COOCH BEHAR PANCHANAN BARMA UNIVERSITY

B.Sc. Honours 3rd Semester Examination, 2019

CHEMISTRY

PHYSICAL CHEMISTRY-II

CORE-5 (CCCEMH5)

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

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

(a) Write down two examples of each of thermodynamic state and path functions.

(b) What is the driving force in osmosis?

(c) Explain under what condition a plot of $\log K_p$ vs $1/T$ is linear.

(d) State Second law of thermodynamics in any one form.

(e) Show that $\mu_{JT} > 0$ implies cooling of a gas.

(f) Write down the expression for K_p for the reaction $CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$.

(g) $F = f(x, y)$, write down the expression for dF.

(h) Classify the following into intensive and extensive variables:

(i) density (ii) concentration (iii) free energy (iv) S_p, heat capacity

(i) What is the net entropy change for an irreversible cyclic process?

(j) Is there be any case of depression of boiling point? — Explain.

(k) Remark whether every closed system is isolated.

(l) Why dw is sometimes written as δw or tw?

GROUP-B

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

2. (a) Prove that adiabatics are steeper than isothermals. 2

(b) A Carnot engine whose low temperature reservoir is at 25°C has an efficiency of 40%. To increase the efficiency to 50%, by how many degree of celsius the temperature of the hot reservoir is to be increased? 3

3. (a) Derive thermodynamically the expression for lowering of freezing point of a solution stating clearly the assumptions and approximations. 3

(b) Under what condition is the Van't Hoff factor for an aqueous solution of an electrolyte $A_x B_y$ equals to $(x+y)$? 2

4. (a) Derive the expression for equilibrium constant from thermodynamic consideration. 3

(b) Distinguish between Joule-Thomson cooling and adiabatic cooling. 2

GROUP-C

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

5. (a) Derive thermodynamically a relation between osmotic pressure and concentration of a solute in a dilute solution. 4

(b) A 0.342 molal solution of AB_X in water depresses the freezing point by 1.91°. Write down the formula of the salt assuming 100% ionization. 2

(c) Does the value of the equilibrium constant depend on the mode of representing Stoichiometric expression of a chemical reaction? Illustrate your answer with reference to the formation of NH_3. 2

(d) What factors influence the point of equilibrium of a reversible reaction? 2

6. (a) An ideal gas is allowed to expand reversibly from the state (P_1, V_1) to the state (P_2, V_2). Calculate the entropy change when the process is carried out (i) isothermally and (ii) adiabatically. 3

(b) Show that in Joule-Thomson experiment $\Delta H = 0$. 3

(c) What happens to the chemical potential of a solvent when a non-volatile, non-electrolyte solute is dissolved in it? What characteristic properties of the solvent are changed as a result? How can such changes be utilized to determine the molecular weight of the solute? 1+1+2

7. (a) Define the term 'Partial molar quantities'. Write down its physical significance. 2+1

(b) Derive the thermodynamic equation of state: 3+1

$$\left(\frac{\partial U}{\partial V}\right)_T = T\left(\frac{\partial P}{\partial T}\right)_V - P$$ and show that for 1 mole of Van der Waals' gas:

$$\left(\frac{\partial U}{\partial V}\right)_T = a/V^2$$

(c) Derive the Kirchhoff's equation. 3

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COOCH BEHAR PANCHANAN BARMA UNIVERSITY

B.Sc. Honours 3rd Semester Examination, 2019

CHEMISTRY (PRACTICAL)

PHYSICAL CHEMISTRY-II

CORE-5 (CCCEMH5)

Time Allotted: 3 Hours | Full Marks: 15

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EXPERIMENT NO.-2

To determine the equilibrium constant of the reaction $KI + I_2 \rightleftharpoons KI_3$ between the supplied liquid A/B and KI solution by partition method.

(Use one compositions of A/B and KI solution and three titrations in each case of I_2 concentration determination)

- Derivation of working formula : 02
- Recording of temperature : $\frac{1}{2}$
- Preparation of one composition : 01
- Standardisation of $Na_2S_2O_3$: 02
- Titration of each layer by the $Na_2S_2O_3$: 03
- Calculation : $2\frac{1}{2}$
- Accuracy : 02
- L.N.B. : 01
- Viva-voce : 01

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COOCH BEHAR PANCHANAN BARMA UNIVERSITY

B.Sc. Honours 3rd Semester Examination, 2019

CHEMISTRY

INORGANIC CHEMISTRY-II

CORE-6 (CCCEMH6)

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

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

(a) Draw the structure of P_4O_{10} molecule.

(b) Arrange NO_2^+, NO_2 and NO_2^- in order of their increasing bond angle.

(c) Identify Lewis acid and base in the reaction–

$$FeCl_3 + Cl^- \longrightarrow [FeCl_4]^-$$

(d) Give a balanced reaction on thermal decomposition of borax.

(e) Predict the position of lone pairs in XeF_2 molecule.

(f) Point out the hybridisation of $S_2O_3^{2-}$ ion.

(g) Name conjugate acid of X^{2-}.

(h) Which factor is useful to distinguish between the hydrolysis reaction among SF_6 and TeF_6 molecule?

(i) Which is the paramagnetic oxide of chlorine?

(j) Give one example of pseudohalide ion.

(k) Among the halogen and interhalogens, which one is more reactive?

(l) From HSAB principle explain the following reaction

$$Ni + 4CO \longrightarrow Ni(CO)_4$$

GROUP-B

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

2. (a) Compare the oxidising behavior among H_2SO_4 and H_2SeO_4. 2

(b) What are the hydrolysed products of XeF_6? Give the balanced equation. 3

3. (a) What is 'inorganic benzene'? Give one preparation of it. 1+1=2

(b) What is known as cosolvating agents? Explain with example. 2

(c) Among Tl^{+} and Tl^{3+}, which one is more stable? 1

4. (a) From MO concept how would you explain hardness and softness character of chemical species? 3

(b) At room temperature CO_2 is a gas but SiO_2 is a solid — Why? 2

GROUP-C

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

5. (a) 'Colour of halogen molecules in different solvents are Lewis acid-base reaction' — Illustrate the statement with suitable examples. 3

(b) Discuss the relative strength of acid like $HClO_4$, HBr, H_2SO_4, HCl, HNO_3 in water and in CH_3COOH medium. 3

(c) From the concept of inert-pair effect, explain the liquid nature of mercury. 2

(d) From Born-Haber cycle, how would you explain the reducing nature of alkali metals? 2

6. (a) 'Titration of boric acid with NaOH solution and detection of sharp end point is performed in presence of organic *cis*-diol not in presence of *trans*-diol' — Justify the statement with proper explanation. 3

(b) Give the preparative method of boron nitride from borax. 2

(c) 'N and P have poor catenating ability on their own. But they catenate together to give a series of polymers' — Explain with examples. 3

(d) $SnCl_2$ can act as both lewis acid and lewis base. — Explain. 2

7. (a) Solution of alkali metals in liquid NH_3 are blue coloured and reducing in nature. — Explain. 2

(b) From MO theory, how would you correct the structure of XeF_2, XeF_4 and XeF_6 molecules? 3

(c) Boiling point of $SiHCl_3$ is less than that of $CHCl_3$ — Explain. 2

(d) When the metals are burned in a free supply of air the predominant product depends on the metal: 3

Li forms the oxide Li_2O, Na forms the peroxide Na_2O_2 whilst K, Rb and Cs form the superoxides MO_2. — Explain.

