



COOCH BEHAR PANCHANAN BARMA UNIVERSITY

B.Sc. Honours 2nd Semester Examinations, 2018

PHYSICS

ELECTRICITY, MAGNETISM AND EMT

CORE-3 (CCPHSH3)

Time Allotted: 1 Hour 30 Minutes

Full Marks: 25

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

All symbols are of usual significance.

Answer Question No. 1 and one each from Group-A and Group-B

1. Answer *all* questions from the following:

1×10 = 10

- (a) Three point charges q_1 , q_2 and q_3 are placed close to each other. If the separation distance between the charges q_1 and q_2 is d , then the force between q_1 and q_2 will be,

$$(i) F = \frac{q_1 q_2}{4\pi \epsilon_0 d^2}, \quad (ii) F > \frac{q_1 q_2}{4\pi \epsilon_0 d^2}, \quad (iii) F < \frac{q_1 q_2}{4\pi \epsilon_0 d^2}.$$

- (b) Calculate the volume density of a charge distribution that produces an electric field $\vec{E} = 3x\hat{i} + 2y\hat{j}$ V/m.
- (c) Justify that an ideal current source should have an infinite internal resistance.
- (d) A coil has an inductance of 0.5 H and resistance of 20 Ω . If a 100 V emf is applied to the coil, calculate the energy stored in the magnetic field after current has build up to its maximum value.
- (e) A series CR circuit is connected to a 5V dc source. Plot the variation of the current in the circuit with time.
- (f) The magnetic susceptibility χ_m of a material is -1 . Find out the magnetic induction vector \vec{B} inside the material when it is placed in a uniform magnetic field \vec{H} .
- (g) What do you mean by the coercive field of a ferromagnetic substance?
- (h) Let a uniform electric field $\vec{E} = 10\hat{j}$ V/m and a uniform magnetic field $\vec{B} = B_0\hat{k}$ T are simultaneously present in a small region of space. A proton enters into the region with a velocity $\vec{v} = 5\hat{i}$ m/s and leaves the region without deviation. Find out the value of B_0 .
- (i) An air cored solenoids of 40 cm long has 500 turns. The diameter of the solenoid is 3 m. Calculate the self inductance.
- (j) Can the vector $\vec{E}(x, y, z) = (x^2 + y^2)\hat{i} + (y^2 + z^2)\hat{j} + (x^2 + y^2)\hat{k}$ represent an electric field?

GROUP-A

Answer any *one* question from the following

5×1 = 5

- 2 (a) Compare the electric repulsion of two electrons separated by a distance r with the gravitational attraction between two same particles. 2
- (b) Consider two electric dipoles with their centres at fixed distance of separation. Show that if the angles of dipoles make with the line joining their centres are θ_1 and θ_2 and if θ_1 is held fixed then for equilibrium

$$\tan \theta_1 + \tan \theta_2 = 0.$$
 3
3. An alternative voltage is applied to a series LCR circuit. Resonance occurs for the following values of the circuit elements: $R = 100 \Omega$, $L = 20 \text{ mH}$ and $C = 2 \mu\text{F}$.
- (a) Determine the frequency of input voltage. 1
- (b) If the voltage drop across the resistor is 2V at resonance, then what would be the voltage drop across the inductor? 2
- (c) Find out the half-power frequencies for this series resonance circuit. 2

GROUP-B

Answer any *one* question from the following

10×1 = 10

4. (a) Two infinite conducting plates are placed parallel to the yz plane at $x = 0$ and $x = d$ respectively. While the plate at $x = 0$ is grounded, the plate at $x = d$ is kept at a constant potential ϕ_d . The space between the plates is filled with electric charge of volume density $\rho = \rho_0 x/d$. Determine the potential at any point located between the two plates. Also calculate the surface charge density on each plate. 4+2
- (b) How the Poisson's equation will be modified if these parallel conducting plates were of finite dimensions? 2
- (c) Find the condition for which the function $\Phi = \alpha x^2 + by^2 - \gamma z^2$ can represent the electrostatic potential in a charge-free region. 2
5. (a) State and prove boundary conditions on \vec{E} & \vec{D} prevailing at the interface of two dielectric media. 3
- (b) Consider the interface $z = 0$ between two dielectrics. The region 1 ($z \geq 0$) is occupied by a dielectric of dielectric constant $k_1 = 4$ and region 2 ($z \leq 0$) is occupied by another dielectric of dielectric constant $k_2 = 3$. If $\vec{E}_1 = 5\hat{i} - 2\hat{j} + 3\hat{k}$ kV/m, find \vec{E} for $z \leq 0$. 3
- (c) Suppose a charge Q is distributed within a sphere of radius R in such a way that the charge density $\rho(r)$ at a distance r from the centre of the sphere is 4

$$\rho(r) = k(R-r), \text{ for } 0 < r < R$$

$$= 0, \text{ for } r > R$$

Determine constant k in terms of Q & R . Calculate the electric field at any point inside the sphere. Find the value of r for which field is maximum. What is the value of this maximum field?



COOCH BEHAR PANCHANAN BARMA UNIVERSITY
B.Sc. Honours 2nd Semester Examinations, 2018

PHYSICS

WAVE AND OPTICS

CORE-4 (CCPHSH4)

Time Allotted: 1 Hour 30 minutes

Full Marks: 25

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All symbols are of usual significance.*

Answer Question No. 1 and one question each from Group-A and Group-B

1. Answer the following questions: 1×10 = 10
- (a) What is the ratio of frequency of the SHM, when the Lissajous figure make a figure of eight (8)?
 - (b) What are normal modes?
 - (c) Explain why sound produced by a stuck string is more melodius than that produced by plucking.
 - (d) The time period of a simple pendulum of infinite length is given by
(i) finite (ii) zero (iii) infinite (iv) none of these.
 - (e) Why are light waves from two different candles not seen to interfere?
 - (f) The fringe width of interference pattern of Young's double slit experiment is
(i) $\frac{D\lambda}{d}$ (ii) $\frac{2d}{D\lambda}$ (iii) $\frac{D\lambda}{2d}$ (iv) $\frac{D}{\lambda d}$.
 - (g) What do you mean by fringes of equal inclination?
 - (h) What do you mean by Rayleigh's criterion of resolution?
 - (i) What do you mean by resolving power of telescope?
 - (j) Explain what would happen in Newton's ring experiment when air in inter-space is replaced by transparent liquid.

GROUP-A

2. (a) Two mutually perpendicular simple harmonic vibration of amplitudes a and b are acting simultaneously on a particle. These time periods are in the ratio 1:2 and their phase difference is $\frac{\pi}{2}$. Show that the resultant curve is parabola. 4
- (b) What is a hologram? 1
3. (a) Consider the wave equation $\frac{\partial^2 y}{\partial x^2} = \frac{1}{v^2} \cdot \frac{\partial^2 y}{\partial t^2}$ 3
- Show that $y(t) = f_1(x - vt) + f_2(x + vt)$ is a general solution of the wave equation.
- (b) How many orders will be visible if the wave length of light 500 nm and number per inch on grating is 2620? 2

GROUP-B

4. (a) Derive an expression for resolving power of a diffraction grating. In what respect is an echelon grating superior to an ordinary ruled grating? 3+1
- (b) The equation of motion of two coupled oscillators are $\ddot{q}_1 + \sqrt{2}q_2 + 4q_1 = 0$ and $\ddot{q}_2 + \sqrt{2}q_1 + 5q_2 = 0$. Find the normal frequencies and the ratios of the amplitude of the normal modes. 3
- (c) What do you mean by group velocity and phase velocity of a plane progressive wave? Derive a relation between them. 3
5. (a) Show that the intensity of wave at a point is given by $T = \frac{P_{\text{rms}}^2}{\rho V}$, where P_{rms} is the root mean square value of the excess pressure. 4
- (b) Distinguish between amplitude resonance and velocity resonance. 3
- (c) How can the refractive index of a liquid be determined using Newton's ring apparatus? 3



COOCH BEHAR PANCHANAN BARMA UNIVERSITY

B.Sc. Programme 2nd Semester Examinations, 2018

PHYSICS

ELECTRICITY, MAGNETISM AND EMT

DSC (DSCPHSG23)

Time Allotted: 1 Hour 30 minutes

Full Marks: 25

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Answer Question No. 1 and one question each from Group-A and B

প্রশ্ন নং ১ আবশ্যিক এবং বিভাগ-ক ও বিভাগ-খ থেকে একটি করে উত্তর দাও

1. Answer *all* questions from the following:

1×10 = 10

নিম্নলিখিত সবগুলি প্রশ্নের উত্তর দাও:

(a) What is the value of λ for which $\vec{v} = 3y\hat{i} + (y - 2z)\hat{j} + (x + \lambda z)\hat{k}$ is solenoidal?

