61502

V Semester B.Sc. Examination, March/April 2022
(CBCS Scheme)
PHYSICS – VI
Astrophysics, Solid State Physics and Semiconductor Physics

Time : 3 Hours Max. Marks : 70

Instructions : *Answer **any five** questions from **each** Part.*
*Non-programmable scientific calculators are **allowed**.*

PART – A

Answer **any five** of the following. **Each** question carries **eight** marks : **(5×8=40)**

1. a) Define luminosity of a star and explain how it varies with the mass ?
   b) Obtain an expression for the core temperature of a star using linear density model. **(2+6)**

2. a) Write any four general characteristics of main sequence star.
   b) State and explain Virial theorem. **(4+4)**

3. a) State Moseley's law. Give any three applications of Moseley's law.
   b) Obtain an expression for the interplanar spacing of a cubic crystal in terms of miller indices. **(4+4)**

4. a) What is hall effect in metals ?
   b) Obtain an expression for the hall voltage and hall coefficient. **(2+6)**

5. a) Explain the phenomenon of superconductivity.
   b) Give the differences between Type – I and Type – II superconductors. **(4+4)**

6. a) What are intrinsic semiconductors ?
   b) Derive an expression for the electron concentration in the conduction band of an intrinsic semiconductor. **(1+7)**

7. a) Give the differences between Zener diode and ordinary diode.
   b) With a circuit diagram, explain the working of Zener diode as a voltage regulator and hence obtain an expression for the minimum value of series resistance. **(2+6)**

P.T.O.

8. a) What is a transistor ?

 b) With a neat circuit diagram, explain the working of NPN transistor in CE mode as an amplifier. (1+7)

PART – B

Solve **any five** of the following. **Each** problem carries **four** marks : (5×4=20)

9. A star whose apparent magnitude is observed to be 15 has a parallax of 0.05″. Find the absolute magnitude and compare the luminosity with that of the Sun. (Absolute magnitude of sun $M_{\odot} = 5$).

10. If the luminosity of white dwarf is 0.015 $L_{\odot}$ and its radius is 650 km, calculate its temperature.

11. Calculate the life time of a star of mass $5M_{\odot}$ if the life time of sun is 12 billion years.

12. X-rays of wavelength 0.25 Å undergoes compton scattering from a carbon block. Calculate the wavelengths of scattered radiation at 60° and 180°.

13. Calculate Fermienergy in eV for silver at absolute zero temperature. Electron density of silver is 5.863×10^{28} m^{-3} and $m_e = 9.11 \times 10^{-31}$ kg.

14. Calculate the current produced in a small Ge plate of area 10^{-4} m^2 and of thickness 0.2×10^{-3} m. When a p.d. of 4V is applied across the faces. Given concentration of free electrons in Ge is $2 \times 10^{19} m^{-3}$, mobilities of electrons and holes are 0.36 m^2/V-S and 0.17 m^2/V-S respectively.

15. For a transistor in CE mode $V_{CC} = 12$ V and Re = 5KΩ, calculate the values of cut off and saturation points to draw dc load line.

16. The h-parameters of a transistor are $h_{ie} = 2k\Omega$, $h_{re} = 3 \times 10^{-4}$, $h_{fe} = 60$ and $h_{oe} = 30 \times 10^{-6}$ mho. Calculate the current gain and voltage gain. ($R_S = 1k\Omega$ and $R_L = 2k\Omega$).

PART – C

Answer **any five** of the following. **Each** question carries **two** marks : **(5×2=10)**

17. a) Does more massive star has shorter wavelength ? Explain.

    b) Can all stars have equal masses ? Explain.

    c) Penetrating power of X-rays is greater than that of visible light. Justify.

    d) Does all the energy levels are filled by electrons at absolute zero ? Explain.

    e) Large currents can not be passed through superconductors even though they have zero electrical resistance. Justify.

    f) The depletion region of a semiconductor diode becomes wide when it is reverse biased. Explain.

    g) Is ordinary light can be used for crystal diffraction ? Explain.

    h) The size of the collector is made wider than emitter and base. Explain.

61503

V Semester B.Sc. Examination, March/April 2022
(CBCS)
CHEMISTRY
Organic Chemistry (Paper – V)

Time : 3 Hours Max. Marks : 70

Instructions : *1) The question paper has **two** Parts. Answer **both** the Parts.*

*2) Draw diagrams and write **chemical** equations **wherever** necessary.*

PART – A

Answer **any eight** of the following questions. **Each** question carries **two** marks. **(8×2=16)**

1. What are enantiomers ? Give an example.
2. How would Ethylamine obtained from acetaldehyde ?
3. Write Haworth structure of Lactose.
4. State Isoprene rule.
5. Write the Nitration of Quinoline.
6. Write the structure of Menthol and its uses.
7. What is Mordant ?
8. Write the structure of Diclofenac and its uses.
9. What is bathochromic effect ? Give an example.
10. What is principle of UV spectroscopy ?
11. Write the D.L. configurations of Glyceraldehyde.
12. What are epimers ? Give an example.

