SYBA/SYBSc/SYBCom – Semester – IV

Foundation Course – IV

Q. P. Code: 34265

23/04/2018 **Time: 2 ½ hours** **Total marks: 75**

NB: (1) All questions are compulsory

(2) Figures to the right indicate full marks

1(A) Briefly describe the following **(any 5)**

1. Consumerism
2. PIL
3. Anthropocentrism
4. Ecofeminism
5. GIS
6. ICT
7. Time management
8. Lateral thinking

OR

(B) Write a comprehensive note on the Foundation Course (Semester IV) project submitted by you. (15)

2. Trace the origins of the RTI Act 2005 and critically evaluate its provisions.

OR

Explain the rationale and the origin of Citizens' Charters in India. (15)

3. Describe the three main principles of sustainability

OR

Explain the view points of bio-centrism and ecocentrism. (15)

4. Describe Nanotechnology and its applications.

OR

With regard to the contemporary technology explain

a. Issues of control and misuse ; **b.** Lack of access (15)

5. Explain in detail Maslow's Theory of Motivation.

OR

Explain the basic details of exams such as GMAT and CAT, conducted for entry into professional courses. (15)

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Sybsc - Semester - IV
Zoology - Paper I
25/04/2018

Q.P. Code : 31000

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

Please check whether you have got the right question paper.

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

Q.1 A) Fill in the blank by choosing the correct option given in the brackets: **05**

a. _____ is the mesoderm free region located anterior to the primitive streak.
(Head Fold, Neural Fold, Proamnion)

b. Cases of unexplained infertility are termed as _____.
(varicocele, idiopathic infertility, autoimmunity)

c. The oldest procedure of assisted reproduction is _____.
(artificial insemination, ZIFT, ICSI)

d. In ICMR, 'C' stands for _____.
(Commission, Center, Council)

e. _____ research is used by philosophers and thinkers to develop new abstracts and for reinterpreting existing ones.
(Quantitative, Conceptual, Applied)

Q.1 B) Match the Column I and Column II and rewrite. **05**

Column I	Column II
a) Development predetermined	1) Eutherians
b) Alecithal eggs	2) Systematic use of animals in research
c) Teratozoospermia	3) STD
d) Genital herpes	4) Abnormal sperm morphology
e) Physician Galen (129-200AD)	5) Mosaic

Q.1 C) State whether true or false: **05**

a. The union of splanchnic mesoderm with endoderm leads to the formation of somatopleure.
b. Talpa (mole) exhibits non-deciduate placenta.
c. Chlamydia is the most common cause of infertility in women with multiple sexual partners.
d. IAEC stands for Institutional Animal Ethics Council.
e. Schedule Y of Drugs and Cosmetics Act regulates approval of wildlife research.

Q.1 D) Define the following: **05**

a. Pseudocoelomates
b. Primitive groove
c. Endometriosis
d. Birth control
e. Research hypothesis

Q.2 A) Give a detailed account on the types of blastulae. 10

OR

A) Briefly describe the morphogenetic movements of embryonic cells. 10

Q.2 B) Explain **ANY TWO** of the following: 10

a. Types of Coelom
b. Meroblastic cleavage
c. Allantois as extra embryonic membrane
d. Classification based on morphological characteristics of placenta.

Q.3 A) Describe the different methods of treatment of infertility 10

OR

A) Explain in detail the technique of *in vitro* fertilization (IVF). Add a note on its applications. 10

Q.3 B) Explain **ANY TWO** of the following: 1

a. Hormonal Regulation of female reproductive system.
b. ICSI
c. Sterilization as a method of contraception.
d. Role of PCOS in infertility

Q.4 A) Describe the components of research paper. 10

OR

A) Give an account of two broad approaches of scientific reasoning. 10

Q.4 B) Explain **ANY TWO** of the following: 10

a. Approval from state Biodiversity Board to conduct research.
b. Application of knowledge gained by research.
c. Critical thinking.
d. Ethics in clinical research.

Q.5 Write short note on **ANY FOUR:** 20

a. Mosaic and regulative egg
b. Cleavage based on symmetry
c. Menopause
d. Ethical issues associated with surrogacy
e. Dissemination of data
f. Types of research reports

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SyBSc - Semester - IV 27/04/2018
Zoology - Paper - II

Q. P. Code:32048

Time: 3 Hours

Marks: 100

N. b.

1. All questions are compulsory and carry equal marks.
2. Figures to right indicate full marks.
3. Draw neat labeled diagrams wherever necessary.
4. Attempt the questions in order.
5. Please check whether you have got the right question paper.

Q.1 A) Fill in the blanks by choosing the correct options given below 05

a) The fluid mosaic model describes the plasma membrane as consisting of---
(Two layers of phospholipids with protein sandwiched between them, A protein bilayer with embedded phospholipids. A phospholipid bilayer with embedded proteins)

b) The peripheral layer of cytoplasmic matrix is called ------
(Endoplasm , Cytoplsmic structures , Ectoplasm)

c) The nuclear envelop is perforated by many specialized openings, called----
----(Nuclear pore, Nuclear Matrix , Nucleoporins)

d) Cisternae is part of ---------
(Nucleus , Lysosome, Golgi Complex)

e) Aldehyde or Ketone derivatives of polyhydroxy alcohols are called ----
(Proteins , Lipids, Carbohydrates)

B) Match the columns I and II and rewrite 05

Column I	Column II
a) Tyrosine	i. Autolysis
b) Serine	ii. Ribosome factory of the Cell.
c) Cell membrane	iii. Found in Silk protein
d) Lysosomes	Iv Lipid bilayer
e) Nucleolus	v. Aromatic non polar amino acids

C) State whether True or False 05

a) Desmosomes are link between the extracellular matrix and cytoskeleton.
b) Communication between neighbouring cells in plant takes place through plasmodesmata .
c) All the sugar names end with suffix 'ine'.
d) Mitochondrial ribosomes are bigger than ribosomes found in the cytoplasm.
e) Our body can synthesize 10 out of 20 amino acids.

D) Define the following. 05

a) Plasma membrane
b) Microvilli
c) Autophagy
d) NADH
e) Vitamin -C

Q.2 A) Describe active transport through plasma membrane 10

OR

A) Describe microfilaments and their function 10

B) **Explain any Two from the following.** 10

a) Give definition and scope of cell biology
b) Describe eukaryotic cell
c) Describe structure and function of interphase nucleus
d) Describe exocytosis with example

Q.3 A) Describe the concept of endomembrane system with suitable diagram 10

OR

A) Describe an ultrastructure of Mitochondria with suitable diagram 10

B) **Explain any Two from the following.** 10

a) Write functions of endoplasmic reticulum
b) Write important functions of lysosomes
c) Draw diagram for forms of Endoplasmic reticulum
d) Write about polymorphism in lysosomes

Q.4 A) Describe the structure of saturated and unsaturated fatty acids 10

OR

A) Describe the structure and functions of lipid soluble vitamins 10

B) **Explain any Two from the following.** 10

a) Explain the linkage in lactose and sucrose
b) Describe types of proteins with suitable examples
c) Write biological role of lipids
d) Write structure and function of Vitamin- A

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

a) Nucleus – shape, size and position
b) Micritubules
c) Marker enzymes
d) Lysosomes function
e) Peptide bond
f) Clinical significance of lipids

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SyBSc - Semester IV
Zoology - Paper III
03/05/2018

Q.P. Code : 30993

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

Please check whether you have got the right question paper.

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

Q.1 A) Fill in the blank by choosing the correct option given in the bracket. **05**

a. Eggs are rich source of _____. (protein, fructose, fibres)
b. _____ hours of sleep are required for healthy life. (six to eight, twelve to fourteen, one to three)
c. The rate of dementia doubles after age of _____ yrs. (50, 55, 60)
d. Edwards syndrome is trisomy of chromosome number _____. (18, 19, 20)
e. Ozone layer is present in _____. (troposphere, stratosphere, mesosphere)

Q.1 B) Match the column I and column II and rewrite. **05**

Column I	Column II
a) Alcohol	1) Down syndrome
b) Fibres in food	2) Bhopal gas tragedy
c) Parkinson's disease	3) Green vegetables
d) Short neck	4) Adverse effects on liver
e) Union Carbide	5) Tremor of limbs

Q.1 C) State whether true or false: **05**

a. Tea and coffee help to reduce risk of cancer.
b. Recreation reduces mental stress.
c. There is no cure for autism spectrum disorder.
d. People with dyslexia have normal intelligence.
e. Mesosphere is outermost layer of atmosphere.

Q.1 D) Answer in one sentence: **05**

a. What is balanced diet?
b. What is single-gene disorder?
c. Which hormone is produced by human placenta?
d. What is environment?
e. Which pollutant is responsible for Minamata disaster?

Q.2 A) Describe the cardiovascular and reproductive health problems related to mental stress. **10**

OR

A) Enlist healthy life style practices and their effects **10**

Q.2 B) Explain **any two** of the following: **10**

a. Effects of drug addiction
b. Sedentary life style
c. Importance of Omega 3 fatty acids
d. Junk food

Q.3 A) Describe Alzheimer's disease with reference to causes and symptoms. 10

OR

A) What is Genetic counseling? Describe different types of genetic counseling. 10

Q.3 B) Explain **any two** of the following: 10

a. Symptoms of super female
b. Symptoms of Klinefelter's syndrome
c. Ultrasonography
d. Amniocentesis

Q.4 A) Give an account of types and sources of solid wastes. 10

OR

A) Describe acidification of Great Barrier Reef. 10

Q.4 B) Explain **any two** of the following: 10

a. Effects of air pollution.
b. Effects of Minamata disaster.
c. Sources of soil pollution.
d. Effects of air pollutants on Taj Mahal.

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

a. Effect of smoking on health
b. Role of diet in prevention of cancer
c. New born screening
d. Detection and treatment of Dyslexia
e. Causes for decline of Indian Vultures.
f. Sources of water pollution

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SyBSc - Semester - IV
Chemistry - Paper I
24/04/2018

Q. P. Code: 34914

[Time: Three Hours] [Marks:100]

Please check whether you have got the right question paper.

N.B.
1. All Questions are compulsory.
2. Figures to the right indicate full marks
3. The use of log-table/nonprogrammable calculator is allowed
4. Answers for the same question as far as possible should be written together

Q.1 A Select the correct option and complete the following sentences: 12

(i) The cell in which the redox reaction which takes place gets reversed by applying an emf (from external source) slightly greater than the emf of the cell, then the cell is said to be ..... cell.
(a) a reversible (b) an irreversible (c) equilibrium

(ii) At 298 K, according to Nernst equation, the reduction potential of hydrogen electrode can given by an equation.....
(a) $E_{H^+/_{H_2}} = -0 \cdot 0592pH$ (b) $E_{H^+/_{H_2}} = 0 \cdot 0592pH$
(c) $E_{H^+/_{H_2}} = 0 \cdot 0592 - pH$
(Given $E^o_{SHE} = 0.0$ V) ($P_{H2} = 1$ atm)

(iii) A saturated solution of sodium chloride is a --------- phase system.
(a) one (b) two (c) three

(iv) The eutectic point of two component system is ----------
(a) bi-variant (b) non variant (c) mono-variant

(v) .....among the following transition elements shows special stability due half-filled level.
(a) Zirconium (b) Niobium (c) Molybdenum

(vi) With increase in covalent character, there is an increase in ..... character of transition compounds.
(a) acidic (b) basic (c) amphoteric

(vii) Diethylenetriamine is ..... type of ligand.
(a) tridentate (b) bidentate (c) monodentate

(viii) The oxidation state of metal ion in $[Ni\ (en)_3]^{2+}$ is .....
(a) +1 (b) +2 (c) +3

(ix) When propanoic acid is treated with aqueous sodium bicarbonate, CO_2 is liberated. The C of CO_2 comes from .....
(a) methyl group (b) carboxylic acid group (c) bicarbonate group

(x) The product of the following reaction:

$$2\,CH_3COOH \xrightarrow{\Delta\ P_2O_5} \text{.....}$$ is
(a) Ethyl ethanoate (b) CO_2 and H_2O (c) Ethanoic anhydride

(xi) Reaction of acetic anhydride with PCl_5 gives .....
(a) acetic acid (b) acetaldehyde (c) acetyl chloride

(xii) Sulphonation of benzene proceeds through .....
(a) Electrophilic Substitution (b) Nucleophilic Substitution
(c) Nucleophilic Addition

B State whether the following sentences are True or False

(i) In one component system, four phases cannot exist in equilibrium

(ii) Zinc atom cannot show any oxidation state higher than +2.