λ -এর কোন মানের জন্য $\vec{v} = 3y\hat{i} + (y - 2z)\hat{j} + (x + \lambda z)\hat{k}$ ভেক্টরটি সলিনয়ডাল হবে?

(b) If $\nabla \times \vec{A} = 0$, what will be the value of $\oint_C \vec{A} \cdot d\vec{r}$?

যদি $\nabla \times \vec{A} = 0$ হয়, তবে $\oint_C \vec{A} \cdot d\vec{r}$ -এর মান কত?

(c) What do you mean by magnetic vector potential?

চৌম্বকীয় ভেক্টর বিভব বলতে কি বোঝো?

(d) What do you mean by magnetic dipole moment of a current carrying loop?

একটি তড়িৎবাহী লুপের চৌম্বক দ্বিমেরু ভ্রামক বলতে কি বোঝো?

(e) Write down the differential form of Gauss's law.

গাউসের সূত্রের অবকলন রূপটি লেখো।

(f) What is the physical significance of $\nabla \cdot \vec{B} = 0$?

$\nabla \cdot \vec{B} = 0$, এই সমীকরণটির ভৌতিক তাৎপর্য কি?

- (g) If a medium has both permittivity and permeability double of that free space, then what will be the speed of light in that medium?

কোন মাধ্যমের তড়িৎভেদ্যতা ও চৌম্বক ভেদ্যতা শূন্য মাধ্যমের তড়িৎভেদ্যতা ও চৌম্বক ভেদ্যতার দ্বিগুণ হলে মাধ্যমটিতে আলোর বেগ কত হবে ?

- (h) For series connection of capacitors the equivalent capacitance will be

- (i) greater than the biggest capacitor (ii) less than the lowest capacitor
(iii) equal to the highest capacitor (iv) equal to the lowest capacitor

ধারকের শ্রেণী সমবায়ের জন্য তুল্য ধারকত্ব

- (i) বৃহত্তর ধারকটির থেকে বড় (ii) ক্ষুদ্রতম ধারকটির থেকে ছোট
(iii) বৃহত্তর ধারকটির সমান (iv) ক্ষুদ্রতম ধারকটির সমান

- (i) An electric dipole is placed at the centre of a sphere. What will be the flux through the surface of the sphere?

একটি তড়িৎদ্বিমেরু একটি গোলকের কেন্দ্রে রাখা আছে। গোলকটির তল দিয়ে অতিক্রান্ত ফ্লাক্স কত হবে ?

- (j) If an electric field is directed along X-axis and a magnetic field along Z-axis, then what will be the direction of flow of energy due to this two fields?

একটি তড়িৎক্ষেত্র X-অক্ষ বরাবর, চৌম্বকক্ষেত্র Z-অক্ষ বরাবর ক্রিয়াশীল। তড়িৎচুম্বকীয় শক্তি প্রবাহের দিক কোনটি হবে ?

Group-A

বিভাগ-ক

Answer any *one* question from the following

5×1 = 5

নিম্নলিখিত যে-কোনো *একটি* প্রশ্নের উত্তর দাও

2. (a) State the Ampere's circuital law. Using Ampere's circuital law, find the magnetic field at a point on the axis of a current carrying solenoid. 1+3

অ্যাম্পিয়ারের সূত্রটি বিবৃত করো। ইহাকে কাজে লাগিয়ে, একটি তড়িৎবাহী সলিনয়েডের অক্ষের উপর অবস্থিত কোন বিন্দুতে চৌম্বক ক্ষেত্রপ্রাবল্য নির্ণয় করো।

- (b) Find the relation between Tesla and Gauss. 1

টেসলা এবং গসের মধ্যে সম্পর্ক নির্ণয় করো।

3. (a) Establish the relation between Relative Permeability (k) and Magnetic Susceptibility (χ). 3

চৌম্বক প্রবনতা (Relative Permeability) এবং চৌম্বক ভেদ্যতা (Magnetic susceptibility)-এর মধ্যে সম্পর্ক স্থাপন করো।

- (b) Calculate the value of Poynting vector on the surface of the Sun if the power radiated by it is 3.8×10^{26} watts. Radius of the Sun $R = 7 \times 10^8$ metre. 2

সূর্য দ্বারা বিকিরিত ক্ষমতা 3.8×10^{26} watts হলে সূর্যের বাইরে পৃষ্ঠে Poynting vector-এর মান নির্ণয় করো। (সূর্যের ব্যাসার্ধ $R = 7 \times 10^8$ মিটার)

Group-B

বিভাগ-খ

Answer any *one* question from the following

10×1 = 10

নিম্নলিখিত যে-কোনো *একটি* প্রশ্নের উত্তর দাও

4. (a) State the Faraday's Law of electromagnetic induction. 3
তড়িৎ চুম্বকীয় আবেশ সংক্রান্ত ফ্যারাডের সূত্রগুলি বিবৃত করো।
- (b) Two infinitely long parallel wires are separated by a distance of 6 cm in air. If current flowing through the wires are respectively 3A and 4A. Calculate the forces between them. 3
দুটি ঋজু, ও দীর্ঘ সমান্তরাল তার পরস্পর হইতে বায়ু মাধ্যমে 6 cm দূরে অবস্থিত। একটি তারে প্রবাহমাত্রা 3A এবং অপর তারে প্রবাহমাত্রা 4A হলে তার দুটির ভিতর পারস্পরিক বল নির্ণয় করো।
- (c) A coil of self-inductance 100 mH is connected in series with another coil of self-inductance 170 mH. The effective inductance of the combination is found to be 70 mH. Find the coefficient of coupling. 2
100 mH এবং 170 mH স্বাবেশাঙ্কের দুটি কুণ্ডলী শ্রেণী সমবায়ে যুক্ত। সমন্বয়টির তুল্য স্বাবেশাঙ্ক 70 mH হলে যুগ্মীকরণ গুণাঙ্ক কত হবে ?
- (d) A particle with charge 1.6×10^{-19} coulomb is moving with a velocity $3\hat{i} + 2\hat{j}$ metre/second in an electric field of intensity $\vec{E} = 6\hat{i} + 6\hat{j} + 3\hat{k}$ volt/meter and magnetic field $\vec{B} = \hat{j} + 2\hat{k}$ tesla. Find the magnitude of the Lorentz force on the particle. 2
 $\vec{E} = 6\hat{i} + 6\hat{j} + 3\hat{k}$ ভোল্ট/মিটার তড়িৎক্ষেত্র এবং $\vec{B} = \hat{j} + 2\hat{k}$ টেসলা চৌম্বক ক্ষেত্রের মধ্যে 1.6×10^{-19} কুলম্ব আধানের একটি কণা $3\hat{i} + 2\hat{j}$ মিটার / সেকেন্ড বেগে গতিশীল। কণাটির উপর প্রযুক্ত লোরেঞ্জ বলের মান নির্ণয় করো।
5. (a) State and explain Gauss's theorem of electrostatic. Find the electric field at a distance 'x' from an infinitely long charged wire. 2+4+2
Find the electric flux through the surface $\vec{S} = 10\hat{j}$ placed in an electric field $\vec{E} = 2\hat{i} + 4\hat{j} + 7\hat{k}$.
স্থিরতড়িৎ সংক্রান্ত গাউসীয় উপপাদ্যটি ব্যাখ্যা করো। একটি তড়িতাহিত অসীম দীর্ঘ ঋজু তারের জন্য তারটি হতে 'x' দূরত্বে তড়িৎক্ষেত্র প্রাবল্য নির্ণয় করো।
একটি তল $\vec{S} = 10\hat{j}$ একটি তড়িৎক্ষেত্র $\vec{E} = 2\hat{i} + 4\hat{j} + 7\hat{k}$ -তে রাখা হল। তলটির মধ্য দিয়ে অতিক্রান্ত ফ্লাক্স কত হবে ?
- (b) Write down the equation of continuity and discuss its significance. 2
ধারাবাহিকতার সমীকরণটি (Equation of continuity) লেখো এবং এর তাৎপর্য ব্যাখ্যা করো।



COOCH BEHAR PANCHANAN BARMA UNIVERSITY

B.Sc. Honours 2nd Semester Examinations, 2018

CHEMISTRY

INORGANIC CHEMISTRY-I

CORE-3 (CCCEMH3)

Time Allotted: 1 Hour 30 Minutes

Full Marks: 25

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GROUP-A

1. Answer any *ten* questions from the following: 1×10 = 10
- (a) Among H_2O and Cl_2O ; which one has higher bond angle?
 - (b) What is F-Centre?
 - (c) Among NaCl and LiCl , which one has higher melting point?
 - (d) Find out the hybridisation of P in POCl_3 .
 - (e) What is the magnetic moment of Ti^{2+} ion?
 - (f) Find out the number of electron in π anti-bonding Molecular orbital of O_2^- (super oxide ion).
 - (g) N–N sigma bond strength is higher than O–O sigma bond. Why?
 - (h) NaClO_4 is 1000 times soluble than KClO_4 . Why?
 - (i) SO_2 has dipole moment but CO_2 does not. Why?
 - (j) Energy of one mole of radio wave photons with a frequency of 909 kHz is —
 - (k) What is the CGS unit of dipole moment?
 - (l) ZnO becomes yellow on heating and white on cooling. Why?
 - (m) Ionisation potential of Phosphorous is more than Sulphur. Why?
 - (n) PCl_5 exist but PH_5 does not, Why?
 - (o) SnCl_4 is colourless but SnI_4 is yellow. — Explain.
 - (p) Which one has higher dipole moment CH_3F or CH_3Cl ?