PART – B

Answer **any nine** of the following questions. **Each** question carries **six** marks. **(9×6=54)**

13. a) Explain optical isomerism of lactic acid.

 b) Write E-Z configurations of 2-butene. **(4+2)**

14. a) Explain Resolution of Racemic mixture by chemical method.

 b) Define Resolution. **(4+2)**

P.T.O.

15. a) Describe Hinsberg test to distinguish primary, secondary and tertiary amines.
    b) How benzene diazonium chloride is converted to chlorobenzene ? (4+2)

16. a) Write classification of carbohydrates, based on number of monomeric units present, with one example per each.
    b) Write erythro and threo isomers of Tartaric acid. (4+2)

17. a) Describe Skraup's synthesis of Quinoline.
    b) Give an example for chichibabin reaction. (4+2)

18. a) Write any four general characteristics of Alkaloids.
    b) Structure of Nicotine and identify chiral carbon. (4+2)

19. a) How Malachite green synthesized ?
    b) R.S. configuration of 2-Amino propanoic acid. (4+2)

20. a) Outline the synthesis of sulphanilamide.
    b) Write the synthesis of pyridine from acetylene. (4+2)

21. a) What is chemical shift ? How it is expressed ?
    b) Why TMS used as standard reference compound in NMR spectroscopy ? (3+3)

22. a) Mention the number of signals and multiplicity of the signals in the NMR spectrum of 1, 1, 2-trichloro ethane.
    b) Write advantages of spectroscopic method over conventional methods. (4+2)

23. a) Explain Gabriel Phthalimide reaction with example.
    b) IUPAC name of Trimethylamine. (4+2)

24. a) How citral synthesized from methyl heptenone ?
    b) Compare the basicity of pyrrole and pyridine. (4+2)

25. a) Draw the two conformations of 1, 2-dimethyl cyclohexane.
    b) Significance of fingerprint region in IR spectroscopy. (4+2)

61501

V Semester B.Sc. Examination, March/April 2022
(CBCS Freshers Scheme) (2020 –21 and Onwards)
PHYSICS – V
Statistical Physics, Quantum Mechanics – I, Atmospheric Physics and Nano-Materials

Time : 3 Hours Max. Marks : 70

Instruction *:Answer* ***any five*** *questions from* ***each*** *part.*

PART – A

Answer **any five** of the following. **Each** question carries **8** marks. **(5×8=40)**

1. a) Define :
   i) Micro state ii) Phase space
   b) Derive the Maxwell-Boltzmann distribution law $n_i = g_i e^{-(\alpha+\beta E_i)}$. **2+6**
2. a) What is meant by Bose-Einstein condensation ?
   b) Explain Bose-Einstein condensation of liquid helium. Mention two special properties of liquid helium – II. **2+6**
3. What are fermions ? Arrive at Fermi-Dirac distribution for a system of fermions. **1+7**
4. Describe briefly the failure of classical mechanics to explain
   i) Photo electric effect
   ii) Atomic spectra. **4+4**
5. Describe with necessary theory G.P. Thomson's experiment for establishing the wave nature of light. **8**
6. a) What are matter waves ? Mention any two of its characteristics.
   b) Derive an expression for de-Broglie wavelength. Hence express it interms of energy and temperature. **3+5**
7. Based on the vertical distribution of temperature, explain different layers in the earth's atmosphere. **8**
8. a) Write a short note on Carbon nano tube.
   b) Mention any four applications of nanomaterial. **4+4**

P.T.O.

PART – B

Answer **any five** of the following. **Each** question carries 4 marks. (5x4=20)

Common data :

$h = 6.625\times10^{-34}Js$; $k = 1.38\times10^{-23}JK^{-1}$

$c = 3\times10^{8}ms^{-1}$; $m_e = 9.1\times10^{-31}Kg$

9. The rms velocity of hydrogen molecules at NTP is 1.84 Kms^{-1}. Calculate the rms velocity of oxygen molecules at NTP. Given molecular weight of hydrogen and oxygen are 2 and 32 respectively.

10. A system has only two particles, show with diagram how these particles can be arranged in three quantum states 1,2,3 using Bose Einstein statistics.

11. The number of conduction electrons per m^3 in silver is 5.85×10^{28} and in lithium is 4.7×10^{28}. If the Fermi energy of silver is 5.48 eV, Calculate the fermi energy of lithium.

12. Find the phase velocity and group velocity of an electron whose de-Broglie wavelength is 1.8Å (neglect relativistic effect).

13. In the Davisson and Germer's experiment electrons of energy 100eV incident on the lattice planes of a crystal produce a strong Bragg's reflection in the first order. Calculate the glancing angle. Given the lattice spacing to be 2.15Å.

14. The position and momentum of 0.4KeV electrons are simultaneously determined. If the position is located within 1Å, what is the uncertainty in its momentum.

15. At what height the pressure of the atmosphere becomes 40% of the pressure at the sea level.Given scale height is 8.5km.