(iii) Carboxylic acid is stronger than H_2SO_4.

C Match the following 05

Column X		Column Y	
1)	Triple point	a)	Anode carries +ve charge
2)	Electrolytic cell	b)	Van't Hoff's Reaction isotherm
3)	Cu^+	c)	colourless
4)	$[CoF_6]^{3-}$	d)	IPSO Reaction
5)	Replacement of $-SO_3H$ group with $-NO_2$ group	e)	Blue
		f)	Outer orbital complex
		g)	F = 0
		h)	HVZ Reaction

Q.2 A i) Derive Nernst equation for the determination of an emf of a voltaic cell in which the following reaction takes place: a A + b B = c C + d D. 05

ii) Find the pH of the solution placed in a hydroquinone half-cell which was coupled with saturated calomel electrode. The emf of the combined cell was determined to be 0.12 V at 298 K. 03
(Given $E^o_{quinone/hydroquinone}$ = 0·697 V; $E_{calomel}$ = 0·242 V)

OR

A i) Explain electrolyte concentration cell without transference reversible to cation with suitable example. 05

ii) The basic reaction which takes place in a standard Weston Cell is 03

$$Cd_{(s)} + Hg_2SO_{4\,(s)} = CdSO_{4\,(aq)} + 2Hg_{(l)}$$

The emf of a cell is 1·018 V at 298K. Its temperature coefficient at constant pressure is $-3{\cdot}88 \times 10^{-5}$ VK^{-1}. Calculate ΔG, ΔS and ΔH for the given cell reaction of Weston Cell. F = 96500 C/mol

B i) Explain the term : i) Phase ii) Components 05

ii) The boiling point of Benzene is 352·2K at $1{\cdot}013 \times 10^5$ N m^{-2}. Calculate the boiling point of benzene at $0{\cdot}63 \times 10^5$ N m^{-2}. The molar heat of vaporization of benzene at its boiling point is 31·8 kJ mol^{-1}. (R= 8·314 JK^{-1} mol^{-1}) 03

OR

B i) Explain the term : i) congruent melting point 05
ii) incongruent melting points

ii) The vapour pressure of a liquid is trebled when its temperature is raised from 298 K to 308 K. Calculate its molar heat of vaporization. 03
(R= 8·314 JK^{-1} mol^{-1})

	C		Define anode and cathode electrode. Which sign (positive or negative) would be assigned to anode and cathode in galvanic cell and in electrolytic cell?	04
			OR	
	C		State and explain condensed phase rule.	04
Q.3	A	i)	Explain the 'additional stability' of chromium and copper from first transition series.	05
		ii)	Give the classification of ligands based on denticity.	03
			OR	
	A	i)	Name the important oxides of Vanadium and give a brief account of V_2O_5.	05
		ii)	Discuss the terms 'Hydrate isomerism' and 'coordination isomerism' with suitable examples.	03
	B	i)	Justify- ' Generally transition metals and their compounds are coloured'.	05
		ii)	What is Effective Atomic Number? How is it obtained for nickel carbonyl?	03
			OR	
		i)	Name the different oxides of Titanium. Give any four chemical properties of TiO_2.	05
		ii)	Write the formulae of following coordination compounds: a) Dichloro bis-(ethylene diamine) cobalt (III) ion b) Potassium *cis*- dichlorodinitroplatinate (II) c) Aquopentammine cobalt (II) iodide.	03
	C		Write a note on ' Magnetic properties of Transition elements'.	04
			OR	
	C		Give the evidences for formation of co-ordination compounds.	04
Q.4	A	i)	What is Claisen Condensation? Write a descriptive note on Claisen Condensation with mechanism.	05
		ii)	How is benzoic acid synthesized from the following -- a) an aromatic alcohol b) aryl cyanide c) alkyl benzene	03
			OR	
	A	i)	How will you convert the following— a) Butanoic acid to butanamide b) Benzene sulphonic acid to Benzene c) Phthalic acid to phthalic anhydride d) Benzene sulphonic acid to benzene sulphonyl chloride e) Para-toluic acid to toluene	05
		ii)	Give synthesis of the following a) acetic acid b) phthalimide c) phthalic acid	03
	B	i)	What is meant by sulphonation and sulphonating agents? Give two examples of sulphonating agents. How will you synthesize α- and β-Naphthalene sulphonic acids?	05
		ii)	Explain Hell-Volhard-Zelinsky reaction. Give its mechanism.	03
			OR	

B i) Answer the following in brief 05
a) Sulphonic acids are stronger than carboxylic acids
b) Decarboxylation and Esterification of carboxylic acids.

ii) Give only reactions for the following— 03
a) Sulphonation of Toluene
b) Action of PCl_5 on Benzene sulphonic acid
c) Action of $NaHCO_3$ on Benzene sulphonic acid

C i) What is Nucleophilic Acyl substitution? Explain with mechanism. 04

OR

C i) What is IPSO substitution? Give one suitable example. 02
ii) Explain giving reactions only, the action of the following on Salicylic acid in presence of concentrated H_2SO_4. 02
a) acetic anhydride b) methanol

Q.5 Attempt any Four of the following

A Explain how emf measurements can be used to determine the change in enthalpy, entropy and free energy of a redox reaction. 05

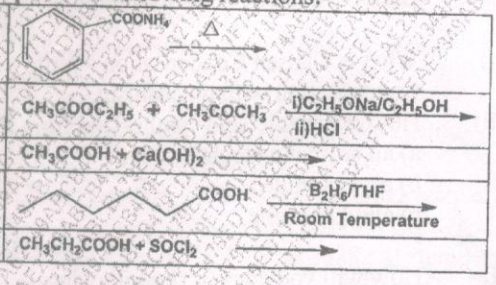
B Give a brief account of metastable equilibrium in sulphur system. 05

C Differentiate between 'Inner Orbital Complex and Outer Orbital Complex'. Explain with an example of each. 05

D Explain the geometry and hybridisation involved in $[Ni(CN)_4]^{2-}$ on the basis of VBT.

E Write a detailed account on Dieckmann Condensation. 05

F Complete the following reactions:- 05

a) 

b) $CH_3COOC_2H_5 + CH_3COCH_3 \xrightarrow[ii)HCl]{i)C_2H_5ONa/C_2H_5OH}$

c) $CH_3COOH + Ca(OH)_2 \longrightarrow$

d)

e) $CH_3CH_2COOH + SOCl_2 \longrightarrow$

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Sy BSc – Semester IV
Chemistry – Paper – II
26/04/2018

Q.P. CODE: 34376

[Time : 3 Hours [Total Marks : 100

Please check whether you have got the right question paper.

N.B. : 1. All Questions are compulsory.

2. Figures to the right indicate full marks.

3. The use of log-table/nonprogrammable calculator is allowed.

4. Answers for the same question as far as possible should be written together.

1. (A) Select the correct option and complete the following sentences. 12

(i) A cube has -------- elements of symmetry.

(a) 8 (b) 14 (c) 23

(ii) --------- are the number of equidistant nearest neighbours that an atom has in a given structure.

(a) Miller indices (b) Coordination numbers (c) Weiss indices

(iii) Catalyst ---------- the rate of a reaction without itself undergoes a chemical change.

(a) only decreases (b) alters (c) only increases

(iv) The enzyme --------- catalyse the conversion starch into maltose sugar.

(a) diastase (b) zymase (c) invertase.

(v) When pK_a value is --------- ,K_a value is large.

(a) large (b) small (c) same

(vi) Ba^{+2} is an example of --------- cations.

(a) feebly acidic (b) non acidic (c) strongly acidic

(vii) ---------- can be done to help forests after acid rain damage?

(a) Nothing (b) Liming (c) Transplantation

(viii) The acid rain leaches away --------.

(a) only calcium (b) only magnesium (c) both calcium and magnesium

(ix) Nitrogen atom in Pyrrole is ----------

(a) sp hybridized b) sp^2 hybridized (c) sp^3 hybridized

(x) IUPAC name of $CH_3\ CH_2CH_2CH_2\ NHCH_3$ is ----------

(a) N-Methyl-1- butanamine (b) N-Methyl-2- butanamine

(c) N-Butyl-1- methanamine

(xi) Diazotization occurs at ---------- temperature.

(a) 0-5^0 C (b) room temperature (c) 60–6 5^0 C

(xii) ---------- Compound is not aromatic.

(a) Pyrrole (b) Piperidine (c)Furan

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

(i) Simple cubic lattice is also known as primitive cubic lattice.

(ii) In aqueous solution of Na^+ ions, concentration of H_3O^+ ions is maximum.

(iii) Aromatic amines are weaker base than Aliphatic amines.

(C) Match the column.

(i)	NaCl	(a)	sp^3 hybridized
(ii)	X rays	(b)	Weakly basic anion
(iii)	F^-	(c)	FCC
(iv)	S^{2-}	(d)	sp^2 hybridized
(v)	'N' atom in Piperdine	(e)	BCC
		(f)	Moderately basic anion
		(g)	10^{-10} m
		(h)	Strongly basic anion
		(i)	10^8 m

2. (A) (i) What are X-rays? Derive Bragg's equation $n\lambda = 2d\sin\theta$. 5

(ii) The second order reflection of X-rays from (100) planes of NaCl occurs at 29.3°. If the wavelength used is 1.54$\dot{A}$, calculate the distance between two successive (100) planes in NaCl.