GROUP-B

Answer any *one* question from the following

5×1 = 5

2. (a) Observed dipole moment of LiF is 6.32 D. Calculate the percentage of ionic character of LiF . [Given: bond length of $\text{Li-F} = 1.56 \text{ \AA}$]

2

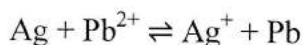
- (b) The polarity of B–X bonds is in the order B–F > B–Cl > B–Br, but Lewis acidity shows the sequence BF₃ < BCl₃ < BBr₃. — Explain. 2
- (c) Calculate the formal charge on the oxygen atom of cyanate ion. 1
3. (a) Calculate the maximum number of electrons that can have principal quantum number $n = 3$ and spin quantum number $m_s = -\frac{1}{2}$. 1
- (b) Calculate the A-R electronegativity of Zn, taking its covalent radius as 125 pm. 2
- (c) Why a sharp rise in I-E is observed on passing from Cr to Mn? 2
4. (a) Show the theoretical Born-Haber cycle for MX ionic compound, where M is mono-valent solid metal and X₂ is a mono-valent diatomic gaseous nonmetal. How can one measure the electron gain enthalpy from the cycle? 3+1
- (b) Write the relation between “Extra-stability” and electronegativity difference when bond energy is expressed in electron volt unit. 1

GROUP-C

Answer any *one* question from the following

10×1 = 10

5. (a) Discuss the factors that govern the ionisation energy of an element. Why ionisation energy of Na⁺ is more than Na? 3+2
- (b) Calculate the electronegativity difference between H and Br. [Given: H–H, Br–Br and H–Br bond energies are 436, 193 and 368 kJ/mol. respectively]. 3
- (c) Explain why Ne₂ molecule does not exist. 2
6. (a) Using VSEPR theory, find out the structure of (i) XeO₂F₂ (ii) ClF₃. 2+2
- (b) The radii of Zn²⁺ and S²⁻ are 0.7 and 1.84 Å. Predict the possible geometry of ZnS. 2
- (c) What is known as ‘Screening effect’? What are the draw backs of Slater’s rule? 2+2
7. (a) Why HCl is not used for quantitative estimation of Fe²⁺ with KMnO₄ solution? 2
- (b) What are ‘Madelung Constant’ and ‘Born Component’? On what factors these two are dependent? 1+1+1.5+1.5
- (c) Using the reduction potential values comment on the spontaneity of the reaction 3



$$E_{\text{Ag}^+/\text{Ag}}^0 = 0.799 \text{ V}, \quad E_{\text{Pb}^{2+}/\text{Pb}}^0 = -0.126 \text{ V}.$$



COOCH BEHAR PANCHANAN BARMA UNIVERSITY

B.Sc. Honours 2nd Semester Examinations, 2018

CHEMISTRY

ORGANIC CHEMISTRY-II

CORE-4 (CCCEMH4)

Time Allotted: 1 Hour 30 Minutes

Full Marks: 25

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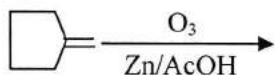
All symbols are of usual significance.

GROUP-A

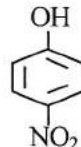
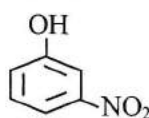
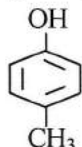
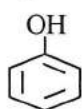
1. Answer any **ten** questions from the following:

1×10 = 10

- (a) Predict the product



- (b) Arrange the following compounds in order of increasing acidity:



- (c) What happens when propene is treated with peracid?
 (d) Define the term atropisomerism with suitable examples.
 (e) Give one example of dissymmetric allene.
 (f) What do you mean by *S-cis* and *S-trans* conformation of conjugated dienes?
 (g) What are stereo selective reaction? Give examples.
 (h) What are the limitations of Friedal Craft alkylation reaction?
 (i) What will be the reagent for following transformations?



- (j) Explain with example 'buttressing effect'.
 (k) What kind of substrate leads to Hofmann products in E₂ reaction?
 (l) How would you distinguish between 1°, 2° and 3° alcohols chemically?



COOCH BEHAR PANCHANAN BARMA UNIVERSITY
B.Sc. Honours 2nd Semester Examinations, 2018

CHEMISTRY

CHEMICAL ENERGETICS, EQUILIBRIA AND FUNCTIONAL
ORGANIC CHEMISTRY-I

GE-2 (GECEMG2)

Time Allotted: 1 Hour 30 Minutes

Full Marks: 25

*The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.
All symbols are of usual significance.*

GROUP-A

বিভাগ-ক

1. Answer any *ten* questions from the following: 1×10 = 10
নিম্নলিখিত যে-কোনো দশটি প্রশ্নের উত্তর দাওঃ
- (a) Which of the following are extensive and intensive properties?
Pressure, Volume, Free energy and Density.
নীচের কোন্ ধর্মগুলি পরিমাণগত এবং কোন্গুলি অবস্থানগত ?
চাপ, আয়তন, মুক্তশক্তি এবং ঘনত্ব
- (b) What is 'entropy'?
'এনট্রপি' কাকে বলে ?
- (c) State the law of mass action.
ভরক্রিয়া সূত্রটি ব্যক্ত করো।
- (d) Which one of the following will act as buffer solution?
নীচের কোনটি বাফার দ্রবণ হিসাবে কাজ করবে ?
 $\text{CH}_3\text{COOH} + \text{CH}_3\text{COONa}$ or / অথবা $\text{NaOH} + \text{CH}_3\text{COONa}$
- (e) What is the ionic product of water?
জলের আয়নীয় গুণফল কি ?
- (f) Write down the name of the reagents used in Gattermann-Koch reaction.
গ্যাটারম্যান-কোচ বিক্রিয়ায় ব্যবহৃত বিকারকগুলির নাম লেখো।
- (g) What is "iodoform test"?
"আয়োডোফর্ম পরীক্ষা" কি ?

(h) How do you distinguish between CH_3CHO and HCHO by a chemical test?
 একটি রাসায়নিক বিক্রয়ার সাহায্যে কিভাবে CH_3CHO এবং HCHO -এর মধ্যে পার্থক্য নিরূপণ করবে ?

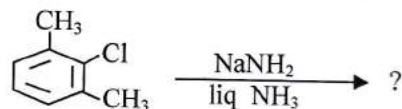
(i) What will be the product of the following reaction?
 নীচের বিক্রিয়াটিতে কি বিক্রিয়াজাত পদার্থ উৎপন্ন হবে ?



(j) Which one of the following reactions will take place more rapidly?
 নীচের বিক্রিয়াগুলির মধ্যে কোনটি সবচেয়ে দ্রুত সংঘটিত হবে ?



(k) What will be the product of the following reaction?



(l) Write down the equation of Clausius-Clapeyron.
 ক্লসিয়াস-ক্ল্যাপেরন সমীকরণটি লেখো।

GROUP-B

বিভাগ-খ

Answer any *one* question from the following

5×1 = 5

নিম্নলিখিত যে-কোনো একটি প্রশ্নের উত্তর দাও

2. (a) What is “common-ion effect”? Give one use of this effect. 1+1
 ‘সমআয়ন প্রভাব’ কি ? এর একটি ব্যবহার লেখো।
- (b) How do you separate a mixture of primary, secondary and tertiary alcohols using “Luca’s reagent”? 2
 ‘লুকাস বিকারকের’ সাহায্যে প্রাইমারী, সেকেন্ডারী এবং টারশিয়ারী অ্যালকোহলের একটি মিশ্রণকে কিভাবে আলাদা করবে ?
- (c) Calculate the solubility product of CaF_2 when it’s solubility is x mol/litre. 1
 CaF_2 -এর দ্রাব্যতা x mol/litre হলে, এর দ্রাব্যতা গুণফল নির্ণয় করো।
3. (a) State the Le-Chatelier’s Principle. 1
 লা-শাটেলিয়ার নীতিটি বিবৃত করো।
- (b) Establish the relationship between K_p and K_c . 2
 K_p এবং K_c -এর মধ্যে সম্পর্কটি প্রতিষ্ঠা করো।

- (c) Alkyl halides are more reactive towards nucleophilic substitution reaction than aryl halides. — Explain. 2

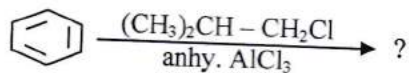
নিউক্লিওফিলিক প্রতিস্থাপন বিক্রিয়ায় অ্যালকিল হ্যালাইডগুলি, অ্যারোম্যাটিক হ্যালাইডগুলির চেয়ে বেশি সক্রিয় ব্যাখ্যা করো।

4. (a) Give an example of an S_Ni reaction. 1
S_Ni-বিক্রিয়ার একটি উদাহরণ দাও।

- (b) Establish the relationship: $C_p - C_v = R$. 2
সম্পর্কটি প্রতিষ্ঠা করো: $C_p - C_v = R$.