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COOCH BEHAR PANCHANAN BARMA UNIVERSITY

B.Sc. Honours 3rd Semester Examination, 2019

CHEMISTRY (PRACTICAL)

INORGANIC CHEMISTRY-II

CORE-6 (CCCEMH6)

Time Allotted: 3 Hours | Full Marks: 15

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. Prepare 250 ml of standard $K_2Cr_2O_7$ solution of $(N/20)$ order and report its strength in normality (N). Report the data in tabular form. 1+1 = 2

2. Determine the strength of supplied solution marked as (S_x) in normality by titration with the standard $K_2Cr_2O_7$ solution prepared by you. 5

3. Prepare the inorganic compound (INP) through the following procedure and report the yield of the properly dried product. 3

Method for the Inorganic Preparation

Dissolve 2.5 gm of A in 20 ml of distilled water in a beaker. Mark this solution X. Dissolve 10 gm of B in 20 ml of water and 1ml of dilute sulphuric acid is added to it. Mark this solution Y. Mix the two solutions X and Y in 250 ml beaker. Heat the mixture for sometime with constant stirring using glass rod, till the crystalisation point is reached. Blow the glass rod dipped in concentrated solution. If some solid deposits on rod, crystalisation point is reached. Transfer the solution to a crystalline dish and donot disturb it. After sometime, when the solution gets cooled, crystals of newly synthesized compounds separate out. Decant the mother liquor and wash the crystals with a small quantity of ice-cold water. Dry the product and record the yield.

4. Viva-voce. 3

5. Laboratory Note Book. 2

Procedure – (For Question No. 2)

Pipette out of 25 ml standard $(N/20)$ $K_2Cr_2O_7$ solution in 250 ml conical flask add 2 gm of pure $NaHCO_3$, 25 ml 4(N) H_2SO_4, 2 gm of KI. The mixture is shaken, then allowed to stand in dark for 5 minutes covering the mouth of the flask with a watch glass to ensure the complete liberation of iodine. The watch glass and sides of the flask are washed down with distilled water, diluted to 200 ml and immediately titrated with sodium thiosulphate solution running from burette until the brown colour fades to straw-yellow. 2 ml of 1% freshly prepared starch solution is added, shaken to obtain a deep blue solution. The titration is continued with continuous shaking until the blue solution just disappears leaving green solution. Record the titre value (Vml).

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COOCH BEHAR PANCHANAN BARMA UNIVERSITY

B.Sc. Honours 3rd Semester Examination, 2019

CHEMISTRY

ORGANIC CHEMISTRY-III

CORE-7 (CCCEMH7)

Time Allotted: 1 Hour 30 Minutes | Full Marks: 25

The figures in the margin indicate full marks.
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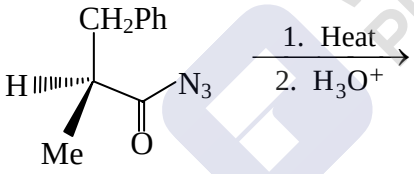
GROUP-A

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

(a) Why is excess of isopropanol is used in MPV reaction?

(b) Why the synthesis of tertiary amines using Gabriel phthalimide is not preferable?

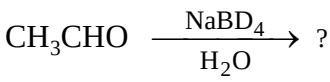
(c) Predict the product:



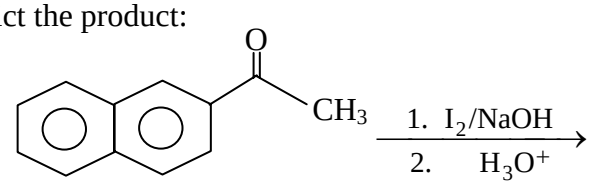
(d) How can you separate a mixture of acetaldehyde and acetone?

(e) Give an example of stable ylides. Why it is so-called?

(f) Write the structure of the organic product of the following reaction:

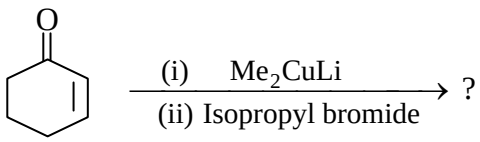


(g) Predict the product:

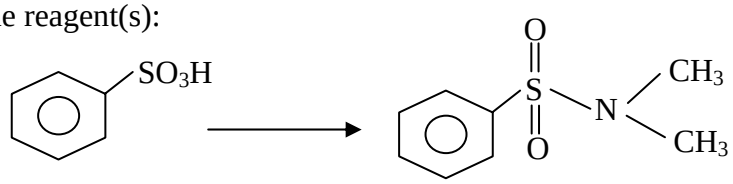


(h) Account for the shorter C–O bond length in an ester compared with an anhydride.

(i) Predict the product of the following reaction:

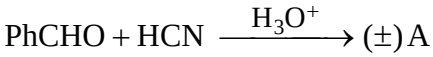


(j) Specify the reagent(s):



(k) Chloral usually form a stable geminal diol. — Explain.

(l) Predict the product:

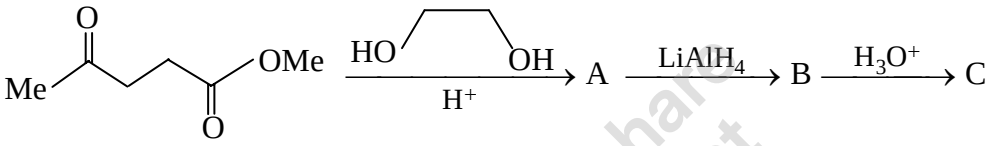


GROUP-B

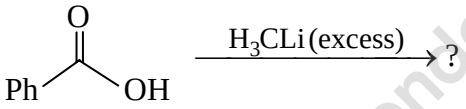
2. Answer any ***one*** question from the following: 5×1 = 5

(a) (i) Account for the formation of mostly 1-naphthalene sulfonic acid at 40-80°C and 2-isomer at 160°C, when naphthalene is sulfonated? 2

(ii) Identify A, B and C: 2

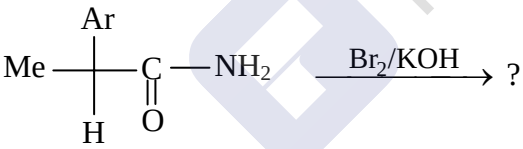


(iii) 1

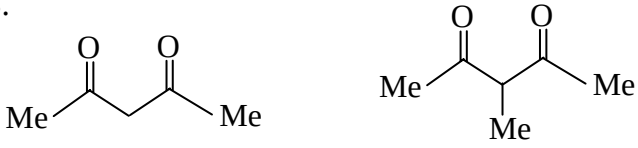


Write down the product.

