER-I

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

Answers may be given either in ***English*** *or in* ***Bengali*** *but all answers must be in one and the same language.*

All symbols have their usual significance.

Answer *any five* questions.

1. (a) Solve the given circuit to find the current through 15 ohm using Thevenin's Theorem as shown in Fig. 1 10

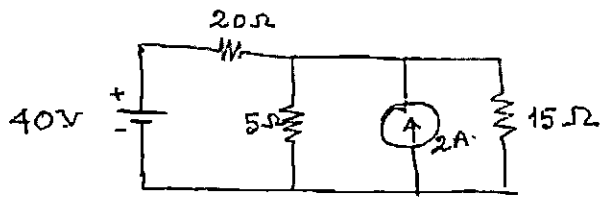

Fig. 1

(b) Given the circuit of Fig.-2, find the current in 2 ohm resistor one leg of which is connected to 5 and 3 ohm resistors by using Superposition principle. 20

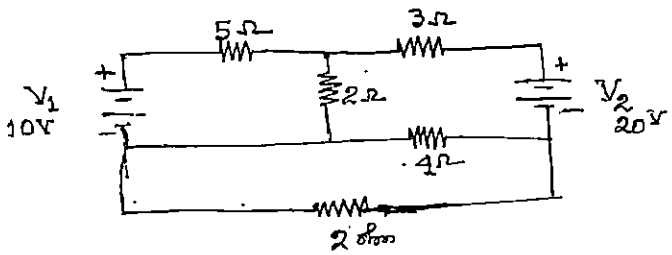

Fig. 2

(c) In the network of Fig.-3 calculate the current I in 50 ohm resistor. Verify the reciprocity theorem by interchanging the voltage source and the resulting current I. 10

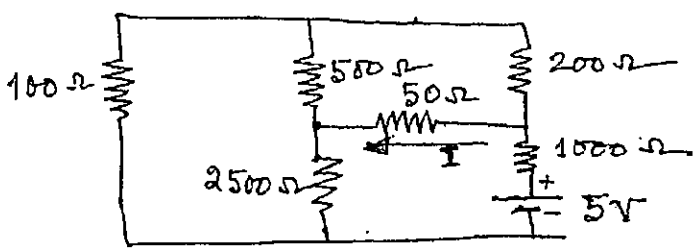

Fig. 3

2. (a) Write the nodal equations for the network of Fig. 4 below and express them in matrix form. 10

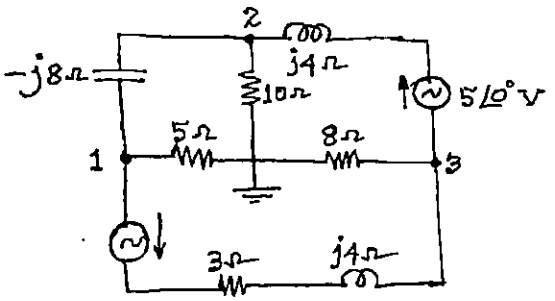

Fig. 4

(b) Find the current I_o in the circuit shown in Fig. 5. 10

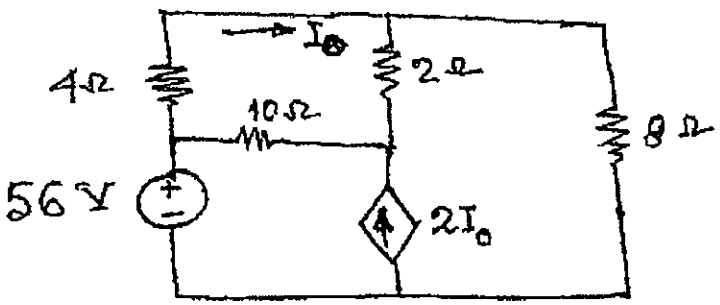

Fig. 5

(c) A three-phase, three-wire, 100 volts, ABC system supplies a balanced delta-connected load with impedances of $20\angle 45°$ ohms. Determine the line currents. 20

3. (a) Determine the unit sample response $\{h(n)\}$ of a linear-phase FIR filter of length $M = 4$ for which the frequency response at $\omega = 0$ and $\omega = \frac{\pi}{2}$ is specified as

$H_r(0) = 1, \quad Hr\left(\frac{\pi}{2}\right) = ½.$ 12

(b) A finite-duration sequance of length L is given as

$$x(n) = \begin{cases} 1, & 0 \le n \le L-1 \\ 0, & \text{otherwise} \end{cases}$$

Determine the N-point DFT of this sequence for $N \ge L$. 12

(c) A parallel plate capacitor has internal separation 'd' between the plates. A dielectric slab with ϵ_γ of thickness 'a' is placed on the lower plate of the capacitor.

Show that electric intensity in the dielectric is $E_1 = \dfrac{\Phi}{\epsilon_\gamma\, d - a(\epsilon_\gamma - 1)}$

Where Φ = Potential difference between the plates. 16

4. (a) (i) Explain the working principle and characteristics of Field Effect Transistor (FET). 10

(ii) A PNP transistor amplifier has input circuit resistance of 300 ohm and a 20 kiloohms resistor connected in collector circuit. If the current gain 'a' is 0.95, find the power gain and voltage gain. 5

(b) What are the various types of errors encounted in electrical measurements? Describe these in brief. Simply discuss the one use of transducers in measurement of non-electrical quantity. 10+5

(c) Discuss with schematic diagram of Microprocessor based 'temperature monitoring system'. 10

5. (a) For the block diagram shown in Fig. 6, determine the overall transfer function. 10

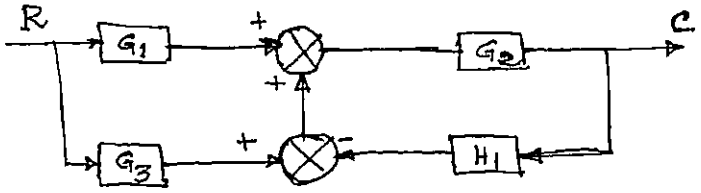

Fig. 6

(b) The block diagram of unity feedback control system is shown in Fig. 7. Determine the characteristic equation of the system, ω_n, ε, ω_d, t_p, the time at which the first undershoot occurs. 10

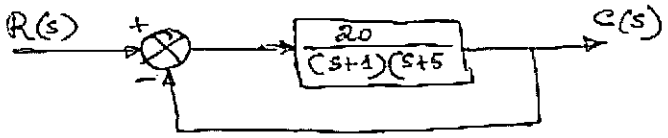

Fig. 7

(c) Apply Routh criterion to determine the stability of the system having the characteristic equation as

$S^3 + 4 \times 10^2 S^2 + 5 \times 10^4 S + 2 \times 10^6 = 0.$ 10

(d) Determine the Z-transform of the function $F(S) = \dfrac{1}{S^2 + 2S + 2}$ and assume sampling time $T = 1$ sec. 10

6. (a) State and explain with suitable example the Thevenin theorem. 10

(b) Find the maximum power that can be delivered to the load resistor R_L of the circuit shown in the Fig. 8. 10

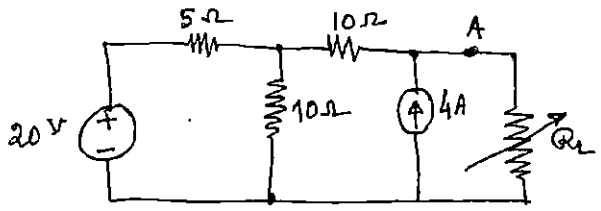

Fig.-8

(c) Find the Fourier series for the waveform shown in Fig. 9. 10

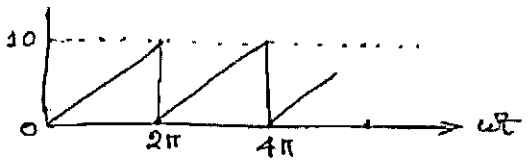

Fig.-9

(d) State and explain Faraday's Law of Electromagnetic Induction. 10

7. (a) Find the short circuit parameters of the circuit shown in Fig. 10. 10

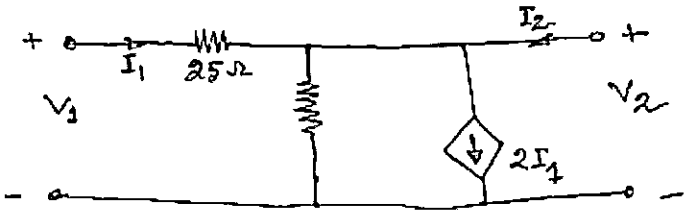

Fig. 10

(b) Determine the Z-transform of the output for the sampled data system shown in Fig. 11 consider input function to be a unit step. 10

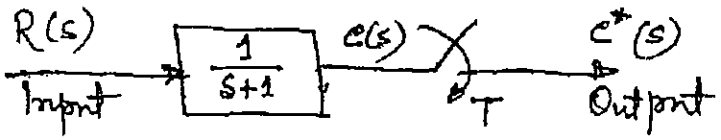

Fig. 11

(c) The state equations of a system are given below:

$\dot{x}_1 = x_1 + x_2 + u$

$\dot{x}_2 = -x_2$

Check the controllability. 10

(d) Determine the state transition matrix given that $\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ 0 & -3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$. 10

2022

ELECTRICAL ENGINEERING

PAPER-II

Time Allowed — 3 Hours *Full Marks — 200*

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Answers may be given either in ***English*** *or in* ***Bengali*** *but all answers must be in one and same language.*

Answer *any five* questions.

1. (a) Deduce the EMF equation of D.C. Machine. 8

   (b) A 220 V d.c. series motor has armature and field resistances of 0·15 Ω and 0·10 Ω repectively. It takes a current of 30A from the supply while running at 1000 rpm. If an external resistance of 1 Ω is inserted in series with the motor, calculate the new steady state armature current and the speed. Assume the load torque is proportional to the square of the speed i.e. $T_L \propto n^2$. 8

   (c) Deduce the condition for maximum efficiency of a transformer. 8

   (d) A 8-pole, 3-phase, 50 Hz induction motor is running at full-load with a slip of 5%. The rotor is star connected and its per phase resistance and standstill reactance are 0·35 Ω and 2 Ω respectively. The EMF between slip rings is 150 V. Determine the rotor current per phase and rotor power factor. Assuming the slip rings are short-circuited. 8

   (e) Show that the locus of the tip of armature current phasor for a synchronous machine, is a circle, when the electromagnetic power is constant. 8

2. (a) What is MOSFET? Explain its construction details. Draw and explain the drain current (I_D) vs drain-to-source voltage (V_{DS}) characteristics curves of it. 2+3+5=10

   (b) Discuss the principle of operation of Chopper Circuit. Also explain the output voltage and current waveforms with time. Where it is used? 10

   (c) What is Switched-Mode Power Supply (SMPS)? Draw the block diagram of a mains operated AC/DC SMPS with output voltage regulation and explain each of the parts for obtaining DC output from AC input. 10

   (d) What is phase controlled rectifier? Draw the schematic diagram of phase controlled rectifier and explain the operation of it. 10

3. (a) A synchronous motor is receiving 35% of the power that it is capable of receiving from an infinite bus. If the load on the motor is doubled, determine the maximum value of load angle δ during the swinging of the motor around its new equilibrium position. 10

   (b) Write short notes on: 5×2=10

   (i) Use of FACTS and its remidies

   (ii) Static VAR Compensation (SVC)

   (c) Explain with a neat circuit diagram the differential protection scheme used to protect Y — Δ transformers. 10

   (d) How the arc is formed in vacuum circuit breaker when it is interrupting short-circuit current? Discuss the main (at least four) advantages of using vacuum circuit breakers. 6+4=10

4. (a) In connection to "Generation and Utilisation" of electrical power, discuss the present scenario of it in West Bengal and India. 10

   (b) Discuss in brief, the main conponents of Hydel power plant. 10

   (c) Write short notes (*any two*): 10×2=20

   (i) Photovoltaic Solar Cells

   (ii) Pollution from energy sources

   (iii) Energy management and Audit

5. (a) What are the advantages of electric heating? What are the desirable properties the materials for heating element should have? 2+5=7

   (b) What is dielectric heating? Derive an expression for the heat produced in a dielectric material. State the laws of illumination. 2+3+5=10

   (c) Discuss the difference between electronic and magnetic ballast. 3

   (d) A hall 30 metres by 15 metres with a ceiling height of 5 metres is to be provided with a general illumination of 120 lumens/m^2. Taking a coefficient of utilisation of 0·5 and depreciation factor of 1·4, determine the number of lamps required, their spacing, mounting height and total wattage. Take illumination efficiency of the lamp as 40 lumens/wall for 80 watt lamp. 20

6. (a) How the pulsating m.m.f. (magneto-motive force) will be developed in case of single-phase induction motor when it is supplied from single-phase A.C. source? 10

   (b) Write short notes on: 5×4=20

   (i) Zener diode

   (ii) Triac

   (iii) Half-controlled bridge converter

   (iv) Semi-conductor materials

   (c) Write short note on HVDC transmission line. 10

7. (a) Distinguish between Radial and Ring main electrical power distribution systems. 10

(b) What do you mean by power system rotor angle stability? Explain with suitable example. 6+6=12

(c) Find the per unit value for each component as shown in Fig.-1 and draw the impedance diagram: 18

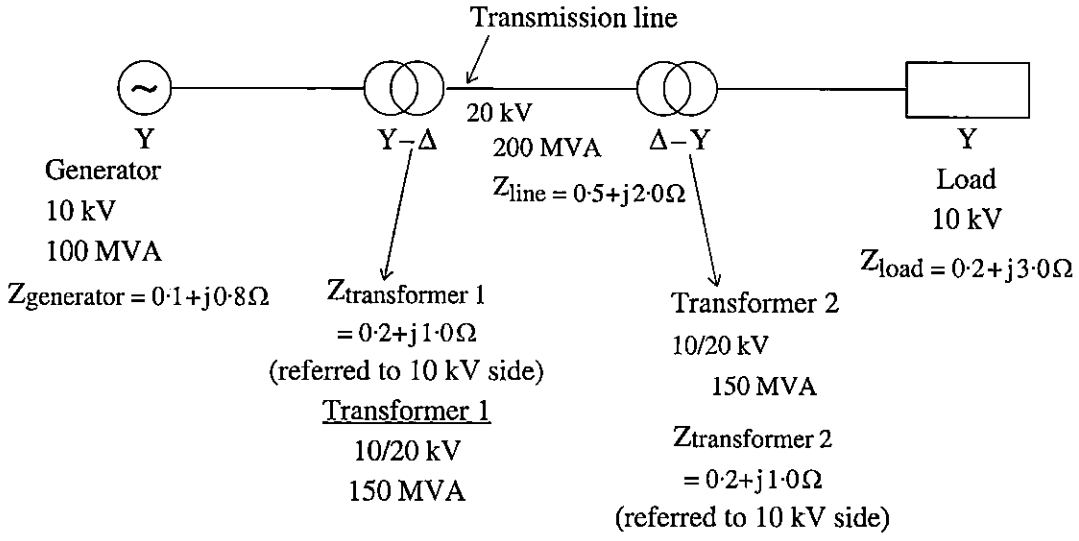

Fig.-1

2022

GEOGRAPHY

PAPER-I

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

Answers may be given either in ***English*** *or in* ***Bengali*** *but all answers must be in one and the same language.*

Illustrate your answers with suitable diagrams/sketches.