16. Calculate the coriolis force at a hill station at 30°N having a zonal wind speed of $20ms^{-1}$.

PART – C

Answer **any five** of the following. **Each** question carries **2** marks. **(5×2=10)**

17. a) Can Maxwell-Boltzmann statistics be applied to electron gas ? Explain.

    b) Does the fermi energy depend on temperature ? Explain.

    c) Can matter waves travel faster than light ? Explain.

    d) Does the concept of Bohr orbit violate the uncertainty principle ? Explain.

    e) Is there a coriolis force near equator ? Explain.

    f) The presence of water vapour in atmosphere is important.Justify.

    g) Does the band gap of nanoparticles increase with decrease in particle size ? Explain.

    h) Graphene is the strongest material. Justify.

61533

V Semester B.Sc. Degree Examination, March/April 2022
(CBCS Scheme)
LIFE SCIENCE
Cell and Molecular Biology

Time : 3 Hours Max. Marks : 70

Instructions : *1) Answer* ***all*** *questions.*
2) ***Draw*** *diagrams* ***wherever*** *necessary.*

Explain **any two** of the following : **(10×2=20)**

1. Justify cell as a unit of life.
2. Explain the different stages of Mitosis.
3. Explain the lac operon concept.
4. Explain the principles of Electron Microscopy.

Write explanatory notes on **any five** of the following : **(5×6=30)**

5. Explain any two stages of Meiosis – II.
6. Describe the structure of chloroplast.
7. Tryptophan operon.
8. Heterochromatin.
9. Membrane proteins and their functions.
10. Describe the structure of DNA.
11. Describe the structure of tRNA.

Write a short note on **any five** of the following : **(5×4=20)**

12. Mitochondrial DNA.
13. Lysosomes.
14. Electron Microscopy.
15. Introns.
16. Ribosome.
17. Genetic code.
18. Euchromatin.

61527

Fifth Semester B.Sc. Degree Examination, March/April 2022
(CBCS)
BIOTECHNOLOGY
Paper – V : Genetic Engineering and Environmental Biotechnology

Time : 3 Hours Max. Marks : 70

***Instruction** : Draw a neat labelled diagrams **wherever** necessary.*

SECTION – A

I. Write short notes on the following. **(5×2=10)**

1) ECOR1
2) pUC-19
3) Southern blotting
4) Gasohol
5) Renewable resources.

SECTION – B

II. Answer **any four** of the following. **(4×5=20)**

6) Explain the salient feature of cosmid.
7) Write a note on DNA library construction.
8) Describe screening of recombinant cell by colony hybridization.
9) Give an account on the treatment of municipal waste water and industrial effluents.
10) What is bioleaching ? Add a note on bioleaching of gold and uranium.

SECTION – C

III. Answer **any three** of the following. **(3×10=30)**

11) What are restriction enzyme ? Give the types and mechanisms of their action.
12) Describe the production of human insulins by rDNA technology.

P.T.O.

13) Write notes on the following :

a) $CaCl_2$ method of gene transfer.

b) SDS-PAGE.

14) What is bioremediation ? Explain the methods of bioremediation of pesticide, heavy metals and detergent.

15) Explain the production of modem fuels. Add a note on their Environmental impact.

SECTION – D

IV. Answer the following. **(10×1=10)**

16) What is cDNA ?

17) The recognition site for ECOR1 is

18) What is denaturation ?

19) COS-site.

20) DNA hybridization.

21) What are biopesticide ?

22) Expand ddNTP's.

23) What are exhaustible fuel ?

24) What is endomycorrhizae ?

25) Name the antibiotic resistance markers in pBR-322.

61528

Fifth Semester B.Sc. Degree Examination, March/April 2022

(CBCS Scheme)

Paper – VI : BIOTECHNOLOGY

Immunology and Animal Biotechnology

Time : 3 Hours Max. Marks : 70

***Instruction** : Draw **neat** labelled diagram **wherever** necessary.*

SECTION – A

I. Write short notes on the following : (5×2=10)

1) Adjuvant

2) Innate immunity

3) Plasma clot

4) Collagen

5) Memory Cell.

SECTION – B

II. **Answer any four** of the following : (4×5=20)

6) Explain Lymph node and their function.

7) Write in brief the steps involved in Phagocytosis.

8) Explain the techniques and application of RIA.

9) What are cell lines ? Add a note on finite cell line.

10) Describe in detail on the importance of serum media.

P.T.O.

SECTION – C

III. Answer **any three** of the following : **(3×10=30)**

11) Define antigen. Explain in detail the factors influencing antigenicity.

12) Define Hypersensitivity. Explain the types of Hypersensitivity.

13) Give an account on :

    a) Components of Complement System.

    b) Labelled antibody.

14) What are Monoclonal antibodies ? Explain its production and application.

15) Explain animal cell culture in Vaccine Production.

SECTION – D

IV. Answer the following in **one** sentence : **(10×1=10)**

16) Plasminogen.

17) Anaphylaxis.

18) PDGF.

19) Microinjection.

20) Hypersensitivity I is ________ antibody mediated.

21) Universal donor.

22) Immunogen.