(b) (i) Predict the product and explain the mechanism involved: 2



(ii) The enol content of A is more than the keto form but the reverse is true in case of B. 2



(A) (B)

(iii) The diazocoupling reaction fails in too alkaline (pH > 10) medium. 1

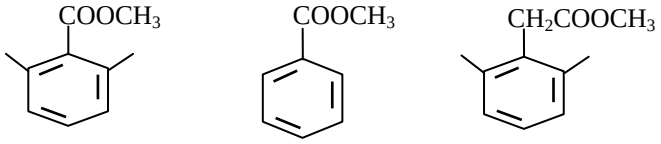
GROUP-C

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

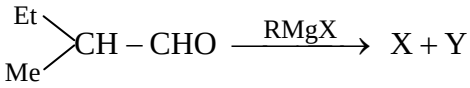
(a) (i) Naphthalene on complete reduction gives two stereoisomers, but 2-methylnaphthalene gives four. — Explain. 2

(ii) How could you prove that Perkin reaction involves intramolecular acetyl transfer through cyclic intermediate. 2

(iii) Rank the following esters in order of its case of hydrolysis. — Explain. 2



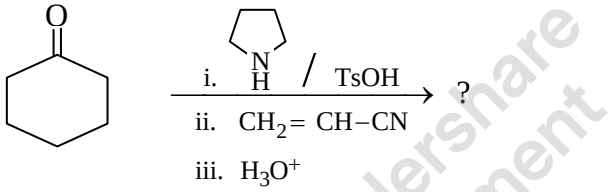
(iv) Predict whether X or Y predominate and explain. 3



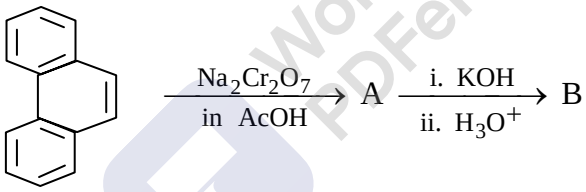
(v) $RSH \xrightarrow{?} RS-SR$; Write down the reagent. 1

(b) (i) What is the limitation of alkylation method with ammonia for the preparation of 1°-amine? How would you overcome this problem? 2

(ii) Predict the product(s) with mechanism: 2

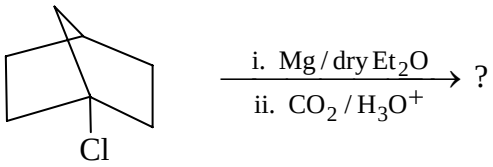


(iii) Predict the product and explain the mechanism of second step: 2



(iv) What happens when a benzene diazonium chloride reacts with a mixture of diethylmalonate and sodium ethoxide? 2

(v) Predict the product and explain the mechanism: 2



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COOCH BEHAR PANCHANAN BARMA UNIVERSITY

B.Sc. Honours 3rd Semester Examination, 2019

CHEMISTRY (PRACTICAL)

ORGANIC CHEMISTRY-III

CORE-7 (CCCEMH7)

Time Allotted: 3 Hours | Full Marks: 15

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1.	Perform the organic preparation according to the direction given. Submit the crude and crystallized product separately. Report the yield of the dried crude product.	11
2.	Laboratory Note Book.	2
3.	Viva-voce.	2

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COOCH BEHAR PANCHANAN BARMA UNIVERSITY

B.Sc. Honours 3rd Semester Examination, 2019

MATHEMATICS

THEORY OF REAL FUNCTIONS

CORE-5 (CCMTMH5)

Time Allotted: 2 Hours | Full Marks: 40

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GROUP-A

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

(a) For the function $f(x) = \dfrac{\sin|x|}{|x|}$, $x \neq 0$
$= 0$, $x = 0$ is $\lim_{x\to 0} f(x) = 1$? — Justify.

(b) Find the value of 'c' of the Mean Value theorem if $f(x) = x^2 + 2x + 3$ in [2, 3].

(c) Prove that if $f'(c)$ exists then the function $f(x)$ is continuous at $x = c$.

(d) Find $\lim_{x\to \pi/2} (\sec x - \tan x)$.

(e) Find the jump of discontinuity of $f(x) = |x|$ at $x = 0$.

(f) Prove that $\sin x < x$ for $0 < x < \pi/2$.

(g) If $f''(0) = 2$, find the value of $\lim_{x\to 0}\left(\dfrac{2f(x) - f(2x) + 3f(4x)}{x^2}\right)$.

(h) State 1st MVT of differential calculus.

(i) Does $f'(c) = 0$ always imply the existence of extremum of $f(x)$ at the point $x = c$? — Justify.

(j) State Cauchy's mean value theorem.

(k) Give an example of a function f such that $f'(c)$ does not exist but $f(x)$ has a minimum at $x = c$.

(l) Is Rolle's theorem applicable to the function $f(x) = \tan x$ in $[0, \pi]$?

(m) Give an example of a function which is everywhere discontinuous in R.

(n) If $f'(a)$ exists then find the value of $\lim_{h\to 0}\left(\dfrac{f(a) - f(a-h)}{h}\right)$.

(o) For $f(x)=\sqrt{x}$, find 2nd Taylor polynomial around $x=3$.

GROUP-B

2. Answer any ***two*** questions from the following: 5×2 =10

(a) Prove that every continuous function defined in a closed interval $[a, b]$ is bounded there and it attains its bounds. 5

(b) If $f(x)=\begin{cases} x\sin\frac{1}{x}, & x\neq 0 \\ 0, & x=0 \end{cases}$, then $f(x)$ is continuous at $x=0$, but $f'(0)$ does not exist. 5

(c) Use Taylor's theorem to prove that $1+\frac{x}{2}-\frac{x^3}{8}<\sqrt{1+x}<1+\frac{x}{2}$, $x>0$. 5

(d) (i) Evaluate $\lim_{x\to 0}\frac{(1+x)^{1/x}-e}{x}$. 4+1

(ii) Give an example of a uniformly continuous function.

GROUP-C

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

(a) (i) A function f is twice differentiable on $[a, b]$ and $f(a)=0=f(b)$. If $f(c)>0$ for some $c\in(a, b)$ prove that there exists a point c in (a, b) such that $f''(c)<0$. 5

(ii) Use MVT to prove $0<\frac{1}{\log(1+x)}-\frac{1}{x}<1$ for $x>0$. 5

(b) (i) If f is differentiable on [0, 1], show by Cauchy's MVT that the equation $f(1)-f(0)=f'(x)/2x$ has at least one solution in (0, 1). 6

(ii) Obtain the power series expression of $\cos x$ mentioning the region of validity. 4

(c) (i) If $f(x+y)=f(x)+f(y)\ \forall x, y\in R$ and f is continuous at the point of R, prove that f is uniformly continuous on R. 5

(ii) If f be a continuous function in $[a, b]$ such that $f(a)f(b)<0$ then there exists a point c in (a, b) such that $f(c)=0$. 5

(d) (i) If $\lim_{x\to 0}\left(\frac{ae^x-b\cos x+ce^{-x}}{x\sin x}\right)=2$, then find the values of a, b, c. 4

(ii) If $y=x^{n-1}e^{1/x}$, prove that $\frac{d^n y}{dx^n}=\frac{(-1)^n e^{1/x}}{x^{n+1}}$. 6

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COOCH BEHAR PANCHANAN BARMA UNIVERSITY

B.Sc. Honours 3rd Semester Examination, 2019

MATHEMATICS

GROUP THEORY

CORE-6 (CCMTMH6)

Time Allotted: 2 Hours | Full Marks: 40

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All symbols are of usual significance.