Answer any five *questions, taking at least* two *from each group.*

Group-A

1. Explain the formation and evolution of a Karst landscape. Provide examples of such landscapes and enumerate the factors contributing to their development. 20+5+15=40

2. How do the jet stream and El Nino influence the monsoon patterns around the world? How are the international efforts and agreements addressing the impacts of climate change on a global change? 20+20=40

3. Explain the major theories of formation of Coral-Reefs. Discuss the physical properties of ocean water. 20+20=40

4. Discuss with examples the principles and components of ecosystem. Give descriptions of the different ecological pyramids. 20+20=40

5. Enlist the key steps using a Dumpy Level instrument for setting up effectively in field-survey. Discuss the properties and applicability of Cylindrical Projection. 20+20=40

Group-B

6. Specify the differences between plantation farming in tropics and intensive-subsistence farming in monsoon lands. Discuss the relevance and applicability of Von Thunen's Land-use model in modern context. 20+20=40

7. How does India's demographic position relate to the Demographic Transition Theory? Illustrate with specific examples the types and consequences of migration in any country. 20+20=40

8. Evaluate the Heartland Theory as propounded by Mackinder. What is the relationship between social ecology and social space and also provide examples related to it. 20+20=40

9. Distinguish between the characteristics of rural and urban settlements. Discuss the basic tenets of Harris and Ullman's model of urban growth. 20+20=40

10. Enumerate the tenets and relevance of Growth Pole Theory of Perroux with examples. Mention the characteristics of different levels of planning on the basis of sustainable development. 20+20=40

2022

GEOGRAPHY

PAPER-II

Time Allowed — 3 Hours *Full Marks — 200*

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Answers may be given either in ***English*** *or in* ***Bengali*** *but all answers must be in one and same language.*

Group-A

Answer *Question No. 1* and *any two* from the rest.

1. How has India's geologic structure and relief features played role in shaping the country's major river networks? The natural vegetation in the Himalayas ranges from tropical to Tundra type of vegetation. Provide reasons in support of this statement. 20+20=40

2. Discuss the factors influencing soil formation. Also mention the causes and measures of soil erosion and salinization in India. Enumerate the major challenges associated with continued reliance on conventional sources of energy in India. 15+10+5=30

3. Describe the physiographic factors which have influenced the pattern of roads and railway networks in India. Support your answer with examples from different parts of India. Why are mineral-based industries mainly concentrated in Chotanagpur Plateau region? Give reasons. 20+10=30

4. Bring out the regional variations in the population distribution and density at the national level. Analyse the challenges and opportunities posed by the increasing urbanisation in India. How does the country address issues such as urban sprawl, inadequate housing and environmental sustainability amidst the growing demand for urban services and amenities? 15+10+5=30

5. How does India's geographical location influence its trade and diplomatic relations with SAARC countries? Discuss the success and challenges of Green Revolution in India's agricultural sector. 15+15

Group-B

Answer *Question No. 6* and *any two* from the rest.

6. Analyse the relationship between the relief features and the regional climatic patterns of West Bengal. Discuss the government initiatives on afforestation and forest management in the Himalayan foothills of Darjeeling District to protect the fragile bio-diversity and ensure sustainable resource utilization in this region of West Bengal. 20+20=40

7. Evaluate the significance of organic farming practices in West Bengal for the reduction of soil degradation. Mention the governmental measures for water conservation in West Bengal. 15+15=30

8. Discuss the factors that contribute to the suitability for Tea cultivation in West Bengal. Also mention the measures taken to ensure sustainable growth and global competitiveness. 20+10=30

9. What are the key challenges faced by industrial regions in West Bengal? Discuss the major schemes of improved transport connectivity of urbanised centres of West Bengal. 20+10=30

10. Analyse the recent trends in literacy rates in West Bengal. Mention the role of educational schemes to address the population-related challenges in West Bengal. 20+10=30

2022

HISTORY

PAPER-I

Time Allowed — 3 Hours *Full Marks — 200*

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*Answers may be given either in **English** or in **Bengali** but all answers must be in one and the same language.*

Group-A

1. Answer *any three* questions: 10×3=30
   (a) Critically examine the different features of Indus Valley Civilisation in the light of archaeological excavations.
   (b) Discuss the different theories about the original home-land of the Aryans.
   (c) What factors led to the origin and growth of Jainism and Buddhism (Protestant movements) during 6th century B. C.?
   (d) "Chandragupta Maurya was the first historical emperor of India." — Evaluate his achievements.
2. Answer any two questions: 20×2=40
   (a) Examine the importance of economic factors in the political expansion of the Kushanas.
   (b) What were the different strategies adopted by Samudragupta during his triumphant march across different parts of India?
   (c) Write a short note on Kaivartya rebellion in the history of Bengal.
   (d) Discuss the central administrative organisation in the Chola kingdom with special reference to local self-government.
3. Write an essay on *any one*: 30×1=30
   (a) Write an essay on the art and architecture in South India during the Pallava period.
   (b) Discuss agricultural expansion in early medieval period with special reference to irrigation and 'Agrahar' (land grant) system.
   (c) Describe how Sanskrit literature and other regional languages flourished during early medieval period.

Group-B

4. Answer *any three* questions: 10×3=30
   (a) In what ways did the invasions of Mahmud of Ghazni differ from that of Muhammad Ghuri? How would you account for the success of the Turks?
   (b) Write a short note on Balban's theory of Kingship.
   (c) Critically analyse the market (Bazar) Control theory of Alauddin Khalji.
   (d) Do you think the schemes of Muhammad-Bin-Tughluq were "correctly conceived, badly executed and disastrously abandoned"?

5. Answer *any two* questions: 20×2=40

   (a) How did Husain Shah bring about political stability in Bengal? What were its effects on the cultural life in medieval Bengal?

   (b) Examine the salient features of Sher Shah's administration. Was he really a precursor of Akbar in the field of administration?

   (c) Do you think Akbar's religious policy was eclectic in nature?

   (d) What were the principal Sufi Silsilas in India during Sultanate period? Assess their impact on contemporary society.

6. Answer *any one* question: 30×1=30

   (a) Write a note on the evolution of Mansabdari system from Akbar to Aurangzeb.

   (b) Write an essay on Mughal architecture.

   (c) Write a short note on Indian Ocean trade during 17th centuries.

2022

HISTORY

PAPER-II

Time Allowed — 3 Hours *Full Marks — 200*

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*Answers may be given either in **English** or in **Bengali** but all answers must be in one and same language.*

Group-A

Answer question *No. 1* and *any two* from the rest.

1. Answer *any one* question:
   (a) What was the significance of the acquisition of 'Diwani'(1765) by the English East India Company? What changes came about in the administration during this time? 10+10=20
   (b) Write a note on the socio-economic impact of Railways in India. 20
   (c) Can Rammahon Roy be called the pioneer of modern age? 20
2. Discuss the character of the peasant movements in the second half of the 19th century. 40
3. Write a note on Quit India Movement. 40
4. Discuss the salient features of Indian Constitution. 40

Group-B

Answer question *No.5* and *any two* from the rest.

5. Answer *any one* question: 20×1=20
   (a) Would you agree that Napolean was both the heir to and liquidator of the revolution?
   (b) Why did Industrial Revolution first take place in England?
   (c) Do you think that the Treaty of Versailles (1919) was a 'dictated peace'?
6. Explain the rise of Nazism in Germany. How did it affect the European balance of power? 25+15=40
7. Assess the impact of the rise of communist China on international politics. 40
8. Explain the policy of Non-Alignment. Assess India's contributions to the growth of non-aligned movement. 10+30=40

2022

LAW

PAPER-I

Time Allowed — 3 Hours *Full Marks — 200*

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Answers may be given either in ***English*** *or in* ***Bengali*** *but all answers must be in one and same language.*

Group-A

Answer any three *questions*.

1. (a) 'Constitutional Remedies as envisaged under the Constitution of India confer real meaning on Part-III of the Constitution.'— Explain.

   (b) Explain the power of Parliament to amend the Constitution with reference to the doctrine of basic structure. 20+20=40

2. (a) Explain the scope of original and advisory jurisdiction of the Supreme Court of India.

   (b) Examine the provisions relating to the appointment of judges in the Supreme Court and High Courts. 20+20=40

3. (a) Critically discuss the constitutional provisions relating to the reservation with reference to decided cases.

   (b) Write notes on —

   (i) Double Jeopardy

   (ii) Right against self-incrimination 20+20=40

4. (a) Is right to 'Privacy' a fundamental right? Write your answer with reference to some leading judgements of the Supreme Court of India.

   (b) Elaborately discuss the various judicial guidelines for imposing President's Rule in India. 20+20=40

5. (a) Write a note on the 'Doctrine of Pleasure'. Discuss the various constitutional safeguards to Civil Servants.

   (b) Write note on Public Service Commission. 20+20=40

6. (a) Explain the concept of 'Uniform Civil Code'. Do you support the view that India should have a Uniform Civil Code? Justify your answer.

   (b) Write notes on —

   (i) GST Council

   (ii) Niti Ayog 20+20=40

Group-B

Answer *any one* question.

7. (a) What are the purposes and principles of the UNO as mentioned in the Charter?

   (b) Briefly discuss the composition, jurisdictions and role of the International Court of Justice. 20+20=40

8. (a) Distinguish between 'Asylum' and 'Extradition'. Write a note on the Indian view of Diplomatic asylum.

   (b) Write notes on —

   (i) Protectorate States

   (ii) Vassal States 20+20=40

Group-C

Answer *any one* question.

9. (a) Define 'Legal Right' as defined by Prof. Holland and Salmond. Discuss the classifications of legal rights with illustrations.

   (b) Critically analyse the definition of law given by Savigny. Write a brief note on the main doctrines of Historical school. 20+20=40

10. (a) Discuss the characteristics of Realistic movement in Jurisprudence.

    (b) Distinguish between American and Scandinavian realism. 20+20=40

2022

LAW

PAPER-II

Time Allowed — 3 Hours *Full Marks — 200*

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Group-A

Answer question No.1 and *any three* questions from the rest of the Group-A.

1. Writes short notes on *any four* of the following: 5×4=20
   (a) Ignorantia juris non excusat
   (b) Public Servent
   (c) Sedition
   (d) Assault and Battery
   (e) Last opportunity rule
   (f) Doctrine of Common Employment

2. (a) "The right of private defence is essentially a right of defence and not offence"— Explain. Discuss the limitations on the right of private defence.
   (b) Discuss the circumstances when consent might not be legal defence to the person inflicting injury. 10+10=20

3. (a) Explain the dictum, 'Actus Non-Facit Reum Nisi Mens Sit Rea' with exceptions if any.
   (b) Distinguish between culpable homicide and murder. 10+10=20

4. (a) Define 'rape'. A man committed rape to a minor girl. Police applied POCSO Act— Whether non-application of IPC could be justified?
   (b) Explain 'Rarest of the rare case' with reference to decided cases. 10+10=20

5. (a) What are the general defences available in case of tortious liability? Explain.
   (b) To what extent is the government of India responsible for the tortious acts committed by its servants? Discuss with the help of Judicial decisions. 10+10=20

6. (a) Explain the principle of contributory negligence with illustrations. What are the defence available in a case of contributory negligence? Discuss.
   (b) Discuss the essentials of tort of convertion. 10+10=20

Group-B

Answer question *No. 7* and *any three* from the rest of the Group-B.

7. Write short notes on *any four* of the following: 5×4=20
   (a) Quantum Meruit
   (b) Caveat Emptor
   (c) Novation of a Contract
   (d) Privity of Contract
   (e) Assignments of Contract
   (f) Contract of Indemnity

8. (a) What is bailment? Discuss the various rights and obligations of a bailor.
   (b) Distinguish between 'Particular lien' and 'General lien'. 10+10=20

9. (a) Define the terms 'Agent' and 'Principal' as stipulated in the Indian Contract Act. Discuss the circumstances when an agency may be terminated.
   (b) Discuss the liabilities of the Principal to the third persons with illustrations. 10+10=20

10. (a) Distinguish between :
    (i) Partnership and Hindu Undivided family
    (ii) Partnership and Co-ownership
    (b) Discuss the various modes of dissolution of firm under Indian Partnership Act. 10+10=20

11. (a) Distinguish between Void, Voidable, Illegal and Unenforceable Contract.
    (b) Write a note on the 'agreement in restraint of trade'. 10+10=20

12. (a) Define 'Quasi Contract'. Discuss the different types of quasi contracts with illustrations.
    (b) Distinguish between Wagering Contract and Contingent Contract. 10+10=20

Group-C

Answer question *No. 13* and *any one* from the rest of the Group-C.

13. Writes short notes on *any four* of the following: 5×4=20
    (a) Doctrine of Resgestae
    (b) Expert opinion
    (c) Doctrine of Estoppel
    (d) Presumptions of law and presumptions of fact
    (e) Judicial notice
    (f) Dying Declaration and its evidentiary value

14. (a) "Relevancy and admissibility are neither co-extensive nor inter-changeable"— Explain.

    (b) Write note on the conclusive and rebuttable presumption. 10+10=20

15. (a) Write a note on the relevance of evidence as to the good character in civil and criminal cases.

    (b) Explain an 'accomplice'. How far and to what extent the testimony of an accomplice can be relied upon? 10+10=20

2022

MATHEMATICS

PAPER-I

Time Allowed — 3 Hours *Full Marks — 200*

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Answers may be given either in ***English*** *or in* ***Bengali*** *but all answers must be in one and same language.*

1. Answer *any two* questions. 10×2=20

   (a) Show the mapping $T : V_2(R) \to V_3(R)$ defined as $T(a, b) = (a + b, a - b, b)$ is a linear transformation from $V_2(R)$ into $V_3(R)$. Find the range, rank, null, space and nullity of T. 4+2+2+2=10

   (b) If λ be an eigenvalue of an orthogonal matrix, then show that $\frac{1}{\lambda}$ is also an eigenvalue.

   (c) If a_1, a_2, a_3 be fixed elements of a field F, then show that the set W of all ordered triads (x_1, x_2, x_3) of elements of F such that $a_1x_1 + a_2x_2 + a_3x_3 = 0$ is a sub-space of V_3 in F.

2. Answer *any two* questions: 10×2=20

   (a) Prove that the sequence $\{x_n\}$ whose n-th term is $x_n = \sqrt{(n+1)} - \sqrt{n}$ converges and find its limit. 8+2=10

   (b) Find the envelop of the family of co-axial ellipses $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ where the parameters a and b are connected by $a^n + b^n = c^n$.

   (c) Find the value of $\lim_{x \to 0} \left(\frac{\sin x}{x}\right)^{\frac{1}{x}}$.

3. Answer *any two* questions: 10×2=20

   (a) Using definition of compact set prove that the set [0, 1] is not a compact set in R.

   (b) Show that $\int_0^1 \log\left(\frac{1+x}{1-x}\right) \cdot \frac{x^3}{\sqrt{1-x^2}} dx$ is convergent.