- (c) Predict the major product of the following organic transformation with plausible mechanism. 2

নীচের জৈব পরিবর্তনটিতে সবচেয়ে বেশি উৎপন্ন পদার্থটিকে সম্ভাব্য কলাকৌশলসহকারে নির্ণয় করো।



GROUP-C

বিভাগ-গ

Answer any *one* question from the following 10×1 = 10
নিম্নলিখিত যে-কোনো *একটি* প্রশ্নের উত্তর দাও

5. (a) Establish the Kirchoff's equation. 2
কারসফের সমীকরণ প্রতিষ্ঠা করো।

- (b) What will be the pH of 0.2 (M) HCl solution? 2
0.2 (M) HCl দ্রবণের pH কত হবে ?

- (c) Carry out the following organic transformations (without mechanism) 2×3 = 6
(any *three*):

নীচের জৈব পরিবর্তনগুলি দেখাও- (কলাকৌশল ব্যতীত)-যে-কোনো ৩টি।

(i) Aniline to iodobenzene / অ্যানিলিন থেকে আয়োডোবেঞ্জিন

(ii) Benzene to benzophenone / বেঞ্জিন থেকে বেঞ্জোফেনন

(iii) Acetonitrile to acetaldehyde / অ্যাসিটোনাইট্রাইল থেকে অ্যাসিট্যালডিহাইড

(iv) Phenol to benzene / ফেনল থেকে বেঞ্জিন

(v) Phenol to picric acid / ফেনল থেকে পিকরিকঅ্যাসিড।

6. (a) State and explain the Hesse's Law of constant heat summation. 2
হেসের তাপসমষ্টির নিত্যতা সূত্রটি বিবৃত ও ব্যাখ্যা করো।

- (b) Calculate the entropy of one mole of an ideal gas at constant pressure when it is heated from 27°C to 127°C. (Given that, $C_p = 5/2 R$ for ideal gas). 3

স্থিরাচাপে এক মোল আদর্শ গ্যাসকে 27°C থেকে 127°C উষ্ণতায় উত্তপ্ত করলে 'এনট্রপি'র পরিবর্তন কত হবে গননা করো। (দেওয়া আছেঃ $C_p = 5/2 R$ আদর্শ গ্যাসের জন্য)

- (c) Write short notes on the following reactions (any *two*): 2.5×2 = 5

- (i) Benzoin condensation
- (ii) Riemer-Tiemann reaction
- (iii) Pinacol-Pinacolone rearrangement reaction
- (iv) Schotten-Baumann reaction.

—x—



COOCH BEHAR PANCHANAN BARMA UNIVERSITY

B.Sc. Programme 2nd Semester Examinations, 2018

CHEMISTRY

CHEMICAL ENERGETICS, EQUILIBRIA AND FUNCTIONAL GROUP

ORGANIC CHEMISTRY-I

DSC-B (DSCCEMG21)

Time Allotted: 1 Hour 30 Minutes

Full Marks: 25

*The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.
All symbols are of usual significance.*

GROUP-A

বিভাগ-ক

1. Answer any *ten* questions from the following: 1×10 = 10
নিম্নলিখিত যে-কোনো দশটি প্রশ্নের উত্তর দাও:
- (a) Write down the name of an alcohol which responds to iodoform reaction.
আয়োডফর্ম বিক্রিয়ায় সাড়া দেয় এরকম একটি অ্যালকোহলের নাম লেখো।
- (b) 1 litre-atmosphere equals to how many joules?
1 লিটার-অ্যাটমসফিয়ার সমান কত জুল ?
- (c) $\text{CH}_3 - \text{CH}_2 - \text{Cl}$ is more reactive than $\text{CH}_2 = \text{CH} - \text{Cl}$. Why?
 $\text{CH}_2 = \text{CH} - \text{Cl}$ অপেক্ষা $\text{CH}_3 - \text{CH}_2 - \text{Cl}$ বেশী সক্রিয় কেন ?
- (d) 'A cup of hot tea' - which type of system is it?
'এক কাপ গরম চা' - কে কি ধরনের সিস্টেম ভাবা হয় ?
- (e) Write down the order of chemical reactivity of the following compounds:
কার্বনিল যৌগের রাসায়নিক সক্রিয়তার ক্রম লেখো:
 HCHO , CH_3CHO , CH_3COCH_3
- (f) For what type of reactions $k_p = k_c = k_x$?
কোন বিক্রিয়াগুলির ক্ষেত্রে $k_p = k_c = k_x$ হবে ?
- (g) CH_3CHO does not respond in Cannizzaro reaction. Why?
 CH_3CHO ক্যানিজারো বিক্রিয়াতে সাড়া দেয় না কেন ?

(h) pH of pure water is 7 explain.

বিশুদ্ধ জলের pH-7 ব্যাখ্যা করো।

(i) Write down the product $\text{CH}_3\text{COCH}_3 \xrightarrow[\text{NaOEt}]{\text{NH}_2-\text{NH}_2}$.

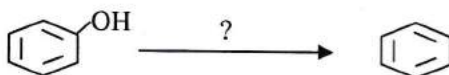
বিক্রিয়াজাত পদার্থটির নাম লেখো $\text{CH}_3\text{COCH}_3 \xrightarrow[\text{NaOEt}]{\text{NH}_2-\text{NH}_2}$.

(j) What do you mean by common-ion effect?

সম-আয়ন প্রভাব কি ?

(k) Write down the suitable reagent.

উপযুক্ত বিকারকটি লেখো।



(l) All natural process are spontaneous. Why?

সমস্ত প্রাকৃতিক প্রক্রিয়াগুলি স্বতঃস্ফূর্ত হয় কেন ?

GROUP-B

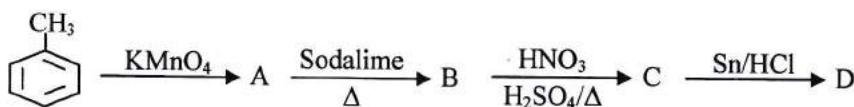
বিভাগ-খ

Answer any *one* question from the following

5×1 = 5

নিম্নলিখিত যে-কোনো একটি প্রশ্নের উত্তর দাও

2. (a) State first law of thermodynamics and derive its mathematical expression. 1+1
তাপগতিবিদ্যার প্রথম সূত্রটি বিবৃত করো এবং উহার গাণিতিক রূপটি প্রতিষ্ঠা করো।
- (b) How can you prepare 3° alcohol from Grignard reagent? 2
গ্রিগনার্ড বিকারক থেকে কিভাবে 3° অ্যালকোহল প্রস্তুত করবে ?
- (c) Give an example of intensive property. 1
একটি ভর-নিরপেক্ষ ধর্মের উদাহরণ দাও।
3. (a) Identify A, B, C, D 4
A, B, C, D কে শনাক্ত করো -



(b) An ideal gas is freely expanded at zero pressure whether it is reversible or irreversible. Give explanation. 1

শূন্য চাপের বিরুদ্ধে একটি আদর্শ গ্যাসের মুক্ত প্রসারণ ঘটানো হলো- প্রক্রিয়াটি পরাবর্ত না অপরাবর্ত কারণসহ বিবৃত করো।

4. (a) Deduce the relationship between k_p and k_x for a gaseous reaction. 2
 কোন গ্যাসীয় বিক্রিয়ার ক্ষেত্রে k_p এবং k_x এর মধ্যে সম্পর্কটি নির্ণয় করো।
- (b) The solubility of $PbCl_2$ at $25^\circ C$ is 1×10^{-3} mole/lit. Calculate its solubility product. 2
 $25^\circ C$ উষ্ণতায় $PbCl_2$ এর দ্রাব্যতা 1×10^{-3} mole/lit. ঐ উষ্ণতায় $PbCl_2$ এর দ্রাব্যতা-গুণফল কত ?
- (c) How will you convert CH_3COOH to CH_3CHO ? 1
 CH_3COOH থেকে CH_3CHO কিভাবে প্রস্তুত করবে ?