OR

(A) (i) What is Avogadro number? How is the study of the crystal lattice of NaCl used as an accurate method for the determination of Avogadro number? 5

(ii) Calculate Miller indices of the faces having the following intercepts with X, Y and Z axes. i) 1a:2b:3c ii) 2a:∞b:∞c . 3

(B) (i) Define the term catalyst. Describe the characteristic features of catalysis. 5

(ii) Explain the role of nanoparticles in catalytic efficiency. 3

OR

(B) (i) What is enzyme catalysis? Derive Michaelis-Menten equation for enzyme catalysis. 5

(ii) With the help of suitable example, explain what is meant by homogeneous and heterogeneous catalysis. 3

(C) State and explain the law of symmetry of crystallography. 4

OR

(C) Explain acid- base catalysis with suitable examples. 4

3. (A) (i) What is predominance diagram? Explain with reference to Cr^{3+} ion and its hydrolytic products in aqueous medium. 5

(ii) With the help of predominance diagram discuss the behaviour of moderately acidic cations in aqueous medium. 3

OR

(A) (i) How does charge and size of anion affect basicity ? 4

(ii) What are the physical properties of concentrated sulphuric acid ? 4

(B) (i) Give a brief account of hydration energy. How is hydration energy calculated using Latimer equation? 5

(ii) Comment on a relationship between pK_a ,acidity and Z^2/r ratio of monoatomic cations. 3

OR

(B) (i) With suitable predominance diagram explain the followings 4

a) weakly basic anion b) moderately basic anion

(ii) How is the concentrated nitric acid useful ? 4

(C) How does a cation get hydrated ? Explain the process of hydrolysis of hydrated cation with the help of a neat diagram. 4

OR

(C) Write a note on environmental aspects of sulphuric acid and related volatile oxides. 4

4. (A) (i) What are Azo compounds ? Explain the preparation of azo compound with mechanism. 5

(ii) Explain the Hofmann degradation of amides with a suitable example. 3

OR

(i) a) Write a note on Sandmeyer reaction. 3

b) How will you convert aniline to phenyl hydrazine. 2

(ii) What is carbylamines test? With reaction explain the carbylamines test. 3

(B) (i) What is the action of acetyl nitrate and acetic anhydride on furan and pyrrole? 5

(ii) Explain why pyridine undergoes nucleophilic substitution more readily. 3

OR

(B) (i) Discuss the aromaticity of Furan and Thiophene. 5

(ii) Explain Hantzsch synthesis for preparation of pyridine. 3

(C) How will you convert 4

(i) Thiophene to thiophene – 2 – sulphonic acid

(ii) Pyrrole to pyrrole – 2 – aldehyde

OR

(C) How will you prepare primary amine from 4

(i) Alkyl halide

(ii) Haloarenes

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

(A) The first order reflection maxima from (100), (110), and (111) planes of a given cubic crystal occur at 7.2°, 10.2°and 12.5° respectively. What type of cubic lattice does the crystal possess? 5

(B) Explain the terms with suitable examples. i) catalytic activity ii) catalytic poisoning. 5

(C) Write a note on effect of charge to radius ratio on acidity of cations. 5

(D) Describe photochemical smog and its effect on the environment. 5

(E) i) Write a note on Gomberg reaction. 2

ii) Explain 'pyridine is not very reactive towards electropillic reagent'. 3

(F) Draw the structure of Ethyl isopropyl amine and give its preparation. 5

XXXXXX

SyBSc - Semester - IV
Chemistry - Paper - III

02/05/2018

Q.P. Code: 34577

Time: 3 hrs (100 Marks)

Please check whether you have got the right question paper.

Note: All questions are compulsory

Figures to the right indicate maximum marks

Use of log tables and non-programmable calculators is permitted.

Answers for the same question as far as possible should be written together.

Q 1. A. Fill in the blanks with suitable option and rewrite the statement. (12)

i. Paper chromatography is a type of _____ chromatography.
   a. Adsorption b .Partition c. Ion-exchange

ii. Ion-exchange is a _____.
   a. Separation method b. Electroanalytical method
   c. Separation method using electrical field

iii. Partition coefficient & distribution ratio will be _____.
   a. Always equal b. Always different
   c. Will be equal only if the molecular condition of the solute is the same in both the phases.

iv. The method of separation of two liquids that differ in boiling point is _____.
   a. Crystallization b. Centrifugation c. Distillation

v. In potentiometric titrations, an electrode whose potential changes during the course of titration is called _____ electrode.
   a. Reference b. Saturated Calomel c. Indicator

vi. The glass electrode is an _____ electrode.
   a. Ion specific b. Ion selective c. Reference electrode

vii. A conductivity cell contains _____ electrode.
   a. Silver b. Nickel c. Platinized Platinum

viii. The unit of cell constant is _____ in conductometry.
   a. S b. S cm^{-1} c. cm^{-1}

ix. The Gaussian curve is symmetrical around _____ .
   a. μ b. $\bar{x}$ c. S

x. The F-test is used for _____
   a. testing of significance b. rejection of data c. obtaining the best fitting line

xi. The method of averages is used for _____
   a. Rejection of data b. Obtaining the best fitting line
   c. Obtaining mean of the set

xii. Confidence limit is defined as _____
   a. $\pm ts/\sqrt{n}$ b. $\pm ts/n$ c. $\pm ts/z$

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

i. R_f value is independent of solvent system.

ii. Coloured solutions cannot be titrated potentiometrically.

iii. Null hypothesis is used to determine whether the two means differ statistically

C. Match the following: (5)

A	B
1. Separation of metal ions	a. Separation of proteins
2. Electrophoresis	b. C_n R
3. Glass electrode	c. Reference Electrode
4. Saturated Calomel Electrode	d. Paper Chromatography
5. Confidence limit	e. Indicator electrode
	f. Separation of uncharged species

Q 2.A. (i) Explain why multiple extraction using a small volume of extractant is more efficient than a single extraction using a large volume of the extractant. (5)

(ii) What is distillation? Explain the principle of steam distillation? (3)

OR

A. (i) With a suitable diagram explain continuous extraction using extracting solvent lighter than water. (5)

(ii) What is electrophoresis? Mention its two applications? (3)

B (i) A 200 cm^3 of an aqueous solution containing 0.05 mole of a certain solute is extracted twice with 25 cm^3 of ether. Calculate the amount of solute remaining unextracted and percentage extraction. ($D_{o/w}$=12) (5)

(ii) Explain ascending thin layer chromatography with a suitable diagram. (3)

OR

B. (i) 100 cm^3 of an aqueous solution is extracted twice with 40 cm^3 portions of an organic phase. If the percentage extraction is 99%, calculate the value of the distribution ratio in favour of the organic phase. (5)

(ii) Explain the classification of chromatographic methods on the basis of nature of stationary phase. (3)

C. Explain the principle of paper chromatography? (4)

OR

C. What are the factors that affect the extraction in solvent extraction process? (4)

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Q 3A. (i) Explain the principle and working of combined glass electrode? (5)

(ii) What are the advantages of conductometric titrations? (3)

OR

A. (i) Explain the construction and working of conductivity cell. (5)

(ii) What are the applications of potentiometric titrations? (3)

B (i) Explain the nature of the curve for the titration of (i) strong acid against strong base and (ii) weak acid against weak base conductometrically. (5)

(ii) What is a pH meter? Explain any two types of pH meters. (3)

OR

B. (i) What is a quinhydrone electrode? Derive an expression between E_{cell} and pH using quinhydrone electrode in acidic medium. (5)

(ii) What are reference and indicator electrodes? Give one example each (3)

C Explain the principle of potentiometric titrations. (4)

OR

C. Discuss the applications of pH metry in biological and environmental analysis? (4)

Q 4.A. (i) Five replicate measurements for the determination of gold in a sample of gold alloy gave the following results. (5)

Test	1	2	3	4	5
% Gold	15.61	15.52	15.63	15.64	15.68

Calculate the 95% confidence limits for the mean if

(a) no additional information about the precision of the method is known

(b) a large number measurements have σ=0.02. [Given : t =2.78 and Z =1.96 at 95% confidence level].

(ii) Write the equation for the Gaussian distribution curve. Explain all the terms involved in it. (3)

OR

A. (i) Explain Q-test for the rejection of data. (5)

(ii) A set of five results for content of magnesium in magnelium alloy using colorimetric procedure gave standard deviation of 0.038. The standard method for the estimation of magnesium gave standard deviation as 0.022 for a set of six replicate measurements. Verify whether two standard deviations differ significantly at 95% confidence level. [Given F_{table} = 5.19]. (3)

B. (i) Six samples were analyzed for their mercury content. The values obtained in ppm of mercury were as follows: (5)

2.06, 2.16, 2.12, 1.93, 1.89 and 1.95

Calculate: Range, Standard deviation, Variance

(ii) Define: a) median b) confidence interval c) relative average deviation. (3)

OR

B. (i) Name the different measures of dispersionδ and explain any two of them. (5)

(ii) Five replicate measurements gave the values of % of copper as 42.44, 42.48, 42.58, 42.50 and 42.55. Calculate the 90 % confidence limit for the mean, if a large number of measurements have given σ = 0.025% of copper. (Given for 90% confidence limit, t=2.02,Z=1.64) (3)

C. Estimation of glucose in a sample of blood gave the following results. (4)

sample	1	2	3	4	5	6
Glucose	105	101	106	105	108	108

Does the value of 101 need rejection on the basis of 2.5 d rule & 4.0 d rule?

OR

C. What is null hypothesis? Explain the variance ratio test? (4)

Q 5. Answer **any four** of the following. (20)

A. 200 cm^3 of an aqueous solution containing 1.5 g of solute A is extracted a number of times with 20 cm^3 portions of an organic solvent. Distribution ratio in favour of the organic phase is 60. Calculate the number of extractions required to bring the amount of the solute in aqueous phase to 0.03g.

B Discuss the applications of thin layer chromatography.

C What are the merits and demerits of the glass electrode?

D Mention the various graphical methods used to determine the equivalence point in potentiometric titrations. Explain any one method.

E i) Discuss the importance of graphical representation of data.
ii) Define a) mean b) mode

F The following results were obtained in the replicate analysis of two samples of blood for its lead content.

Sample I (ppm)	0.752	0.756	0.760
Sample II (ppm)	0.764	0.768	0.772

If the combined standard deviation value is 0.004 ppm. Find whether the two methods differ statistically or only numerically. Given t_{table}=2.78 for 4 observations at 95% confidence limit.

* * *

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SyBsc - Semester - IV
Botany - Paper I
24/04/2018

Q. P. Code: 32000

[Time: Three Hours] [Marks: 100]

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

Q.1 (A) **Choose the correct option from the following and rewrite the sentence.** **(10)**

i) Ascomycetes is also known as _____
   a) club fungi
   b) sac fungi
   c) fungi-algae
   d) imperfect fungi

ii) *Xylaria* is commonly known as _____.
   a) powdery mildew
   b) rust
   c) blight
   d) dead man's finger

iii) *Usnea* is an example of _____ Lichen.
   a) crustose
   b) foliose
   c) fructicose
   d) terricolous

iv) _____can be controlled by dusting Sulphur.
   a) Powdery mildew
   b) Late blight of potato
   c) Rust
   d) Smut

v) In *Selaginella,* the rhizophores, are positively _____
   a) phototrophic
   b) autotrophic
   c) geotropic
   d) heterotrophic

vi) The fossil, transformation of the organic tissue into stone is called _____.
   a) Cast
   b) Compression
   c) Impression
   d) Petrification

vii) In *Rhynia* the T.S. of stem shows _____.
- a) siphonostele
- b) protostele
- c) solenostele
- d) eustele

viii) _____ is the largest order of living gymnosperm.
- a) Cordaitales
- b) Ginkgoales
- c) Coniferales
- d) Gnetales

ix) *Cordaites* seeds are assigned to the genus _____.
- a) Artisia
- b) Amyelon
- c) Cordianthus
- d) Cardiocarpus

x) In *Pinus* stem, the stele is _____
- a) siphonostele
- b) protostele
- c) eustele
- d) solenostele

(B) Answer the following in one or two sentences: **(10)**

i) What is perithecium?
ii) State any two uses of Lichen with example.
iii) What is an amber?
iv) Name two types of vegetative reproduction in *Selaginella*.
v) Name any two species of *Pinus*.

Q.2 Answer any two of the following: **(20)**

i) Give an account of general characters of ascomycetes.
ii) Explain in detail the sexual reproduction in *Erysiphe*.
iii) Describe the sexual reproduction of *Xylaria*.
iv) Give the causal organism, symptoms, and disease cycle of Powdery mildew. Add a note on its control measure.

Q.3 Answer any two of the following: **(20)**

i) Give an account of Psilophyta. Add a note on its classification up to order.
ii) With the help of neat labelled diagram, describe T.S. of stem of *Selaginella*.
iii) Explain the process of fossilization. Add a note on Cast.

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iv) With reference to *Rhynia*, explain-
(a) External morphology (b) internal structure of stem

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

i) Enlist salient features of Coniferophyta.
ii) With the help of neat labeled diagram explain internal structure of *Pinus* old stem.
iii) Describe the L.S of female cone in *Pinus.* Add a note on V.S. of ovule.
iv) Give a detailed account of the internal structure of *Cordaites* stem. Add a note on its systematic position.

