No. of Printed Pages : **2**

21BSC5C6BTL

Sl. No.

B.Sc. V Semester Degree Examination, April/May - 2024

BIOTECHNOLOGY

Bt - 5.2 : Animal Biotechnology

(NEP)

Time : 2 Hours | Maximum Marks : 60

Note : *(i) Answer **all** sections.*

(ii) Draw the labelled diagrams wherever necessary.

SECTION - A

Answer the following sub-questions in **one** word or **one** sentence each. **10x1=10**

1. (a) What is Stem cell ?

(b) Define Pluripotency.

(c) What do you mean by Biotransformation ?

(d) Mention any two limitations of organ culture.

(e) Define Embryo transfer.

(f) What is recombinant vaccine ?

(g) Name a common retrovirus used in gene transfer in animals.

(h) Define vector.

(i) What is gene transfer ?

(j) Name a common technique involving the injection of foreign DNA into Embryo's.

SECTION - B

Answer **any four** of the following questions. **4x5=20**

2. Briefly explain Gene knockout technology.

3. What is animal tissue culture ? Briefly explain its advantages and disadvantages.

4. Explain the process of artificial insemination in animals and its application.

5. Write a short note on direct DNA transfer.

6. Explain the concept of targeted gene transfer and its relevants in transgenic animal production.

7. Give the brief account of Embryo transfer and invitro fertilization.

SECTION - C

Answer **any three** of the following questions. **3x10=30**

8. Give the detail account of the suspension and Monolayer culture.

9. Discuss the potential uses of stem cells in regenerative medicine.

10. Explore the use of probiotics for disease control in animals, emphasizing their mechanisms and effectiveness.

11. Explain the future prospects and advancements in vectors for gene transfer in animals.

12. Discuss the molecular techniques used for transgene integration and identification.

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No. of Printed Pages : **2**

21BSC5C6ZOL

B.Sc. V Semester Degree Examination, April/May - 2024

ZOOLOGY

Z - 5.2 : Chordates and Comparative Anatomy

(NEP)

Time : 2 Hours Maximum Marks : 60

Note : *(i) Answer **all** sections.*

(ii) Draw the labelled diagrams wherever necessary.

SECTION - A

1. Answer the following sub-questions in **one** word or **one** sentence each. **10x1=10**

(a) Define Retrogressive metamorphosis.

(b) What are the basic chordate characters ?

(c) What is Ichthyology ?

(d) What do you mean by Aestivation ?

(e) Define Paedogenesis.

(f) What is catadromous migration ?

(g) What is Atlas ?

(h) What is Acetabulum ?

(i) Define cutaneous respiration.

(j) What is Homeotherm ?

SECTION - B

Answer **any four** of the following questions. **4x5=20**

2. Enumerate the general characteristics of chordates.

3. Write the differences between Chondrichthyes and Osteichthyes.

4. Give the brief account of the parental care in Amphibians.

5. Explain the comparative account of the heart of Scoliodon and Frog.

6. Briefly explain the interesting features of Archaeopteryx.

7. Write the general characteristics of the Agnatha and classify upto classes.

P.T.O.

SECTION - C

Answer **any three** of the following questions. **3x10=30**

8. Describe the detail account of the Retrogressive metamorphosis in Ascidian tadpole larva with a neat labelled diagram.

9. Write the unique features of the class Amphibia and classify upto orders with examples.

10. Explain the flight adaptations in birds.

11. Give an account of the comparative account of the brain of Scoliodon and Man.

12. Enumerate the salient features of the class Mammalia.

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No. of Printed Pages : **2**

21BSC5C5PHL

B.Sc. V Semester Degree Examination, April/May - 2024

PHYSICS

5.1 : Classical Mechanics and Quantum Mechanics - I

(NEP)

Time : 2 Hours Maximum Marks : 60

Note : *(i) Answer **all** the questions.*

(ii) Non-programmed scientific calculators are allowed.