GROUP-C

বিভাগ-গ

Answer any *one* question from the following

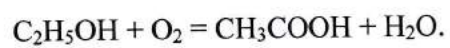
নিম্নলিখিত যে-কোনো একটি প্রশ্নের উত্তর দাও

$10 \times 1 = 10$

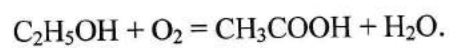
5. (a) Deduce the expression of pH of hydrolysis of salt of strong acid and weak base. 4
 তীব্র অ্যাসিড এবং মৃদু ক্ষারের লবনের আর্দ্রবিশ্লেষণের দ্রবণের pH সমীকরণ প্রতিষ্ঠা করো।
- (b) Find the pH of the solution of 0.05 (M) lactic acid and 0.1 (M) sodium lactate. 2
- (c) Write short notes on (ant *two*): 2 \times 2
 সংক্ষিপ্ত টীকা লেখো: (যে-কোনো দুটি)
- (i) E2 reaction / E2 বিক্রিয়া
- (ii) Williamson's-ether synthesis / উইলিয়ামসন-ইথার সংশ্লেষণ
- (iii) Pinacol-Piwacolone reaction / পিনাকল-পিনাকোলন বিক্রিয়া
6. (a) How would you differentiate: 2+2
 কিভাবে পার্থক্য করবে:
- (i) 1° -Alcohol and 2° -Alcohol / 1° -অ্যালকোহল এবং 2° -অ্যালকোহল
- (ii) Methanol and Phenol / মিথানল এবং ফেনল
- (b) Write down the suitable reagent. 2
 উপযুক্ত বিকারকের নাম লেখো:
- (i) $CH_3CH_2OH \xrightarrow{?} CH_3CH_2Cl$
- (ii) $CH_3CHO \xrightarrow{?} CH_3 \underset{OH}{\text{CH}} - CH_2 - CHO$
- (c) Discuss the effect of temperature and pressure on the equilibrium for the production of NH_3 by Haber Process. 2
 হেবার পদ্ধতিতে অ্যামোনিয়া সংশ্লেষণ বিক্রিয়ার সাম্যাবস্থার উপর উষ্ণতা ও চাপের প্রভাব আলোচনা করো।

- (d) The heat of combustion of ethyl alcohol and acetic acid is -325100 Cal and -209500 Cal respectively. Calculate the heat of formation for the following reaction.

2



ইথাইল অ্যালকোহল এবং অ্যাসিটিক অ্যাসিডের দহনতাপ যথাক্রমে -325100 Cal এবং -209500 Cal হলে নিম্নলিখিত বিক্রিয়ার ক্ষেত্রে উদ্ভূত তাপ নির্ণয় করো।



—x—



COOCH BEHAR PANCHANAN BARMA UNIVERSITY

B.Sc. Honours 2nd Semester Examinations, 2018

MATHEMATICS

REAL ANALYSIS

CORE-3 (CCMTMH3)

Time Allotted: 2 Hours

Full Marks: 40

*The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.
All symbols are of usual significance.*

GROUP-A

1. Answer any **ten** questions from the following: 1×10 = 10
- Give an example of an infinite set which has no limit point.
 - Find the domain of real valued function $f(x) = \log(\sin x)$.
 - Determine whether the function $f(x) = \log(x + \sqrt{1+x^2})$ is even or odd.
 - Find the limit of the sequence $\left\{ \left(1 + \frac{1}{n^2+2} \right)^{1/n^2} \right\}$.
 - Find a limit point of the set $S = \left\{ (-1)^n \left(1 + \frac{1}{n} \right) \right\}$.
 - State the density property of \mathbb{R} .
 - Give an example of a set $S \subset \mathbb{R}$ such that S is a proper subset of S' (derived set of S).
 - Examine whether the set $S = \left\{ x \in \mathbb{R} : \sin \frac{1}{x} = 0 \right\}$ is open or closed.
 - Find $\lim u_n$, where $u_n = \frac{n}{4} - \left[\frac{n}{4} \right]$.
 - Show that the series $\frac{1}{1.2} + \frac{1}{2.3} + \frac{1}{3.4} + \dots + \frac{1}{n(n+1)} + \dots$ is convergent.
 - State whether the series $\left\{ \frac{\cos nx}{n} \right\}$ is Cauchy sequence or not.
 - Give an example of a conditionally convergent series.

GROUP-B

2. Answer any **two** questions from the following: 5×2 = 10
- (a) Prove that union of countable family of countable set is countable. 5
- (b) Prove that if a sequence of real numbers $\{x_n\}$ is m.i. and bounded above, then it converges to $\sup x_n$. 5
- (c) If $\{u_n\}$ be a Cauchy sequence in \mathbb{R} having a subsequence converging to a real number l , then prove that $\lim u_n = l$. 5
- (d) Test the convergence of the series $1 + \frac{1}{2^3} + \frac{1}{2^2} + \frac{1}{2^5} + \frac{1}{2^4} + \dots$. 5

GROUP-C

3. Answer any **two** questions from the following: 10×2 = 20
- (a) (i) If the sequences $\{s_n\}$ and $\{t_n\}$ converges to zero and if $\{t_n\}$ is strictly decreasing then show that $\lim_{n \rightarrow \infty} \frac{s_n}{t_n} = \lim_{n \rightarrow \infty} \frac{s_n - s_{n+1}}{t_n - t_{n+1}}$ provided the limit on the right hand side exists. 5
- (ii) Prove that an absolutely convergent series is convergent but the converse is not true. 5
- (b) (i) Test the convergence of the series $\sum_{n=2}^{\infty} \frac{1}{n(\log n)^3}$. 5
- (ii) State and prove D'Alembert's ratio test for convergence of an infinite series $\sum u_n$ of positive terms. 5
- (c) (i) Show that the sequence $\{x_n\}$ defined by $x_n = \left(1 - \frac{1}{n}\right) \sin \frac{n\pi}{2}$ has a convergent subsequence but the sequence is not convergent. 5
- (ii) If $x_n = \sqrt{x_{n-1} + 7}$ with $x_1 = \sqrt{7}$, prove that $\{x_n\}$ converges to the positive root of the equation $x^2 - x - 7 = 0$. 5
- (d) (i) Prove that the supremum or infimum of a bounded non-empty linear point set S , when not a member of S , is a limit point of the set S . 6
- (ii) Test the convergence of the following series 4

$$1 - \frac{1}{2} + \frac{1}{2} \cdot \frac{3}{4} - \frac{1}{2} \cdot \frac{3}{4} \cdot \frac{5}{6} + \dots$$



COOCH BEHAR PANCHANAN BARMA UNIVERSITY

B.Sc. Honours 2nd Semester Examinations, 2018

MATHEMATICS

DIFFERENTIAL EQUATIONS-II

CORE-4 (CCMTMH-4)

Time Allotted: 1.30 Hours

Full Marks: 25

*The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.
All symbols are of usual significance.*

GROUP-A

1. Answer any *six* questions from the following: 1×6 = 6
- (a) If $e^{ax}u(x)$ is a P.I. of $y'' - 2ay' + a^2y = f(x)$, where 'a' is a constant, then find y'' .
 - (b) Find the number of solution of the differential equation $xy' - y = 2x^2$ with initial condition $y(0) = 0$.
 - (c) Suppose $y_p(x) = x \cos 2x$ is a particular solution of $y'' + \alpha y = -4 \sin 2x$, then find the value of constant 'α'.
 - (d) If $y = e^x$ be one of the solutions of $xy'' - y' + (1-x)y = 0$, then find the second linear independent solution.
 - (e) An equation contains 'n' arbitrary constants, then what will be the order of the differential equation derived from it?
 - (f) Check whether the solutions, e^x, e^{-x} and e^{2x} of the differential equation $y''' - 2y'' - y' + 2y = 0$ are linearly independent.
 - (g) Give an example of a continuous function which may not satisfy Lipschitz condition.
 - (h) Define Phase Plane of a system of linear differential equation.