Q.5 Write short notes. (Any Four) **(20)**

i) Systematic position of *Erysiphe*.
ii) V.S. of homiomerous lichen thallus.
iii) T.S. of rhizophore of *Selaginella.*
iv) Systematic position of *Rhynia*
v) T.S. of *Pinus* needle.
vi) Female Strobilus of *Cordaites*

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SyBSc – Semester-IV
Botany – Paper-I
25/04/2018

Q. P. Code: 33002

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

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

Q.1 (A) Choose the correct option from the following and rewrite the sentence. (10)

i) *Erysiphe* is an _____.
   a) endoparasite
   b) ectoparasite
   c) saprophyte
   d) autotrophs

ii) *Xylaria* is a member of _____
   a) phycomycetes
   b) ascomycetes
   c) basidiomycetes
   d) deuteromycetes

iii) The well- known ' Reindeer moss' is a _____
   a) Moss
   b) Fern
   c) Fungi
   d) Lichen

iv) Late blight of potato is caused by_____.
   a) *Erysiphe graminis*
   b) *Erysiphe polygonii*
   c) *Phytophthora infestans*
   d) *Xylaria hypoxylon*

v) In *Selaginella*, the strobilus is developed at the end of _____
   a) branches
   b) stem
   c) leaves
   d) roots

vi) *Rhynia* is a member of _____
   a) Psilophyta
   b) Lepidophyta
   c) Calamophyta
   d) Pterophyta

vii) _____ is a fossilized tree resin.
   a) Cast
   b) Compression
   c) Impression
   d) Amber

viii) *Pinus gerardiana* seeds are commonly known as _____
   a) Sago
   b) Chilgoza
   c) Chirongi
   d) Chirota

ix) The male and female fructifications are assigned to the genus _____.
   a) Artisia
   b) Amyelon
   c) Cordiainthus
   d) Cardiocarpus

x) Pollination in *Pinus* is through _____.
   a) wind
   b) insects
   c) water
   d) animals

(B) Answer the following in one or two sentences: **(10)**

i) Give any two examples of Crustose lichen.
ii) Mention the location and function of trabeculae in the stem of *Selaginella*.
iii) What is Geological time scale?
iv) What is pycnoxylic wood?
v) Name the different types of Shoots in *Pinus*.

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Q.2 Answer any two of the following: **(20)**

i) Describe the sexual reproduction in *Erysiphe*. Add a note on cleistothecium.

ii) Explain asexual reproduction in *Xylaria*. Add a note on its systematic position.

iii) Give the causal organism, symptoms, and disease cycle of late blight of potato. Add a note on its control measure.

iv) With the help of neat labeled diagram explain the V.S. of heteromerous and homomerous types of lichen thallus.

Q.3 Answer any two of the following: **(20)**

i) Discuss the salient features of Lepidophyta and Psilophyta.

ii) With the help of neat and labelled diagrams, explain external and internal structure of leaf of *Selaginella.*

iii) Explain the process of fossilization. Add a note on Pterification.

iv) Describe the external morphology of *Rhynia* plant. Add a note on its systematic position.

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

i) Enlist the salient feature of Coniferophyta.

ii) With the help of neat labeled diagram describe T.S. of *Pinus* needle. Add a note on xerophytic adaptations in *Pinus*.

iii) Describe the external and internal structure of male cone of *Pinus*.

iv) With reference to *Cordaites* explain: i) T.S. of leaf ii) T.S. of root

Q.5 Write short notes. (Any Four) **(20)**

i) Systematic position of *Erysiphe*.

ii) Ecological significance of lichens.

iii) T.S. of rhizophore of *Selaginella.*

iv) Compression

v) V.S. of *Pinus* ovule

vi) Economic importance of Coniferophyta.

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SyBSc – Semester – IV
Botany – Paper – II
26/04/2018

Q. P. Code: 31989

3Hrs. **Total Marks: 100**

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

Q.1 (A) Choose the correct option from the following and rewrite the sentence. **10**

i. Fusiform initials produce _____ phloem towards the outer side.

(a) primary (b) secondary (c) tertiary (d) no

ii. _____ is deposited in phellem.

(a) Tannins (b) Starch (c) Oils (d) Suberin

iii. Fruit pulp of pear shows _____.

(a) Trichosclereids (b) Macrosclereids (c) Osteosclereids (d) stone cells

iv. The strength of the girder increases with _____ in distance between the two flanges.

(a) increase (b) decrease

(c) reduction (d) intercept

v. The phenomenon of photorespiration was observed for the first time in _____.

(a) *Chlorella* (b) *Cosmarium* (c) *Chlamydomonas* (d) *Chara*

vi. The _____is that continuous duration of light, which must not be more than the required in SDPs and should always be more than in LDPs in order to bring them to flower.

(a) Critical photoperiod (b) Clinical photoperiod

(c) Cronical photoperiod (d) Creative photoperiod

vii. _____ is a natural flowering hormone.

(a) Xanthophyll (b) Parachlorobenezene (c) Chlorophyll (d) Florigen

viii. _____ oxidizes nitrite to nitrate.

(a) *Nitrobacter* (b) *Azotobacter* (c) *Aspergillus* (d) *Nostoc*

ix. A group of individuals of the same species is known as _____.

(a) species diversity (b) genus (c) variety (d) population

x. _____ is highly influenced by the size and shape of the quadrats studied

(a) density (b) frequency (c) relative density (d) vulnerability

Q.1 (B) Answer in one or two sentences **10**

i. What is sap wood ?

ii. What is phellogen?

iii. Define vernalization.

iv. What are edaphic factors?

v. What is transpiration?

Q. 2 Answer any two of the following. **20**

i. Explain the following with the help of neat and labeled diagram:

a. Lenticels b. Tylosis

ii. What are vascular bundles? Give an account of different types of closed vascular bundles.

iii. Explain in brief, distribution of mechanical tissues with respect to inextensibility in roots.

iv. Enlist the components of xylem and explain their role as mechanical tissues.

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Q. 3 Answer any two of the following. **20**

i. Describe the different steps involved in glycolysis and add a note on its energetics.

ii. What is Phytochrome? Describe the mode of phytochrome transformation and phytochrome action.

iii. Differentiate between aerobic & anaerobic respiration.

iv. Describe the Citric acid cycle in plants

Q. 4 Answer any two of the following. **20**

i. What are quantitative characters of community? Explain in detail any two characters.

ii. Describe ecological factors.

iii. What is weathering? Give an account of Physical, chemical and biological weathering.

iv. What are Raunkiaer's life forms? Explain in detail the types of life forms.

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

i. Collenchyma as mechanical tissue

ii. growth rings

iii. Schematic diagram of ETS

iv. Differentiate between Pr and Pfr

v. Soil air

vi. Stratification

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SyBSc - Semester - IV
Botany Paper - II
27/04/2018

Q. P. Code: 31986

3Hrs. Total Marks: 100

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

Q.I (A) Choose the correct option from the following and rewrite the sentence. 10

1. Trichosclereids are found in _____.

(a) xerophytes (b) Hydrophytes

(c) Hygrophytes (d)Epiphytes

2. Phloem sclerenchyma are also known as _____.

(a) hard fibres (b) bast fibres

(c) medullary rays (d) medullary fibres

3. In root, vascular bundles are _____.

(a) collateral, open (b) Collateral, closed

(c) radial (d) concentric

4. _____is the energy currency of the cell.

(a) Glucose (b) DNA (c) ATP (d) Enzymes

5. The response of plants to the photoperiod expressed in the form of flowering is called as _____.

(a) Photosynthesis (b) Photoperiodism

(c) Vernalization (d) Respiration

6. The effect of cold treatment may be reversed by high temperature, this phenomenon is called _____.

(a) Devernalization (b) Vernalization

(c) Chilling effect (d) Temperature substitution

7. Photorespiration results into loss of photosynthetic productivity in_____ plants

(a) C_3 (b) C_4 (c) CAM (d) Intermediate

8. _____are absolutely essential for the normal growth of the plant.

(a) Rocks (b) Salts (c) Nutrients (d)Sulphates

9. The study of the relationship of plants and animals making up a natural community is called _____.

(a) Community ecology (b) autoecology

(c) population ecology (d) succession

10. General appearance of vegetation is referred to as _____

(a) Physiognomy (b) life forms

(c) pioneer colonizer (d) ecesis

Q.I (B) Answer in one or two sentences **10**

1. Define Dendrochronology.

2. What are the types of collateral vascular bundles?

3. Explain the role of Rubisco in photorespiration.

4. What is water holding capacity.

5. Enlist any two environmental factors.

Q.II Answer any two of the following. **20**

1. Give a detailed account of periderm formation. Add a note on lenticels.

2. Describe mechanical tissues observed in stems giving suitable examples.

3. Explain the formation of growth rings in woody perennial plants.

4. With the help of suitable diagrams, describe secondary growth in a typical dicot root.

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Q. III Answer any two of the following. 20

1. Explain the mechanism of action for phytochromes in SDPs and LDPs.

2. Explain the importance of vernalization in plants.

3. Give an account of TCA cycle and explain its significance in plants.

4. What is terminal oxidation? Describe the process with reference to respiration in plants.

Q.IV Answer any two of the following. 20

1. What are ecological factors? Explain any three edaphic factors.

2. Give a detail account of Raunkiaer's life form.

3. What is soil profile. Write a note on the components of soil profile.

4. Discuss Community Ecology in detail.

Q. V Write short notes on any four 20

1. Xylem as mechanical tissue

2. Shearing stress

3. Physico-chemical property of phytochrome

4. Significance of photoperiodism

5. Species diversity

6. Soil humus

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SyBSc - Semester IV
Botany - Paper III
02/05/2018

Q. P. Code : 33021

Duration: Three Hours **Marks: 100**

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

Q.1. A. Choose the correct option from the following and rewrite the sentence. **10**

i. The branch of horticulture which deals with fruit cultivation is called _____.
a) olericulture b) pomology c) floriculture d) arboriculture

ii. Area separating garden from its surrounding is _____.
a) path b) lawn c) hedge d) edge

iii. Lloyd Botanical Garden is located at_____.
a) Kolkata b) Lucknow c) Darjeeling d) Shillong

iv. To carry out aseptic work, _____ instrument is commonly used.
a) autoclave b) laminar air flow c) illuminated rack d) swab of alcohol

v. Restriction enzymes are used to _____ DNA.
a) modify b) join c) cut d) hybridize

vi. The term 'Totipotency' was given by _____.
a) T.H. Morgan b) G. Haberlandt c) Schwann d) De Robertis

vii. The statistical tool used to evaluate the difference between observed and expected data is called as _____.
a) Chi square test b) Coefficient of correlation c) Z test d) t- test

viii. Coefficient of correlation can range from ____.
a) -1 to +1 b) -1 to +10 c) -10 to +1 d) -2 to +2

ix. NCBI stands for :
a) National Centre for Bioinformatics Institute b) National Centre for Biotechnology Information
c) National Centre for Bioinformatics Information d) National Council for Biotechnology Institutes

x. _____ compares a nucleotide query sequence against a nucleotide sequence database.
a) blastp b) blastn c) blastx d) tblastn

Q.1. B. Answer the following in one or two sentences. **10**

i. Mention botanical names of any two plants suitable for hedge.
ii. What is organogenesis?
iii. Write any two characteristic features of pUC- 18 plasmid.
iv. What do you mean by perfect positive correlation?
v. What do you mean by blastp?