   (c) The function f is defined by the equality $f(x) = 1 + 2 \cdot 4x + 3 \cdot 4^2x^2 + 4 \cdot 4^3x^3 + \ldots + \cdot n \cdot 4^{n-1} x^{n-1} + \ldots$

   Show that f is continuous on $\left(-\frac{1}{4}, \frac{1}{4}\right)$. Evaluate $\int_0^{\frac{1}{8}} f(x)dx$. 7+3=10

4. Answer *any two* questions: 10×2=20

   (a) Show that $\sum_{n=1}^{\infty} xe^{-nx}$ is not uniformly convergent on [0, 1].

   (b) Find the asymptotes of the curve $x=\frac{t^2}{1+t^3}$, $y=\frac{t^2+2}{1+t}$.

   (c) If $y=\cos\left(10\cos^{-1}x\right)$, show that $\left(1-x^2\right)y_{12}=21xy_{11}$.

5. Answer *any two* questions: 10×2=20

   (a) Find the condition that the line $\frac{1}{r}=A\cos\theta+B\sin\theta$, may touch the conic $\frac{l}{r}=1+e\cos\theta$.

   (b) Show that if one of the lines given by $ax^2+2hxy+by^2=0$ be perpendicular to one of the lines given by $a'x^2+2h'xy+b'y^2=0$, then $(aa'-bb')^2+4(ah'+hb')(ha'+bh')=0$.

   (c) If the perpendicular straight lines $ax+by+c=0$ and $bx-ay+c'=0$ be taken as the axes of x and y respectively, then show that the equation $(ax+by+c)^2-2(bx-ay+c')^2=1$ will be transformed into $y'^2-2x'^2=\frac{1}{a^2+b^2}$.

6. Answer *any two* questions: 10×2=20

   (a) Obtain the equation of the plane containing the line $\frac{x}{a}+\frac{z}{c}=1$, $y=0$ and parallel to the line $\frac{y}{b}-\frac{z}{c}=1$, $x=0$.

   (b) The plane $\frac{x}{a}+\frac{y}{b}+\frac{z}{c}=1$, meets the coordinate axes in A, B and C. Prove that the equation of the cone generated by lines drawn from the origin to meet the circle ABC is $yz\left(\frac{b}{c}+\frac{c}{b}\right)+zx\left(\frac{c}{a}+\frac{a}{c}\right)+xy\left(\frac{a}{b}+\frac{b}{a}\right)=0$.

   (c) Show that the line $\frac{x+2}{2}=\frac{y}{3}=\frac{z-1}{-2}$ is a generator of the quadric $\frac{x^2}{4}-\frac{y^2}{9}=z$.

7. Answer *any two* questions: 10×2=20

   (a) Find orthogonal trajectories of $r^n\sin nx=a^n$.

   (b) Solve: $(D^2+1)\,y=3\cos^2x+2\sin^3x$

   (c) Find the singular solution of $y^2\left(y-x\frac{dy}{dx}\right)=x^4\left(\frac{dy}{dx}\right)^2$.

8. Answer *any two* questions: 10×2=20

   (a) Solve the boundary value problem $y''+2y'+y=0$, given $y(0)=0$ and $y(1)=2$, where $y''=\frac{d^2y}{dx^2}$ and $y'=\frac{dy}{dx}$ by using Laplace transform.

   (b) Apply Charpit's method to solve the differential equation $pxy+pq+qy-yz=0$.

   (c) Solve $(t+y+z)\frac{\partial t}{\partial x}+(t+z+x)\frac{\partial t}{\partial y}+(t+x+y)\frac{\partial t}{\partial x}=x+y+z$ by Lagrang's method.

9. Answer *any two* questions: 10×2=20

(a) A square, of side $2a$, is placed with its plane vertical between two smooth pegs, which in same horizontal line and at a distance c. Show that it will be in equilibrium when the inclination of one of its edges to the horizon is either 45° or $\frac{1}{2}\sin^{-1}\left(\frac{a^2-c^2}{c^2}\right)$.

(b) A ladder whose c.g. divides it into two portion of length 'a' and 'b' rest with one end on a horizontal floor and other end against a rough vertical wall. If the coefficient of friction at the floor and the wall respectively μ and μ', show that the inclination of the ladder to the floor, when the equilibrium is limiting, is $\tan^{-1}\frac{a-b\mu\mu'}{\mu(a+b)}$.

(c) Two forces act, one along the line $y = 0$, $z = 0$ and the other along the line $x = 0$, $z = c$. As the forces vary, show that the surface generated by the axis of their equivalent wrench is $(x^2 + y^2)\, z = cy^2$.

10. Answer *any two* questions: 10×2=20

(a) Find the law of force to the pole when the path is the cardioid $r = a\,(1 - \cos\theta)$.

(b) If v_1 and v_2 are the linear velocities of a planet when it is respectively nearest and farthest from the sun, prove that $(1 - e)\, v_1 = (1 + e)\, v_2$.

(c) An engine is pulling a train and works at a constant power doing H units of work per second. If M be the mass of the whole train and F the resistance supposed to be constant, show that the time generating the velocity v from rest is $\left(\frac{MH}{F^2}\log\frac{H}{H-Fv} - \frac{Mv}{F}\right)$ seconds.

2022

MATHEMATICS

PAPER-II

Time Allowed — 3 Hours *Full Marks — 200*

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Answers may be given either in ***English*** *or in* ***Bengali*** *but all answers must be in one and same language.*

Group-A

Answer *any five* questions.

1. (a) Find the remainder when 72^{1001} is divided by 31.

   (b) Solve $z^8 + z^7 + z^6 + z^5 + z^4 + z^3 + z^2 + z + 1 = 0$ in the field of complex numbers. 14+14=28

2. (a) If α, β, γ be the roots of the equation $x^3 - 3x^2 + x - 1 = 0$ from the equation whose roots are $\alpha\beta + \frac{1}{\alpha} - \frac{1}{\beta}$, $\beta\gamma + \frac{1}{\beta} - \frac{1}{\gamma}$, $\alpha\gamma + \frac{1}{\gamma} - \frac{1}{\alpha}$.

   (b) If α be a special root of the equation $x^8 - 1 = 0$, then prove that $(\alpha + 2)(\alpha^2 + 2) \ldots (\alpha^7 + 2) = 85$. 14+14=28

3. (a) Let G be a finite group and $a, b, \in G$. If $b = gag^{-1}$ for some $g \in G$, then prove that $O(a) = O(b)$.

   (b) If U is an ideal of a ring R and let $[R : U] = \{x \in R : rx \in U \ \forall \ r \in R\}$. Prove that $[R : U]$ is an ideal of R. 14+14=28

4. (a) If $\frac{x^2}{a^2+u} + \frac{y^2}{b^2+u} + \frac{z^2}{c^2+u} = 1$, prove that $\left(\frac{\partial u}{\partial x}\right)^2 + \left(\frac{\partial u}{\partial y}\right)^2 + \left(\frac{\partial u}{\partial z}\right)^2 = 2\left(x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} + z\frac{\partial u}{\partial z}\right)$.

   (b) What is the area of the entire surface formed when the cardioide $r = a(1 + \cos\theta)$ is revolved about the initial line? 14+14=28

5. (a) Find divergence and curl of the vector $\vec{v} = \frac{\hat{r}}{r}$, where $\hat{r}$ is the unit vector along $\vec{r}$ and r is the magnitude of the vector $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$.

   (b) Verify Green's theorem in the xy–plane for $\oint_C \{(xy + y^2)dx + x^2dy\}$, where C is the closed curve of the region bounded by $y = x$ and $y = x^2$. (7+7)+14=28

6. (a) Let H be the set of all sequence of real numbers $x = \{x_n\}$ such that $|x_n| \leq 1$ for all $n \in N$. Consider the function $d : H \times H \to R$ given by $d(x, y) = \sum_{n \in N} \frac{1}{2^n} |x_n - y_n|$ where $x = \{x_n\}$, $y = \{y_n\} \in H$. Prove that (H, d) is a metric space.

   (b) Prove that $u = y^3 - 3x^2y$ is a harmonic function. Determine its harmonic conjugate and find the corresponding analytic function $f(z)$ in terms of z. 14+(5+5+4)=28

7. (a) Evaluate the missing terms in the following table:

x :	0	1	2	3	4	5
$f(x)$:	0	—	8	15	—	35

(b) Find the root of $x^3 - 8x - 4 = 0$, which between 3 and 4, by Newton-Raphson Method, correct to four decimal places. 14+14=28

Group-B

Answer *any five* questions.

8. Express the Boolean expression in three variables $(x + y + z)\,(xy + x'z)'$ in DNF. 12

9. Draw a flowchart to calculate the mean and standard deviation of N numbers. 12

10. Let X and Y be independent random variables and each be distributed with common mean zero and unit variance. Find the probability density function of $U = \sqrt{X^2 + Y^2}$. 12

11. For a set of bivariate data x and y, the lines of regression are $4x + 3y + 7 = 0$ and $2x + 5y = 4$. Identify the lines and hence, find the correlation coefficients between x and y. 7+5=12

12. Examine if $X = \{(x_1, x_2)/2x_1 + x_2 \geq 20, x_1 + 2x_2 \leq 80, x_1 + x_2 \leq 50, x_1, x_2 \geq 0\}$ is a convex set. 12

13. Find the optimal solution and the corresponding cost of transportation in the following transportation problem: 10+2=12

	D_1	D_2	D_3	D_4	Availability (a_i)
O_1	19	14	23	11	11
O_2	15	16	12	21	13
O_3	30	25	16	39	18
Requirement (b_j)	6	10	11	15	

14. Consider the following problem of assigning four operators to four machines. The assignment costs in rupees are given below. Find the optimal cost of assignment. 12

Operators \ Machines	1	2	3	4
1	18	26	17	11
2	13	28	14	26
3	38	19	18	15
4	19	26	24	10

ZOOLOGY

PAPER-I

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

*Answer may be given either in **English** or in **Bengali** but all answer must be in one and same language.*

Group-A

1. Answer *any ten* questions (4x10 =40)
   a. How old and new species are delimited?
   b. Explain the terms 'bee pasturage' and 'emergency queen'
   c. What do you understand by goodness of fit?
   d. What is meant by' Ramsar' site?
   e. State Hutchinson's proposition of niche concept
   f. Elucidate the location and function of Organ of Bojanus and Green Gland
   g. State the location and function of Mehlis's gland.
   h. 'Running birds cannot fly'- Justify.
   i. What is RAM ventilation. Explain with example.
   j. Determine the systematic position of (i) Sea Fur (ii) Sea Horse
   k. Explain the 'concept of climax' with reference to ecological succession.
   l. What is the difference between Deme and Cline?

Group-B

Answer ***any four*** questions

2. Distinguish between: (5X4=20)
   a. Errantia and Sedentaria
   b. Ductus Caroticus and Ductus Botali
   c. Protostomia and Deuterostomia
   d. Basic pattern of aortic arches between Reptiles and Mammals

3. Write short notes on the following: (5X4=20)
   a. Affinities of Onychophora
   b. Poison apparatus of Snake
   c. Book gill
   d. Ruminant stomach of Camel

4. Why is *Paramaecium* known as heterokaryotic animal? Give an account of ciliary movement in *Paramaecium*. Discuss the role of microfibrils in Amoeboid locomotion (4+8+8=20).

5. Justify the inclusion of *Balanoglossus* under Non-Chordata as an independent phylum. State the primitive characters of *Limulus*. State the salient features that distinguish Phylum Annelida from other Non-Chordate Phyla. (8+4+8=20)

6. How does double respiration take place in the lung of pigeon? Discuss the evolutionary position of Monotremata. (10+10=20)

7. Explain (10+10=20)
   a. The phenomenon of eusociality in Termites.
   b. Polymorphism in *Physalia*
8. Discuss the structural modifications present in Cetacea to enable echolocation. Elucidate the methods of sound production and reception in Chiroptera. (10+10= 20)

Group-C

Answer ***any four*** questions

9. Distinguish between: (5X4=20)
   a. Altruism and reciprocal altruism
   b. Phenetic classification and cladistic classification
   c. Panmictic and apomictic species
   d. *Ex-situ* and *in-situ* conservation

10. Write short notes on the following: (5X4=20)
    a. FAP
    b. Reproductive isolating mechanisms
    c. Keystone species
    d. Heavy metal toxicity

11. a. A test cross of monohybrid gray mouse to an albino strain results in 64 gray and 48 albino progenies. Test the goodness of fit of these data to a 1:1 ratio, using the Chi-square test (use 5% level of significance and assume that for 1 degree of freedom, $x^2_{0.005}$= 3.84).

    b. What are the properties of 't'- distribution? Differentiate between unpaired and paired 't'-test. What do you mean by null hypothesis and alternative hypothesis? What is two-tailed t-test?

    c. Explain how genetic diversity is related to phenetic diversity? (5+5+3+2+5=20)

12. a. Discuss the role of Wildlife Protection Act, 1972 in the conservation of tigers.

    b. Narrate the utility of remote sensing for promotion of sustainable diversity.

    c. Differentiate with examples Acute and chronic toxicity in relation to water pollution.

    d. 'No two species can co-exist if they occupy the same niche '- explain with reasons.

    (6+6+4+4=20)

13. "The operations of an ecosystem is consistent with the laws of thermodynamics" Justify. Distinguish between race and species. What are sibling species? Why is recognition of kinship important in social behavior of animals. (8+4+4+4=20)

14. Explain 'J' shaped and 'S' shaped growth curves citing examples. What do you understand by 'group properties' of population? What is the difference between absolute growth rate and specific growth rate? Explain the influence of carrying capacity of habit on the intrinsic rate of population growth. (5+5+5+5=20)

CSM(O)/ZOO-II/22

2022

ZOOLOGY

PAPER-II

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

*Answer may be given either in **English** or in **Bengali** but all answer must be in one and same language.*

Group-A

1. Answer any ten questions (4x10 =40)

a. Explain midblastula transition?

b. What is decidua basalis?

c. What is IS element?

d. Define insertion and replacement vector

e. Enumerate the role of "rho factor" in prokaryotic transcription.

f. What is hyperchromic shift in DNA?

g. What is scotopic vision?

h. State the role of pyridoxal phosphate in transamination.

i. State the role of ATM and ATR in cell cycle check points

j. Bacteriophage is a beneficial virus-Justify

k. What is PKDL? Mention its symptoms.

l. What are oligophagus and polyphagus pest?