23) MALT.

24) Myeloid lineage.

25) Transgenic mice.

61504

Fifth Semester B.Sc. Degree Examination, March/April 2022
(CBCS Scheme)
CHEMISTRY
Paper – VI : Physical Chemistry

Time : 3 Hours Max. Marks : 70

Instructions : 1) *The question paper has **two** Parts.*
2) *Answer **both** the Parts.*
3) ***Draw** diagrams and **write** chemical equation **wherever** necessary.*

PART – A

Answer **any eight** of the following questions. **Each** question carries **2** marks. **(8×2=16)**

1. Define ionic conductance. How it is related to transport number of an ion ?
2. Calculate the resistance of 0.1 M KCl solution whose specific conductance is 2.21 Sm^{-1} (Cell constant is 2.62 m^{-1}).
3. Direct current can not be used in conductance measurements. Give reason.
4. Write any two advantages of Quinhydrone electrode.
5. Why Weston-Cadmium cell is used as standard cell ?
6. What is the effect of temperature on degree of hydrolysis of a salt ?
7. Explain induced dipole moment with an example.
8. State Born-Oppenheimer approximation.
9. HCl exhibits rotational spectrum where as Cl_2 does not. Why ?
10. Define force constant. Mention its significance.
11. What are stokes and anti-stokes lines ?
12. Mention any two disadvantages of DME.

P.T.O.

PART – B

Answer **any nine** of the following questions. **Each** question carries **6** marks. **(9×6=54)**

13. a) Describe the determination of transport number of H^+ ion by moving boundary method.

    b) The molar conductance of CH_3COONa, HCl and NaCl at infinite dilution are 11.23×10^{-3}, 44.26×10^{-3} and 14.56×10^{-3} Sm^{-2}/mol respectively. Calculate the molar conductance of CH_3COOH at infinite dilution. **(4+2)**

14. a) Explain the principle involved in the conductometric titration of weak acid and strong base.

    b) Calculate the electrode potential of Ag electrode at 25°C which is in contact with 0.25 molar of Ag^+ ions in solution [E°Ag = 0.8 V]. **(4+2)**

15. a) Explain asymmetric and electrophoretic effect of strong electrolytes based on Debye-Huckel theory.

    b) Write DHO equation and indicate the terms involved in it. **(4+2)**

16. a) With neat labelled diagram, explain the working of Calomel electrode.

    b) Write any two limitations of Arrhenius theory of electrolytic dissociation. **(4+2)**

17. a) How is standard electrode potential (E°) value of Zinc electrode determined using SHE ?

    b) KCl is used in salt bridges. Give reason. **(4+2)**

18. a) Explain the acid-base theory of indicators by taking phenolphthalein as an example.

    b) Give one example each for acidic and basic buffer. **(4+2)**

19. a) Define :

    i) Thomson effect and

    ii) Seebeck effect.

    b) CO_2 has zero dipole moment and SO_2 has permanent dipole moment. Give reason. **(4+2)**

20. a) What are polar and non-polar molecules ?

b) Write Clausius-Mossotti equation and indicate the terms involved in it.

c) Calculate the reduced mass of HCl molecule. Given atomic masses of hydrogen and chlorine are 1.008 amu and 35.5 amu respectively. [$N_A = 6.023 \times 10^{23}$]. (2+2+2)

21. a) Derive the relationship between moment of inertia and bond length for a diatomic molecule.

b) Write the selection rules for pure rotational and vibrational transitions of a hetero atomic molecule. (4+2)

22. a) Write the different modes of CO_2 and which mode is infrared active ? Why ?

b) State Hooke's law. (4+2)

23. a) Write any four differences between Raman and I.R. spectra.

b) State Frank-Condon principle. (4+2)

24. a) Define the terms :

i) Limiting current and

ii) Residual current.

b) The force constant of HBr is 410 Nm^{-1}. Calculate the fundamental vibrational wave number. [Given $\mu = 1.64 \times 10^{-27}$ kg and $c = 3 \times 10^{8}$ m/s]. (4+2)

25. a) Write Ilkovic equation. Mention its applications.

b) What is half wave potential ? Give its significance. (4+2)

61509

V Semester B.Sc. Degree Examination, March/April 2022
(CBCS) (Semester Scheme) (Freshers + Repeaters)
COMPUTER SCIENCE – V
Paper – V : Object Oriented Programming Using Java

Time : 3 Hours Max. Marks : 70

Instruction : *Answer **all** the Sections.*

SECTION – A

I. Answer **any ten** questions. **Each** question carries **2** marks. **(10×2=20)**

1) Mention any two features of OOPs.

2) Write the syntax of switch statement.

3) What is command line arguments ?

4) Define class and object.

5) Mention various access specifiers in Java.

6) What is a vector ?

7) Define thread priorities.

8) What is an error ? Mention types of errors.

9) What is the use of import keyword ? Give example.

10) What are two types of interactive I/O ?

11) What is character stream classes ?

12) What is File Writer Class ?