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

i. Define botanical garden. Add a note on Veermata Jijabai Bhosale Udyan.
ii. Describe water garden and focal point.
iii. Highlight the importance of horticulture. Add a note on Lawn.
iv. Citing suitable examples of plants, explain the following-
a) Edge b) Path c) Flower bed d) Avenue

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

i. Explain the basic requirements to set up a plant tissue culture laboratory.
ii. Describe the process of root culture. Add a note on it's importance.
iii. Describe the technique of gene cloning.
iv. Define sterilization. Describe different methods of sterilization used in Plant Tissue Culture techniques.

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

i) The following are the length in cm and number of seeds in bean pods.

Length (cm)	8	9	10	9	8	8	9	10	10	9	10
Number of seeds	6	7	7	7	5	6	5	6	6	7	8

Calculate the coefficient of correlation and comment on the result.

ii) In a certain plant, red colour of flower is dominant to white colour of flower. When two heterozygote red flowered plants were crossed, 110 red flowers and 40 white flowers were obtained.

Calculate X^2 to test the hypothesis for Mendelian monohybrid 3:1 ratio.
(Given , tabulated X^2 at 5% significance =3.84)

iii) Give an account of bioinformatics programme in India.
iv) What is a Database? With reference to Database organization, explain the different types of Databases used in bioinformatics.

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

i. Informal Garden.
ii. Objectives of horticulture.
iii. PGRs used in Plant Tissue Culture.
iv. Reverse transcriptase.
v. Steps involved in the working procedure of chi-square test.
vi. Services offered by ENTREZ

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SyBSc - Semester-IV
Botany Paper-III
03/05/2018

Q. P. Code : 33020

[Time: Three Hours] [Marks: 100]

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

Q .1(A) Choose the correct option from the following and REWRITE the sentence. 10

i) The area of land on which fruit trees are cultivated in a significant density is called _____
a) field
b) orchard
c) nursery
d) park

ii) _____ help demarcating the garden from public road and adjacent buildings
a) edges
b) Pergola
c) hedges
d) Arches

iii) Jijamata Udhyan is located in _____
a) Mumbai
b) Kolkata.
c) Delhi
d) Banglore.

iv) An appropriate plant for the purpose of fencing is _____
a) *Rosa*
b) *Poa*
c) *Ziziphus*
d) *Petunia*

v) _____ is commonly used as sterilizing agent for Plant Tissue Culture.
a) Sodium chloride
b) Sodium hypochlorite
c) Sodium sulphate
d) Barium chloride

vi) _____ is added to prevent browning of culture medium.
a) Vitamin E
b) Vitamin C
c) Vitamin A
d) Vitamin K

vii) Plasmid pBR-322, in this naming BR stand for _____.
a) Baskin and Robins
b) Bolivar and Rodges
c) Brooklyn and Rose
d) Bolivar and Rodriguez

viii) In perfect negative correlation, the two variables are _____ proportional to each other.
a) directly
b) inversely
c) not
d) all of these

ix) DDBJ is located in _____
a) Austria
b) USA
c) Japan
d) London

x) OMIA stands for _____.
   a) Online Mendelian Inheritance in Apes
   b) Output of Mendelian Inheritance in Apes
   c) Online Mendelian Inheritance in Animals
   d) None of these

Q .1(B) Answer the following in a sentence or two. 10

i) Mention the types of Informal gardens
ii) What is anther culture?
iii) Write any two characteristic features of Ti plasmid
iv) What is *Goodness of fit* test?
v) What is blastx?

Q. 2. Answer any two of the following 20

i) With reference to suitable examples, explain- a) Edge b) Water garden c) Avenue d) Flower bed
ii) What is a botanical garden? Discuss its important functions.
iii) Write an account of different branches of horticulture with suitable examples
iv) Write an essay on Veermata Jijabai Bhonsle Udyan (VJBU).

Q. 3. Answer any two of the following 20

i) Give an account of laboratory organization for plant tissue culture.
ii) Define totipotency. Discuss the importance of totipotency in Plant Tissue Culture.
iii) What are cloning vectors? Give an account of different vectors used in r-DNA technology.
iv) Give a detailed account of different enzymes used in gene cloning process.

Q. 4. Answer any two of the following 20

i) Calculate the coefficient of correlation of the following data and Comment on the result

X	1	2	3	4	5	6	7	8	9
Y	10	11	12	14	13	15	16	17	18

ii) In a cross between two heterozygous tall (Tt) plants, 1574 tall and 554 dwarf plants were obtained. Suggest if the ratio is suitable for 3:1 ratio or not.
(Given tabulated value at 5% significance, X^2=3.84)

iii) What is internet? How is it useful to mankind?

iv) Write an account of different types of tools related to biotechnology used in bioinformatics.

Q. 5. Write short notes on any FOUR of the following. 20

i) Informal Garden
ii) Sanjay Gandhi national park
iii) PGRs used in PTC
iv) Micropropagation
v) Types of BLAST
vi) EBI

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S.Y.B.Sc - Semester - IV
Physics - Paper - I
25/04/2018

Q.P.Code: 34643

[Time: 3 Hours] [Marks: 100]

N.B: **(1) All questions are compulsory.**
(2) Figures to the right indicate maximum marks.
(3) Use of non-programmable calculators is permitted.
(4) Symbols used have their usual meaning.

Q 1 A **Select the correct option** 12

(i) To observe diffraction , size of the aperture

(a) Should be of the same order as wavelength of light

(b) Should be much smaller than the wavelength of light

(c) Should have no relation with the wave length of light

(d) Should be exactly $\lambda/2$

(ii) In Fraunhofer diffraction due to a single slit, the screen is placed at a distance of 1m from the slit and the slit is illuminated by light of wavelength 5893Å. If the separation between the central maximum and the first minimum is 0.5893cm, then the slit width is

(a) 10^{-4} (b) 10^{-3} (c) 2 mm (d) 10^{-5} m

(iii) Liquid crystal devices are based on the phenomenon of _____

(a) Interference (b) Reflection (c) Polarization (d) Diffraction

(iv) Huygen explained the phenomenon of double refraction on the basis of _____.

(a) Secondary wavelets (b) Dispersion (c) Scattering (d) Interference

(v) The time period of the input clock signal to a 3 bit ripple counter is 0.1ms. What is the time period of the output of the last flip flop ?

(a) 0.3 (b) 0.8ms (c) 0.4 ms (d) 0.025ms

(vi) Hex number 111 represents _____ in decimal.

(a) 7 (b) 6F (c) 273 (d) 1101111

B **Answer in one sentence:** (3)

(i) Why do we use lenses in Fraunhofer diffraction?

(ii) What is a polarizer?

(iii) How are the clock signals applied in a synchronous counter ?

TURN OVER

C **Fill in the blanks** (5)

(i) An arrangement consisting of a large number of equidistant narrow parallel rectangular slits of equal width separated by equal opaque portions is called a _____

(ii) Diffraction is due to the superposition of _____ wavelets originating from different parts of the same wave front

(iii) Superimposition of a linearly polarized and unpolarized light, results in the formation of _____ _____ light.

(iv) _____ is a device used to detect the vibration of linearly polarized light.

(v) Binary 1011 is equal to decimal .....

Q2 A **Attempt any one** 8

(i) Explain the diffraction due to a narrow wire. Obtain the expression for the interference band width formed in the geometrical shadow of the wire. Explain with relevant diagram the intensity distribution in the shadow for the thin wire and for the thick wire.

(ii) Explain the interference phenomenon occurring in Fraunhofer double slit set up. Prove that angular separation for two consecutive minima or two consecutive minima is equal to $\frac{\lambda}{(a+b)}$

B **Attempt any one** 8

(i) What are half-period zones? Show that the radii of half period zones are proportional to the square roots of natural numbers and the area of each half period zone is $\pi b\lambda$.

(ii) In case of Fraunhofer diffraction due to a single slit, show that the intensity at any point on the screen is proportional to $\left(\frac{\sin\alpha}{\alpha}\right)^2$ where α is the phase difference between the secondary waves from the two ends of the slit. Draw the intensity distribution curve for this type diffraction.

C **Attempt any one** 4

(i) Light of wavelength 5896 Å was allowed to fall normally on a plane diffraction grating having 15000 lines per inch. Calculate the difference in the angles of diffraction in the first and second order.

TURN OVER

C **Fill in the blanks** (5)

(i) An arrangement consisting of a large number of equidistant narrow parallel rectangular slits of equal width separated by equal opaque portions is called a _____

(ii) Diffraction is due to the superposition of _____ wavelets originating from different parts of the same wave front

(iii) Superimposition of a linearly polarized and unpolarized light, results in the formation of _____ _____ light.

(iv) _____ is a device used to detect the vibration of linearly polarized light.

(v) Binary 1011 is equal to decimal .....

Q2 A **Attempt any one** 8

(i) Explain the diffraction due to a narrow wire. Obtain the expression for the interference band width formed in the geometrical shadow of the wire. Explain with relevant diagram the intensity distribution in the shadow for the thin wire and for the thick wire.

(ii) Explain the interference phenomenon occurring in Fraunhofer double slit set up. Prove that angular separation for two consecutive minima or two consecutive minima is equal to $\frac{\lambda}{(a+b)}$

B **Attempt any one** 8

(i) What are half-period zones? Show that the radii of half period zones are proportional to the square roots of natural numbers and the area of each half period zone is $\pi b\lambda$.

(ii) In case of Fraunhofer diffraction due to a single slit, show that the intensity at any point on the screen is proportional to $\left(\frac{\sin\alpha}{\alpha}\right)^2$ where α is the phase difference between the secondary waves from the two ends of the slit. Draw the intensity distribution curve for this type diffraction.

C **Attempt any one** 4

(i) Light of wavelength 5896 Å was allowed to fall normally on a plane diffraction grating having 15000 lines per inch. Calculate the difference in the angles of diffraction in the first and second order.

(ii) A light of wavelength 4500 Å illuminates a narrow rectangular slit placed at a distance of 0.2m from a straight edge. Calculate the separation first and the second bright band produced on a screen at a distance of 0.5m from the straight edge.

Q3 A **Attempt any one** 8

(i) Explain the formation of linearly polarized light from unpolarized light through Refraction with a neat diagram.

(ii) Give the properties of calcite crystal. What is optic axis? Explain the double refraction in calcite crystal.

B **Attempt any one** 8

(i) What is a Retarders or wave plates? Explain construction of Quarter wave plate .Obtain the equation of the thickness of the quarter wave plates for a given 'λ'.

(ii) Discuss theoretically the superposition of two linearly polarized light wave propagating in the same direction having same frequency when the optical vectors are mutually perpendicular to each other for phase difference of odd and even multiple of π.

C **Attempt any one** 4

(i) For quartz crystal μ_o=1.55085 and μ_E=1.54181. Determine the thickness of a half wave plate for the Fraunhofer (line) of wavelength 6563 A^0.

(ii) A light of wavelength 5890A^0 passes through 1.47×10^{-2} mm thick double refractive plate. The plate produces a path difference of λ/4 between the ordinary and extraordinary ray, calculate the difference in their refractive indices.

Q4 A **Attempt any one** 8

(i) With the help of diagram and truth table explain the working of RS flip using NAND gates . Draw the logic symbol of RS flip flop and show how it is converted into D flip flop . Write the truth table for D flip flop

(ii) X and Y are two binary numbers X = 11010 and Y = 10110 . Use 2' complement method to find X – Y and Y – X . In which case is answer positive? When the answer is negative, find the magnitude of the answer.