Group-B

Answer any four questions

2. Distinguish between: (5X4=20)

a. R state and T state of haemoglobin

b. Complementation and recombination

P.T.O.

c. nullisomy and monosomy

d. Osmoregulator and Osmoconformer

3. Write short notes on the following: (5X4=20)

a. Podocytes

b. Write short note on ADA-SCID and gene augmentation therapy

c. Role of TMAO in osmoregulation

d. Saponification number

4. Describe the histology of typical graafian follicle in mammal with a labelled diagram. Write a note on hormonal influences on insect diapause. Distinguish the mechanism of action of steroid hormone and protein hormone. (10+5+5=20)

5. Explain the effects of pH and temperature on enzyme activity Digits of an EC number has specific significance- Justify the statement with example. What happens when [S] =Km and [S] > Km in enzyme substrate reaction. Explain with examples of feedback inhibition and competitive inhibition. (5+5+5+5=20)

6. Define insertion and replacement vector. What is hypopolymer tailing in RDT? How does histone acetylation control gene expression? Explain chimeric DNA and RNA editing. Briefly describe the positive control of Lac Operon. (4+3+3+5+5= 20)

7. If the G-C content of a DNA molecule in 56% what are the percentages of four bases (A, T, G,and C)? Explain dicentric bridge and paracentric inversion. "Sxl gene acts as a master regulator in Drosophila sex determination process" – Justify. Describe briefly the process of capping, splicing, and polyadenylation of hnRNA. (5+5+5+5=20)

Group-C

Answer any four questions (5X4=20)

8. Distinguish between:

a. Dexiotropic cleavage and Laetropic cleavage

b. Gene frequency and genotype frequency

Contd...P3

c. Hapten and epitope

d. Breeding hapa and hatching hapa

9. Write short notes on the following: (5X4=20)

a. IVF

b. Mitochondrial bottle neck

c. Role of Adjuvants in T Cell activation

d. Zoonosis

10. Describe with labelled diagrams the acrosome reaction that occurs in mammals. Write note on prevention of polyspermy during fertilization. Delineate briefly the development of eye in chick with special reference to lens formation and add a note on the major inductive events that occur during the process.

(5+5+10 =20)

11. Explain the role of migration affecting Hardy-Weinberg equilibrium. How would you calculate heterozygosity of a population? Illustrate the xeric adaptation of camel for thermoregulation. Explain cryptic colouration. Describe a technique of fossil dating. (5+3+5+4+3=20)

12. "Man can stand erect while anthropoid apes cannot". Discuss the anatomical changes that occur in man due to erect posture.

(10)

13. Write a note on pathogenicity of the disease conditions caused by Plasmodium falciparum. Give a schematic diagram to show different developmental stages of this parasite within the hepatocytes and RBC. What is obstructive filariasis? Give a brief idea on the life cycle of the causative organism.

(5+5+5+5 =20)

CSM(O)/SANT-I/22

2022

SANTALI

PAPER – I

Time Allowed – 3 Hours **Full Marks – 200**

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining once ignored.

Answers may be given in the Santali language and 'Ol Chiki' Script.

SECTION – A

1. ᱡᱚᱛᱚ ᱠᱩᱠᱞᱤ ᱨᱮᱭᱟᱜ ᱛᱮᱞᱟ ᱚᱞ ᱢᱮ (Answer all the questions) : 10x5 = 50

(ᱚ) ᱥᱟᱱᱛᱟᱲᱤ ᱯᱟᱹᱨᱥᱤ ᱨᱮᱭᱟᱜ ᱫᱟᱸᱜᱟ ᱠᱚ ᱚᱞ ᱢᱮ।

(ᱛ) ᱟᱲᱟᱝ ᱟᱹᱨᱩ ᱨᱮᱭᱟᱜ ᱠᱟᱨᱚᱱ ᱠᱚᱭᱚ ᱫᱮᱭ ᱫᱮᱭ ? ᱯᱟᱹᱨᱚᱩᱞ ᱥᱟᱸᱣᱚᱮ ᱛᱮᱞᱟ ᱮᱢ ᱢᱮ ।

(ᱜ) ᱟᱹᱭᱟᱹᱛ ᱥᱟᱸᱫᱮᱥ ᱞᱟᱹᱭᱚᱮ ᱫᱮᱭ ᱮᱢ ᱵᱩᱡᱷᱟᱹᱣᱟ ? ᱱᱚᱣᱟ ᱵᱟᱵᱚᱛᱤ ᱯᱩᱥᱛᱟᱹᱣ ᱛᱮ ᱚᱞ ᱢᱮ।

(ᱝ) ᱥᱟᱱᱛᱟᱲᱤ ᱨᱚᱱᱚᱲ ᱞᱮᱠᱟᱛᱮ ᱣᱩᱱᱩᱢ ᱨᱮᱭᱟᱜ ᱦᱟᱹᱴᱤᱧ ᱠᱚ ᱤᱟᱹᱭᱠᱟᱹ. ᱟᱛᱮ ᱛᱮᱞᱟ ᱨᱩᱣᱟᱹᱲ ᱢᱮ।

(ᱞ) ᱥᱟᱱᱛᱟᱲᱤ ᱯᱟᱹᱨᱥᱤ ᱤᱟᱲᱢᱟᱠᱟᱲ ᱞᱟᱹᱜᱤᱫ 'ᱚᱞ ᱫᱤᱠᱤ' ᱫᱤᱠᱤ ᱨᱮᱭᱟᱜ ᱮᱱᱮᱢ ᱛᱤᱱᱟᱹᱜ ᱜᱟᱱ ᱢᱮᱱᱟᱜ-ᱟ ? ᱵᱤᱫᱟᱹᱣᱱᱟᱹᱣᱛᱮ ᱚᱞ ᱢᱮ।

2. ᱡᱟᱸᱦᱟᱜᱮ ᱵᱟᱨᱭᱟ (2) ᱠᱩᱠᱞᱤ ᱨᱮᱭᱟᱜ ᱛᱮᱞᱟ ᱮᱢ ᱢᱮ (Answer any two questions) : 25X2 = 50

(ᱚ) ᱥᱟᱱᱛᱟᱲᱤ ᱟᱹᱲᱟᱹ. ᱢᱩᱨᱟᱹᱭ ᱞᱟᱦᱟᱱᱛᱤ ᱨᱮᱭᱟᱜ ᱱᱟᱜᱟᱢ ᱚᱞ ᱢᱮ।

(ᱛ) ᱥᱟᱱᱛᱟᱲᱤ ᱨᱚᱱᱚᱲ ᱨᱮ ᱜᱚᱨᱚᱱ ᱤᱚ ᱚᱠᱟ ᱠᱚ ᱢᱮᱛᱟᱜ-ᱟ ? ᱱᱚᱣᱟ ᱨᱮᱭᱟᱜ ᱦᱟᱹᱴᱤᱧ ᱠᱚ ᱚᱞ ᱥᱚᱤᱚᱨ ᱢᱮ।

(ᱜ) ᱯᱟᱹᱨᱥᱤ ᱥᱤᱨᱡᱚᱱ ᱨᱮᱭᱟᱜ ᱟᱹᱨᱤ ᱠᱚ ᱵᱟᱵᱚᱛᱤᱛᱮ ᱢᱤᱫᱷᱟᱝ ᱚᱱᱚᱞ ᱚᱞ ᱢᱮ।

P.T.O.

(ᱝ) [illegible]

SECTION – B

3. ᱡᱚᱛᱚ ᱠᱩᱠᱞᱤ ᱨᱮᱭᱟᱜ ᱛᱮᱞᱟ ᱚᱞ ᱢᱮ (Answer all questions) : 10X5 = 50

(ᱚ) [illegible]

(ᱛ) [illegible]

(ᱜ) [illegible]

(ᱝ) [illegible]

(ᱞ) [illegible]

4. ᱡᱟᱦᱟᱸᱜᱮ ᱵᱟᱨᱭᱟ (2) ᱠᱩᱠᱞᱤ ᱨᱮᱭᱟᱜ ᱛᱮᱞᱟ ᱚᱞ ᱢᱮ (Answer any two question) : 25X2 = 50

(ᱚ) [illegible]

(ᱛ) [illegible]

(ᱜ) [illegible]

(ᱝ) [illegible]

2022

SANTALI

PAPER – II

Time Allowed – 3 Hours **Full Marks : 200**

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining once ignored.

Answers may be given in Santali Language and 'Ol Chiki' Script.

SECTION – A

1. ᱞᱟᱛᱟᱨ ᱨᱮ ᱮᱢ ᱟᱠᱟᱱ ᱠᱩᱠᱞᱤ ᱠᱚ ᱨᱮᱭᱟᱜ ᱛᱮᱞᱟ ᱮᱢ ᱢᱮ (Answer all question) : 10X5=50

(ᱚ) ᱥᱟᱫᱷᱩ ᱨᱟᱢᱪᱟᱸᱫ ᱢᱩᱨᱢᱩ ᱫᱚ ᱪᱮᱫ ᱞᱟᱹᱜᱤᱫ 'ᱫᱮᱵᱚᱱ ᱛᱤᱸᱜᱩᱱ ᱟᱹᱰᱤᱵᱟᱥᱤ ᱵᱤᱨ' ᱥᱮᱨᱮᱧ ᱮ ᱚᱞ ᱞᱮᱫ ᱛᱟᱸᱦᱮ ᱠᱟᱱᱟ ?

(ᱛ) 'ᱵᱷᱟᱨᱟᱢ ᱱᱟᱥᱟᱣ' ᱚᱱᱚᱲᱦᱮᱸ ᱨᱮ ᱚᱱᱚᱲᱦᱤᱭᱟ ᱫᱚ ᱚᱠᱟ ᱞᱮᱠᱟᱛᱮ ᱵᱷᱟᱨᱟᱢ ᱱᱟᱸᱥᱟᱜ ᱠᱟᱱᱟ ᱢᱮᱱᱛᱮᱭ ᱚᱞ ᱟᱠᱟᱫᱟ ?

(ᱜ) "ᱪᱟᱢᱯᱟ ᱨᱮ ᱟᱹᱰᱤ ᱡᱩᱜᱤᱞᱮ ᱛᱟᱸᱦᱮ ᱠᱟᱱᱟ, ᱟᱨ ᱚᱸᱰᱮ ᱢᱟᱨᱟᱝ ᱜᱮᱞᱮ ᱛᱟᱸᱦᱮ ᱠᱟᱱᱟ। ᱩᱱᱨᱮ ᱟᱠᱚᱭ ᱡᱟᱸᱜᱟ ᱞᱟᱛᱟᱨ ᱨᱮᱦᱚᱸ ᱵᱟᱞᱮ ᱛᱟᱸᱦᱮ ᱠᱟᱱᱟ"- ᱱᱚᱣᱟ ᱠᱟᱛᱦᱟ ᱨᱮᱭᱟᱜ ᱵᱷᱮᱫᱭ ᱵᱷᱟᱸᱫᱟᱭ ᱢᱮ।

(ᱝ) 'ᱵᱤᱫᱩ ᱪᱟᱸᱫᱟᱱ' ᱜᱟᱭᱟᱱ ᱨᱮ ᱢᱮᱱᱟᱭ 'ᱪᱟᱸᱫᱟᱱ' ᱟᱜ ᱪᱩᱨᱤᱛ ᱚᱞ ᱢᱮ।

(ᱞ) 'ᱥᱟᱝᱥᱟᱨ ᱯᱷᱮᱸᱫ' ᱜᱟᱭᱟᱱ ᱨᱮᱭᱟᱜ ᱟᱥᱚᱞ ᱡᱚᱥ ᱫᱚ ᱪᱮᱫ ᱠᱟᱱᱟ ? ᱵᱤᱥᱛᱟᱹᱨᱚᱛᱮ ᱚᱞ ᱢᱮ।

2. ᱵᱟᱨᱭᱟ (2) ᱠᱩᱠᱞᱤ ᱨᱮᱭᱟᱜ ᱛᱮᱞᱟ ᱠᱷᱟᱡᱚᱜᱠᱟᱱ ᱞᱮᱠᱟᱛᱮ ᱚᱞ ᱢᱮ : 25X2=50

(ᱚ) 'ᱵᱟᱜᱫ ᱡᱩᱞᱩᱝ' ᱚᱱᱚᱲᱦᱮᱸ ᱨᱮᱭᱟᱜ ᱢᱩᱞ ᱢᱚᱨᱢᱚ ᱚᱞ ᱥᱟᱫᱟᱨ ᱢᱮ।

(ᱛ) ᱪᱮᱫ ᱠᱷᱟᱹᱛᱟᱨ ᱠᱟᱥᱟᱢ ᱜᱚᱸᱥᱟᱭ ᱮ ᱩᱥᱟᱹᱨ ᱞᱮᱱᱟ ? ᱵᱤᱥᱛᱟᱹᱨ ᱛᱮ ᱚᱞ ᱥᱟᱫᱟᱨ ᱢᱮ।

ᱟᱨ ᱵᱟᱝᱠᱷᱟᱱ/OR

(ᱜ) 'ᱡᱚᱢᱥᱤᱢ ᱵᱤᱱᱛᱤ' ᱨᱮ 'ᱯᱤᱩᱟᱹ ᱜᱚᱸᱥᱟᱭ' ᱟᱜ ᱮᱱᱮᱢ ᱚᱞ ᱢᱮ।

(ঙ) বাক্যটিতে ব্যবহৃত সর্বনামের শ্রেণি এবং সংজ্ঞা লিখে বাক্য রচনা করো। 2

SECTION – B

3. যেকোনো চারটি প্রশ্নের উত্তর দাও (Answer all the questions) : 10X5=50

(ক) 'আজ বিশ্বমাতৃ' অনুষ্ঠানটির আয়োজন কে এবং কবে হয়েছিল ? 2

(খ) বিশ্বজননী ট্রাস্টের কর্মীরা কীভাবে 'বিশ্বমোহিনী ট্রান্সপোর্ট লিমিটেড বিশ্বমাতৃ' হয়ে ওঠে ট্রান্সপোর্ট-বিশ্বমাতৃ সম্পর্কের ব্যাখ্যা প্রসঙ্গে তাদের দায়িত্ব কী ছিল ? 2

(গ) বিশ্বমোহিনী বিশ্বমাতৃ কে 'অগ্নিশ্বাসিনী বিশ্বমাতৃ' সম্বোধনে ডাকতেন ? 2

(ঘ) বিশ্বজননীর বিশ্বমাতৃ কে 'অগ্নিশ্বাসিনী বিশ্বমাতৃ' সম্বোধনে ডাকতেন ? 2

(ঙ) 'ওরে, এই আমাদের অগ্নিবাহন সম্বোধনটি ব্যাখ্যা করো। 2

4. যেকোনো (2) প্রশ্নের উত্তর দাও ঘটনাপ্রবাহের প্রসঙ্গসহ : 25X2=50

(ক) বিশ্বজননীর ট্রান্সপোর্টগুলি চালানোর জন্য 'মাসে ৯০.০৮' টাকা বেতনে কাদের নিয়োগ করা হয়েছিল ? 2

(খ) 'বিশ্বমোহিনী ওয়াচ' ওয়ার্কশপে সম্পন্ন কাজ বা ঘটনা উল্লেখ করে তার গুরুত্ব আলোচনা করো ? 2

এই অংশটির সঙ্গে প্রথম অংশের কোন্ কোন্ ঘটনা জড়িত আছে ? 2

অথবা / OR

(গ) বিশ্বমোহিনী বিশ্বমাতৃ অনুষ্ঠানটিতে কে 'ট্রান্সপোর্ট অগ্নিবাহন' ট্রান্সপোর্টের সম্পর্কে বলেছে ? 2

(ঘ) বাইশাখ অর্থনীতিটির জন্য 'প্রতিষ্ঠানের ৫২ বিশ্বমাতৃর' বলে যে অনুচ্ছেদটি প্রযোজ্য হয়েছে তার ২ মাত্রাটি বিশ্লেষণ করো ? 2

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2022

MECHANICAL ENGINEERING

PAPER-I

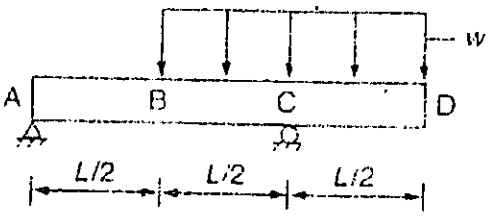
Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

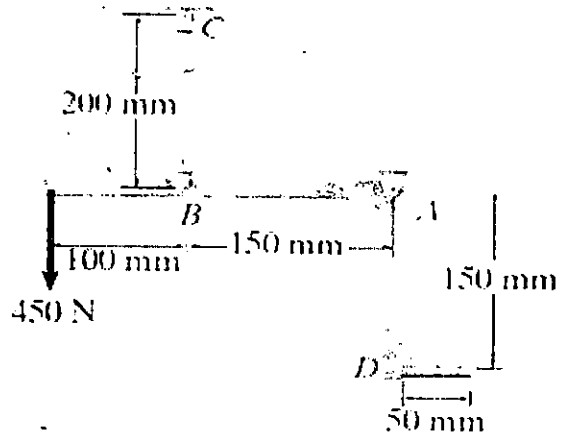
*Answers may be given either in **English** or in **Bengali** but all answers must be in one and same language.*

Answer any five questions

1. (a) Draw the shear force and bending moment diagrams for a simply supported beam with overhang loaded as shown in figure below.