GROUP-B

2. Answer any *three* questions from the following: 3×3 = 9
- (a) Find the critical points of the system $\frac{dx}{dt} = 14x - 2x^2 - xy$; $\frac{dy}{dt} = 16y - 2y^2 - xy$. 3
- (b) Solve: $(x^3D^3 + 3x^2D^2 + xD + 1)y = x \log x$. 3
- (c) Solve: $(D^5 - D)y = 4e^x + 8 \sin 2x$. 3
- (d) If $y = u$ is a solution of $y'' + Py' + Qy = 0$ then another solution $y = v$ is given by $v = u \int \frac{W(u, v)}{u^2} dx$ where P and Q are functions of x and the Wronskian $W(u, v)$ satisfies the equation $W' + PW = 0$. 3
- (e) Apply Picard's method to solve the following initial value problem upto third approximation $y' = 3e^x + 2y$, $y(0) = 0$. 3

GROUP-C

3. Answer any *two* questions from the following: 5×2 = 10
- (a) Find the power series solution of the initial value problem $y'' + 8xy' - 4y = 0$, $y(0) = 1$, $y'(0) = 0$. 5
- (b) Solve $y'' + 2y' + y = x^{-2}e^{-x}$ by the method of variation of parameters. 5
- (c) Solve by the method of undetermined coefficients $y'' - 3y' = x + e^x \sin x$. 5
- (d) Solve: $tDx + 2(x - y) = t$, $tDy + x + 5y = t^2$ [where $D \equiv \frac{d}{dt}$]. 5



COOCH BEHAR PANCHANAN BARMA UNIVERSITY

B.Sc. Programme 2nd Semester Examinations, 2018

MATHEMATICS

DIFFERENTIAL EQUATIONS

DSC-2 (DSCMTMG-22)

Time Allotted: 2 Hours

Full Marks: 40

*The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.
All symbols are of usual significance.*

GROUP-A

বিভাগ-ক

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

নিম্নলিখিত যে-কোনো **দশটি** প্রশ্নের উত্তর দাও:

(a) What is the geometrical meaning of the solution of $\frac{dy}{dx} = -\frac{y}{x}$?

নিম্নলিখিত অবকল সমীকরণের সমাধানের জ্যামিতিক তাৎপর্য কি ?

$$\frac{dy}{dx} = -\frac{y}{x}$$

(b) Choose the correct option —

Solution of the differential equation $(D^2 - 1)y = e^{2x}$ is an - (i) Implicit solution,
(ii) Explicit solution.

সঠিক উত্তরটি নির্বাচন করো -

$(D^2 - 1)y = e^{2x}$ যেখানে $D \equiv \frac{d}{dx}$ -সমীকরণের সমাধানটি হলো - (i) 'Implicit' সমাধান,

(ii) 'Explicit' সমাধান।

(c) Find the differential equation of all parabolas having their axes parallel to Y axis.

Y-অক্ষের সমান্তরাল অক্ষ বিশিষ্ট পরাবৃত্তের অবকল সমীকরণ নির্ণয় করো।

(d) Determine the type of the equation $\frac{\partial^2 z}{\partial x^2} - 4\frac{\partial^2 z}{\partial y^2} = 0$.

নিম্নলিখিত আংশিক অবকল সমীকরণের প্রকৃতি নির্ণয় করো -

$$\frac{\partial^2 z}{\partial x^2} - 4\frac{\partial^2 z}{\partial y^2} = 0$$

(e) Is the following differential equation integrable?

$$(y dx + x dy)(a - z) + xy dz = 0$$

নিম্নলিখিত অবকল সমীকরণটি সমাকলনযোগ্য কিনা বিচার করো -

$$(y dx + x dy)(a - z) + xy dz = 0$$

(f) Differentiate Singular solution and General solution.

'Singular solution' ও 'General solution' -এর মধ্যে পার্থক্য নিরূপন করো।

(g) Find particular integral of the differential equation $(D^2 - 4)y = e^{2x}$.

নিম্নলিখিত অবকল সমীকরণের 'Particular integral' নির্ণয় করো $(D^2 - 4)y = e^{2x}$.

(h) Form a partial differential equation of the curve $z = e^{mx}\phi(x + y)$.

নিম্নলিখিত বক্রের আংশিক অবকল সমীকরণ নির্ণয় করো: $z = e^{mx}\phi(x + y)$.

(i) Give an example of a nonlinear partial differential equation.

একটি 'non-linear' আংশিক অবকল সমীকরণের উদাহরণ দাও।

(j) Find the Charpit's subsidiary equation for the differential equation $(x^2 - y^2)pq - xy(p^2 - q^2) = 1$.

$(x^2 - y^2)pq - xy(p^2 - q^2) = 1$ অবকল সমীকরণের চার্পিট-এর সহায়ক সমীকরণটি নির্ণয় করো।

(k) Find integrating factor of the differential equation:

$$(3x^2y^4 + 2xy)dx + (2x^3y^3 - x^2)dy = 0.$$

$(3x^2y^4 + 2xy)dx + (2x^3y^3 - x^2)dy = 0$ -অবকল সমীকরণের সমাকল গুণাক্ষ নির্ণয় করো।

(l) Write the general solution of the differential equation: $(D^4 - 1)y = 0$.

$(D^4 - 1)y = 0$ যেখানে $D \equiv \frac{d}{dx}$, অবকল সমীকরণের সাধারণ সমাধান নির্ণয় করো।

GROUP-B

বিভাগ-খ

2. Answer any *two* questions from the following:

5×2 = 10

নিম্নলিখিত যে-কোনো দুটি প্রশ্নের উত্তর দাও:

(a) Solve: / সমাধান করো:

$$(xy^2 - x^2)dx + (3x^2y^2 + x^2y - 2x^3 + y^2)dy = 0.$$

(b) Prove that the integrating factor of the differential equation $\frac{dy}{dx} + Py = Q$ is

$e^{\int P dx}$; where P, Q are functions of x .

প্রমাণ করো $\frac{dy}{dx} + Py = Q$ অবকল সমীকরণের সমাকল গুণাক্ষ হলো $e^{\int P dx}$, যেখানে P, Q হলো x -এর অপেক্ষক।

(c) Solve: $y^2 p - x y q = x(z - 2y)$ where $p = \frac{\partial z}{\partial x}$ and $q = \frac{\partial z}{\partial y}$.

সমাধান করো: $y^2 p - x y q = x(z - 2y)$ যেখানে $p = \frac{\partial z}{\partial x}$ এবং $q = \frac{\partial z}{\partial y}$.

(d) Form a PDE of the curve $z = f(x - z) + g(x + y)$.

$z = f(x - z) + g(x + y)$ বক্রের আংশিক অবকল সমীকরণ নির্ণয় করো।

GROUP-C

বিভাগ-গ

3. Answer any *two* questions from the following: 10×2 = 20

নিম্নলিখিত যে-কোনো দুটি প্রশ্নের উত্তর দাও:

(a) (i) Show that the differential equation $\frac{dy}{dx} = 2y^{1/2}$; $y(0) = 0$ has no-unique solution. 4+6

দেখাও যে নিম্নলিখিত অবকল সমীকরণের কোনো সমাধান নেই -

$$\frac{dy}{dx} = 2y^{1/2}; y(0) = 0$$

(ii) Solve by the method of variation of parameters

$$\frac{d^3 y}{dx^3} - 6 \frac{d^2 y}{dx^2} + 11 \frac{dy}{dx} - 6y = e^{2x}.$$

'Method of variation of parameter' সহযোগে সমাধান করো

$$\frac{d^3 y}{dx^3} - 6 \frac{d^2 y}{dx^2} + 11 \frac{dy}{dx} - 6y = e^{2x}.$$

(b) (i) Show by substituting $ax + by + c = z$ in the equation $\frac{dy}{dx} = f(ax + by + c)$, the variables can be separated. 2+3+5

$\frac{dy}{dx} = f(ax + by + c)$ সমীকরণের $ax + by + c = z$ প্রতিস্থাপন করে দেখাও যে, চলগুলিকে পৃথক করা যায়।

(ii) Solve: / সমাধান করো:

$$p^2 - p(e^x + e^{-x}) + 1 = 0, \quad p = \frac{dy}{dx}.$$

(iii) Solve: / সমাধান করো:

$$(D^3 - 5D^2 + 7D - 3)y = e^{2x} \cosh x.$$

(c) (i) Solve: / সমাধান করো:

$$xp + 3yq - 2z + 2x^2 q^2 = 0.$$

5+5

(ii) Solve: / সমাধান করোঃ

$$(1+2x)^2 \frac{d^2y}{dx^2} - 6(1+2x) \frac{dy}{dx} + 16y = 8(1+2x)^2.$$

(d) (i) Solve the following simultaneous differential equation

5+5

$$\frac{d^2x}{dt^2} - \frac{d^2y}{dt^2} + x - y = 5e^{2t};$$

$$2 \frac{dx}{dt} = \frac{dy}{dt} + y$$

given that $x=1, y=2, \frac{dx}{dt}=0$ for $t=0$.

নিম্নলিখিত যুগপত সমীকরণগুলির সমাধান নির্ণয় করো -

$$\frac{d^2x}{dt^2} - \frac{d^2y}{dt^2} + x - y = 5e^{2t};$$

$$2 \frac{dx}{dt} = \frac{dy}{dt} + y$$

প্রদত্ত $x=1, y=2, \frac{dx}{dt}=0$ যখন $t=0$.