GROUP-A

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

(a) Give an example of a non-commutative group whose subgroup is commutative.

(b) Find an isomorphism from the group $(\mathbb{Z}, +)$ onto itself other than the identity isomorphism.

(c) The number of elements of order 5 in $\mathbb{Z}_{1000}$ is

(i) 1 (ii) 4 (iii) 5 (iv) none of these

(d) Find $O(\alpha)$ in S_4, where $\alpha = (1\ 3\ 2)$.

(e) Suppose a group G contains elements 'a' and 'b' such that $O(a) = 4,\ O(b) = 2,\ a^3b = ba$. Then what will be the order of ab?

(f) Define direct product of two groups.

(g) Find the number of elements of order 3 in A_4.

(h) Find the order of the permutation $(1\ 2\ 3\ 4)(5\ 6)$ in S_6.

(i) What will be the order of any non-identity element of $\mathbb{Z}_3 \times \mathbb{Z}_3$.

(j) Give an example of a non-abelian group G and a proper normal subgroup N of G such that G/N is abelian.

(k) "If all proper subgroups of a group G be cyclic, then the group G is also cyclic" — Is the statement true? Justify your answer.

(l) Is the direct product $\mathbb{Z}_6 \times \mathbb{Z}_4$ a cyclic group? Justify your answer.

(m) Find the images of the elements 3 and 4 for the permutation $\rho = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 6 & 5 & & & 4 & 3 \end{pmatrix}$, if it is given that ρ is an even permutation.

(n) What is the number of generators for a cyclic group of order 10?

(o) Prove that the multiplicative groups $\mathbb{R}\setminus\{0\}$ and $\mathbb{C}\setminus\{0\}$ cannot be isomorphic.

GROUP-B

2. Answer any ***two*** questions from the following: 5×2 = 10

(a) Prove that the group $S_n (n \geq 3)$ is not abelian. 5

(b) Prove that $4\mathbb{Z}/12\mathbb{Z} \simeq \mathbb{Z}_3$. 5

(c) Let G be a group of order 28. Show that G has a non-trivial subgroup. 5

(d) Show that for a non-abelian group G, the quotient group $G/Z(G)$ is non-cyclic. 5

GROUP-C

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

(a) (i) Find all subgroups of S_3. Show that union of any two non-trivial distinct subgroups of S_3 is not a subgroup of S_3. 5

(ii) Find all homomorphisms from $(\mathbb{Z}_8, +)$ to $(\mathbb{Z}_6, +)$. 5

(b) (i) Let G_1 and G_2 be two groups. Show that the direct product $G_1 \times G_2$ is commutative iff G_1 and G_2 are commutative. 5

(ii) Prove that every subgroup of a cyclic group is cyclic. 5

(c) (i) Let H and K be finite subgroups of a group G. Then prove that $|HK| = \frac{|H||K|}{|H \cap K|}$. 5

(ii) State and prove 'Third isomorphism theorem'. 5

(d) (i) Let H and K be two finite groups. Then show that the order of the element (a, b) in the group $H \times K$ is the l.c.m of $O(a)$ and $O(b)$, where $O(a)$ is the order of a in H and $O(b)$ is the order of b in K. 5

(ii) Let G be a finite commutative group of order n and $\gcd(m, n) = 1$. Prove that $\phi : G \to G$ defined by $\phi(x) = x^m$, $x \in G$ is an isomorphism. 5

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COOCH BEHAR PANCHANAN BARMA UNIVERSITY

B.Sc. Honours 3rd Semester Examination, 2019

MATHEMATICS

PARTIAL DIFFERENTIAL EQUATION

CORE-7 (CCMTMH7)

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

1. Answer any ***six*** questions from the following: 1×6 = 6

(a) Find the differential equation of all spheres of radius λ, having centre in the xy-plane.

(b) Find the value of 'μ' for which the equation

$(D^2 + 5DD' + 4D'^2 + 3D + 2D' + \mu)z = 0$ is reducible.

(c) Is the principle of superposition is valid for all linear PDE?

(d) Find the region in which the PDE $z_{xx} - xz_{xy} + z_{yy} + z_y = 0$ is hyperbola.

(e) Find the general solution of the PDE $p - q = z$.

(f) The general solution of the equation $4u_{xx} - u_{yy} = 0$ is of the form

(i) $u = f(x+2y) + g(x-2y)$ (ii) $u = f(2x+y) + g(2x-y)$

(iii) $u = f(x) + g(x+y)$ (iv) $u = f(x+4y) + g(x-4y)$

(g) The PDE: $x(y+z)p - y(z+x)q + z(x+y) = 0$ is

(i) linear (ii) semi-linear (iii) quasi-linear (iv) non-linear.

(h) Classify the PDE: $x^2 z_{xx} + 2xy\, z_{xy} + y^2 z_{yy} = 0$.

GROUP-B

2. Answer any ***three*** questions from the following: 3×3 =9

(a) Find the equation of the integral surface of the differential equation $2y(z-3)p+(2x-z)q=y(2x-3)$ which passes through the circle $z=0,\ x^2+y^2=2x$. 3

(b) Find the complete integral of the partial differential equation $(p^2+q^2)y=qz$ by Charpit's method. 3

(c) Solve: $z_{xx}+z_{yy}=\cos mx\sin ny$. 3

(d) Form a PDE by eliminating the arbitrary function φ from $\varphi(x+y+z,\ x^2+y^2-z^2)=0$. 3

(e) Find the characteristics of the quasilinear equation $zp+q=1$ and determine the integral surface through the intersection of the planes $x=y$ and $2y=z$. 3

GROUP-C

3. Answer any ***two*** questions from the following: 5×2 = 10

(a) Find the integral surface of the equation $(x-y)y^2p+(y-x)x^2q=(x^2+y^2)z$ through the curve $xz=a^3,\ y=0$.

(b) Find the surface of revolution satisfying the equation $z_{xx}=12x^2+4y^2$ and touching the plane $z=0$.

(c) Reduce the equation $z_{xx}=x^2z_{yy}$ to canonical form.

(d) Find the complete integral of the equation $2(z+xp+yq)=yp^2$.