(b) The rigid link is supported by a pin at A, a steel wire BC having an unstretched length of 200 mm and cross-sectional area of 22.5 mm^2 and a short aluminium block having an unloaded length of 50 mm and cross-sectional area of 40 mm^2 as shown in figure. If the link is subjected to the vertical load shown, determine the rotation of the link about the pin A. Modulus of elasticity of steel, E_{st} = 200 GPa and Modulus of elasticity of aluminium, E_{al} = 70 GPa.



(c) Show that, in a general two-dimensional stress system

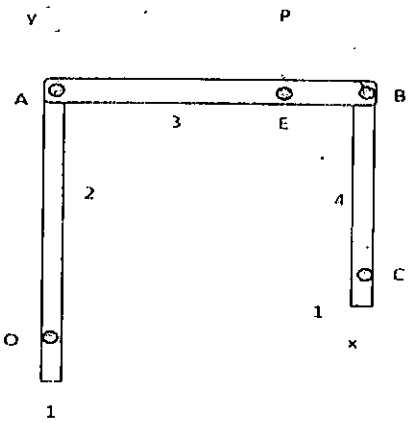
(i) Sum of normal stresses in any two mutually perpendicular directions is constant.

(ii) Principal planes are planes of maximum normal stresses also.

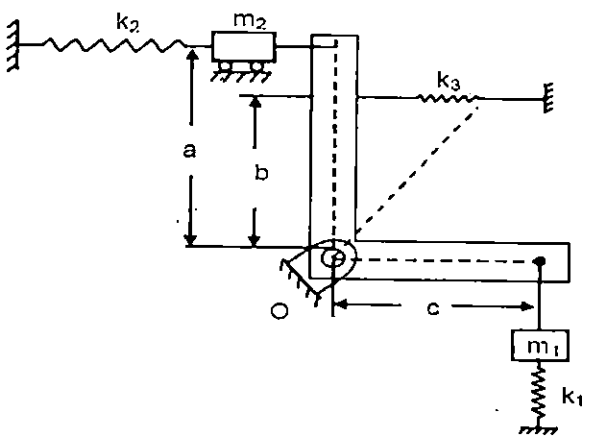
20+10+10=40

P.T.O.

2. (a) For the four-bar linkage in the position illustrated in figure below, a vertical load 'P' is acting at point 'E' on the horizontal coupler link '3', (i.e., link is parallel to the 'X'-axis). The coupler link is pinned to the vertical side links '2' and '4' at points 'A' and 'B'. The links are made of a steel alloy with a compressive Yield strength σ_{ys}= 410 MPa and a modulus of elasticity 'E'= 207GPa. The side links have hollow circular cross-sections with 50 mm outside diameters and 6.25 mm wall thicknesses. Assume that the value for the end-condition constant for both side links is 'C'=1. The known link lengths are 'R_{AO}' = 2.4 m, 'R_{BA}' = 1.8 m, 'R_{BC}' = 1.5 m and 'R_{EA}' = 1.2 m. Determine (i) the radii of gyration for links '2' and '4', (ii) the values of the slenderness ratios for links '2' and '4' and at the point of tangency between Euler's column formula and Johnson's parabolic equation, (iii) the critical loads for links '2' and '4', and (iv) the maximum value of load 'P' if the factors of safety guarding against buckling for links '2' and '4' are both specified as N=2.



(b) Figure below shown is an indicator mechanism. The bell crank arm is pivoted at *O* and has mass moment of inertia 'I'. Find natural frequency of the system.



30+10=40

3. (a) A 200 mm wide x 22 mm thick strip of metal is fed through a pair of powered rolls to reduce its thickness to 18 mm in one pass. The rolls are of 500 mm diameter and rotating at 60 rpm. If the coefficient of friction between the rolls and the work material is taken as 0.15, determine whether or not the rolling operation is possible. If it is possible, calculate the roll force. Assume average flow stress, σ as 150 MPa.

(b) A strip of brass 200 mm wide and 20 mm thick is rolled at room temperature to a thickness of 16 mm in a single pass. The roll radius is 300 mm and the rolls rotate at 120 rpm. Taking the true stress of brass in the unstrained condition as 200 MPa and in the strained condition as 300 MPa, Calculate the roll force required. How much will be the torque on the roll? Also determine the power requirement.

20+20=40

Contd...P3

4. (a) Using an open-die forging operation, a solid cylindrical piece of stainless steel having 100 mm dia x 72 mm height is reduced in height to 60 mm at room temperature. Assuming the coefficient of friction as 0.22 and the flow stress for this material at the required true strain as 1000 MPa, calculate the forging force at the end of hammer stroke.

(b) A billet of metal 800 mm long x 150 mm diameter is to be extruded into a cylindrical component. Direct extrusion process is to be used. If the estimated extrusion ratio is 4.0 and average flow stress experienced by the metal during deformation is 100 MPa, calculate the true strain and the force necessary for the extrusion process. State any assumption made.

(c) A company that operates for 50 weeks in a year is concerned about its stocks of copper cable. This costs Rs 240 a meter and there is a demand for 8,000 meters a week. Each replenishment costs Rs 1,050 for administration and Rs 1,650 for delivery, while holding costs are estimated at 25 per cent of value held a year. Assuming no shortages are allowed, what is the optimal inventory policy for the company? How would this analysis differ if the company wanted to maximize its profits rather than minimize cost? What is the gross profit if the company sells the cable for Rs 360 a meter?

10+10+20=40

5. (a) State the effect of electrolyte concentration on metal removal rate in Electrochemical machining process.

(b) For machining a metallic sheet in EDM, the charging capacitance is 15 microfarad and gap voltage is 130 volts. Calculate the surface roughness value of the machined surface is K is considered as 4.

(c) In a RC type pulse generator, the maximum charging voltage is 100 volts and charging capacitance is 100 microfarad. Determine the sparking energy between the electrodes.

(d) During EDM drilling process of a 15 mm diameter hole in 6 mm thickness plate, brass tool electrode is used and kerosene dielectric was utilised. The resistance and capacitance in the relaxation circuit used as 50 Ω and 20 μF. The supply voltage given is 150 V and the discharge gap is so maintained that discharge takes place at the condition of maximum power delivery to the discharging circuit. Considering constant K to be 0.18, determine the volumetric material removal rate and approximate cycle time.

10+6+6+18=40

6. (a) What would be the crystal structure of an alloy if the density of the alloy is 11270 Kg/m^3, the atomic weight is 184.4 g/mole and the radius of an atom is 0.146 nm.

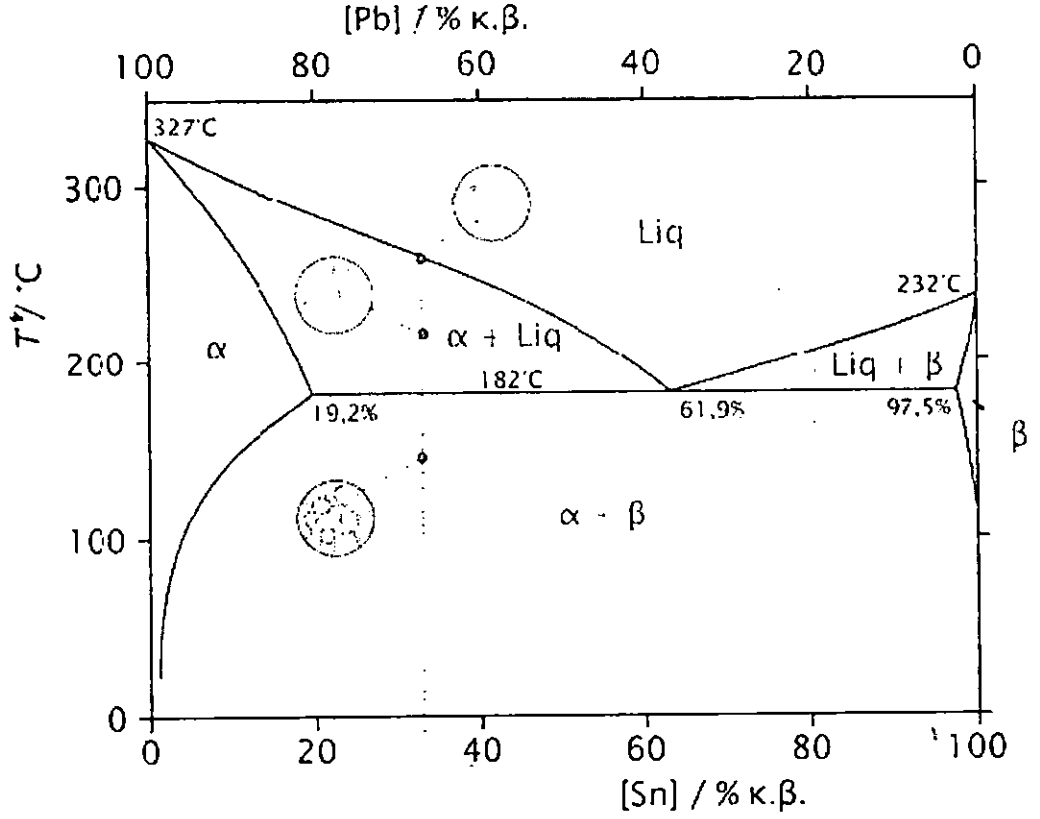
(i) SC (ii) FCC (iii) BCC

Explain the reason behind your choice.

(b) The yield strength of a polycrystalline material increases from 115 MPa to 215 MPa if average grain diameter decreases from 0.04 mm to 0.01 mm. find the yield strength of the material if grain size number is ASTM 9.

20+20=40

7. (a) A crucible contains 1 Kg of an alloy of composition 90% Tin and 10% Lead at a temperature just above the Eutectic Temperature. Calculate the amount of tin to be added to the crucible to completely solidify the alloy without changing the system temperature. Pb-Sn phase diagram is given below:



(b) Plot Fe-Fe_3C phase diagram and determine the amount of different phases in SAE 1050 steel at

(i) Just above A3 Critical Temperature

(ii) Just above A1 Critical Temperature

(iii) Just below A1 Critical Temperature

(iv) Room Temperature considering very slow cooling

(c) What is strain hardening? Give the reasons of strain hardening.

15+15+ 10=40

2022

MECHANICAL ENGINEERING

PAPER-II

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

*Answers may be given either in **English** or in **Bengali** but all answers must be in one and same language.*

Any data if needed may be assumed, but it must be clearly mentioned.

Answer any five questions

1. (a) At the inlet to a certain nozzle, the enthalpy of the fluid passing is 3000 kJ/kg and the velocity is 60 m/s. At the discharge end, the enthalpy is 2760 kJ/kg. The nozzle is horizontal and there is negligible heat loss from it. Find the velocity at the nozzle exit. If the inlet area is 0.1 m^2 and specific volume at inlet is 0.187 m^3/kg, find the mass flow rate. If the specific volume at the nozzle exit is 0.498 m^3/kg, find the exit area of the nozzle.

   (b) A heat engine is used to drive a heat pump. The heat transfers from the heat engine and from the heat pump are used to heat the water circulating through the radiators of a building. The efficiency of the heat engine is 27% and COP of the heat pump is 4. Evaluate the ratio of the heat transfer to the circulating water to the heat transfer the heat engine.

20+20=40

2. (a) With the help of the T-s and h-s diagrams, describe the working principle of a reheat Rankine cycle. Define the steam rate and heat rate of a Rankine cycle.

   (b) Consider a steam power plant operating on the ideal reheat Rankine cycle. Steam enters the high-pressure turbine at 15 MPa and 600°C and is condensed in the condenser at a pressure of 0.1 MPa. If dryness fraction at the low-pressure turbine exit is not allowed to fall below 0.896, estimate the pressure at which steam should be reheated. Also determine thermal efficiency of the reheat Rankine cycle. Assume that the steam is reheated to the inlet temperature of the high-pressure turbine. Steam table is allowed.

10+30=40

3. (a) With a neat sketch and a T-s diagram describe operation of an ideal Brayton cycle. Show that the efficiency of an ideal Brayton cycle is a function of its pressure ratio.

(b) In an air standard Brayton cycle, the compression ratio 16, and at the beginning of isentropic compression, the temperature is 15°C and the pressure is 0.1 MPa. Heat is added until the temperature at the end of the constant pressure process is 1480°C. Calculate the cut-off ratio, the heat supplied per kg of air, the cycle efficiency and mean effective pressure.

15+25=40

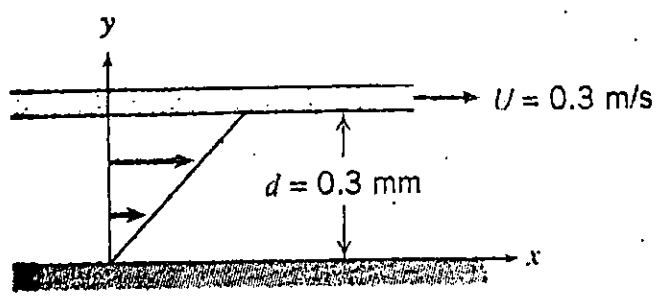
4. (a) Derive the expression of heat transfer through uniform cross-sectional area fin assuming heat loss from the fin-tip is negligible. Define fin efficiency and effectiveness.

(b) The aluminium square fins (0.5 mm× 0.5 mm) and 10 mm length are provided on a surface of a semiconductor electronic device to carry 1 W of energy generated by the electronic device. The temperature of the surface of the device should not exceed 80°C when the surrounding temperature is 40°C. Neglecting the heat loss from the fin tip, estimate the number of fins required to carry out the above duty. It is given that the thermal conductivity of the fin material is 200 W/m °C and the convective heat transfer coefficient is 15 w/m^2 °C.

(c) An oil cooler for a large diesel engine is to cool engine oil from 60°C to 45°C, using seawater at an inlet temperature of 20°C with a temperature rise of 15°C. The design heat load is Q=140 kW and the overall heat transfer coefficient is 80 W/m^2 K. Find the heat transfer surface area for single pass counter flow and parallel flow arrangement.