TURN OVER

B		**Attempt any one**	8
	(i)	Draw a circuit diagram of three bit asynchronous counter. Write its working and truth-table. Draw the necessary waveforms	
	(ii)	What is a shift register ? Give the full form of SISO and SIPO in shift registers . Describe 4 bit SIPO shift register in detail. Draw necessary diagram.	
C		**Attempt any one**	4
	(i)	Draw the circuit diagram and write the truth table for a mod 5 binary counter.	
	(ii)	Explain the concept of toggle in negative edge triggered JK flip flop ? What are the required values of J and K inputs for the output to toggle in JK flip flop ?	
Q 5		**Attempt any four**	20
	(i)	Derive expression for the angular width of a principal maximum generated by a plane diffraction grating.	
	(ii)	Derive an expression for the width of central maximum in case of single slit Fraunhofer diffraction.	
	(iii)	State the five applications of polarized light.	
	(iv)	Two equations representing two waves are a) $E_x = E_1 \cos(\omega t - kx)$, $E_y = 0$ b) $E_x = E_2 \cos(\omega t - kz)$, $E_y = \cos(\omega t - kz - \pi/2)$ Determine the state of polarization in each case.	
	(v)	Convert decimal 166 . 80 into hexadecimal system . Convert hexadecimal C3 into binary system.	
	(vi)	With the help of logic symbol for JK flip flop , show how do you construct JK master slave flip flop? Taking the example of the inputs J = 0 , K =1 , explain why it is called master slave flip flop ?	

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Sybsc - Semester - IV
Physics - Paper - II
27/04/2018

Q. P. Code: 34744

(3 Hours) [Total Marks: 100

N.B: (1) All questions are compulsory.
(2) Figures to the right indicate maximum marks.
(3) Use of non-programmable calculators is permitted.
(4) Symbols used have their usual meaning.

Q 1 A **Select the correct option** 12

(i) ψ must be .....at all points where the particle can be present.

a. finite b. infinite c. zero d. unity

(ii) A wave function satisfying the condition $\int \psi^* \psi dV = 1$ is called as .....wave function.

a. normalized b. standard c. varying d. stationary

(iii) The potential energy of a free particle is
(a) infinite (b) zero (c) half of the total energy
(d) twice the total energy

(iv) If the energy in the first excited state of a particle confined to a one dimensional infinitely deep potential well is 4eV then its energy in the ground state is

(a) 2eV (b) 1eV (c) 3eV (d) 4eV

(v) The phenomenon of α-particle emission from the nucleus is due to _____

(a) tunneling (b) bombardment
(c) emission d) fission

(vi) In transmission across a potential barrier _____

(a) R=0 (b) T=0
(c) R+T=1 d) R=T

B **Answer in one or two sentences:** (3)

(i) Define non degenerate states.
(ii) What is meant by a step potential?
(iii) What is Zero point energy?

C **Fill in the blanks** (5)

(i) H^ is called as ..... Operator.

(ii) Quantum mechanics is .....in nature.

(iii) Any linear combination of degenerate energy eigenfunctions is an eigenfunction of _____ eigenvalue.

(iv) The solution to the one dimensional time dependent Schrodinger equation for a free particle is a plane wave propagating along the _____ x-direction.

(v) In quantum mechanics, the transmission coefficient has small but _____ value.

Q2 A **Attempt any one** 8

(i) What is meant by superposition of wave functions? Show that the wave functions obey the principle of superposition but the corresponding probability densities do not obey.

(ii) Derive Schrodinger's time independent equation.

B **Attempt any one** 8

(i) What are operators? Discuss their role in quantum mechanics. Explain Hamiltonian operator.

(ii) Derive equation of continuity in quantum mechanics and discuss its significance.

C **Attempt any one** 4

(i) what is meant by normalization of wave function?.

(ii) Given $\frac{\partial^2 y}{\partial x^2} = -k^2 y$, explain how k is related to y.

Q3 A **Attempt any one** 8

(i) Write the one dimensional time dependent Schrodinger Equation for a free particle. Obtain its general solution and interpret it.

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(ii) What is meant by a one dimensional infinitely deep potential well? Obtain an expression for the allowed energy levels and the corresponding eigenfunctions for a particle of mass 'm' in such a potential.

B **Attempt any one** 8

(i) What is meant by a particle in a one dimensional finitely deep potential well? Set up the Schrodinger equation for such a particle and solve it to obtain an expression for the energy eigenfunctions.

(ii) Set up the Schrodinger time independent equation for a particle approaching a step potential with energy greater than the height of the step. Solve the equation and obtain expressions for the reflection and transmission coefficients. Comment on the result.

C **Attempt any one** 4

(i) Find the degeneracy of the energy level of a particle of mass 'm' in a cubical box of edge L when its energy is 14 $(\frac{\hbar^2}{8mL^2})$

(ii) Prove that all energy eigenvalues are real.

Q4 **A** **Attempt any one** 8

(i) a) Solve the liner Harmonic Oscillator equation and obtain an expression for energy eigen values.
b) Calculate the Zero point energy of system consisting of a mass of 1 gm fixed to a spring which is stretched by 1 cm by a force of 10,000 dynes, the movement being constraint only along X-axis.

(ii) State and explain the correspondence principle with the help of probability density plot. Draw necessary diagrams.

B **Attempt any one** 8

(i) For a potential well of finite height and width mark the three regions. Obtain the wave functions in these three regions. Also explain the Tunnel effect.

(ii) With help of Tunnel effect, explain the phenomenon of α-decay. Show that the decay constant depends on the transition probability.

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C **Attempt any one** 4

(i) For an electron beam of energy 3eV incident on a potential barrier of height 4eV. Width of the barrier is 20Å. Calculate the percentage transmission of the beam through the barrier.

(ii) Anα-particle having energy 10 MeV approaches a potential barrier of height 30 MeV. Find the width of the barrier potential if the transmission coefficient is $2x10^{-3}$. Given mass of the α-particle is 4 amu.

Q 5 **Attempt any four** 20

(i) Normalize the following wave function:

$$\psi_n = sin\frac{n\pi x}{l} \; ; \; 0 < x < l, \text{ n is an integer.}$$

(ii) Find the expectation value of x for a wave function

$$\psi(x) = \sqrt{\frac{2}{l}} sin\frac{\pi x}{l}; 0 < x < l$$

(iii) Calculate the probability that a particle in a one dimensional infinitely deep potential well of width 'L' can be found between 0.45 L and 0.55 L in the ground state.

(iv) A beam of monoenergetic particles of energy E_0 each approaches a potential step of height V_0. Find the ratio $\frac{E_0}{V_0}$ for which the coefficient of transmission is 50%.

(v) In the limit of large quantum number quantum physics yields the same result as the classical physics. Explain.

(vi) Give the relation between the reflection and transmission coefficient of a particle incident on a barrier of finite height and width.

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SyBSc- Semester IV
Physics - Paper III
03/05/2018

Q.P Code 34649

[Time: 3 Hrs.] [Total Marks: 100]

N.B: (1) All questions are compulsory.
(2) Figures to the right indicate maximum marks.
(3) Use of non-programmable calculators is permitted.
(4) Symbols used have their usual meaning.

Q 1 A Select the correct option 12

(i) In India the magnetic declination ranges from _____
(a) -2^0 to 3^0 (b) -12^0 to 13^0 (c) -22^0 to 23^0 (d) -32^0 to 33^0

(ii) _____ word means all earth.
(a) Pangea (b) Gondwanaland (c) Laurasia (d) Lunar

(iii) The 8085 microprocessor is ---- bit processor.
(a) 64 b) 16 c) 8 d) 32

(iv) A register in the microprocessor that keeps track of the answer or results of any arithmetic or logic operation is the:
(a) Program Counter (b) accumulator
(c) Stack Pointer (d) All of these

(v) In Electromagnetic spectrum which of the following will have highest Frequency
(a) Radio Waves (b) Micro Waves
(c) Infrared Waves (d) Ultraviolet Waves

(vi) Frequency modulation is _____
(a) Modulation of analog carrier by an analog signal
(b) Modulation of analog carrier by a digital signa
(c) Modulation of digital carrier by an analog signal
(d) Modulation of digital carrier by a digital signal

B Answer in one sentence: 3

(i) What is the relation between Tesla and Gauss?
(ii) What will happen if HLT instruction is executed in 8085 processor?
(iii) Write down any two units used to measure Radiation.

C Fill in the blanks 5

(i) The theory of continental drift was proposed by _____.
(ii) _____ is the most abundant element in the earth's crust.
(iii) There are ---------- addressing modes.
(iv) After performing arithmetic operation, the Zero flag will be set when the contents of the accumulator is ------.
(v) The process of recovering the information signal from the modulated wave is known as_____.

Q2	A		**Attempt any one**	8
		(i)	Explain the variation of the following physical properties in the interior of the earth a) Temperature b) Pressure c) Density d) Gravity	
		(ii)	Explain the cause of earthquakes. How are they measured? How can they be predicted?	
	B		**Attempt any one**	8
		(i)	Explain the major divisions of the internal structure of the earth.	
		(ii)	Explain gravity and magnetic anomalies. How the study of these anomalies does helps in understanding geophysics?	
	C		**Attempt any one**	4
		(i)	Explain the types of Seismic waves.	
		(ii)	Describe the theory of convection currents to explain continental drift.	
Q3	A		**Attempt any one**	8
		(i)	Explain with suitable examples various addressing modes of 8085 microprocessor.	
		(ii)	Write an assembly language program to multiply two 8-bit hexadecimal numbers by successive addition method.	
	B		**Attempt any one**	8
		(i)	What is bus? Explain the structure and functions of address bus, data bus and control bus in reference to 8085 microprocessor.	
		(ii)	Write the 8085 instructions to: 1. Load 90H in the accumulator. 2. Add 32H to the contents of accumulator. 3. Initialize stack pointer to FF00H. 4. Rotate accumulator left through carry. 5. Store the contents of the accumulator into memory location E500H. 6. Transfer the program control to memory location D500H if carry flag is set. 7. Complement the content of the accumulator. 8. Stop program execution	
	C		**Attempt any one**	4
		(i)	Write a program to add AAH and 55H. Comment on the result obtained.	
		(ii)	Write the ALP to Subtract the contents of memory location 4001H from the memory location 4000H and place the result in memory location 4002H. (assume that there is no borrow)	

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Q4	A		**Attempt any one**	8
		(i)	Explain β & γ radiation with suitable example.	
		(ii)	Explain tuned radio frequency receiver along with block diagram. What are its shortcomings?	
	B		**Attempt any one**	8
		(i)	What is Dosimetry & TLD? Describe the principle and working of a TLD.	
		(ii)	Obtain an expression for noise factor. The signal to noise ratio at the input of a receiver is 3.7dB. If the signal power is 1.5 microwatt. Find noise power.	
	C		**Attempt any one**	4
		(i)	The half-life of radioactive material is 40 Hrs. Calculate its Decay Constant & Mean Life.	
		(ii)	What should be the farthest distance from a 64-metre-high transmitting tower from another tower of same height for effective line of sight communication? If the height of tower is increased four times, what will be the farthest distance?	
Q5			**Attempt any four**	20
		(i)	What are meteorites? Explain their types	
		(ii)	Write a short note on: Geophysical surveys.	
		(iii)	What are the functions of the accumulator?	
		(iv)	Write an ALP to load 77H in registers B and 90H in the accumulator. Swap the data between these two register.	
		(v)	What is Radiation? Explain Any two of its applications.	
		(vi)	Explain three ways in which radio waves are transmitted in space communication.	

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SyBsc - Semester - IV

Mathematics - Paper - I

24/04/2018

Q. P. Code: 34468

(3 Hours) [Total Marks : 100]

N.B. 1. All questions are compulsory.

2. Figures to the right indicate marks for respective parts

3. Use of Calculator is not allowed.

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

i. Which of the following sequence does not have convergent subsequence

(a) $((-1)^n)$) (b) 1, 2, 1, 3, 1, 4, 1, 5 ... ...