SECTION – B

II. Answer **any five** questions. **Each** question carries **10** marks. **(5×10=50)**

13) a) Explain the structure of Java program. 5

b) Explain any three types of operators in Java with suitable example. 5

P.T.O.

14) a) Explain any two looping statements with example. 5

b) Explain if-else statement and else-if ladder with syntax and example. 5

15) a) Explain any five string methods in Java. 5

b) Write a note on constructors. 5

16) a) Write a note on one dimensional array. 5

b) Difference between method overloading and method overriding in Java. 5

17) a) Explain life cycle of thread. 6

b) Write a short note on : i) throw ii) finalizer method. 4

18) a) Explain creating and implementing user-defined packages. 5

b) Write a note on exceptions in Java. 5

19) a) Explain Life cycle of an applet. 5

b) Write a note on Byte stream classes. 5

20) a) Write a program to implement keyboard events. 5

b) Explain any two methods in the graphics class. 5

61534

V Semester B.Sc. Degree Examination, March/April 2022
(CBCS Scheme)
LIFE SCIENCE
Paper – VI : Developmental Biology

Time : 3 Hours | Max. Marks : 70

Instructions : 1) *Answer **all** questions.*
2) *Draw diagrams **wherever** necessary.*

Explain **any two** of the following. (10×2=20)

1. Explain the program of developments in Vertebrates.
2. Explain how endocrine control metamorphosis in Amphibia and Insects.
3. Explain the Anther wall structure.
4. Explain the structure and types of Endosperm.

Write explanatory notes on **any five** of the following. (6×5=30)

5. Types of Fertilization.
6. Primary organizer.
7. Syngamy.
8. Classification of Embryogeny.
9. Importance of cleavage.
10. Pollen germination.
11. Mature Embryo Sac.

Write short notes on **any five** of the following. (4×5=20)

12. Gastrulation.
13. Hox genes.
14. Haustoria.
15. Double Fertilization.
16. Tapetum.
17. Androecium.
18. Regeneration.

61510

V Semester B.Sc. Degree Examination, March/April 2022
(CBCS) (Semester Scheme)
COMPUTER SCIENCE – VI
Visual Programming

Time : 3 Hours Max. Marks : 70

Instruction : *Answer **all** Sections.*

SECTION – A

I. Answer **any 10** questions. **Each** question carries **2** marks. **(10×2=20)**

1) Mention any two visual basic editions.

2) What is form object ?

3) What is dynamic array ?

4) Distinguish between picture box and image box.

5) What is menu editor ?

6) Mention keyboard events in VB.

7) Define polymorphism.

8) Differentiate between ADO and DAO.

9) What is ODBC ?

10) What is MFC ?

11) What are Resources in VC++ ?

12) Define serialization.

P.T.O.

SECTION – B

II. Answer **any 5** questions. **Each** question carries **10** marks. (5×10=50)

13) a) What are the features of visual basic. 5

b) Explain about the visual basic IDE. 5

14) a) Explain any two intrinsic controls in VB. 4

b) Explain the pre-defined dialog boxes in VB. 6

15) a) Explain the select-case statement with examples. 5

b) Explain any two looping statements in VB. 5

16) a) Explain any three array functions used in VB. 6

b) Explain any two microsoft windows common controls in VB. 4

17) a) What is file ? Write a note on sequential file in VB. 5

b) Write a note on DLL in VB. 5

18) a) Write a short notes on DAO data control. 5

b) Write a note on Data Grid control in VB. 5

19) a) Write a VB program to encrypt and decrypt a string. 6

b) Compare between SDI and MDI in VC++. 4

20) a) Explain the VC++ components. 5

b) Explain the features of VC++. 5

____

61503

V Semester B.Sc. Examination, March/April 2022
(CBCS)
CHEMISTRY
Organic Chemistry (Paper – V)

Time : 3 Hours Max. Marks : 70

Instructions : *1) The question paper has* ***two*** *Parts. Answer* ***both*** *the Parts.*
2) Draw diagrams and write ***chemical*** *equations* ***wherever*** *necessary.*

PART – A

Answer **any eight** of the following questions. **Each** question carries **two** marks. (8×2=16)

1. What are enantiomers ? Give an example.
2. How would Ethylamine obtained from acetaldehyde ?
3. Write Haworth structure of Lactose.
4. State Isoprene rule.
5. Write the Nitration of Quinoline.
6. Write the structure of Menthol and its uses.
7. What is Mordant ?
8. Write the structure of Diclofenac and its uses.
9. What is bathochromic effect ? Give an example.
10. What is principle of UV spectroscopy ?
11. Write the D.L. configurations of Glyceraldehyde.
12. What are epimers ? Give an example.

PART – B

Answer **any nine** of the following questions. **Each** question carries **six** marks. (9×6=54)

13. a) Explain optical isomerism of lactic acid.
    b) Write E-Z configurations of 2-butene. (4+2)
14. a) Explain Resolution of Racemic mixture by chemical method.
    b) Define Resolution. (4+2)

P.T.O.