10+15+15=40

5. (a) An infinite plate is moved over a second plate on a layer of liquid as shown. For small gap width d, we assume a linear velocity distribution in the liquid. The liquid velocity is 0.0065 g/cm.s and its specific gravity is 0.88.

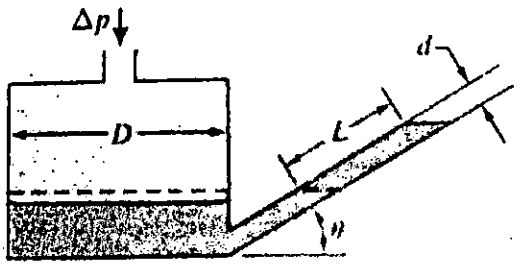


Determine:

(i) The absolute viscosity of the liquid in N.s/m^2.
(ii) The kinematic viscosity of the liquid in m^2/s.
(iii) The shear stress on the upper plate in N/m^2.
(iv) The shear stress on the lower plate in Pa.
(v) The direction of each shear stress calculated in parts (iii) and (iv).

Contd...P3

(b) An inclined tube reservoir manometer is constructed as shown. Derive a general expression for the liquid deflection, L in the inclined tube, due to the applied pressure difference, Δp. Also obtain an expression for the manometer sensitivity.



20+20=40

6. (a) A hot air balloon (approximated as a sphere of diameter 15 m) is to lift a basket load of 2670 N. To what temperature must the air be heated in order to achieve liftoff?

(b) Water flows under a sluice gate on a horizontal bed at the inlet to a flume. Upstream from the gate, the water depth is 0.45 m and speed is negligible. At the vena contracta downstream from the gate, the flow streamlines are straight and the depth is 50 mm. Determine the flow speed downstream from the gate and discharge in cubic meter per second per meter of width.

20+20=40

7. (a) The basic design of a centrifugal pump has a dimensionless specific speed of 0.075 rev. The blades are forward facing on the impeller and the outlet angle is 120° to the tangent, with an impeller passage width at outlet being equal to one-tenth of the diameter. The pump is to be used to raise water through a vertical distance of 35 m at a flow rate of 0.04 m^3/s. The suction and delivery pipes are each of 150 mm diameters and have a combined length of 40 m with a friction factor of 0.005. Other losses at pipe entry, exit, bends, etc. are three times the velocity head in the pipes. If the blades occupy 6% of the circumferential area and the hydraulic efficiency (neglecting slip) is 76 %, what must be the diameter of the pump impeller.

(b) A power station supplies the following loads to the customers:

Time in hours	0-6	6-10	10-12	12-16	16-20	20-22	22-24
Load in MW	30	70	90	60	100	80	60

i) Estimate the load factor of the plant.

ii) What is the load factor of a standby equipment of 30 MW capacity if it takes up all loads above 70 MW? What is its use factor?

20+20=40

2022

GEOLOGY

PAPER-I

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

*Answers may be given either in **English** or in **Bengali** but all answers must be in one and same language.*

Group-A

Answer *any three* questions.

1. a. Describe the layered structure of Earth with descriptions of chemical properties and physical properties in terms of density, temperature and pressure. 20

   b. What are the heat sources in the interior of the earth? Write short notes on each. Write a very brief account on earth's heat flow. What is geothermal gradient? Why does the geothermal gradient vary? What is negative geothermal gradient? 5+5+2+6+2=20

2. a. Define strain. Define longitudinal, volume and shear strain. Why and how the strain ellipsoid is conceived? Define 'lines of no finite strain' and 'plain strain'. What do the prolate and oblate strain ellipsoids indicate? Explain with necessary sketches and graphical representations. 2+6+4+4+4=20

   b. What is a shear zone? Define, with suitable sketches, left lateral and right lateral shear. Classify mylonites with a brief description of texture of each class. Describe with sketches two different indicators of sense of shear. 1+4+9+6=20

3. a. Define and describe with neat sketches: structure of passive continental margins and continental rifts. 10x2=20

   b. (i) Write the principle of radiometric age estimation of rocks. Write and explain the age equation. Why is Rb-Sr method used for determination of ages of old igneous and metamorphic rocks and also of Lunar rock samples? 8+6

   (ii) What are the reasons behind the separation of (A) Archaen and Proterozoic Eons, (B) Palaeozoic and Mesozoic Eras. 6

4. a. Write a note on evolution of Equidae. Describe with neat sketch(es) the hard part morphology of cephalopoda. 10+10=20

   b. Draw a vertical section of distribution of groundwater and give a geological description of it. Describe in brief two methods of groundwater recharge. 10+10=20

5. a. Describe, with labelled sketches, four different types of unconformities. 20

   b. Write notes on (i) Seismic zones of India, (ii) Cretaceous-Tertiary Boundary. 20

Group B

Answer any two questions

6. a. What are systematic joints and joint systems; define with explanatory sketches. Describe the features present on a joint surface. Draw joint superpositions / intersection patterns to show younger and older joints in an area with more than one joint set. 4+10+6=20

   b. Classify schistosity/rock cleavage. Draw sketches of each class. 20

7. a. Write in detail the engineering classification of intact rocks. Describe the geological investigations carried out before construction of a tunnel. 10+10=20

   b. Write in brief the history of formation of the Himalayan Mountain Belt since break-up of India from Gondwanaland to the present. 20

8. a. Write a detailed description of natural processes of preservation of plants and animals as fossils. 20

   b. Describe the lithostratigraphic succession and tectonic setting of the Bengal basin. 20

2022

GEOLOGY

PAPER-II

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

*Answers may be given either in **English** or in **Bengali** but all answers must be in one and same language.*

Group-A

Answer *any three* questions.

1. Answer any four questions

a) Define mineral and crystal? Are all mineral crystals? Justify your answer. What are the relations between lengths of crystallographic axes and angles between them in different crystal systems? 5+5=10

b) Describe morphology of any four types of intrusive igneous bodies. 2.5x4=10

c) What do you mean by CIPW norm? What are the bases of CIPW norm calculation? Describe in brief the use of norm. What are the disadvantages of CIPW norm?

1+3+4+2=10

d) What is a Tsunami? Describe, with a self-explanatory sketch, how does submarine faulting create a Tsunami? How does the character of Tsunami wave changes from ocean interior to the coast. 1+5+4=10

e) Describe, in brief, the processes of petroleum accumulation at structural traps. 10

2. a) Define (i) crystal form, (ii) crystal zone and (iii) crystal class with neat labelled sketches. Define 'Normal class' of crystal system. Describe, with a sketch, the general form of the normal class of Tetragonal system. Show, in a stereographic projection (hand-drawn, unmeasured projection), plots of the faces of this form and also the symmetry elements involved. 9+1+6+4=20

b) State and explain the Pauling's rules. Use sketches wherever necessary. 20

3. a) (i) Describe a typical facies association of barrier bar sediments. Explain how the facies members of this association indicates the geomorphological set up of the basin, nature of transporting agency(ies) and changes in energy conditions during deposition. 20

b) Define roundness and sphericity of clasts and sorting of clastic sediments. How do these help in interpretation of the maturity of the sediment? Write how the mineralogy of the clasts helps to interpret the nature of provenance. 3+7+10=20

4. a) Give a detailed account of Barrovian metamorphism of pelitic rocks in the Chlorite and Biotite zones. 20

   b) What are the physical and geological conditions of rock melting and formation of magma? Describe how magma from a single source is diversified to give different types of rock. 10+10=20

5. a) Write very brief accounts of mineral/ore present in the deposit, morphology and occurrence and origin of two important types of hydrothermal deposit. 20

   b) What are the bases of grading of coking and non-coking coals? How are coals classified in Indian Standard Classification? Write a short note on mode of occurrences of diamond deposits in India. 2+10+8=20

Group-B

Answer any two questions

6. a) What are different types of landslides? Give a geological description of each in brief. Write a note on measures practised for protection of hill-slopes and mitigation of landslide related hazards. 2+8+10=20

   b) How does mining activities pollute the soil and atmosphere? Describe the processes of industrial and nuclear waste disposal? 8+12=20

7. a) Draw a neat labelled representation of the Diopside (Di)-Anorthite (An) system. Describe the crystallisation behaviour of an initial melt of Composition $Di_{20}An_{80}$. Describe the petrogenetic significance of the system. 6+6+8=20

   b) What is metasomatism? Write a note on the roles of agents of metasomatism. What are the two main types of mantle metasomatism? Give one examples of each types? 2+10+6+2=20

8. a) Write notes on description of morphology and origin of four important types of fluvial landforms. 20

   b) Compare between alluvial fan and estuarine delta in terms of sediment type, sediment sequence, sedimentary structures and energy conditions of sedimentation. 20

2022

CIVIL ENGINEERING

CSM(O)/CE-I/22

PAPER-I

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

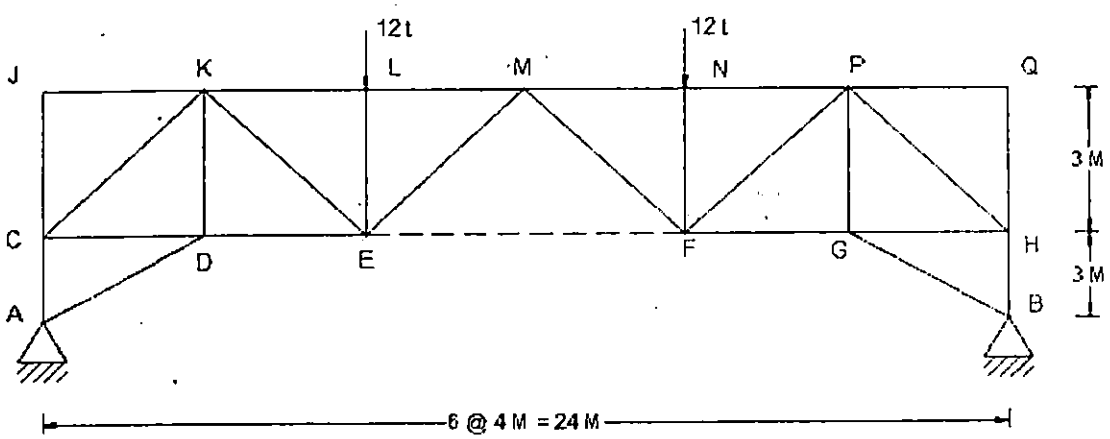
Answer may be written either in **English** *or in* **Bengali** *but all answer must be in one and the same language.*

All notations / symbols have their usual meanings, unless otherwise specified.

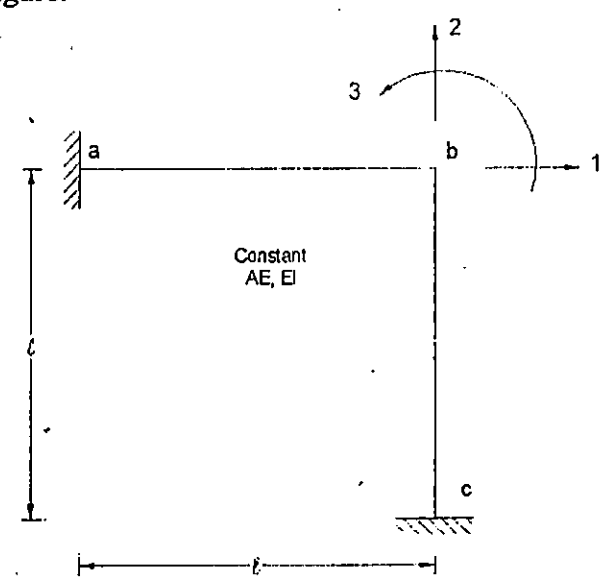
Group-A

Answer any Four questions 32 x 4 = 128

1. a) Assuming all members of the truss shown below to be pin joined, calculate forces in all members.----------20



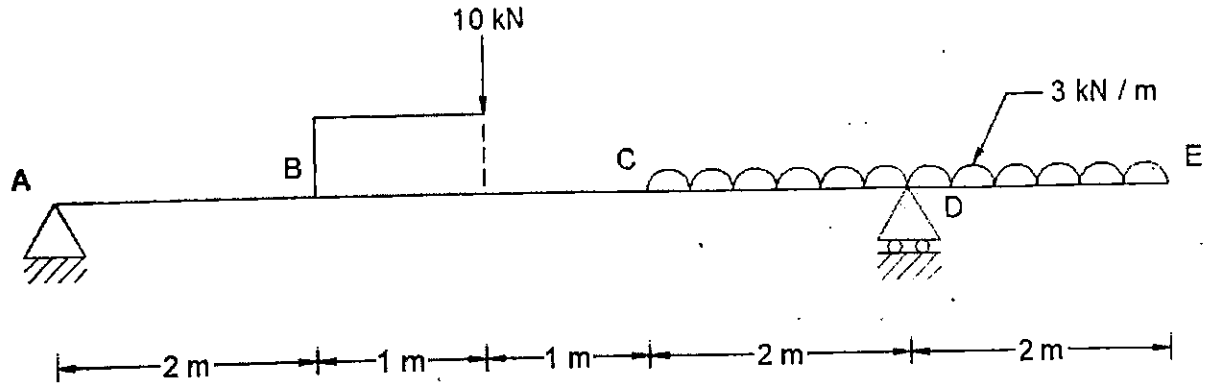
b) Generate the stiffness matrix for the frame corresponding to Three degree of freedom **(1,2,3) in the below figure.** -------- 12



P.T.O

2. a) i)What are the assumptions in Euler's theory of long columns. ----------5
   ii)Write with expressions – the definition of and comparison of Modulus of Elasticity and Modulus of Rigidity? --------- 7

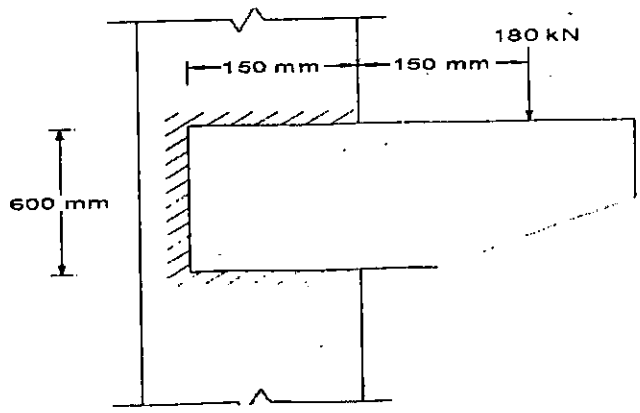
   b) Calculate and draw the Bending Moment and Shear Force Diagramwith values and sign conventions. ---------- 20



3. a) Define Permeability of Soil. What are the factors on which Permeability depend upon. What is the co-efficient of Permeability? ------- 4+4+4
   b) Describe Mohr's Circle and Coulomb's Law with expression. Draw and describe the required steps to be followed. -----10 +10

4. a) Describe in detail, the difference between 'Working Stress Method' of design and 'Limit state method' of design. Explain if there is any Economic advantage between the two, then What and How? ----------8+4= 12

   b) A Column of 9.0m. effective length has to support an Axial Load of 1200kN. Design the Column consisting of Two Channel Sections placed back to back at a suitable spacing and connected through a diagonal lacing system. Consider, $f_y = 250\ N / mm^2$ ---------- 20