I. Answer **all** questions : **10x1=10**

(a) Define Non-Inertial frame of Reference.
(b) State law of conservation of Linear momentum.
(c) State D'Alember's principle.
(d) Mention expression for Coriolis Force.
(e) Mention the relation of variation of mass with velocity.
(f) Mention one failure of classical mechanics.
(g) State Heisenberg's Uncertainty Principle.
(h) What is Wave Packet ?
(i) What is Zero Point Energy ?
(j) State Ehrenfest Theorem.

II. Answer **any four** of the following : **4x5=20**

1. State and explain law of conservation of Angular momentum.

2. Derive an expression for Time-Dilation.

3. Derive the relation between Phase velocity and Group velocity.

4. Write a note on Normalisation and Orthoganality of wave function.

5. State and explain Law of Conservation of Energy.

6. Derive an expression for apparent frequency in case of Longitudinal Doppler Effect.

P.T.O.

III. Answer **any three** of the following. **3x10=30**

1. (a) With neat diagram derive an expression for displacement of Atwood's machine. **7+3**

(b) Write a note on constraints.

2. With neat diagram explain Michelson's Morley experiment and write its negative results.

3. (a) Derive an expression for Compton Shift. **7+3**

(b) X-ray of wavelength 2 Å are scattered from a block. The scattered photon are absorbed at Right angle to deviation of incident beam. Find the wavelength of scattered photon.

4. Derive an expression for Energy Eigen value of a particle in a one dimensional infinite potential well.

5. (a) Derive an expression for time dependent Schrodinger Wave Equation. **5+5**

(b) With neat diagram explain G.P. Thamson's Experiment.

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No. of Printed Pages : **2**

21BSC5C6CSL

B.Sc. V Semester Degree Examination, April/May - 2024

COMPUTER SCIENCE

DSC6 : Computer Networks

(NEP)

Time : 2 Hours Maximum Marks : 60

Answer the following sub-questions. Each sub question carries **one** mark. **10x1=10**

1. (a) Define Computer Network.
(b) What are the major components of communication system ?
(c) Define Signal.
(d) State any two advantages of coaxial cable.
(e) What is point-to-point protocol ?
(f) Define Channelization.
(g) What is function of transport layer ?
(h) Expand :
  (i) RCP
  (ii) UDP
(i) What is the purpose of Domain Name system ?
(j) Define FTP.

Answer **any four** questions. Each question carries **five** marks. **4x5=20**

2. Explain different network topologies.

3. Discuss functions of Physical Layer.

4. Write a short note on CSMA/CD.

5. Explain Circuit Switching.

6. Write a short note on Token Passing.

7. Write a short note on SMTP.

P.T.O.

Answer **any three** questions. Each question carries **ten** marks. **3x10=30**

8. Explain TCP/IP reference model with diagram.

9. Discuss OSI reference model.

10. Explain the different multiplexing techniques.

11. Explain TELNET.

12. Discuss Dynamic Host Configuration protocol.

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No. of Printed Pages : **2**

21BSC5C6ELL

Sl. No.

B.Sc. V Semester Degree Examination, April/May - 2024

ELECTRONICS

DSC - 6 : Digital Circuits and Microprocessors

(NEP)

Time : 2 Hours | Maximum Marks : 60

Note : *Answer* ***all*** *sections.*

SECTION - A

1. Answer **all** sub-questions. **10x1=10**

(a) What is shift register ?

(b) Expand EPROM.

(c) What is D/A converter ?

(d) What is Assembly language ?

(e) What is flow chart ?

(f) What is Asynchronans counter ?

(g) What is PPI and USART ?

(h) What is MVI B, 82 Instructions ?

(i) Expand DVD and CCD.

(j) ROM timing in memory device.

SECTION - B

Answer **any four** questions. **4x5=20**

2. Explain the working of 1 to 16 demultiplexer.

3. Write a note on Basic memory cell.

P.T.O.