15. a) Describe Hinsberg test to distinguish primary, secondary and tertiary amines.
    b) How benzene diazonium chloride is converted to chlorobenzene ? (4+2)

16. a) Write classification of carbohydrates, based on number of monomeric units present, with one example per each.
    b) Write erythro and threo isomers of Tartaric acid. (4+2)

17. a) Describe Skraup's synthesis of Quinoline.
    b) Give an example for chichibabin reaction. (4+2)

18. a) Write any four general characteristics of Alkaloids.
    b) Structure of Nicotine and identify chiral carbon. (4+2)

19. a) How Malachite green synthesized ?
    b) R.S. configuration of 2-Amino propanoic acid. (4+2)

20. a) Outline the synthesis of sulphanilamide.
    b) Write the synthesis of pyridine from acetylene. (4+2)

21. a) What is chemical shift ? How it is expressed ?
    b) Why TMS used as standard reference compound in NMR spectroscopy ? (3+3)

22. a) Mention the number of signals and multiplicity of the signals in the NMR spectrum of 1, 1, 2-trichloro ethane.
    b) Write advantages of spectroscopic method over conventional methods. (4+2)

23. a) Explain Gabriel Phthalimide reaction with example.
    b) IUPAC name of Trimethylamine. (4+2)

24. a) How citral synthesized from methyl heptenone ?
    b) Compare the basicity of pyrrole and pyridine. (4+2)

25. a) Draw the two conformations of 1, 2-dimethyl cyclohexane.
    b) Significance of fingerprint region in IR spectroscopy. (4+2)

61506

V Semester B.Sc. Examination, March/April 2022
(CBCS)
MATHEMATICS
Mathematics – VI

Time : 3 Hours   Max. Marks : 70

Instruction : *Answer* ***all*** *questions.*

PART – A

1. Answer **any five** questions : (5×2=10)

   a) Write the Euler's equation when f is independent of x.

   b) Find the differential equation of the functional $I = \int_{x_1}^{x_2} \left[y^2 + (y')^2 + 2ye^x\right] dx$

   c) Define geodesic on a surface.

   d) Evaluate $\int_C (5x\,dx + y\,dy)$, where C is the curve $y = 2x^2$ from (0, 0) to (1, 2).

   e) Evaluate $\int_0^2 \int_0^1 (x + y)\, dx dy$.

   f) Evaluate $\int_0^1\int_0^1\int_0^1 e^{x+y+z}\, dx dy dz$.

   g) State Gauss' divergence theorem.

   h) If V is the volume of a region bounded by a closed surface S, then show that $\iint_S \left(\nabla r^2 \cdot \hat{n}\right) ds = 6V$.

PART – B

Answer **two full** questions : (2×10=20)

2. a) Find the extremal of the functional $I = \int_0^{\frac{\pi}{2}} \left[y^2 - (y')^2 - 2y\sin x\right] dx$ under the end conditions $y(0) = y\left(\frac{\pi}{2}\right) = 0$.

   b) Find the geodesic on a plane.

OR

P.T.O.

3. a) Find the function y which makes the integral $\int_{x_1}^{x_2} \left[y^2 + 4(y')^2\right] dx = 0$ an extremum.

b) Find the geodesics on a surface given that the arc length on the surface is $S = \int_{x_1}^{x_2} \sqrt{x\left[1 + (y')^2\right]}\, dx$.

4. a) If a cable hangs freely under gravity from two fixed points, then show that the shape of the curve is a catenary.

b) Find the extremal of the functional $\int_0^1 \left[(y')^2 + x^2\right] dx$ subject to the constraint $\int_0^1 y dx = 2$ and having end conditions y(0) = 0, y(1) = 1.

OR

5. a) Find the extremal of the functional $I = \int_0^{\pi} \left[(y')^2 - y^2\right] dx$ under the conditions y(0) = 0, y(π) = 1 subject to the condition $\int_0^{\pi} y dx = 1$.

b) Find the extremal of the functional $I = \int_{x_1}^{x_2} \left[1 + x y' + x(y')^2\right] dx$.

PART – C

Answer **two full** questions : **(2x10=20)**

6. a) Evaluate $\int_C [(2x + y)dx + (3y + x)dy]$ along the line joining (0,1) and (2, 5)

b) Evaluate $\iint_R xy\, dxdy$ over the positive quadrant of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$.

OR

7. a) Change the order of integration and evaluate $\int_0^3 \int_0^{\sqrt{4-y}} (x + y) dxdy$.

b) Find the area between the parabolas $y^2 = 4ax$ and $x^2 = 4ay$ by double integration.

8. a) Evaluate $\int_0^a \int_0^{\sqrt{a^2-x^2}} \int_0^{\sqrt{a^2-x^2-y^2}} \frac{dxdydz}{\sqrt{a^2-x^2-y^2-z^2}}$.

b) Evaluate $\iint_R xy\,(x^2+y^2)^{3/2}\,dxdy$ over the positive quadrant of the circle $x^2+y^2=a^2$ by transforming to polar co-ordinates.