Contd...P3

5. a) A reinforced concrete wall of 175mm. thickness and 3.2m. Effective Height is needed to withstand a compressive Load of 1000kN/m. Design the wall using M15 grade Concrete and Mild steel reinforcement ----------8

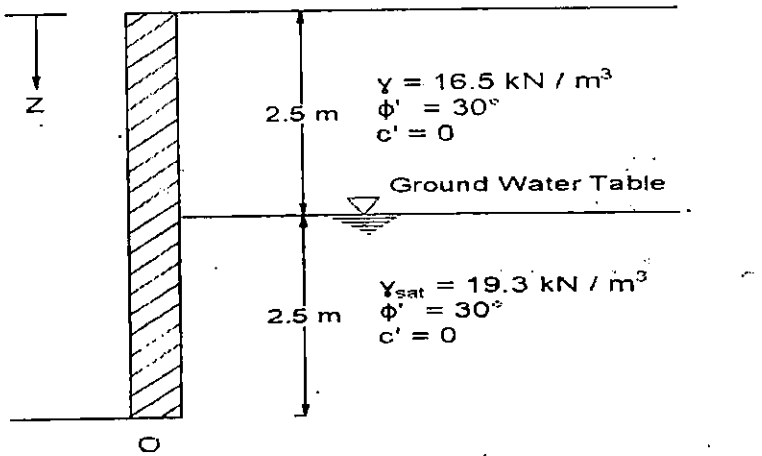
b) Design a rectangular beam for an effective simply supported span of 6.0m. The superimposed load is 80kN /m. Size of the beam is limited to 300mm x 700mm. overall. Use M20 Concrete and Fe415 grade Steel. ----------12

c) A reinforced concrete beam of rectangular section 550mm. wide and overall depth of 750 mm. It is subjected to an ultimate bending moment of 1500 kN-m and ultimate Twisting Moment of 50kN-m. M15 Grade concrete and Fe415 grade steel are used. The beam is provided with 3-20mmϕ. bars as main reinforcement at the bottom. For the beam in question, determine the transverse reinforcement required, if it carries. In addition, an ultimate shear force of 130kN. Use relevant IS code of Provisions. ------12

6. a) Describe various methods, how Bearing Capacity of Soil is determind. Also mention how Pile capacity is determined. ----------6 + 6 = 12

b) A capillary permeability test was conducted in two stages under a head of 600mm.and 1800mm. respectively, at the entry end. In the first stage, the wetted surface moved from 15mm. to 70mm in 7 minutes. In the Second stage, it advanced from 70mm. to 185mm. in 24 minutes. The degree of saturation at the end of the test was 85% and the Porosity was 35%. Determine the capillary head and Coefficient of Permeability. ----------10

c) For a retaining wall shown in figure below, determine the lateral earth force at rest per unit length of wall. Also determine the location of resultant force and also draw the pressure distribution Diagram. ----------10



Group-B

Answer any Four questions 18 x 4 = 72

7. a) What is the definition of 'Consolidation'? Write difference between Compaction and Consolidation. – (2+4)

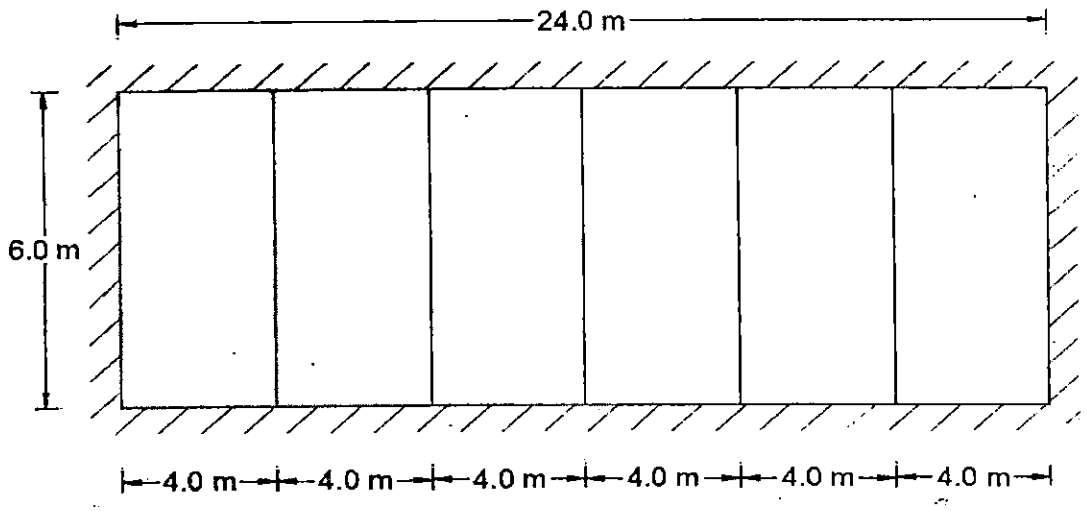
b) In a Plate bearing test on pure clayey soil failure occurred at a load of 12.2 tonnes. The size of the plate was 450mm. x 450mm. and the test was done at the depth of 1.0m. below ground level. Find out the ultimate bearing capacity for a 1.5m. wide continuous wall footing with its base at a depthof 2.0m. below the ground level. The unit weight of clay may be taken as 1.9 gm /cc and $N_c = 5.7$ and $N_q = 1$ and $N_\gamma = 0$.----------12

8. a) What is the difference between a Truss member and a Beam member. Describe in brief the steps of a Built -Up Steel Plate Girder Design. --------(2+ 4)

b) A 12mm. thick bracket plate is connected to a column flange as in the figure and transmit a Load of 80kN. Design a suitable Shop Weld connection as per the figure. Permissible stress in the weld are: In Bending – 15.45 kN / cm^2; In shear – 10.05 kN / cm^2 -------12

9. A hall 6.0m x 24 m. is to be covered with a RCC Slab and beam system. Beams are located at 4.0m. intervals and supported on 350mm thick walls alround. Live load on the roof is 2 kN / m^2 and floor finish is 0.2 kN / m^2.

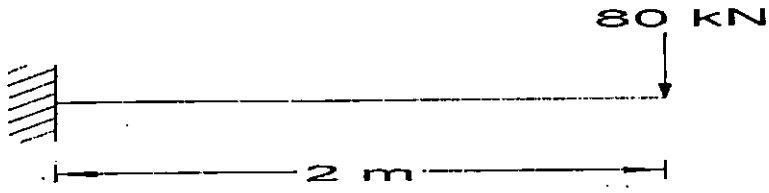
Using working stress method of design and adopting M15 Grade concrete and mild steel reinforcement, design the slab in the end panel only. ----------18



10. a) Describe Mohr's theorem. Write in brief basics of Matrix method of Analysis. 4+4

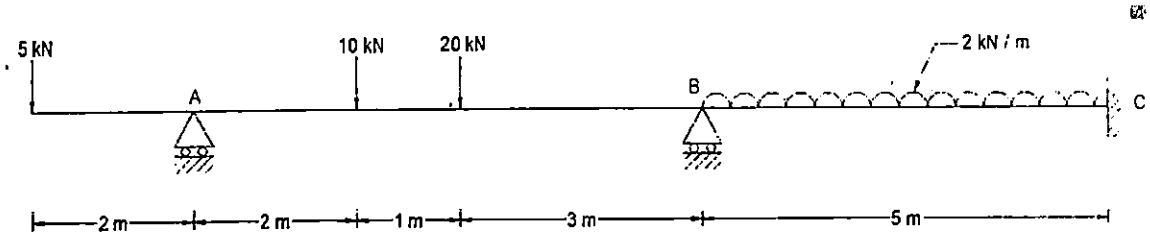
Contd...P 5

b) A cantilever beam of dimension 200mm. wide 250mm. deep projects 2.0 m. out of a wall and in carrying a point load of 80 kN at the free end as shown in figure below. Find the Slope and Deflection of the Cantilever at the free end. Consider E = 210 GPa.----10



11. a) State Castigliano's two theorems. ----------6

b) A Continuous beam is loaded as shown in Fig. below. Analyze the beam by the method of moment distribution and draw Bending Moment and Shear Force diagram. -------- 12



CIVIL ENGINEERING CSM(O)/CE-II/22

PAPER-II

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

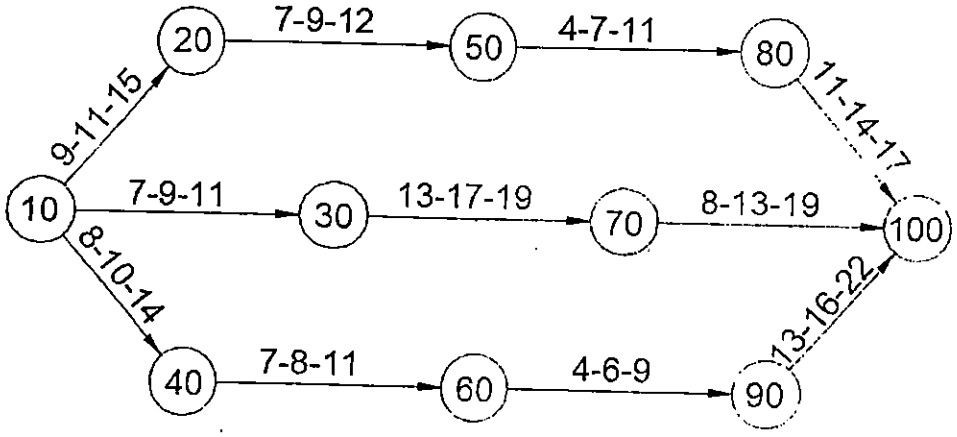
Answer may be given either in **English** *or in* **Bengali** *but all answer must be in one and the same language.*

All notations / symbols have their usual meanings, unless otherwise specified.

GROUP – A

Answer any Four questions 32 x 4 = 128

1. a)



In the given Network, the optimistic, the most likely and the pessimistic time estimates are given for each aotivitie. If 10 and 100 are the START and the END events respectively, find the Critical path through the Network. ----- 16

b) Explain under what condition, Non – destructive Tests of Concrete structure become necessary. Mention at least Five types of NDT and their procedures including the parameters obtained from those tests. -------- 16

2. a) What is Chain Survey? When Chain Survey is Preferred ? --------- 4

b) In a closed traverse ABC, following readings are taken ---------- 8

Line	Fore Bearing	Back Bearing
AB	20^0	201^0
BC	101^0	178^0
CA	278^0	50^0

c) A levelling staff is held vertical at a distance of 100 m. and 300 m. from the axis ofa Tacheometer and the staff intercept for the horizontal sight are 0.99m and 3.00m. respectively. Find the Constant of the Instrument.

The instrument set up at a station A and the staff held vertical at Point B. With the telescope inclined at a depression angle 10^0 to horizontal. the reading on the staffs are 2.67m., 1.835m. 1.0m. Calculate the RL of B and its horizontal distance from A. Given – Height of Instrument = 1.42m. and RL of A = 450.5m. ---------- (7+ 7)

d) What is Remote Sensing. Briefly explain the components of a remote sensing system.... 6

3. Explain why width of Roads in Horizontal Curves require Widening ------- 6
Define Traffic Volume and Establish the expression for Traffic Density. Establish the expression for Traffic Capacity of Roadway. -----6+5

Describe various types of Traffic Signals and their Applications ----------8
Draw a sketch for Cross Section of a Highway, mentioning and defining various Layers of Construction. ---------- 7

4. **a) Define:** ----------6

i) Direct Run – off
ii) Rainfall Excess
iii) Effective Rainfall

b) Describe various types of reservoirs. Find out expression for reservoir capacity by various methods. ----------6

e) An irrigation channel is to carry a full supply discharge of 30 cubic meter per second at a velocity of 1.7 m/sec. The side slopes are to be 1 Horizontal : 1 Vertical. The ratio of full supply depth to bed width is to be 1: 6. Assuming the Manning's 'n' as 0.018, the full supply depth, bed width and bed slope of the channel. ---------- 10

f) A 200 mm. diameter well fully penetrates a confined Aquifer of 30m. depth. For pumpage of 35 litres / second, the steady drawdown at 100 m. and 300 m. distance from the well are observed as 3.2 m. and 2.5 m. respectively. Estimate the co-efficient of Permeability in m / day and transmissibility of the aquifer in m^2 / day. ------10

5. **a) Describe types of undesirable organisms found out in consumptive water, causing infections to Human and are harmful.** ----------6

b) Mention various impurities found in untreated naturally resourced water. Also mention their effect, if consumed. ----------6

c) Describe the commonly employed water treatment methods. Also elaborate each process. ----------10

d) Design a rectangular sedimentation tank to remove spherical particles of size equal to and greater than 50 µm (micro meter) with a specific gravity of 2.3 from 100MLD (Million litres per day) of turbid water, Also determine the detention time of the tank.--10

Assume:

i) Stoke's Law of sedimentation is applicable
ii) Length to width ratio is 3:1 forn the tank
iii) Depth of Tank is 3.0m.
iv) Kinemetic Viscosity of water is 1.01×10^{-6} m^2/sec

Contd...P3

6. a) What is an 'ELECTRO STATIC PRECIPITATOR'? Where it is used? --------6
b) Explain various sources of Noise Pollution generation and also mention the mitigation procedures ----------8
c)Describe methods of Remote Sensing. What are the important usage of Remote Sensing – Write an overview of GPS system -------10
d)Estimate the basic capacity of a traffic lane at a speed of 60kmph and assume the following ---------- 8
i) All vehicles are of average length of 6.1m.
ii) Average reaction time is 2.5 sec.
iii) Co-efficient of longitudinal friction is 0.35.
iv) There is no Gradient.

GROUP – B

Answer any Two questions 36 x 2 = 72

7. a) Mention the important steps (At least Five) involved in optimization of Cost in a project ----------6

b) Explain the importance and frequency of updating in completion of a project – (5+5)

c) 20 kgs. Of Coarse aggregate were taken for sieve analysis. Weight retained on 80mm. 40mm., 20mm., 10mm., 4.75mm. sieves are 1, 5,10,12 and 8kgs respectively. **Find the Fineness Modulus.** ----------10

d) Write short notes on----------5x2 = 10
i) Rapid Hardening Cement
ii) Low Heat Cement

8. a) Classify the solid wastes, including suitable example for each of them --------10

b) Explain different methods of disposal of above category of solid waste -------10

c) **What do you understand by Air Pollution. Describe the effects of Air Pollution on Human, Plant and materials** ----------10

d) Name different methods for removal of temporary and Permanent hardness of water – 6

9. a) What are the various method of doing Theodolite Traversing ----------6

b) Define Contour, Contour interval. Discuss various factors affecting the choice of contour intervals ----------4+6

c) Define: ----------3x2 =6

i) Water bound Macadam (WBM)

ii)Super Elevation

d) Derive the relation between Super Elevation and speed of Vehicle on Horizontal Curve ----------6

e) Design the rate of Super elevation from a horizontal curve of a radius 66m. and speed of 120 km / Hr. ----------8

10 a) What is the difference between PERT and CPM ----------8

b) What is Float? Explain different type of Floats ----------8

c) Describe various types of Dams ----------8

d) Write a short note on Consumptive use of water. Enumerate the assumptions made in Lacy's theory of Canal design ----------(5 + 7) = 12

2022

ARABIC

PAPER – I

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

SECTION-A

أجب عن أي واحد من الأسئلة التالية: 25

1. ماذا تعرف عن علم اللغة الحديث؟
2. بين أهمية علم الأصوات بالتفصيل.