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COOCH BEHAR PANCHANAN BARMA UNIVERSITY

B.Sc. Honours 3rd Semester Examination, 2019

MATHEMATICS (PRACTICAL)

PARTIAL DIFFERENTIAL EQUATION

CORE-7 (CCMTMH7)

SET-I

Time Allotted: 3 Hours | Full Marks: 15

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. Find the characteristics of the equation $p+q=1$ and determine the integral surface which passes through the curve $x=0,\ y^2=z$ analytically. Then, plot the integral surface for $x,\ y\in[-0.5,\ 0.5]$ using any software. 6+4

2. Viva with practical note book. 5

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COOCH BEHAR PANCHANAN BARMA UNIVERSITY

B.Sc. Honours 3rd Semester Examination, 2019

MATHEMATICS (PRACTICAL)

PARTIAL DIFFERENTIAL EQUATION

CORE-7 (CCMTMH7)

SET-II

Time Allotted: 3 Hours | Full Marks: 15

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. Solve the wave equation $u_{tt} = c^2 u_{xx}$ subject to the boundary condition $u(0, t) = u(l, t) = 0$ for all $t \geq 0$ and the initial condition $[u_t]_{t=0} = 0,\ 0 \leq x \leq l$ and the initial displacement $u(x, 0) = u_0 \sin^2\left(\frac{\pi x}{l}\right)$. Then plot the solution of the wave equation for $t = 20$ to 400 with $\Delta t = 10$ and $l = 25,\ u_0 = 2,\ c = 0.1$ using any software. 6+4

2. Viva with practical note book. 5

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COOCH BEHAR PANCHANAN BARMA UNIVERSITY

B.Sc. Honours 3rd Semester Examination, 2019

MATHEMATICS (PRACTICAL)

PARTIAL DIFFERENTIAL EQUATION

CORE-7 (CCMTMH7)

SET-III

Time Allotted: 3 Hours | Full Marks: 15

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. Solve the heat equation $u_t = ku_{xx}$ subject to the boundary condition $u(0, t) = u(l, t) = 0$ for all $t \geq 0$ and the initial condition $u(x, 0) = lx - x^2, 0 < x < 1$. Then plot the solution of the heat equation for $t = 100$ to 1000 with $\Delta t = 50$, $l = 25$ and $k = 0.15$ using any software. 6+4

2. Viva with practical note book. 5

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COOCH BEHAR PANCHANAN BARMA UNIVERSITY

B.Sc. Honours 3rd Semester Examination, 2019

MATHEMATICS (PRACTICAL)

PARTIAL DIFFERENTIAL EQUATION

CORE-7 (CCMTMH7)

SET-IV

Time Allotted: 3 Hours | Full Marks: 15

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. Find the integral surface of the equation $xp + yq = z$ and which passes through the curve $x + y = 1,\ yz = 1$ analytically. Then, plot the integral surface for $x, y \in [-1, 1]$ using any software. 6+4

2. Viva with practical note book. 5

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COOCH BEHAR PANCHANAN BARMA UNIVERSITY

B.Sc. Honours 3rd Semester Examination, 2019

MATHEMATICS (PRACTICAL)

PARTIAL DIFFERENTIAL EQUATION

CORE-7 (CCMTMH7)

SET-V

Time Allotted: 3 Hours | Full Marks: 15

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. Solve the wave equation $u_{tt} = c^2 u_{xx}$ subject to the boundary condition $u(0, t) = u(l, t) = 0$ for all $t \geq 0$ and the initial condition $[u_t]_{t=0} = 0,\ 0 \leq x \leq l$ and the initial displacement $u(x, 0) = u_0 \sin^2\left(\frac{\pi x}{l}\right)$. Then plot the solution of the wave equation for $t = 10$ to 500 with $\Delta t = 10$, $l = 25$, $c = 0.15$ and $u_0 = 3$ using any software. 6+4

2. Viva with practical note book. 5

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COOCH BEHAR PANCHANAN BARMA UNIVERSITY

B.Sc. Honours 3rd Semester Examination, 2019

MATHEMATICS (PRACTICAL)

PARTIAL DIFFERENTIAL EQUATION

CORE-7 (CCMTMH7)

SET-VI

Time Allotted: 3 Hours | Full Marks: 15

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. Solve the heat equation $u_t = ku_{xx}$ subject to the boundary condition $u(0, t) = u(l, t) = 0$ for all $t \geq 0$ and the initial condition $u(x, 0) = x$, when $0 \leq x \leq l/2$; $u(x, 0) = l - x$, when $l/2 \leq x \leq l$. Then plot the solution of the heat equation for $t = 100$ to 1000 with $\Delta t = 100$, $l = 30$ and $k = 0.1$ using any software. 6+4

2. Viva with practical note book. 5

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COOCH BEHAR PANCHANAN BARMA UNIVERSITY

B.Sc. Honours 3rd Semester Examination, 2019

MATHEMATICS (PRACTICAL)

PARTIAL DIFFERENTIAL EQUATION

CORE-7 (CCMTMH7)

SET-VII

Time Allotted: 3 Hours | Full Marks: 15

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. Find the integral surface of the equation $yp - 2xyq = 2xz$ and which passes through the curve $x = t,\ y = t^2,\ z = t^3$ analytically. Then, plot the integral surface for $x,\ y \in [-1, 1]$ using any software. 6+4

2. Viva with practical note book. 5

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COOCH BEHAR PANCHANAN BARMA UNIVERSITY

B.Sc. Honours 3rd Semester Examination, 2019

MATHEMATICS (PRACTICAL)

PARTIAL DIFFERENTIAL EQUATION

CORE-7 (CCMTMH7)

SET-VIII

Time Allotted: 3 Hours | Full Marks: 15

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. Solve the wave equation $u_{tt} = c^2 u_{xx}$ subject to the boundary condition $u(0, t) = u(l, t) = 0$ for all $t \geq 0$ and the initial condition $[u_t]_{t=0} = 0,\ 0 \leq x \leq l$ and the initial displacement $u(x, 0) = 10\sin^3\left(\frac{\pi x}{l}\right)$. Then plot the solution of the wave equation for $t = 10$ to 500 with $\Delta t = 10$, $l = 25$ and $c = 0.15$ using any software. 6+4

2. Viva with practical note book. 5

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COOCH BEHAR PANCHANAN BARMA UNIVERSITY

B.Sc. Honours 3rd Semester Examination, 2019

MATHEMATICS (PRACTICAL)

PARTIAL DIFFERENTIAL EQUATION

CORE-7 (CCMTMH7)

SET-IX

Time Allotted: 3 Hours | Full Marks: 15

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. Find the integral surface of the equation $4yzp + q + 2y = 0$ and which passes through the curve $y^2 + z^2 = 1,\ x + z = 2$ analytically. Then, plot the integral surface for $x,\ y \in [-5, 5]$ using any software. 6+4

2. Viva with practical note book. 5

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COOCH BEHAR PANCHANAN BARMA UNIVERSITY

B.Sc. Honours 3rd Semester Examination, 2019

MATHEMATICS (PRACTICAL)

PARTIAL DIFFERENTIAL EQUATION

CORE-7 (CCMTMH7)