OR

9. a) Find the volume bounded by the cylinder $x^2+y^2=4$ and the planes $y+z=3$ and $z=0$.

b) Evaluate $\iiint_R z\,(x^2+y^2)\,dx\,dy\,dz$, $x^2+y^2 \leq 1$; $2 \leq z \leq 3$ by changing to cylindrical polar co-ordinates.

PART – D

Answer **two full** questions : **(2×10=20)**

10. a) State and prove Green's theorem in a plane.

b) By using Green's theorem, evaluate $\int_C (y-\sin x)\,dx + \cos x\,dy$, where C is the triangle in the xy-plane bounded by the lines $y=0$, $x=\frac{\pi}{2}$ and $y=\frac{2x}{\pi}$.

OR

11. a) Evaluate $\iint_S \vec{F}\cdot\hat{n}\,ds$ using divergence theorem, where $\vec{F}=(x^2-yz)\,\hat{i}+(y^2-zx)\,\hat{j}+(z^2-xy)\,\hat{k}$ taken over the rectangular parallelopiped $0 \leq x \leq a$, $0 \leq y \leq b$, $0 \leq z \leq c$.

b) Evaluate $\int_C e^{-x}\sin y\,dx + e^{-x}\cos y\,dy$, using Green's theorem, where C is the rectangle with vertices (0, 0), (π, 0), $\left(\pi, \frac{\pi}{2}\right)$ and $\left(0, \frac{\pi}{2}\right)$.

12. a) Using Stoke's theorem evaluate $\int_C \vec{F}\cdot d\vec{r}$, where $\vec{F}=y^2\,\hat{i}+x^2\,\hat{j}-(x+z)\,\hat{k}$ and C is the boundary of the triangle with vertices (0, 0, 0) , (1, 0, 0) and (1, 1, 0).

b) Using Green's theorem, evaluate for the scalar line integral of $\vec{F} = (x^2 - y^2)\hat{i} + 2xy\hat{j}$ over the rectangular region bounded by the line $x = 0, y = 0; x = a, y = b$.

OR

13. a) Evaluate using Gauss' divergence theorem $\iint_S \vec{F} \cdot \hat{n} ds$, where $\vec{F} = (x\hat{i} + y\hat{j} + z^2\hat{k})$ and s is the closed surface bounded by the cone $x^2 + y^2 = z^2$ and the plane $z = 1$.

b) Evaluate by Stoke's theorem $\oint_C (\sin z dx - \cos x dy + \sin y dz)$, where 'C' is the boundary of the rectangle, $0 \le x \le \pi, 0 \le y \le 1, z = 3$.

QP – 173

V Semester B.A./B.Sc. Examination, March/April 2022
(Semester Scheme)
(CBCS) (F + R) (2016 – 17 and Onwards)
MATHEMATICS (Paper – V)

Time : 3 Hours Max. Marks : 70

***Instruction** : Answer **all** questions.*

PART – A

1. Answer **any five** questions. **(5×2=10)**

a) In a ring (R, +,·), show that $a\cdot(-b) = (-a)\cdot b = -(a\cdot b)$ for all $a, b \in R$.

b) Define subring of a ring. Give an example.

c) Give an example of

i) Commutative ring without unity.

ii) A non commutative ring without unity.

d) If $\phi(x, y, z) = x^2y^2z^2$ and $\vec{F} = 2x\hat{i} + y\hat{j} + 3z\hat{k}$ find $\vec{F}.\nabla\phi$.

e) Find the unit normal vector to the surface $x^2 - y^2 + z = 3$ at the point (1, 0, 2).

f) Evaluate : $\Delta^3[(1-x)(1-2x)(1-3x)]$.

g) Write Lagrange's interpolation formula.

h) Evaluate : $\int_0^1 \frac{dx}{1+x}$ using Trapezoidal rule, given

x	0	$\frac{1}{6}$	$\frac{2}{6}$	$\frac{3}{6}$	$\frac{4}{6}$	$\frac{5}{6}$	1
y	1	0.8571	0.75	0.6667	0.6	0.5455	0.5

PART – B

Answer **two full** questions. **(2×10=20)**

2. a) Prove that every field is an integral domain.
Is the converse of the above theorem is true ? Justify with example.

b) Show that set R = {0, 1, 2, 3, 4, 5} is a commutative ring w.r.t $\oplus_6$ and $\otimes_6$ as two compositions.

OR

P.T.O.

3. a) Prove that a ring R without zero divisors if and only if the cancellation laws holds.

   b) Show that necessary and sufficient condition for a non-empty subset S of a ring R to be a subring of R are

      i) $a - b \in S \quad \forall a, b \in S$

      ii) $ab \in S \quad \forall a, b \in S$

4. a) Prove that an ideal S of the ring (z, +, ·) is maximal if and only if S is generated by some prime integer.

   b) Find all the principal ideals of the ring R = {0, 1, 2, 3, 4, 5} w.r.t $\oplus_6$ and $\otimes_6$

OR

5. a) If $f : R \to R'$ be a homomorphism of R into R', then show that Ker f is an ideal of R.

   b) State and prove fundamental theorem of homomorphism.