4. Explain the general purpose registers in 8085 microprocessor.

5. Write a note on Branch instructors in 8085 microprocessor.

6. Write a note on two byte instructions in 8085.

7. Write a note on integration type A/D converter.

SECTION - C

Answer **any three** questions. **3x10=30**

8. With neat logic diagram explain the working of 3-bit ripple counter along with truthtable and timing diagram.

9. Explain the working of successive approximation A to D converter.

10. With neat block diagram explain 8085 architecture.

11. Explain the addressing modes of 8085 Microprocessor.

12. Write an assembly level program to transfer data from memory location 8065 to memory location 8089 and store data in 8092 location.

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21BSC5C5ELL

No. of Printed Pages : **2**

Sl. No.

B.Sc. V Semester Degree Examination, April/May - 2024

ELECTRONICS

DSC - 5 : Electronic Communication

(NEP)

Time : 2 Hours | Maximum Marks : 60

Note : *Answer* ***all*** *sections.*

SECTION - A

1. Answer **all** questions. **10x1=10**

(a) What is antenna ?
(b) Define ionospheric wave propagators.
(c) What is lumped parameters ?
(d) What is modulation ?
(e) Expand AM and FM.
(f) What is modulation index ?
(g) Define sensitivity of radio receivers.
(h) What is AGC ?
(i) What is VSWR ?
(j) What is gain of antenna ?

SECTION - B

Answer **any four** questions. **4x5=20**

2. Explain the different methods of radio wave propagations.

3. Write a note on Maxwell's equations in vector modes.

4. Explain the importance of communication in electronics.

5. Explain the working of collector modulator.

6. Explain the working of Varactor diode as FM modulator.

7. Write a note on TRF receiver with block diagram.

P.T.O.

SECTION - C

Answer **any three** questions. **3x10=30**

8. Write antenna parameters and explain in brief.

9. Explain different types of Transmission lines in brief.

10. Derive an expression of Amplitude modulations in communication system.

11. With a neat circuit diagram explain Balanced modulator.

12. With a neat circuit block diagram explain AM Superheterodyne receiver. Mention its advantages.

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No. of Printed Pages : **2**

21BSC5C4PHL

B.Sc. V Semester Degree Examination, April/May - 2024

PHYSICS

5.2 : Elements of Atomic, Molecular and Laser Physics

(NEP)

Time : 2 Hours Maximum Marks : 60

Note : *(i) Answer **all** the sections.*

(ii) Non programmed scientific calculators are allowed.

SECTION - A

1. Answer the following sub-questions, each sub-question carries **one** mark. **10x1=10**

(a) Define impact parameter.

(b) Write Bohr's frequency condition.

(c) What is the ionization potential required for hydrogen atom ?

(d) State Pauli's exclusion principle.

(e) What is Stark effect ?

(f) What is the nature of molecular spectra ?

(g) What is Phosphorescence ?

(h) What is Metastable state ?

(i) What is optical pumping ?

(j) What is Spontaneous emission ?

SECTION - B

Answer **any four** of the following questions, each carries **five** marks. **4x5=20**

2. Derive the expression for the energy of the electron in the n^{th} Bohr orbit.

3. Describe Frank-Hertz experiment.

4. Discuss J-J coupling scheme.

5. What is Raman effect ? Mention its characteristics.

6. Explain briefly the requisites of Laser.

7. Derive the relation between Einstein's co-efficients and radiation energy density.

P.T.O.

SECTION - C

Answer **any three** of the following questions, each question carries **ten** marks. **3x10=30**

8. (a) Explain in brief sommerfeld's atomic model. **4+6**

(b) Derive the condition for allowed elliptical orbits from sommerfeld's atomic model.

9. (a) Explain in brief quantum numbers associated with vector atom model. **7+3**

(b) Calculate Lande g-factor for P electron.

10. Obtain an expression for rotational energy of a diatomic molecule as a rigid rotator. **10**

11. (a) Describe the experimental setup used to study normal Zeeman effect. **5+5**

(b) Discuss the quantum theory to explain Raman effect.

12. (a) Explain the construction and working of Nd : YAG Laser. **7+3**

(b) Write any three applications of Laser.

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No. of Printed Pages : **2**

21BSC5C6BOL

B.Sc. V Semester Degree Examination, April/May - 2024

BOTANY

DSC - 6 : Genetics and Plant Breeding

(NEP)

Time : 2 Hours Maximum Marks : 60

Note : *(i) Answer **all** the Sections.*

(ii) Draw diagram wherever necessary.