(c) (n^2) (d) None of these

ii. Which of the following sets is uncountable

(a) set of all even natural numbers (b) Interval [0, 9]

(c) $A = \{1, 2, 5, 7\}$ (d) None of these

iii. The set A that has the property that "For every family of open intervals $G \equiv \{J_\alpha : \alpha \in \Lambda\}$ such that $A \subseteq \bigcup_{\alpha \in \Lambda} J_\alpha$ there exists a finite subset F of Λ such that $A \subseteq \bigcup_{\alpha \in F} J_\alpha$" is _____. (i.e. The set A for which every open cover of A has a finite subcover; is _____)

(a) $\mathbb{R}$ (b) $\mathbb{N}$

(c) [1, 2] (d) None of these

iv. The rational representation of 0.66.....66... is

(a) 1/9 (b) 1/3

(c) 33/50 (d) None of these

v. S1 : A continuous function on closed and bounded interval is integrable.

S2 : A monotonic function on closed and bounded interval is integrable.

S3 : An integrable function on closed and bounded interval is continuous

S4 : An integrable function on closed and bounded interval is monotonic.

(a) S1, S2, S3, S4 are always true. (b) S1, S2, S3, S4 are always false.

(c) S1, S2 are always true but S3, S4 need not be true. (d) None of these

vi. Let f and g be functions such that function $f + g$ is integrable on I, then

(a) Both f and g must be integrable on I (b) At least one of f and g must be integrable on I

(c) f and g may or may not be integrable on I (d) None of these

vii Let $f : [0,100] \to \mathbb{R}$ be defined as $f(x) = \lfloor x \rfloor$, (Where $\lfloor x \rfloor$ is floor function of x). Then

(a) f is discontinuous hence not R-integrable. (b) f is R-integrable and $\int_0^{100} f(x)dx = 5000$

(c) f is R-integrable and $\int_0^{100} f(x)dx = 4950$ (d) None of these

viii Description of the region D bounded by $x^2 + y^2 = 1$ in fourth quadrant is

(a) $D = \{(r,\theta): 0 \le r \le 1, 3\pi/4 \le \theta \le 2\pi\}$ (b) $D = \{(r,\theta): 0 \le r \le 2, \pi/2 \le \theta \le \pi\}$

(c) $D = \{(r,\theta): 0 \le r \le 1, 0 \le \theta \le \pi\}$ (d) None of these

ix. The average value of the function $f(x,y) = 10$ over the region D bounded by straight lines $x = 1, x = 2, y = 2$ and $y = 4$ is

(a) 5 (b) 2

(c) 10 (d) None of these

x. Let $F: [3,5] \to \mathbb{R}$ defined by $F(x) = \int_3^{x^2} t^2 dt$ then $F'(x) =$

(a) x^5 (b) $2x^5 - 1/3$

(c) $2x^5$ (d) None of these

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

i. Using Nested Interval Theorem prove that if $f: [a,b] \to \mathbb{R}$ is a continuous function with $f(a).f(b) < 0$, then there exists $c \in (a,b)$ such that $f(c) = 0$.

ii. State and prove Nested Intervals Theorem in $\mathbb{R}$.

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

i. Let $A = \left(0, \frac{3}{4}\right]$. Show that for a family of open intervals $G \equiv \left\{\left(\frac{1}{n+3}, \frac{1}{n}\right) : n \in \mathbb{N}\right\}$, $A \subseteq \bigcup_{n=1}^{\infty} J_n$ but there does not exist a finite subset $F \subseteq \mathbb{N}$ such that $A \subseteq \bigcup_{n \in F} J_n$. (i.e. Show that G is an open cover of A, but it doesn't have a finite subcover.)

ii. If $I_n = \left[0, \frac{1}{n}\right]$ for all $n \in \mathbb{N}$, then prove that $\bigcap_{n=1}^{\infty} I_n = \{0\}$.

iii. If the function $f: (0,1) \to \mathbb{R}$ is continuous and injective on $(0,1)$, then using Intermediate value theorem, prove that f is strictly monotonic on $(0,1)$.

iv. Using Nested Intervals Theorem prove that closed interval [0,1] is uncountable.

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

i. Let $f: [a,b] \to \mathbb{R}$ be a bounded function with $m = Inf\ (f)$ and $M = Sup(f)$ on $[a,b]$. With usual notations, define $L(P,f)$ and $U(P,f)$ where P is a partition of $[a,b]$. Hence prove that

$$m(b-a) \leq L(P,f) \leq U(P,f) \leq M(b-a).$$

ii. Let $f:[a,b]\to\mathbb{R}$ be an integrable function and let $k>0$ be a real number. Prove that kf is also an integrable function on $[a,b]$ and $\int_a^b kf = k\int_a^b f$

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

i. Let $f:[1,2]\to\mathbb{R}$ be defined by $f(x)=3x^2$ and let P_n be a partition of $[1,2]$ where $P_n=\left\{1,1+\frac{1}{n},1+\frac{2}{n},\cdots,1+\frac{n-1}{n},2\right\}$. Calculate $U(P_n,f)$ and $L(P_n,f)$.

ii. Let $f:[0,2]\to\mathbb{R}$ be defined as follows

$$f(x)=\begin{cases}1 & if\ \ 0\le x<1\\ 2 & if\ \ 1\le x<2\\ 3 & if\ \ x=2\end{cases}$$

Let $P=\{0,1-\delta,1+\delta,2-\delta,2\}$ be a partition of $[0,2]$ such that the sub-parts of P do not overlap, where $\delta>0$ is a real number. Sketch a graph of f and Compute $L(P,f)$, $U(P,f)$. Using Riemann's criteria, check if f is R-integrable.

iii. Let $f:[a,b]\to\mathbb{R}$ be a monotone function. Then show that f is Riemann integrable on $[a,b]$.

iv. Let $f:[a,b]\to\mathbb{R}$ be an integrable function. Prove that $|f|$ is also integrable on $[a,b]$. Is the converse true? Justify.

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

i. State and prove Second fundamental theorem of integral calculus.

ii. Prove that the integral $\int_0^1 x^{m-1}(1-x)^{n-1}\,dx$ exists if and only if m and n are both positive.

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

i. State Fubini's theorem for a function f defined on a rectangular region. Also calculate $\iint_D f(x,y)dA$ where $f(x,y)=x+y$ and D is region bounded by $y=x^2$ and $y=4-x^2$.

ii. Discuss convergence of each of the following:

I) $\int_2^\infty \frac{x^2+x+1}{x^4+3x+1}dx$. (II) $\int_0^1 \frac{dx}{\frac{1}{x^2}(1+x^2)}$

iii. Let $f: [a, b] \to \mathbb{R}$ be a continuous function. Prove that there exists $c \in [a, b]$ such that $\int_a^b f(x)\, dx = f(c)(b - a)$.

iv. Find center of mass of a thin plate bounded by $x^2 + y^2 = 4$ and whose density function is given as $\delta(x, y) = 5$.

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

a) State Bolzano Weierstrass theorem for sequences and find a convergent subsequence of $(\sin\frac{n\pi}{2})$

b) Show that 0.23 and 0.229....9... represent the same rational number.

c) Let $P = \{0, 0.5, 1, 1.5, 2\}$ be a partition of $[0, 2]$ and $f : [0, 2] \to \mathbb{R}$ is a function such that $f(x) = 4x - 3$. Find the upper sum $U(P, f)$ and lower sum $L(P, f)$.

d) Let $f: [0, 1] \to \mathbb{R}$ defined by $f(x) = \begin{cases} 1 & \text{if } x \in [0, 1] \cap \mathbb{Q} \\ -1 & \text{if } x \in [0, 1] \setminus \mathbb{Q} \end{cases}$

Compute Lower integral $L(f)$ and Upper integral $U(f)$ and hence check if f is Riemann integrable on [0,1].

e) Use definition to show that $\int_0^\infty \frac{1}{x^2+1} dx$ is convergent, and evaluate the integral.

f) Prove the equality $\beta(m, n) = \beta(n, m) = 2\int_0^{\pi/2} sin^{2m-1}\theta\, cos^{2n-1}\theta\, d\theta$.

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SyBSc - Semester IV
Mathematics - Paper II
26/04/2018

Q.P Code: 34518

(3 Hours) [Total Marks: 100

Note: (*i*) All questions are compulsory.
(*ii*)Figures to the right indicate marks for respective parts.

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

i. The order of a D.E. is a

(a) Positive integer (b) Rational number

(c) Negative integer (d) Whole number

ii. $y^2 = cx$ is the general solution of which of the first order O.D.E.?

(a) $y' = \frac{2y}{x}$ (b) $y' = \frac{2x}{y}$

(c) $y' = \frac{y}{2x}$ (d) $y' = \frac{x}{2y}$

iii. The first order O.D.E. $e^x \frac{dy}{dx} + 3y = x^2 y$ is

(a) Variable separable & Bernoulli (b) Variable separable but not Bernoulli

(c) Bernoulli but not variable separable (d) Neither variable separable nor Bernoulli

iv. The equation of the orthogonal trajectories to the family of parabolas $y^2 = 2x + c$ is (Here c & k are arbitrary constants).

(a) $y = ke^{-x}$ (b) $y = ke^{2x}$

(c) $y = ke^{x}$ (d) $y = ke^{-2x}$

v. For existence and uniqueness theorem for $y'' + P(x)y' + Q(x)y = R(x)$, with unique solution $y(x_0)$ on $x_0 \in [a, b]$

(a) P, Q and R should be continuous on $[a, b]$ (b) P and Q should be continuous on $[a, b]$

(c) P or Q should be continuous on $[a, b]$ (d) P and R should be continuous on $[a, b]$

vi. If $y_1(x) = \cos 2\pi x$, $y_2(x) = \sin 2\pi x$, value of Wronskian $W(y_1, y_2)$ is

(a) 0 (b) 1

(c) π (d) 2π

vii. If $y_1(x)$ and $y_2(x)$ are two independent solutions for the equation $y'' + P(x)y' + Q(x)y = 0$ then

(a) $y_1(x) = k\,y_2(x)$ where k is a constant.

(b) $y_1(x)y_2(x) = k$ where k is a constant.

(c) $y_2(x) = u(x)\,y_1(x)$, $u(x)$is not constant.

(d) None of these.

viii. The auxiliary equation of the following linear system of homogeneous differential equations $\begin{cases} \frac{dx}{dt} = a_1x + b_1y \\ \frac{dy}{dt} = a_2x + b_2y \end{cases}$ is

(a) $m^2 - (a_1 + b_2)m + a_1b_2 - a_2b_1 = 0$

(b) $m^2 - (a_2 + b_1)m + a_1b_2 - a_2b_1 = 0$

(c) $m^2 + (a_1 + b_2)m + a_1b_2 - a_2b_1 = 0$

(d) $m^2 - (a_2 + b_1)m + a_2b_1 - a_1b_2 = 0$

ix. The auxiliary equation of the linear system of homogeneous differential equations $\begin{cases} \frac{dx}{dt} = 5x + 4y \\ \frac{dy}{dt} = -x + y \end{cases}$ has

(a) Real and distinct roots

(b) Roots which are complex conjugates

(c) Roots which are real and repeated

(d) No roots

x. (e^{4t}, e^{4t}) and $(e^{-2t}, -e^{-2t})$ are linearly independent solutions of $\begin{cases} \frac{dx}{dt} = x + 3y \\ \frac{dy}{dt} = 3x + y \end{cases}$ then particular solution for which $x(0) = 5, y(0) = 1$ is

(a) $(3e^{4t} + 2e^{4t}, 3e^{-2t} - 2e^{-2t})$

(b) $(4e^{4t} + e^{4t}, 4e^{-2t} - 3e^{-2t})$

(c) $(3e^{4t} + 2e^{-2t}, -2e^{4t} + e^{-2t})$

(d) $(3e^{4t} + 2e^{-2t}, 3e^{4t} - 2e^{-2t})$

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

i. Show that the general solution of the linear first order ordinary differential equation $\frac{dy}{dx} + Py = Q$, where P and Q are continuous functions of x on an interval I , is

$y = e^{-\int P dx}\left(\int Q e^{\int P dx} dx + c\right)$, c being an arbitrary constant.