(ii) Solve: / সমাধান করোঃ

$$\frac{yz}{x^2+y^2} dx - \frac{xz}{x^2+y^2} dy - \tan^{-1} \frac{y}{x} dz = 0.$$



COOCH BEHAR PANCHANAN BARMA UNIVERSITY

B.Sc. Honours 2nd Semester Examinations, 2018

BOTANY

BRYLOGY, PALAEOBOTANY AND PALYNOLOGY

CORE-3 (CCBOTH3)

Time Allotted: 1 Hour 30 minutes

Full Marks: 25

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

1. Answer the following questions: 1×10 = 10
 - (a) What do you mean by Sulci?
 - (b) What is sporopollenin?
 - (c) Name two Indian species of *Funaria*.
 - (d) Why bryophytes are called amphibians in plant kingdom?
 - (e) Name two aquatic Bryophytes.
 - (f) What is index fossil?
 - (g) How form genus differ from organ genus?
 - (h) Mention the era and period of origin of Angiosperms.
 - (i) What is hydroid and leptoid?
 - (j) What is pseudoelater and where it is found?

2. Answer any **one** question from the following: 5×1 = 5
 - (a) Write notes on: 2.5×2
 - (i) Impression
 - (ii) Compression
 - (b) What is NPC system? Describe NPC systems of classification of pollen grains. 1+4
 - (c) Explain why *Anthoceros* is regarded as a synthetic group. 5

3. Answer any **one** question from the following: 10×1 = 10
 - (a) (i) Write short notes on— (2.5×2)+5
 1. Peristome teeth
 2. Major events in plant life during Carboniferous period
 - (ii) Describe the process of honey formation by honeybees.
 - (b) Explain the spore dispersal mechanism of *Marchantia*, *Pellia*, *Sphagnum* and *Funaria*. 2.5×4
 - (c) Give the structural details of *Williamsonia* with reference to the contribution of Prof. Sahani. Mention its affinities. 8+2



COOCH BEHAR PANCHANAN BARMA UNIVERSITY

B.Sc. Honours 2nd Semester Examinations, 2018

BOTANY

PTERIDOLOGY AND GYMNOSPERMS

CORE-4 (CCBOTH4)

Time Allotted: 1 Hour 30 minutes

Full Marks: 25

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

All symbols are of usual significance.

1. Answer the following questions: 1×10 = 10
 - (a) What do you mean by gradate sorus? Give one example.
 - (b) Where do you find vessels in gymnosperms?
 - (c) Define annulus and mention its function.
 - (d) Name one Fossil water fern.
 - (e) Mention the era and period when first vascular land plants occur.
 - (f) What is pre-ovule? Give one example.
 - (g) What is "shower of sulphur"?
 - (h) What is coralloid root? Where it is found?
 - (i) What is trabeculae and where it is found?
 - (j) Mention two Indian species of *Gnetum*.

2. Answer any **one** question from the following: 5×1 = 5
 - (a) Describe briefly the post-fertilization changes in *Pinus* sp. 5
 - (b) Describe *Rhynia* with suitable sketches. 5
 - (c) Mention the economic importance of gymnosperms. 5

3. Answer any **one** question from the following: 10×1 = 10
 - (a) Briefly describe with suitable diagram the structure and development of ovule and female prothallus of *Gnetum* sp. 10
 - (b) With suitable diagrams, describe the spore bearing structure of *Pteris* sp. 6+4
Distinguish between the cone structure of *Equisetum* and *Selaginella*.
 - (c) What is telome and how does it differ from mesomes? With suitable diagrams, explain the main steps of "Telome theory" on land Plant evolution. 2+8



COOCH BEHAR PANCHANAN BARMA UNIVERSITY

B.Sc. Honours 2nd Semester Examinations, 2018

BOTANY

PTERIDOPHYTA GYMNOSPERMS AND PALAEOBOTANY

GE-2 (GEBOTG2)

Time Allotted: 1 Hour 50 minutes

Full Marks: 25

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

All symbols are of usual significance.

1. Answer the following questions: 1×10 = 10
 - (a) Mention one economic importance of *Pinus*.
 - (b) What is coralloid root, where it is found?
 - (c) What is elater? What are their functions?
 - (d) Name one heterosporous ligulate pteridophyte.
 - (e) Define living fossil. Give an example.
 - (f) Mention one fern character of *Cycas*.
 - (g) Name one renowned Indian Palaeobotanist.
 - (h) What type of stomata is present in *Gnetum*?
 - (i) Define Synangium.
 - (j) Name one Indian species of *Selaginella*.

2. Answer any **one** question from the following: 5×1 = 5
 - (a) Describe the anatomical features of *Cycas* leaflet. 5
 - (b) State economic importance of Gymnosperms. 5
 - (c) Give geological distribution and the characteristics of *Rhynia* sp. 5

3. Answer any **one** question from the following: 10×1 = 10
 - (a) What is stele? Describe different types of stele found in Pteridophytes with examples. 2+8
 - (b) Describe with suitable diagram the spore bearing structure of *Equisetum* sp. Mention different types of fossils on the basis of mode of preservation. 5+5
 - (c) Mention the advanced features of *Gnetum*. Describe with suitable diagram the structure of ovule of *Gnetum* sp. 4+6



COOCH BEHAR PANCHANAN BARMA UNIVERSITY

B.Sc. Programme 2nd Semester Examinations, 2018

BOTANY

PTERIDOPHYTA GYMNOSPERMS AND PALAEOBOTANY

DSC (DSCBOTG22)

Time Allotted: 1 Hour 30 minutes

Full Marks: 25

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

All symbols are of usual significance.

1. Answer the following questions: 1×10 = 10
- (a) Give one example of homosporous pteridophyte.
 - (b) What is trabeculae and where it is found?
 - (c) What is indusium?
 - (d) What is coralloid root?
 - (e) Mention one fern character of *Cycas*.
 - (f) What is coal ball?
 - (g) Name one living fossil.
 - (h) What type of stoma is found in *Cycas*?
 - (i) Define index fossil.
 - (j) What is horsetail?
2. Answer any **one** question from the following: 5×1 = 5
- (a) Describe *Rhynia* with suitable diagram. 5
 - (b) Mention the economic importance of Gymnosperms. 5
 - (c) Write short notes on: 2.5×2
 - (i) Compression
 - (ii) Impression.
3. Answer any **one** question from the following: 10×1 = 10
- (a) Compare the spore bearing organs of *Equisetum* and *Selaginella*. 5+5
 - (b) Draw and describe the male and female flower of *Gnetum*. 5+5
 - (c) Describe the internal structure of *Cycas* leaflet. State the xerophytic characters of *Cycas*. 8+2



COOCH BEHAR PANCHANAN BARMA UNIVERSITY
B.Sc. Honours 2nd Semester Examinations, 2018

ZOOLOGY

CCN: CELL BIOLOGY

CORE-4 (CCZOOH4)

Time Allotted: 1 Hour 30 Minutes

Full Marks: 25

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

All symbols are of usual significance.

1. Answer any **ten** questions from the following: $1 \times 10 = 10$
- (a) Fluid mosaic model of plasma membrane was proposed by _____.
 - (b) Which of the following is a microfilament inhibitor?
 - (i) Aspirin
 - (ii) Cinchonine
 - (iii) Colchicine
 - (iv) Cytochalasin-B
 - (c) Chromosome movement during cell division is maintained by
 - (i) Microtubules
 - (ii) Microfilaments
 - (iii) Intermediate filaments
 - (iv) All of these.
 - (d) The number of nuclear pores depends on the DNA content of the cell — (T / F).
 - (e) The light stained and diffused region of chromatin is known as _____.
 - (f) The diameter of microtubules in monomer is — (25 / 12 / 8 / 5).
 - (g) What is paracrine signalling?
 - (h) Ras is a multimeric protein. (T / F)
 - (i) Expand PIP.
 - (j) Define second messenger.
 - (k) The sodium - glucose transporter is an (Uniport / Symport / Antiport).
 - (l) (IP3 / DAG) causes the release of Ca from ER.