SECTION - A

Answer **all** the following questions. **10x1=10**

1. (a) Define gene frequency.

(b) What are lethal alleles ?

(c) What are autosomes ?

(d) Who proposed the Chromosome theory of inheritance ?

(e) Define Acclimatization.

(f) Define Pleotropy.

(g) What are transposons ?

(h) What method is employed to emasculation in minute flowers ?

(i) Differentiate between genotype and phenotype.

(j) Define Recombination frequency.

SECTION - B

Answer **any four** of the following questions. **4x5=20**

2. What are Mutagens ? Explain its types.

3. Write the difference between monogenic and polygenic inheritance.

P.T.O.

4. Write a note on Cytological basis of crossingover.

5. Explain the importance of Plant breeding in Crop improvement.

6. Write a note on DNA repair mechanism.

7. What is incomplete dominance ? Explain with suitable example.

SECTION - C

Answer **any three** of the following questions. **3x10=30**

8. What is linkage ? Explain the types of linkage with suitable examples.

9. Describe the quantative inheritance with reference to Kernel colour in wheat.

10. Explain CIB method of mutation detection.

11. Write a short note on :
(a) Centres of origin of Crop Plants
(b) Advantages and limitation of hybridization

12. Describe the numerical based gene mapping.

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No. of Printed Pages : **2**

21BSC5C5CHL

B.Sc. V Semester Degree Examination, April/May - 2024

CHEMISTRY

V : DSC - 5 : Inorganic Chemistry and Spectroscopy

(NEP)

Time : 2 Hours Maximum Marks : 60

Note : *Answer* ***all*** *questions.*

SECTION - A

1. Answer the following Sub-questions. Each sub-question carries **one** mark. **10x1=10**

(a) What are Zeolites ?

(b) State HSAB concept.

(c) What are isotopes ?

(d) Define Quarks.

(e) What is absorption spectroscopy ?

(f) Calculate the number of vibrations in CO_2 molecule.

(g) What is Raman effect ?

(h) What is molecular spectroscopy ?

(i) How many proton NMR signals would you expect for $CH_3CH_2CH_3$?

(j) What is Larmor frequency ?

SECTION - B

Answer **any four** of the following questions. Each question carries **five** marks. **4x5=20**

2. Write the preparation and structure of Borazine.

3. Discuss the liquid model of nucleus.

4. Explain significance of finger print region.

5. Discuss the Raman effect based on Quantum theory of radiation.

6. Explain chemical shift write the different scales.

7. Discuss the anisotropic effect in NMR spectroscopy.

P.T.O.

SECTION - C

Answer **any three** of the following questions. Each question carries **ten** marks. **3x10=30**

8. (a) Write the classification and structure of silicates. **6**

(b) Write any four applications of HSAB concept. **4**

9. (a) Explain nuclear deformation due to nucleons outside filled shells with respect to collective model of nucleus. **6**

(b) Write a note on secular and transient equilibrium. **4**

10. (a) Explain different electronic transitions in UV spectroscopy. **6**

(b) Discuss Wood ward rules for the calculation of λ_{max} with examples. **4**

11. (a) Write a note on the vibrational spectroscopy for a diatomic molecule behaving like simple harmonic oscillator. **6**

(b) Explain briefly vibrational Raman spectra. **4**

12. (a) Discuss the principles of NMR spectroscopy. **6**

(b) Explain the methods of fragmentation in mass spectroscopy. **4**

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No. of Printed Pages : **2**

21BSC5C5ZOL

B.Sc. V Semester Degree Examination, April/May - 2024

ZOOLOGY

Z-5.1 : Non-Chordates and Economic Zoology

(NEP)

Time : 2 Hours Maximum Marks : 60

Note : *(i) Answer **all** sections.*

(ii) Draw the labelled diagrams wherever necessary.

SECTION - A

Answer the following sub-questions in **one word** or **one sentence** each. **10x1=10**

1. (a) Define saprozoic nutrition.