SET-X

Time Allotted: 3 Hours | Full Marks: 15

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. Solve the heat equation $u_t = ku_{xx}$ subject to the boundary condition $u(0, t) = u(\pi, t) = 0$ for all $t \geq 0$ and the initial condition $u(x, 0) = x$, when $0 \leq x \leq \pi/2$; $u(x, 0) = \pi - x$, when $\pi/2 \leq x \leq \pi$. Then plot the solution of the heat equation for $t = 100$ to 1000 with $\Delta t = 100$ and $k = 0.1$ using any software. 6+4

2. Viva with practical note book. 5

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COOCH BEHAR PANCHANAN BARMA UNIVERSITY

B.Sc. Honours 3rd Semester Examination, 2019

MATHEMATICS (PRACTICAL)

PARTIAL DIFFERENTIAL EQUATION

CORE-7 (CCMTMH7)

SET-XI

Time Allotted: 3 Hours | Full Marks: 15

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. Solve the wave equation $u_{tt} = c^2 u_{xx}$ subject to the boundary condition $u(0, t) = u(l, t) = 0$ for all $t \geq 0$ and the initial condition $[u_t]_{t=0} = 0,\ 0 \leq x \leq l$ and the initial displacement $u(x, 0) = \mu x(1 - x)$. Then plot the solution of the wave equation for $t = 10$ to 500 with $\Delta t = 10$, $l = 25$, $c = 0.1$ and $\mu = 0.25$ using any software. 6+4

2. Viva with practical note book. 5

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COOCH BEHAR PANCHANAN BARMA UNIVERSITY

B.Sc. Honours 3rd Semester Examination, 2019

MATHEMATICS (PRACTICAL)

PARTIAL DIFFERENTIAL EQUATION

CORE-7 (CCMTMH7)

SET-XII

Time Allotted: 3 Hours | Full Marks: 15

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. Find the integral surface of the equation $(2xy-1)p+(z-2x^2)q=2(x-yz)$ and which passes through the line $y=0,\ x=1$ analytically. Then, plot the integral surface for $x, y \in [-0.5, 0.5]$ using any software. 6+4

2. Viva with practical note book. 5

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COOCH BEHAR PANCHANAN BARMA UNIVERSITY

B.Sc. Honours 3rd Semester Examination, 2019

MATHEMATICS (PRACTICAL)

PARTIAL DIFFERENTIAL EQUATION

CORE-7 (CCMTMH7)

SET-XIII

Time Allotted: 3 Hours | Full Marks: 15

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. Solve the heat equation $u_t = ku_{xx}$ subject to the boundary conditions: u is bounded as $t \to \infty$; $u_x(0, t) = u_x(a, t) = 0$ for all $t \geq 0$ and the initial condition $u(x, 0) = x(a - x), 0 \leq x \leq a$. Then plot the solution of the heat equation for $t = 100$ to 1000 with $\Delta t = 100$, $a = 10$ and $k = 0.1$ using any software. 6+4

2. Viva with practical note book. 5

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COOCH BEHAR PANCHANAN BARMA UNIVERSITY

B.Sc. Honours 3rd Semester Examination, 2019

MATHEMATICS (PRACTICAL)

PARTIAL DIFFERENTIAL EQUATION

CORE-7 (CCMTMH7)

SET-XIV

Time Allotted: 3 Hours | Full Marks: 15

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. Solve the heat equation $u_t = ku_{xx}$ subject to the boundary condition $u(0, t) = u(2\pi, t) = 0$ for all $t \geq 0$ and the initial condition $u(x, 0) = \sin^3 x$, $0 \leq x \leq 2\pi$. Then plot the solution of the heat equation for $t = 10$ to 200 with $\Delta t = 20$ and $k = 0.01$ using any software. 6+4

2. Viva with practical note book. 5

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COOCH BEHAR PANCHANAN BARMA UNIVERSITY

B.Sc. Honours 3rd Semester Examination, 2019

MATHEMATICS (PRACTICAL)

PARTIAL DIFFERENTIAL EQUATION

CORE-7 (CCMTMH7)

SET-XV

Time Allotted: 3 Hours | Full Marks: 15

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. Find the integral surface of the equation $x^2 p + y^2 q + z^2 = 0$ and which passes through the hyperbola $xy = x + y,\ z = 1$ analytically. Then, plot the integral surface for $x,\ y \in [1, 5]$ using any software. 6+4

2. Viva with practical note book. 5

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COOCH BEHAR PANCHANAN BARMA UNIVERSITY

B.Sc. Honours 3rd Semester Examination, 2019

PHYSICS

MATHEMATICAL PHYSICS-II

CORE-5 (CCPHSH5)

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

(a) What is regular singular point for a second order linear differential equation?

(b) Write down the value of the integral

$$\int_{-1}^{+1} (2x+1)\, P_3(x)\, dx$$

(c) Write down the Laplace's equation in cylindrical polar co-ordinate system.

(d) Find the value of the ratio $\frac{\Gamma(-3/2)}{\Gamma(-1/2)}$.

(e) What is propagation of errors?

(f) Show that the Beta function is symmetric in its arguments.

(g) Write down the orthogonal properties for Laguerres polynomial.

(h) Prove that $\Gamma(1) = 1$.

(i) What is periodic function?

(j) What are the advantages of Fourier series?

(k) Solve $\frac{\partial^2 u}{\partial x^2} = 0$, subject to the conditions $u = \lambda^2$ when $x = 0$ and $u = 1$ when $x = 1$.

(l) What is Parsevals identity for Fourier transformation?

(m) Starting position of an object is represented as $x = 5 \cdot 1 \pm 0 \cdot 2$ m and finishing position is $x = 6 \cdot 9 \pm 0 \cdot 3$ m. What will be the displacement and error in the experiment?

(n) Express the following in terms of Legendre polynomials $x^3 + 1$.

(o) What are Cauchy boundary conditions?

GROUP-A

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

2. (a) A periodic function of period 4 is defined as $f(x)=|x|$, $-2<x<2$. Find its Fourier series expansion. 3

   (b) Express $f(x)=x$ as a sine series in $0<x<\pi$. 2

3. Solve the differential equation using the method of separation of variable 5

$$\frac{\partial^2 u}{\partial x^2}=\frac{\partial u}{\partial t}.$$

Given that $u=0$ when $t\to\infty$, as well as $u=0$ at $x=0$ and $x=l$.

4. (a) Prove that $\beta(m+1,n)=\frac{m}{m+n}\beta(m,n)$. 2

   (b) Show that $\int_0^1 \frac{x^{m-1}(1-x)^{n-1}}{(a+x)^{m+n}}dx=\frac{\beta(m,n)}{a^n(1+a)^m}$. 3

GROUP-B

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

5. (a) Obtain the recursion relation for the Hermite polynomial: $H_{n+1}(x)=2xH_n(x)-H_n'(x)$. Show that this leads to the second order ordinary differential equation $\frac{d^2y}{dx^2}-2x\frac{dy}{dx}+2ny=0$, satisfied by $H_n(x)$. 4+2

   (b) Find the power series solution of $(1-x^2)y''-2xy'+2y=0$ about $x=0$. 4

6. (a) Show that $P_n(x)=\frac{1}{2^n n!}\frac{d^n}{dx^n}(x^2-1)^n$. 4

   (b) Prove that $J_0^2+2J_1^2+2J_2^2+\ldots=1$. 3

   (c) Evaluate $\int_0^1 \frac{dx}{(1-x^n)^{1/n}}$. 3

7. (a) Using the method of separation variables, solve $\frac{\partial u}{\partial x}=2\frac{\partial u}{\partial y}+u$, 3

   where, $u(x,0)=2e^{-3x}+3e^{-5x}$.