2. Answer any *one* question from the following: 5×1 = 5
- (a) Briefly discuss about nucleosomes with suitable diagram.
 - (b) Write a short note on secondary active transport.
 - (c) Briefly describe the steps in cell signalling via G-protein coupled receptors in epinephrine signalling.
3. Answer any *one* question from the following: 10×1 = 10
- (a) Describe in brief the fluid mosaic model of plasma membrane. Why is plasma membrane called a dynamic membrane? 6+4
 - (b) With the help of proper diagram discuss about the mitochondrial respiratory chain complexes and mention the flow of electron through it. Write two important functions of peroxisome. 8+2
 - (c) State the role of MPF in cell cycle. Write a short note on Synaptonemal complex. 6+4



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B.Sc. Honours 2nd Semester Examinations, 2018

ZOOLOGY

GE-2 (GEZOOG2)

Time Allotted: 1 Hour 30 Minutes

Full Marks: 25

*The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.
All symbols are of usual significance.*

Comparative Anatomy & Developmental Biology of Vertebrates

1. Answer any **ten** questions from the following: 1×10 = 10
নিম্নলিখিত যে-কোনো **দশটি** প্রশ্নের উত্তর দাওঃ
- (a) Which one is not an integumentary gland?
এদের মধ্যে কোনটি বহিরাবরণ গ্রন্থি নয় ?
(i) Sweat gland (ii) Sebaceous gland (iii) Mammary gland (iv) Pancreatic gland
- (b) First visceral arch is known as _____ arch.
প্রথম visceral arch-এর নাম হ'ল _____।
- (c) Largest digestive gland is _____.
বৃহত্তম পরিপাক গ্রন্থি হল _____।
- (d) How many numbers of air sacs are found in *Columba*?
Columba-এর শরীরে কতগুলি air sac থাকে ?
- (e) Incompletely separated four chambered heart is found in
(i) Amphibia (ii) Reptilia (iii) Bird (iv) Mammalia.
অসম্পূর্ণভাবে বিভক্ত চার প্রকোষ্ঠের হৃদপিণ্ড পাওয়া যায়
(i) Amphibia (ii) Reptilia (iii) Bird (iv) Mammalia-এর মধ্যে (সঠিক বিকল্পটি লেখো)।
- (f) Number of aortic arches in human is
মানুষের শরীরে কতগুলি aortic arch থাকে
(i) 3 (ii) 6 (iii) 8 (iv) 9
- (g) Ureotelic animals excrete excess nitrogen as _____.
Ureotelic প্রাণীরা অতিরিক্ত Nitrogen রেচন করে _____ হিসেবে।
- (h) Cochlea is part of
Cochlea কিসের অঙ্গ
(i) Eye (ii) Ear (iii) Nose (iv) Brain

- (i) Receptors that perceive mechanical sensations in skin is known as _____.
চামড়ায় যান্ত্রিক সংবেদন গ্রহণকারী receptor হল _____।
- (j) What is holoblastic cleavage?
Holoblastic cleavage কি ?
- (k) In human we find (Diffused / Zonary / Cotyledonary / Discoidal) placenta.
মানুষের মধ্যে আমরা (Diffused / Zonary / Cotyledonary / Discoidal) আমরা দেখতে পাই।
- (l) Name one hormone that regulates frog metamorphosis.
ব্যাঙের রূপান্তর নিয়ন্ত্রনকারী hormone-এর নাম কি ?
2. Answer any **one** question from the following: 5×1 = 5
নিম্নলিখিত যে-কোনো **একটি** প্রশ্নের উত্তর দাওঃ
- (a) What is Venous Heart? With suitable diagram elucidate the blood flow through human heart. 2+3
Venous Heart কি ? মানুষের শরীরে রক্ত সঞ্চালন প্রক্রিয়াটি সচিত্র বর্ণনা করো।
- (b) Write a short note on succession of kidney. What is Wolffian duct? 3+2
Kidney-এর ক্রমবিকাশের উপর একটি সংক্ষিপ্ত টীকা লেখো। Wolffian duct কি ?
- (c) Write a short note on 'blocks to polyspermy'. 5
'Polyspermy'-এর রোধ (block) প্রক্রিয়াগুলি সংক্ষেপে লেখো।
3. Answer any **one** question from the following: 10×1 = 10
নিম্নলিখিত যে-কোনো **একটি** প্রশ্নের উত্তর দাওঃ
- (a) Give a brief account of types of gills. Write on functions of Air sacs in birds and Swim bladder in fishes. 5+3+2
ফুলকা -এর বিভিন্ন প্রকারগুলি লেখো। মাছের Air sac এবং Swim bladder-এর কাজ গুলি লেখো।
- (b) Write a comparative account of brain in Amphibians, Reptiles and Mammals. 10
Amphibia, Reptilia এবং Mammalia-এর মস্তিষ্কের গঠনের তুলনামূলক আলোচনা করো।
- (c) Define implantation. Discuss about the types of placenta on the basis of histology. Briefly write about the metamorphic events in frog life cycle. 2+5+3
Implantation-এর সংজ্ঞা দাও। কলাতন্ত্রের (histology) উপর ভিত্তি করে আমরা প্রকারগুলি আলোচনা করো। ব্যাঙের জীবনচক্রে রূপান্তরকারী ঘটনাগুলি (metamorphic events) সংক্ষেপে লেখো।



COOCH BEHAR PANCHANAN BARMA UNIVERSITY

B.Sc. Programme 2nd Semester Examinations, 2018

ZOOLOGY

COMPARATIVE ANATOMY AND DEVELOPMENTAL BIOLOGY OF VERTEBRATE

DSC (DSCZOOG23)

Time Allotted: 1 Hour 30 Minutes

Full Marks: 25

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

1. Answer any **ten** questions from the following:

1×10 = 10

নিম্নলিখিত যে-কোনো দশটি প্রশ্নের উত্তর দাও:

(a) What is Ductus Caroticus?

Ductus Caroticus কাকে বলে ?

(b) Dura mater is outer covering of brain (T/F).

Dura mater হলো মস্তিষ্কের বাইরের আবরণ (সত্য / মিথ্যা)।

(c) Receptor that senses pressure is called _____.

চাপের (pressure) অনুভূতি গ্রহণকারী receptor হলো _____।

(d) Which ion(s) is responsible for fast block to polyspermy?

কোন ion(s) polyspermy-র fast block-এর জন্য দায়ী ?

(e) The acrosome is derived from Golgi Complex (T/F).

Acrosome Golgi Complex থেকে উদ্ভূত (সত্য / মিথ্যা)।

(f) Notochord is derived from Chorda mesoderm (T/F).

Notochord Chorda mesoderm থেকে উদ্ভূত (সত্য / মিথ্যা)।

(g) What is Foramen of Panizza?

'Foramen of Panizza' কাকে বলে ?

(h) Ears are statoacoustic receptors (T/F).

কান হলো statoacoustic receptors (সত্য / মিথ্যা)।

(i) Bile contains no digestive enzymes (T/F).

পিত্তের (Bile) মধ্যে কোনো পাচক উৎসেচক পাওয়া যায় না (সত্য / মিথ্যা)।

(j) Primary spermatocyte is diploid in nature (T/F).

Primary spermatocyte diploid হয় (সত্য / মিথ্যা)।

(k) Insect eggs show the superficial cleavage (T/F).
পতঙ্গের ড্রুণে superficial cleavage দেখা যায় (সত্য / মিথ্যা)।

(l) Define Epiboly.
Epiboly বলতে কি বোঝা ব্যাখ্যা করো।

2. Answer any **one** question from the following: 5×1 = 5

নিম্নলিখিত যে-কোনো একটি প্রশ্নের উত্তর দাওঃ

(a) Write about fate map of frog with diagram. 3+2

ব্যাঙের fate map সচিত্র বর্ণনা করো।

(b) Write about the digital cornifications of vertebrate. 5

মেরুদণ্ডী প্রাণীর আঙুলের (digital) cornification সম্বন্ধে লেখো।

(c) Write about the location and functions of Femoral and Uropygial glands. 5

Femoral এবং Uropygial গ্রন্থির অবস্থান ও কার্য সম্বন্ধে লেখো।

3. Answer any **one** question from the following: 10×1 = 10

নিম্নলিখিত যে-কোনো একটি প্রশ্নের উত্তর দাওঃ

(a) Write about the comparative account of brain to fish, amphibia, aves and mammals. 2+4+2+2

Fish, amphibia, aves এবং mammals-এর মস্তিষ্কের সংগঠন সম্পর্কে তুলনামূলক আলোচনা করো।

(b) Write about different types of modifications of aortic arches in vertebrates. Write about vomeronasal organ with its functions. 7+3

মেরুদণ্ডী প্রাণীর aortic arch-এর সংগঠনের পরিবর্তনগুলি লেখো। Vomeronasal organ ও তার কাজগুলি সম্বন্ধে লেখো।

(c) What is vitellogenesis? Write about the different types of egg membranes found in vertebrate. Write about cortical reaction. 2+5+3

Vitellogenesis কাকে বলে ? মেরুদণ্ডী প্রাণীর বিভিন্ন প্রকার ড্রুণাবরণ সম্বন্ধে লেখো। Cortical reaction সম্বন্ধে লেখো।