(b) What is Encystation ?

(c) In which phylum do you find mesenchyme ?

(d) What do you mean by pseudocoelom ?

(e) What are the locomotory organs in phylum Annelida ?

(f) Define tergum.

(g) What is the function of mantle ?

(h) What is Aristotles lantern ?

(i) What is the scientific name of sugarcane leaf hopper ?

(j) Define vermiculture.

SECTION - B

Answer **any four** of the following questions. **4x5=20**

2. Briefly explain the morphology of paramecium with a neat labelled diagram.

3. Write the salient features of ctenophora.

4. Give the brief account of the second maxillipede of prawn.

P.T.O.

5. Explain the unique characteristics of the phylum Arthropoda.

6. Write a short note on water vascular system.

7. Give an account of Rhodents as pests and its control measures.

SECTION - C

Answer **any three** of the following questions. **3x10=30**

8. Write the general characteristics and classification of the phylum porifera with examples.

9. Explain the Reproductive system of Hirudinaria with a neat labelled diagram.

10. Describe the nervous system of pila globosa with labelled diagram.

11. Give the detail account of the life cycle of mosquitoes and add a note on its control measures.

12. Explain the external features of Obelia with the help of labelled diagram.

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No. of Printed Pages : **2**

21BSC5C6CHL

B.Sc. V Semester Degree Examination, April/May - 2024

CHEMISTRY - VI

DSC 6 : Organic and Physical Chemistry

(NEP)

Time : 2 Hours | Maximum Marks : 60

Note : *Answer* ***all*** *sections.*

SECTION - A

1. Answer the following sub-questions. Each sub-question carries **one** mark. **10x1=10**

(a) What are non-alternant hydrocarbons ?
(b) Write Taft equation.
(c) Define Cram's rule.
(d) Write the Haworth Structure of glucose.
(e) Write the structure of imidazole.
(f) Mention the chemical name of Vitamin B_1.
(g) What is Hamiltonian operator ?
(h) Mention the types of angular momentum operators.
(i) What are fast reactions in kinetics ?
(j) What is homogeneous catalysis ?

SECTION - B

Answer **any four** of the following questions. Each question carries **five** marks. **4x5=20**

2. Draw the energy levels for benzyl cation.

3. Write a note on conformational analysis of cyclobutane.

4. Describe the structure and reactivity of thiazole.

5. Explain Quantum Mechanical degeneracy.

6. Write a short note on Flash photolysis.

7. Explain briefly temperature jump method of fast reactions in Kinetics.

P.T.O.

SECTION - C

Answer **any three** of the following questions. Each question carries **ten** marks. **3x10=30**

8. (a) Explain the method of determining mechanisms based on Structure of products. **6**

(b) Write the energy levels for benzyl carbanion. **4**

9. (a) Write briefly the Kiliani-Fischer synthesis in chain lengthening in aldoses. **6**

(b) Write a note on epimerization. **4**

10. (a) Describe the synthesis of Vitamin-B_6. **6**

(b) Write the biological importance of Vitamin-E. **4**

11. (a) Describe the application of Schrödinger equation to harmonic oscillator. **6**

(b) Explain briefly commutation of operators. **4**

12. (a) Write a note on Henri-Michaelis-Menten mechanism for enzyme catalytic reaction. **6**

(b) Explain the effect of enzyme concentration and pH on enzyme activity. **4**

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No. of Printed Pages : **2**

21BSC5CBTL

B.Sc. V Semester Degree Examination, April/May - 2024

BIOTECHNOLOGY

Bt : 5.1 Plant Biotechnology

(NEP)

Time : 2 Hours Maximum Marks : 60

Note : *(i) Answer **all** Sections.*

(ii) Draw the labelled diagrams wherever necessary.

SECTION - A

1. Answer the following sub-questions in **one word** or **one sentence** each. **10x1=10**

(a) Define Acclimatization.
(b) What is Callus ?
(c) What do you mean by Elicitors ?
(d) What are Terpenoids ?
(e) Define Electroporation.
(f) Define Enhancers.
(g) Name any two key elements of transgene regulatory sequences.
(h) Mention any two famous transgenic crops.
(i) What is biosafety ?
(j) Expand CRISPR.