SECTION-B

أجب عن أي اثنين من الأسئلة التالية: **25X2=50**

1. أكتب عن المفاعيل الخمسة بالأمثلة
2. ماذا تعرف عن اسم الفاعل؟ وضّح بالأمثلة.
3. عرّف الحال و أنواعه بالتفصيل.

SECTION-C

ترجم أي اثنين من الفقرات التالية من العربية إلى الإنجليزية: **25X2=50**

1. إنّ أجمل ما يميز الإنسان هو تمسكه بالقيم وتحليه بالأخلاق الحسنة، وممّا هو أكثر نقاء أن تكون أخلاق المجتمع كلها حسنة، وإنّ كلمتي القيم والأخلاق كثيرًا ما ترِدان متلازمَتَين مع بعضهما، حتى صار من الشائع أنهما مترادفتان ومتلازمتان مع بعضهما في أي نقاش أو حوار تربوي اجتماعي. أما من الناحية التربويّة فإن القيم ترتبط بالفرد، فلكل فرد قيمه التي يتمسك بها ويُحافظ عليها، واجتماع قيم الأفراد في كل مجتمع هي التي تكون أساسًا لأخلاق هذا المجتمع، وتميزه عن غيره من المجتمعات، مثل اشتراك مجموعة من الأفراد في إحدى المجتمعات بامتلاكهم

لقيمة احترام قانون السير، سيكون هذا سبب لاتصاف المجتمع بأخلاق تتعلق باحترام قانون السير، والالتزام بها. القيم هي تلك الجذور الطيبة، والأرض الخصبة التي تُبنى عليها أخلاق المجتمعات وتثمر، فكلما كانت الجذور طيبة و الأرض صالحة، كلما كانت الشجرة أكثر ثباتاً وأعظم إنتاجًا.

2. الهند هي أكبر دول العالم الديمقراطيّة من حيث عدد السكان. وهي جمهوريّة برلمانيّة ذات نظام متعدد الأحزاب، بها ثمانية أحزاب وطنية معترف بها، بما في ذلك حزب المؤتمر الوطني الهندي وحزب بهاراتيا جاناتا (بي جاي بي)، وأكثر من 40 حزبًا إقليميًا. يعد حزب المؤتمر الوطني الهندي من يسار الوسط في الثقافة السياسية الهندية، ويعدّ حزب بهاراتيا جاناتا حزبًا يمينيًا. خلال معظم الفترة بين عام 1950 –عندما أصبحت الهند جمهورية لأول مرة– وأواخر الثمانينيات، كان لحزب المؤتمر أغلبية في البرلمان. منذ في الانتخابات العامة الثلاثة الأولى لجمهورية الهند، في 1951 و 1957 و 1962، حقق حزب المؤتمر بقيادة جواهر لال نهرو انتصارات سهلة.

3. أبو بَكر الصّدّيق رضي الله تعالى عنه هو أولُ الخُلفاء الراشدين، وأحد العشرة المبشرين بالجنَّة، وهو وزيرُ نبيّ الإسلام مُحمد وصاحبهُ، ورفيقهُ عند هجرته إلى المدينة المنورة. وكان من أغنياء قُريش في الجاهليَّة، فلما دعاه النبي مُحمد صلى الله عليه وسلّم إلى الإسلام أسلمَ دون تردد، فكان أول من أسلم مِن الرجال الأحرار. ثم هاجر أبو بكر مُرافقاً للنبيّ مُحمد صلى الله عليه وسلّم من مكة إلى المدينة، وشَهِد غزوة بدر والمشاهد كلها مع النبي صلى الله عليه وسلّم، ولما مرض النبي مرضه الذي مات فيه أمر أبا بكر أن يَؤمَّ الناس في الصلاة. بعد وفاة النبي صلى الله عليه وسلّم، يوم الإثنين 12 ربيع الأول سنة 11هـ، بويع أبو بكر بالخِلافة في اليوم نفسه، فبدأ بإدارة شؤون الدولة الإسلامية من تعيين الولاة والقضاة وتسيير الجيوش، وارتدت كثير من القبائل العربية عن الإسلام. توفي أبو بكر يوم الإثنين 22 جمادى الآخرة سنة 13هـ، وكان عمره ثلاثاً وستين سنة.

CONTD. P/3

SECTION-D

25X2=50 ترجم أي اثنين من الفقرات التالية من الإنجليزية إلى العربية:

1. The Mughal Empire was founded by Babur, a Timurid prince and ruler from Central Asia. Babur was a direct descendant of the Timurid Emperor Tamerlane on his father's side, and the Mongol ruler Genghis Khan on his mother's side. He established himself in Kabul and then pushed steadily southward into India from Afghanistan through the Khyber Pass. Babur's forces occupied much of northern India after his victory at Panipat in 1526. The instability of the empire became evident under his son, Humayun, who was driven into exile in Persia by rebels. Humayun's exile in Persia established diplomatic ties between the Safavid and Mughal Courts and led to increasing West Asian cultural influence in the Mughal dynasty.

2. 'Uthman bin 'Affan (R.A.) was the third Rashidun caliph, who ruled for twelve years, the longest of all Rashidun caliphs, and during his reign, the Rashidun Caliphate reached its greatest extent. He is known for having ordered the compilation of the first standard version of the Holy Quran.

   'Uthman (R.A.) was an affluent merchant of Makkah Following his conversion to Islam, he became a prominent companion of the Prophet Muhammad (PBUH). Though, Uthman (R.A.) didn't participate in the early Muslim battles, he extensively contributed his wealth in support of the Muslims. After Muhammad's (PBUH) death in 632, 'Uthman served as a close aide to the first and second caliphs Abu Bakr and Umar (R.A). Under 'Uthman's (R.A.) leadership, the entire Persia came under the Muslim rule. He conquests into Iran, Afghanistan and Armenia too.

3. The new National Education Policy 2020 introduced by the central government is expected to bring the changes to education in India. The policy approved by the Cabinet of India on 29 July 2020, outlines the vision of India's new education system. The policy is a comprehensive framework for elementary education to higher education as well as vocational training in both rural and urban India. The policy aims to transform India's education system by 2021.The National Education Policy has emphasized on the use of

mother tongue or local language as the medium of instruction till Class 5 while, recommending its continuance till Class 8 and beyond

SECTION-E

25

أجب عن أي واحد من الأسئلة التالية:

1. عرّف التشبيه وبين أغراضه مع الأمثلة.
2. ما هو الفرق بين الاستعارة التصريحية والاستعارة المكنية؟

2022

ARABIC

PAPER – II

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

SECTION-A

العصر الجاهلي:

أجب عن أي خمسة من الأسئلة التالية: **30X5=150**

1. ا"الشعر ديوان العرب" وضّح هذه العبارة بالتفصيل.
2. ناقش أثر القرآن الكريم على النثر العربي في العصر الإسلامي.
3. أكتب عن تطور الأدب العربي في العصر العباسي.
4. أكتب عن حياة جبران خليل جبران و اسهاماته في الأدب العربي المهجري.
5. ناقش مساهمة توفيق الحكيم في المسرحيات العربية.
6. أكتب عن تطور العشر العربي الرومانسي في العصر الحديث.
7. ناقش تطور الأدب العربي في بلاد المغرب العربي.
8. ألقي الضوء على حياة حافظ إبراهيم وخدماته في الشعر العربي الحديث.

SECTION-B

1. بيّن معنى الكلمات التي تحتها خط: **10**

ارج النسيم سوى من الزوراء	سحرا فاحيا ميت الأحياء
اهدا لنا ارواح نجد عرفه	فالجو منه معنبر الارجاء

وروى أحاديث الاحبة مسندا	عن اذخر باذاخر وسحاء
فكسرت من ريا حواشي برده	وسرت حميا البرء في ادوائي
يا راكب الوجناء بلغت المنى	عج بالحمى ان جزت بالجرعاء

2. **من أي معلقة أُقتبست هذه الأبيات؟ واشرحها شرحاً تاماً.** **10**

كَأَنِّي غَدَاةَ البَيْنِ يَوْمَ تَحَمَّلُوا	لَدَى سَمُرَاتِ الحَيِّ نَاقِفُ حَنْظَلِ
وُقُوْفًا بِهَا صَحْبِي عَلَيَّ مَطِيَّهُمُ	يَقُوْلُوْنَ: لا تَهْلِكْ أَسًى وَتَجَمَّلِ
وإِنَّ شِفائِيَ عَبْرَةٌ مُهْرَاقَةٌ	فَهَلْ عِنْدَ رَسْمٍ دَارِسٍ مِنْ مُعَوَّلِ؟
كَدَأْبِكَ مِنْ أُمِّ الحُوَيْرِثِ قَبْلَهَا	وَجَارَتِهَا أُمِّ الرَّبَابِ بِمَأْسَلِ
إِذَا قَامَتَا تَضَوَّعَ المِسْكُ مِنْهُمَا	نَسِيْمَ الصَّبَا جَاءَتْ بِرَيَّا القَرَنْفُلِ
فَفَاضَتْ دُمُوْعُ العَيْنِ مِنِّي صَبَابَةً	عَلَى النَّحْرِ حَتَّى بَلَّ دَمْعِيَ مِحْمَلِي

3. **إشرح العبارة مع ذكر السياق والسباق:** **15**

فاذا كان الاعتداء كثيراً عاماً في جميع أبواب المعاش كان القعود عن الكسب كذلك لذهابه بالآمال جملة بدخوله من جميع أبواب. و إن كان إعتداء يسيراً كان الانقباض عن الكسب على نسبته. و العمران و وفوره و نفاق أسواقه أنما هو الأعمال وسعي الناس و المصالح و المكاسب ذاهبين وجائين. فاذا قعد الناس عن المعاش وانقبضت أيديهم عن المكاسب كسدت أسواق العمران وإنتفضت الأحوال و ابذعرّ و الناس في الآفاق من غير تلك الإيالة في طلب الرزق فيما خرج عن نطاقها فخف ساكن القطر و خلت دياره وخربت أمصاره وأختلّ اختلاله حال الدولة والسلطان لما أنها صورة للعمران تفسد بفساد مادّتها ضرورة.

4. **شكّل العبارة ولخّصها بالعربية:** **15**

الأدب هوأحد أشكال التعبير الإنساني عن مجمل عواطف الإنسان وأفكاره وخواطره وهواجسه بأرقى الأساليب الكتابية التي تتنوع من النثر إلى النثر المنظوم إلى الشعر الموزون لتفتح للإنسان

أبواب القدرة للتعبير عما لا يمكن أن يعبر عنه بأسلوب آخر .يرتبط الأدب ارتباطاً وثيقاً باللغة ، فالنتاج الحقيقي للغة المدونة والثقافة المدونة بهذه اللغة' يكون محفوظاً ضمن أشكال الأدب وتجلياته والتي تتنوع باختلاف المناطق والعصور وتشهد دومًا تنوعات وتطورات مع مر العصور والأزمنة، وثمة العديد من الأقوال التي تناولت الأدب ومنها ما قاله وليم هازلت. إن أدب أي أمة هو الصورة الصادقة التي تنعكس عليها أفكارها.

PALI
PAPER-I

Time Allowed : 3 Hours Full Marks : 200

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

Candidates may use **Devnagari** or **Roman** or **Bengali** Script in their answers, quotations or expressions in **Pali.**

Group- A

1. Write a note on the various stages of Indo Aryan Languages. 12
2. Pali is considered as an M.I.A. language- Explain the statement stating the features of Pali. 20
3. Explain *any three* of the following phonetic tendencies in Pali with apt examples: - 6 x 3 = 18
   a) Palatalization, b) Syncope, c) Analogy, d) Prothesis, e) Anaptyxis.

Group- B

4. What is Samāsa? Write a note on the different types of Samāsas in Pali. 18
5. Explain the formation of either Gerund or Past Participles in Pali. 12
6. a) Decline *either* 'bhikkhu' or 'phala' in Nominative and Accusative forms. 6
   b) Conjugate *either* '√dis' or '√vad' in the Sattami. 6
   c) Write any two sentences in Pali showing the use of Indeclinables. 4 x 2 = 8

Group- C

7. Translate into English *either* of the following verses adding grammatical notes on the words underlined. 10 + 4 = 14
   a) "na hi <u>verena</u> verāni sammantīdha kudācanaṃ /
   averena ca sammanti esa dhammo sanantano //"
   b) "sekho <u>pathaviṃ</u> vijessati yamalokañca imaṃ sadevakaṃṃ /
   sekho dhammapadaṃ sudesitaṃ kusalo pupphamiva pacessati //"
8. Translate into English *either* of the following verses adding grammatical notes on the words underlined. 10 + 4 = 14
   a) "dve me bhikkhave antā pabbajitena na sevitabbā. katame dve? yo cāyaṃ kāmesu kāmasukhallikānuyogo hīno gammo pothujjaniko anariyo anattha-saṃhito, yo <u>cāyaṃ</u> atta-kilamathānuyogo dukkho anariyo anattha- saṃhito."
   b) "Bhagavā tattha āgañchi, sīsaṃ <u>mayhaṃ</u> parāmasi, bāhāya maṃ gahetvāna saṃghārāmaṃ pavesayī. svākkhāto Bhagavatā dhammo, dhammaṃ namassāmi"
9. Translate into Pali ***any one*** of the following passages: 22
   a) Then the Buddha stayed in Nigrodhārāma in the vicinity of the city Kapilāvatthu. Having gone to Nigrodhārāma the monks saw the Buddha and paid homage (to him). The Buddha expounded the doctrine for getting rid of lust, anger and delusion.
   b) We see visible forms with eyes, hear sounds with ears, and smell odours with nose. Let the girls go with their brothers to the city to see the Buddha. They gave ear to hear the teaching of the Buddha.

Group- D

10. Write an essay in Pali on ***any one*** of the following: 50
    a) Ariyo aṭṭhaṅgiko maggo, b) Tipiṭaka, c) Bodhisattva

PALI

PAPER-II

Time Allowed : 3 Hours Full Marks : 200

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

Candidates may use **Devnagari** or **Roman** or **Bengali** Script in their answers, quotations or expressions in **Pali.**

Group- A

Answer ***question No.5*** and ***any two*** from the rest.

1. Define Pañcanikāya. Write note on any one of the Nikāyas. 30
2. Discuss about the life and works of Buddhadatta. 30
3. Write a note on the causes of the rise and spread of Buddhism. 30
4. Write a note on the causes and the impact of the Second Buddhist Council. 30
5. Write short notes on *any four* of the following: 10 x 4 = 40
   a) Khandhaka, b) Milindapañha, c) Visuddhimagga, d) Kusinārā, e) Pasenadi, f) Yogācāra

Group- B

Attempt all questions. Answers in this group should be in **Pali.**

6. a) Summarise the content of either the Padhāna Sutta or the Citta Vagga. 30
   b) Write a note on Milinda or 'aṭṭhagarudhammā'. 30
7. a) Write a note on the authorship of Vuttodaya and Subodhālaṅkāra. 20
   b) Explain with suitable examples ***any two*** of the following: 10 x 2 = 20
   Cittapadā, Vaṃsaṭṭhā, Abbhutopamā, Dhammohīnopamā