   (b) Prove the following relations 2+2

   (i) $\frac{d}{dx}\left[x^n J_n(x)\right]=x^n J_{n-1}(x)$. (ii) $P_n'-xP_{n-1}'=nP_{n-1}$

   (c) Solve 3

$$\frac{\partial^2 z}{\partial x^2}+\frac{\partial^2 z}{\partial x\partial y}-6\frac{\partial^2 z}{\partial y^2}=x+y$$

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COOCH BEHAR PANCHANAN BARMA UNIVERSITY

B.Sc. Honours 3rd Semester Examination, 2019

PHYSICS (PRACTICAL)

MATHEMATICAL PHYSICS-II LAB

CORE-5 (CCPHSH5)

Time Allotted: 3 Hours | Full Marks: 15

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.

LNB → 01

VIVA → 02

Programming → (06 + 06) = 12

Write and Execute any *two* programs from the following on lottery basis

1. Write a Scilab program to calculate the area of the curved surface and volume of a sphere of given radius.

2. Write a Scilab program to solve the following differential equation $\frac{dy}{dx} = -2x - y$ with initial condition $y(0) = -1,\ y(0.4) = ?$

3. Write a Scilab program to integrate the function $f(x) = \sin^2 x \cos^2 x$ from 0 to $\frac{\pi}{2}$.

4. Write a Scilab program to find the first order and second order derivative of the function $f(x) = x^3 + 3x^2 + 2x + 5$.

5. Write a Scilab program using if-else statement. Check whether a number is positive or negative or zero.

6. Write a Scilab program to find the roots of the quadratic equation $x^2 - 5x + 6 = 0$.

7. Write a Scilab program to verify whether the following three vectors are coplanar or not

$$\vec{A} = 3\hat{i} + 2\hat{j} + \hat{k}, \quad \vec{B} = 3\hat{i} + 4\hat{j} + 5\hat{k} \text{ and } \vec{C} = \hat{i} + \hat{j} + \hat{k}.$$

8. Write a Scilab program using while loop, find the factorial of a number.

9. Write a Scilab program to find the solution of the following set of equations:

$$x + z = 4$$

$$2x + y + z = 7$$

$$x + y + 2z = 9$$

10. Using Scilab program, plot graphs of the following functions in a single plot

$y_1 = x\cos(x)$ and $y_2 = 3\sin(x)$.

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COOCH BEHAR PANCHANAN BARMA UNIVERSITY

B.Sc. Honours 3rd Semester Examination, 2019

PHYSICS

THERMAL PHYSICS

CORE-6 (CCPHSH6)

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

(a) Calculate the value of $\gamma(C_P/C_V)$ for a diatomic molecule.

(b) What do you mean by a Quasi-static process?

(c) If the efficiency of a Carnot engine is 100%, what will be the temperature of the sink?

(d) Explain the statement "The entropy of Universe is increasing".

(e) Find out the expression for adiabatic work done for an expansion of an ideal gas.

(f) Write down the essential feature of Brownian motion.

(g) Why real gas do not obey ideal behaviour?

(h) What is Helmholtz free energy?

(i) What are the differences between isothermal and adiabatic process?

(j) State third law of thermodynamics.

(k) 'Specific heat of saturated steam is negative' — Explain.

(l) Can a kitchen be cooled by leaving the door of an electric refrigerator open? — Explain.

(m) Define Gibb's function.

(n) The volume of gas expands isothermally to 4 times of its initial value. Write down the change in entropy interms of *R*.

(o) Explain the cooling by evaporation on the basis of Maxwellian distribution of molecular speeds.

GROUP-A

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

2. (a) An ideal gas at 27°C is compressed adiabatically to $\frac{8}{27}$ of its original volume. Find out the rise in temperature $(\gamma = 5/3)$. 3

   (b) What is the total change of internal energy in a cyclic process? 1

   (c) Explain why decreasing sink temperature is more effective than increasing source temperature to increase efficiency of a Carnot engine. 1

3. (a) The mean Kinetic energy of a molecule at 27°C is 4×10^{-14} ergs. Calculate the molecular density of the ideal gas at 27°C and pressure of 20 mm Hg. (Hg density = 13.6 g/cc) 2

   (b) No molecules of a gas have λ mean free path. What fraction of molecule will have free paths between λ and 2λ ? 2

   (c) What is the difference between vapour and gas? 1

4. (a) Show mathematically that dW is an inexact differential. 2

   (b) Show that $C_P - C_V = \frac{TV\alpha^2}{k_T}$, where α is the volume co-efficient of expansion and k_T is the isothermal compressibility. 3

GROUP-B

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

5. (a) Find the values of critical constants for a non-ideal gas with the equation of state 4

$$P = \frac{RT}{V-b} e^{-\frac{a}{RTV}}$$

   (b) What is the physical implication of J-T co-efficient? Show how it can be treated as the superposition of deviation from Joule's law and Boyle's law. 1+3

   (c) State and explain Zeroth law of thermodynamics. 2

6. (a) Show that for one mole of Van der Waals gas 3

$$dQ = C_V dT + \frac{RT}{(V-b)} dV$$

   (b) What are the first and second order phase transitions? What are phase diagram and triple point? 2+2

   (c) The critical temperature and pressure of argon are –122°C and 48 atm respectively. Calculate the radius of argon atom. 3

7. (a) Show that $Tds = C_V\left(\frac{\partial T}{\partial P}\right)_V dP + C_P\left(\frac{\partial T}{\partial V}\right)_P dV$. 3

   (b) Show that viscosity η can be expressed by $\eta = \frac{1}{3}\rho\bar{c}\lambda$. Where the symbols have their usual meaning. 4

   (c) From Maxwells velocity distribution, derive an expression for average velocity. 3

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COOCH BEHAR PANCHANAN BARMA UNIVERSITY

B.Sc. Honours 3rd Semester Examination, 2019

PHYSICS (PRACTICAL)

THERMAL PHYSICS

CC-6 (CCPHSH6)

Time Allotted: 3 Hours | Full Marks: 15

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.