SECTION - B

Answer **any four** of the following questions. **4x5=20**

2. Describe the commercial micropropagation of Banana.

3. Give an account of the concept of elicitation and its impact on secondary metabolites.

4. Explain the benefits of contraversies in associated with transgenic plants.

5. Explore how genetic engineering enhances pest resistance in transgenic crops.

6. Write a short notes on Intelluctual Property Rights.

7. Discuss the role of risk assessment in determining the safety of transgenic plants for human consumption.

P.T.O.

SECTION - C

Answer **any three** of the following questions. **3x10=30**

8. Give the detail account of case studies of Shikonin.

9. Analyze the challenges and limitations faced in the field of transgenic plant research.

10. Define Genetic Engineering. Describe the process of Agrobacterium mediated gene transfer in plants.

11. Discuss the potential benefits and risks of using CRISPR-Cas 9 in precision breeding of crops.

12. Write a short note of the following :

(a) Anther culture.

(b) Application of tissue culture in Horticulture.

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No. of Printed Pages : **2**

21BSC5C5BOL

B.Sc. V Semester Degree Examination, April/May - 2024

BOTANY

Plant Morphology and Taxonomy

(NEP)

Time : 2 Hours Maximum Marks : 60

Note : *(i) Write **all** the questions.*

(ii) Draw diagram wherever necessary.

SECTION - A

1. (a) What is Stipule ? **10x1=10**
(b) What type of modification found in Zinger ?
(c) What is Rappus ?
(d) What is Drupe ?
(e) What is Monographe ?
(f) Expand term ICBN.
(g) What is natural system of classification ?
(h) What is the new name of Leguminaceae ?
(i) What is apomorphy ?
(j) Define a Cladogram.

SECTION - B

Answer **any four** of the following questions. **4x5=20**

2. Define a stem explain aerial modification of stem with examples.

3. Write a short note on :
(a) Phylloclade
(b) Verticillaster

4. Give salient feature of family Malvaceae.

5. Write a merit and demerit of Benthem and Hooker classification.

6. Give the general floral diagram and floral formula of Brassicaseae.

7. Explain the origin of angiosperm briefly.

P.T.O.

SECTION - C

Answer **any three** of the following questions. **3x10=30**

8. What is Herbarium ? Explain preparation of Herbarium technique.

9. What is Aestivation ? Write the different types of Aestivation.

10. Write the salient feature of family Labiatae and mention any four plants, write the Botanical name and Economic Importance.

11. What is taxonomy ? Write the objective and scope of taxonomy.

12. Write the Botanical name and Economic Importance of the following :

(a) Ground nut
(b) Sunflower
(c) Rice
(d) Cotton

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No. of Printed Pages : **2**

21BSC5C5CSL

B.Sc. V Semester Degree Examination, April/May - 2024

COMPUTER SCIENCE

DSC5 : Programming in Python

(NEP)

Time : 2 Hours Maximum Marks : 60

Note : *Answer* ***all*** *Sections.*

SECTION - A

1. Answer the following sub-questions. Each sub-question carries **one** mark. **10x1=10**

(a) Name two modes of Python.

(b) What is a statement ?

(c) What is an exception ?

(d) Mention the types of function.

(e) Write the basic tuple operations.

(f) What is sets ?

(g) Mention the basic file types.

(h) What is Polymorphism ?

(i) What is Tkinter ?

(j) Why do we use NumPy ?

P.T.O.