Hence solve $\frac{dy}{dx} + 2y \cot x = \cot x$.

ii. Suppose that x_0 bacteria are placed in a nutrient solution at time $t = 0$, and that $x = x(t)$ is the population of the colony at a later time t. If food and living space are unlimited, and if as a consequence the population at any moment is increasing at a rate proportional to the population at that moment, find x as a function of t. Further if the population x increases at an overall rate of 0.2% per unit time, find the time required for the population to double. (Given $\log 2 = 0.6931$)

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

i. Show that the following differential equation is non-exact. Hence find an integrating factor and solve.

$$\left(y + \frac{1}{3}y^3 + \frac{1}{2}x^2\right) dx + \frac{1}{4}(x + xy^2)dy = 0$$

ii. Solve: $(15x + 11y)dx + (5y + 9x)dy = 0$

iii. Solve the Bernoulli's Differential equation $x\frac{dy}{dx} + y = x^3y^6$.

iv. Find the orthogonal trajectories of the family of curves $e^x + e^{-y} = c$.

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

i. If $y_1(x)$ and $y_2(x)$ are solutions to the differential equation $y'' + P(x)y' + Q(x)y = 0$ on the interval $[a, b]$, then show that, their Wronskian $W(y_1, y_2) = y_1y_2' - y_2y_1'$ is identically zero if and only if $y_1(x)$ and $y_2(x)$ are linearly dependent.

ii. If $y_1(x)$ is a non-zero solution to the differential equation $y'' + P(x)y' + Q(x)y = 0$, then show that another linearly independent solution $y_2(x)$ is given by

$$y_2(x) = y_1(x) \int \frac{1}{y_1^2} e^{-\int P\,dx}\,dx$$

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

i. Show that $y(x) = ax^2 + bx + 3$ is solution for the equation $x^2y'' - 2xy' + 2y = 6$, hence find hence find a particular solution satisfying $y(1) = 0, y'(1) = 1$

ii. Solve the differential equation

$$\frac{d^2y}{dx^2} + 5\frac{dy}{dx} + 6y = e^{4x}$$

iii. Using the method of variation of parameters solve

$$\frac{d^2y}{dx^2} + 4y = \sin x$$

iv. Define the Wronskian determinant, and hence determine whether the functions $y_1 = x^2$ and $y_2 = \sqrt{x}$ are linearly independent on an interval not containing origin.

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

i. When is a linear system of first order ODE in two variables with constant coefficients said to be homogeneous? What is the auxiliary equation of such a system? State the expressions for the general solution of the system when the roots of the auxiliary equation are (i) Real and distinct, (ii) Complex and (iii) Real and equal.

ii. Define Wronskian $W(t)$ of the two solutions

$\begin{cases} x = x_1(t) \\ y = y_1(t) \end{cases}$ and $\begin{cases} x = x_2(t) \\ y = y_2(t) \end{cases}$ of the homogeneous

system $\begin{cases} \frac{dx}{dt} = a_1(t)x + b_1(t)y \\ \frac{dy}{dt} = a_2(t)x + b_2(t)y \end{cases}$ where a_1, a_2, b_1, b_2 are

continuous functions on $[a, b]$. Show that their Wronskian is either identically zero or nowhere zero on $[a, b]$.

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

i. Obtain the general solution of a system of first order homogeneous linear O.D.E. in two variables and with constant coefficients, when its auxiliary equation has two real and distinct roots.

ii. Solve the following homogeneous linear system:

$$\begin{cases} \frac{dx}{dt} = 5x - 2y \\ \frac{dy}{dt} = 4x - y \end{cases}$$

iii. Solve the following homogeneous linear system:

$$\begin{cases} \frac{dx}{dt} = -4x - y \\ \frac{dy}{dt} = x - 2y \end{cases}$$

iv. Solve the following homogeneous linear system: $\begin{cases} \frac{dx}{dt} = x - 4y \\ \frac{dy}{dt} = x + y \end{cases}$

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

a) Check whether the following differential equation is exact and solve: $(\sec x \tan x \tan y - e^x)dx + (\sec x \sec^2 y)dy = 0$.

b) Solve : $\tan x \sin^2 y\, dx + \cos^2 x \cot y\, dy = 0$

c) Find the particular solution of $y'' + y = 0$ satisfying $y(0) = 2$ and $y'(0) = 3$.

d) Verify that $y = c_1 x^{-1} + c_2 x^5$, is a solution of $x^2 y'' - 3xy' - 5y = 0$ on any interval, not containing the origin.

e) Show that both $\begin{cases} x = e^{4t} \\ y = e^{4t} \end{cases}$ and $\begin{cases} x = e^{-2t} \\ y = -e^{-2t} \end{cases}$ are solutions of the system $\begin{cases} \frac{dx}{dt} = x + 3y \\ \frac{dy}{dt} = 3x + y \end{cases}$. Show that these solutions are linearly independent on every closed and bounded interval.

f) If the homogeneous system $\begin{cases} \frac{dx}{dt} = a_1(t)x + b_1(t)y \\ \frac{dy}{dt} = a_2(t)x + b_2(t)y \end{cases}$ has two \ solutions $\begin{cases} x = x_1(t) \\ y = y_1(t) \end{cases}$ and $\begin{cases} x = x_2(t) \\ y = y_2(t) \end{cases}$ on $[a,b]$, then show that for any real numbers c_1 and c_2, $\begin{cases} x = c_1x_1(t) + c_2x_2(t) \\ y = c_1y_1(t) + c_2y_2(t) \end{cases}$ is also a solution of the system on $[a,b]$.

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SyBSC-Semester-IV
Mathematics-Paper-III
02/05/2018

Q. P. Code : 37612

Duration 3 Hrs

Marks: 100

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

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

(i) What does the symbol ◯ represent in a flow chart?
(a) Input/Output (b) Process (c) Decision Symbol (d) Connector

(ii) What are algorithms and flow charts used for?
(a) Better programming (b) Easy testing
(c) Efficient Coding (d) all (a), (b) and (c)

(iii) If $a = 14$ and $b = 4$, what is the output of
>>> $a\%b$?
(a) 3 (b) 3.5 (c) 2 (d) None of the above

(iv) What is the output of the expression,
>>> $3 * 1 * *3$
(a) 27 (b) 9 (c) 3 (d) 1

(v) Which keyword is used to define a function in Python?
(a) function (b) def (c) define (d) None of these

(vi) What is the output of
>>>int (- 5.9)
(a) −5 (b) −59 (c) −6 (d) None of these

(vii) The statements in the for loop which have to be executed iteratively are
(a) indented (b) enclosed in curly brackets
(c) enclosed in square brackets (d) None of these

(viii) Which of the following functions will be used to add a new element 'x' to the list K?
(a) K.add() (b) K.add('x') (c) K.append('x') (d) K.append()

(ix) Which type of operator will we use to access a part of the string?
(a) { } (b) [ ] (c) < > (d) ( )

(x) What will be the output of the given code?
>>>S = "Hello World"
>>> print len(S)
(a) 11 (b) 12 (c) 10 (d) None of these

2. (a) Attempt any ONE from the following: (8)
(i) Explain any three dimensions basis to analyze a problem.
(ii) What do you mean by data types in Python? Explain the data types numeric, string and boolean.

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

(i) Define a flow chart and state any four rules to draw a flow chart.

(ii) What is an assignment statement. Find errors if any, in the following and rectify them.

(I) >>> $x, y, z = 1, 2.4,$ 'Hi'

(II) >>> $x = 3$
>>> $x+ = 5$

(III) >>> $y = 2$
>>> $y = *6$

(IV) >>> $x =$ sqrt 5

(iii) (I) Explain Concatenation Operator.

(II) Explain Boolean expression.

(iv) (I) Explain relational operators in Python.

(II) If $a = 10, b = 30.75, c = 10$, then find the values of

(1) >>> $(a > b)$ (2) >>> $(a == c)$ (3) >>> $(a! = b + c)$

3. (a) Attempt any ONE from the following: (8)

(i) Explain if, if-else and nested if-else statements in Python. Write the syntax of each.

(ii) Explain recursion in Python. Write a code to display Fibonacci series using recursion function.

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

(i) Write a short note on parameters in Python. Write a program to demonstrate the use of parameterized function.

(ii) Discuss while statement and write a code to display first 10 odd numbers using while statement.

(iii) Write the different steps in adding a new function.

(iv) Find syntax errors if any and correct them.

(I) >>> if $x = 25$:
print 'it is a perfect square'

(II) >>> while $x >= 0$
print " x is non negative"

(III) >>> $2 = y$

(IV) def wish():
print "Good Morning"

(V) >>> for i in range(5):
print i+2:

(VI) >>> x = sqrt 17

4. (a) Attempt any One from the following: (8)

(i) What is a string in Python? Write the Python code for the following and write the output for each print statement.

(I) Store the string Antarctica in a variable called S.

(II) Print the second character of the string S.

(III) Print all characters of the string S from the characters indexed at 3 to the last character.

(IV) Print all characters in the string S appearing before the character r, including r.

(V) Print all characters in the string S starting from the character indexed at 2 to the character indexed at 4 both inclusive.

(VI) Print the last character in the string S.

(ii) What are pop and remove operators in a List? Explain each with an example. Also give one difference between them.

(b) Attempt any Two of the following: (12)

(i) Write a function called search in Python for searching a given character in a given string. Return the index of the character if it is present in the string. Return −1 if the character is not present in the string. The function search has two parameters called name and letter. Call the function to search for the letter 'z' in the string 'Mahabharat'.

(ii) Write the output of the given code?

>>>s1 = "Good Morning"
>>>s2= "Smile please"
>>>print s1[5]
>>>print s1 *3
>>>print s1[2:]
>>>print s1[1: 6]
>>>print s1 + s2
>>>print s2 + "Python"

(iii) L=[10, 20, 30, 40, 50, 60, 70, 80, 90, 100]. Use range function to write a code in Python for the following:

(I) Print the integers 20, 40, 60, 80, 100 from the list L.

(II) Find the sum of the integers 20, 40, 60, 80, 100 from L.

(iv) D is a dictionary with 1, 2, 3, 4 as keys and the respective values are 'Apurva', 'Sushil', 'Milind', 'Samar'. Write a code in Python for each of the following and write the output for every print statement.

(I) Construct and print the dictionary D.

(II) Change the value of the key 3 as 'Mangala' and print the updated dictionary D.

(III) Add the key 5 with value 'Neil' in D and print the updated dictionary D.

5. Attempt any Four from the following: (20)

(a) Draw a flow chart to calculate the factorial of a positive integer n.

(b) Write a code in Python to accept length and breadth of a rectangle from the user. Calculate and print the area and perimeter of the rectangle.

(c) Explain nested loops. Write any one example to explain nested loops by giving commands in Python.

(d) What do you mean by "Lists are mutable"? Explain with an example.

(e) Let T = ['Sarita', 'Manali', 'Vaishali', 'Jyoti', 'Madhura', 'Seema'].
Use slice operator to write a code in Python to print the following . Also write the output for every print statement.

(I) all the names from Manali to Madhura both inclusive.

(II) all names before Jyoti including Jyoti.

(III) all names after Vaishali including Vaishali.

(f) Let A be an empty list. Use append method to add 4 elements : dog, cat, crow, sparrow in A. then print the list. Write down the output of the above program.

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