Record of Laboratory Works (LNB):	2
Viva-Voce to be held at the examinations hall :	2
Experiment:	11
TOTAL	15

Answer any *one* question from the following on lottery basis

1. Determine Mechanical Equivalent of Heat, J, by Callendar and Barnes' constant flow method.

[Working Formula: 2; Method +Tabulation: 6; Graph: 0; Calculation: 2; Accuracy: 1]

2. Determine the Coefficient to Thermal Conductivity of Copper by Searle's Apparatus.

[Working Formula: 2; Method + Tabulation: 6; Graph: 0; Calculation: 2; Accuracy: 1]

3. Determine the Coefficient of Thermal Conductivity of Copper by Angstrom's Method.

[Working Formula: 2; Method + Tabulation: 6; Graph: 0; Calculation: 2; Accuracy: 1]

4. Determination of thermal conductivity of glass in form of a tube by cylindrical heat flow method.

[Working Formula: 2; Method + Tabulation: 6; Graph: 0; Calculation: 2; Accuracy: 1]

5. Determine the Coefficient of Thermal Conductivity of bad conductor by Lee and Charlton's method.

[Working Formula: 2; Method + Tabulation: 5; Graph: 2; Calculation: 1; Accuracy: 1]

6. Determine the Temperature Coefficient of Resistance by Platinum Resistance Thermometer (PRT).

[Working Formula: 2; Method + Tabulation: 6; Graph: 0; Calculation: 2; Accuracy: 1]

7. Study the variation of Thermo-emf of a Thermocouple with difference of temperature of its two junctions.

[Working Formula: 2; Method + Tabulation: 5; Graph: 2; Calculation: 1; Accuracy: 1]

8. Calibrate a thermocouple to measure temperature in a specified Range using

(a) Null Method

(b) Direct measurement using Op-Amp difference amplifier.

[Working Formula: 2; Method + Tabulation: 6; Graph: 0; Calculation: 2; Accuracy: 1]

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COOCH BEHAR PANCHANAN BARMA UNIVERSITY

B.Sc. Honours 3rd Semester Examination, 2019

PHYSICS

DIGITAL SYSTEMS AND APPLICATIONS

CORE-7 (CCPHSH7)

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

(a) How many bits are there in one megabyte?

(b) Write De Morgan's theorem.

(c) Prove that $A \oplus B = \overline{A} \oplus \overline{B}$.

(d) Explain the terms bit and nibble.

(e) Draw a two input AND gate using diodes.

(f) Simplify the relation $A(A+B)$, using Boolean Algebra.

(g) The inputs to a NOR gate are A = 1100 and B = 1010. What will be the output of the NOR gate?

(h) I/O devices are interfaced with microprocessor using _____.

(i) What do you mean by ALU?

(j) Define propagation delay of Flip-flop.

(k) What do you mean by Preset and Clear?

(l) What do you mean by don't care condition?

(m) Explain what is a latch circuit.

(n) Define a sequential logic circuit.

(o) What is bus?

GROUP-A

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

2. (a) Prove that $\bar{A}BC + A\bar{B}C + AB\bar{C} + ABC = AB + BC + CA$. 3

   (b) Convert the following number to binary. 2

   $(11 \cdot 75)_{10}$

3. Discuss the full adder circuit, along with required Boolean algebra and show the corresponding truth table explaining its operation. 5

4. What is multiplexer? Explain the operation of 4:1 multiplexer. What is the difference of a multiplexer and an encoder? 1+3+1

GROUP-B

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

5. (a) Obtain the truth table of Boolean function 3

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

   (b) Simplify the Boolean function in sum of products using the don't care conditions 3

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

   (c) Discuss briefly about the Ring Counter. 4

6. (a) What is shift register? Explain the operation to store 1011 in a series in parallel out shift register. 4

   (b) Design and explain the operation of a J K flip-flop. 3

   (c) Simplify $F(A,B,C,D) = ABC + BCD + A\bar{C}D + \bar{A}B + A$ using Karnaugh map. 3

7. (a) Design and explain two bit digital comparator. 3

   (b) What are deflection sensitivity and deflection factor? Obtain an expression for the magnetic deflection sensitivity in a Cathode Ray tube. 1+1+3

   (c) What is duty cycle of a signal? 2

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COOCH BEHAR PANCHANAN BARMA UNIVERSITY

B.Sc. Honours 3rd Semester Examination, 2019

PHYSICS (PRACTICAL)

DIGITAL SYSTEMS AND APPLICATION LAB

CORE-7 (CCPHSH7)

Time Allotted: 3 Hours | Full Marks: 15

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.

Distribution of Marks

LNB-	02
Viva-	02
Experiment-	11
Total-	15

Answer any *one* question on lottery basis

1. To measure (a) voltage and (b) time period of periodic waveform using CRO. (at least three sets)

[Measurement of voltage- 4, Measurement of frequency- 4,
Comparison of data- 2, Discussion - 1]

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2. To construct NOT Gate using discrete circuit components and to verify their truth tables.

[Calculation of resistance- 2, Design circuit and Tabulation- 8, Discussion- 1]

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3. To verify and design AND, OR, NOT and XOR Gates using NAND / NOR Gates and verify the truth tables.

[Circuit- 4, Data and Tabulation- 6, Discussion- 1]

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4. Design and verify combinational logic system for a given Truth Table.

A	B	C	Y
0	0	0	0
0	1	0	1
1	0	0	0
0	0	1	0
1	1	0	1
0	1	1	1
1	0	1	0
1	1	1	1

[Circuit- 4, Data and Tabulation- 6, Discussion- 1]

5. Convert the following Boolean expression into logic circuit and design it using logic gate ICs. $Y = \bar{A}BC + A\bar{B}C + AB\bar{C} + ABC$.
[Circuit- 4, Data and Tabulation- 6, Discussion- 1]

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6. Minimize the Boolean relation $Y = \bar{A}\bar{B}\bar{C} + \bar{B}C\bar{D} + BC\bar{D} + A\bar{B}\bar{C}$. Verify and design minimized Boolean relation.
[Circuit- 4, Data and Tabulation- 6, Discussion- 1]

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7. Design and verify
(a) Half adder (2 bits)
(b) Full adder (3 bits or 4 bits)
[Circuit- 4, Data and Tabulation- 6, Discussion- 1]

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8. Design and verify
(a) Half subtractor (2 bits)
(b) Full subtractor (3 bits or 4 bits)
[Circuit- 4, Data and Tabulation- 6, Discussion- 1]

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9. Design and verify
(a) Clocked RS Flip-Flop
(b) JK Flip-Flop, using NAND Gates
[Circuit- 4, Data and Tabulation- 6, Discussion- 1]

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10. Design and verify JK Master-Slave Flip-Flop using Flip-Flop ICs.
[Circuit- 4, Data and Tabulation- 6, Discussion- 1]

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11. Design and verify Shift Register - (Serial and Parallel) using ICs.
[Circuit- 4, Data and Tabulation- 6, Discussion- 1]

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12. Design and verify counter using ICs and study timing diagram.
[Circuit- 4, Data and Tabulation- 6, Discussion- 1]

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13. Design and study astable multivibrator of a given specification using 555 Timer ICs.
[Circuit- 2, Data and Tabulation- 8, Discussion- 1]

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14. Design and study monostable multivibrator of given specification using 555 Timer ICs.
[Circuit- 2, Data and Tabulation- 8, Discussion- 1]

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15. Write the following Programme using 8085 microprocessor.
(a) Addition and substraction of two 8 bits number using direct addressing mode.
(b) Addition and substraction of two 8 bits numbers using Indirect addressing mode.
[Data and Tabulation- 10, Discussion- 1]

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