SECTION - B

Answer **any four** of the following questions. Each question carries **five** marks. **4x5=20**

2. Discuss the basic datatypes of Python.

3. Write a Python program to demonstrate user defined function.

4. Explain the built in functions used on dictionaries.

5. Describe the various access modes of the file.

6. What is SQLite ? Mention the operations on tables in SQLite.

7. Explain exception handling with an example.

SECTION - C

Answer **any three** of the following questions. Each question carries **ten** marks. **3x10=30**

8. Explain features of Python.

9. Explain any five string methods with syntax and example.

10. Define List. Write a Python program to demonstrate the use of list.

11. What is inheritance ? Explain the types of inheritance.

12. Write a Python program to draw line chart and bar chart using Matplotlib.

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No. of Printed Pages : **2**

21BSC5C5MTL

B.Sc. V Semester Degree Examination, April/May - 2024

MATHEMATICS

DSC - 5 : Real Analysis - II and Complex Analysis

(NEP)

Time : 2 Hours | Maximum Marks : 60

Note : *Answer **all** sections.*

SECTION - A

1. Answer the following sub-questions, each sub-question carries **one** mark. **10x1=10**

(a) Define segment of the Partition.

(b) Define norm of the partition P.

(c) State first Mean Value theorem.

(d) If $f(x)=\cos x$ find the primitive of $f(x)$.

(e) What is Complex number ?

(f) What is Agrand plane ?

(g) Define transformation.

(h) Define Linear transformation.

(i) If C is made up of C_1, C_2, C_3, ... then $\int_C f(z)dz =$

(j) State Green's theorem.

SECTION - B

Answer **any four** of the following questions, each question carries **five** marks. **4x5=20**

2. If x^2 is defined on [0, 1] and P={0, 1/6, 2/6, 3/6, 4/6, 5/6, 1} then find U(p, f) and L(p, f).

3. Evaluate $\int_0^{\pi/4} \left(\sec^4 x - \tan^4 x\right) dx$ by fundamental theorem of integral calculus.

4. Find whether function is differentiable sin$z$ at i.

5. Prove that Bilinear transformation preserve the cross-ratio of four points.

P.T.O.

6. Evaluate $\int_C \left(x^2 - iy^2\right)dz$ along $y = 2x^2$ from (1, 2) to (2, 8).

7. Using the substitution $x = \pi - t$ show that $\int_0^{\pi} x\varphi(\sin x)dx = \pi/2 \int_0^{\pi} \varphi(\sin x)dx$

SECTION - C

Answer **any three** of the following questions, each question carries **ten** marks. **3x10=30**

8. (a) State and prove Necessary and Sufficient condition of Riemann integrability.

(b) If $f(x)$ is the function defined on [a, b] by $f(x) = \begin{cases} 1 & \text{if } x \text{ is rational} \\ -1 & \text{if } x \text{ is irrational} \end{cases}$

then find the oscillation of $f(x)$ in [a, b].

9. (a) By applying Mean Value Theorem to the integral $\int_0^{\pi/4} \sec x\,dx$.

Show that $\frac{\pi}{4} \le \int_0^{\pi/4} \sec x\,dx \le \pi/2\sqrt{2}$

(b) Show that $\int_0^{\pi/2} x \cdot \cos x\,dx = \frac{\pi}{2} - 1$ By using integration by parts.

10. (a) Show that $f(z) = \cosh z$ is analytic and hence find $f'(z)$.

(b) Show that $u = e^x \cos y + xy$ is harmonic and find its harmonic conjugate.

11. (a) Find the Bilinear transformation which maps $z_1 = -1$, $z_2 = 0$, $z_3 = 1$ into $w_1 = 0$, $w_2 = i$, $w_3 = 3i$.

(b) Find the region in the w-plane bounded by the line $x = 1$, $y = 1$, $x + y = 1$ under the transformation $w = z^2$.

12. (a) If a function $f(z)$ be analytic at all points within and on closed contour C then $\int_C f(z) = 0$.

(b) Evaluate $\int_C \frac{1}{z(z-1)}dz$ where C is the circle $|z| = 3$.

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No. of Printed Pages : **3**

21BSC5C6MTL

B.Sc. V Semester Degree Examination, April/May - 2024

MATHEMATICS

6, DSC-6 : Vector Calculus and Analytical Geometry

(NEP)

Time : 2 Hours Maximum Marks : 60

Note : *Answer* ***all*** *sections.*

SECTION - A

1. Answer the following sub-questions, each sub-question carries **one** mark. **10x1=10**

(a) Prove that if two of three vectors are equal or parallel their scalar triple product vanishes.

(b) Write the Formulae of Serret-Frenet for space curve.

(c) If $\phi = x^2 - y^2$ show that $\nabla^2\phi = 0$

(d) Prove that Curl (gradϕ) = 0

(e) State Stoke's theorem.

(f) Find the area of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ Using Green's theorem.

(g) If (4,2,3) are the direction ratio's of the straight line then find direction cosines of the straight line.

(h) Find the angle between the planes $3x - 6y + 2z + 5 = 0$ and $4x - 12y + 3z - 3 = 0$.

(i) Write the equation of sphere, its centre and radius.

(j) Define right circular cylinder.

P.T.O.

SECTION - B

Answer **any four** of the following questions. Each question carries **five** marks. **4x5=20**

2. Prove that $\left[\vec{a}\times\vec{b},\ \vec{b}\times\vec{c},\ \vec{c}\times\vec{a}\right] = 2\left[\vec{a}\ \vec{b}\ \vec{c}\right]$.

3. Find the angle between the surfaces $x^2+y^2+z^2=9$ and $z=x^2+y^2-3$ at the point $(2, -1, 2)$.

4. Evaluate $\int\int_S \vec{F}.\hat{n}\,ds$ *when* $\vec{F} = 4xzi - y^2j + yzk$ and S is the surface of the cube bounded by $x = 0$, $x = 1$, $y = 0$, $y = 1$, $z = 0$ and $z = 1$ by divergence theorem.

5. Find the equation of the plane passing through the points $(-1, -2, -3)$, $(3, 4, 5)$, $(0, 6, 2)$.

6. Find the equation of the sphere which passes through the points $(1, 0, 0)$, $(0, 1, 0)$ $(0, 0, 1)$ and $(2, -1, 1)$.

7. Prove that Curl (Curl $\vec{f}$) = grad (div $\vec{f}$) $- \nabla^2 \vec{f}$

SECTION - C

Answer **any three** of the following questions. Each question carries **ten** marks. **3x10=30**

8. (a) For the Curve $x=t$, $y=t^2$, $z=t^3$ find the equation of the normal plane at $t=1$.

(b) A particle moves along a curve whose parametric equations are $x = e^{-t}$, $y = 2\cos 3t$, $z = 2\sin 3t$ Where 't' is the time.

(i) Find velocity at any time and its magnitude at $t=0$.

(ii) Find acceleration at any time and its magnitude at $t=0$.

9. (a) If $\vec{r} = xi + yj + zk$, $r = |\vec{r}|$ prove that $\nabla.(r^n \vec{r}) = (n+3)r^n$.

(b) Find directional derivative of $\phi = x^2yz + 4xz^2$ at $(1, -2, -1)$ along $2i - j - 2k$.

10. (a) Evaluate $\int_C \vec{F}.d\vec{r}$ where $\vec{F} = xyi + (x^2 + y^2)j$ along the path of a straight line from (0, 0) to (1, 0) and then to (1, 1).

(b) Evaluate $\int_C \vec{F}.d\vec{r}$, where $\vec{F} = 2yi + 3xj - z^2k$ using Stoke's theorem, where 'C' is the boundary of upper half of the surface of the sphere $x^2 + y^2 + z^2 = 9$.

11. (a) Find the equation of the planes bisecting the angle between the planes $3x - 4y + 5z - 3 = 0$ and $5x + 3y - 4z - 9 = 0$.

(b) (i) Find the equation of the line passes through the point $(1, -1, 1)$ and parallel to the vector $i - j + k$.

(ii) Find the equation of the line passing through the point (2, 5, 8) and $(-1, 6, 3)$.

12. (a) Find the condition that the line $\frac{x-\alpha}{l} = \frac{y-\beta}{m} = \frac{z-\gamma}{n}$ should intersect the polar of the line.

(b) Find the equation of the tangent planes to the cone $9x^2 - 4y^2 + 16z^2 = 0$ which contain the line $\frac{x}{32} = \frac{y}{72} = \frac{z}{72}$.

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