PART – C

Answer **two full** questions. **(2×10=20)**

6. a) Find the directional derivative of $\phi(x, y, z) = xyz - xy^2z^3$ at the point (1, 2, –1) in the direction of $\hat{i} - \hat{j} - 3\hat{k}$.

   b) If $\vec{F} = \text{grad}(x^3 + y^3 + z^3 - 3xyz)$, find div $\vec{F}$ and curl $\vec{F}$.

OR

7. a) Find the values of 'a' and 'b' so that the surface $5x^2 - 2yz - 9x = 0$ may cut the surface $ax^2 + by^3 = 4$ orthogonally at (1, – 1, 2).

   b) If ϕ is a scalar point function and $\vec{F}$ is a vector point function, prove that $\text{div}(\phi\vec{F}) = \phi(\text{div}\vec{F}) + (\text{grad}\,\phi).\vec{F}$.

8. a) If $\vec{u} = x^2\hat{i} + y^2\hat{j} + z^2\hat{k}$ and $\vec{v} = yz\hat{i} + zx\hat{j} + xy\hat{k}$. Show that $\vec{u} \times \vec{v}$ is a solenoidal vector.

   b) Show that $\vec{F} = (6xy + z^3)\hat{i} + (3x^2 - z)\hat{j} + (3xz^2 - y)\hat{k}$ is irrotational. Find ϕ such that $\vec{F} = \nabla\phi$.

OR

9. a) Prove that :

      i) $\text{div}(\text{curl}\,\vec{F}) = 0$.

      ii) $\text{curl}(\text{grad}\,\phi) = 0$.

   b) For any vector field $\vec{f}$ and $\vec{g}$ prove that $\text{div}(\vec{f} \times \vec{g}) = \vec{g}.\text{curl}\,\vec{f} - \vec{f}.\text{curl}\,\vec{g}$.

PART – D

Answer any two full questions. (2×10=20)

10. a) Use the method of separation of symbols. Prove that

$$u_0 + \frac{u_1 x}{1!} + \frac{u_2 x^2}{2!} + \ldots\ldots = e^x\left[u_0 + x\frac{\Delta u_0}{1!} + x^2\frac{\Delta u_0}{2!} + \ldots\right].$$

b) Obtain the function whose first difference is $6x^2 + 10x + 11$.

OR

11. a) Find a cubic polynomials which takes the following data and hence evaluate f(4).

x	0	1	2	3
f(x)	1	2	1	10

b) Find f(1.4) from the following data using difference table.

x	1	2	3	4	5
f(x)	10	26	58	112	194

12. a) Use Newton divided difference formula and find f(8) from the following data :

x	1	3	6	11
f(x)	4	32	224	1344

b) Evaluate $\int_0^6 \frac{1}{1+x^2}\,dx$ by using Simpson's $\frac{3}{8}^{th}$ rule by taking n = 6.

OR

13. a) By using Lagrange's interpolation formula, find f(6) from the following data :

x	3	7	9	10
f(x)	168	120	72	63

b) Evaluate $\int_0^{0.6} e^{-x^2}\,dx$ by taking 6 subintervals by using Simpson's $\frac{1}{3}^{rd}$ rule.

61505

V Semester B.A./B.Sc. Examination, March/April 2022
(CBCS)
MATHEMATICS – V

Time : 3 Hours   Max. Marks : 70

***Instruction** : Answer **all** questions.*

PART – A

Answer **any five** questions :   (5×2=10)

1. a) In a ring (R, +, .) prove that $a.(b - c) = a.b - a.c, \forall a, b, c \in R$.

   b) Define sub-ring of a ring. Give an example.

   c) Show that $f : (z, +, .) \to (z, +, .)$ defined by $f(x) = x, \forall x \in z$ is a homomorphism.

   d) Find the unit normal vector to the surface $xy^3z^2 = 4$ at (–1, –1, 2).

   e) If $\vec{F} = yz\hat{i} + zx\hat{j} + xy\hat{k}$, show that $\vec{F}$ is irrotational.

   f) Evaluate $\Delta^{10}\left[(1-ax)\left(1-bx^2\right)\left(1-cx^3\right)\left(1-dx^4\right)\right]$.

   g) Write Lagrange's interpolation formula for unequal intervals.

   h) Evaluate $\int_0^b \frac{1}{1+x^2}\,dx$ using Simpson's $\frac{3}{8}^{th}$ rule given

x	0	1	2	3	4	5	6
y	1	0.5	0.2	0.1	0.0588	0.0385	0.027

PART – B

Answer **two full** questions :   (2×10=20)

2. a) Prove that every field is an integral domain.

   b) Prove that the set R = {0, 1, 2, 3, 4, 5} is a commutative ring w.r.t. $+_6$ and x_6 as the two compositions.

OR

P.T.O.

3. a) Prove that a ring R is without zero divisors if and only if cancellation laws hold in R.

b) Find all the principal ideals of the ring

$R = \{0, 1, 2, 3, 4, 5\}$ w.r.t. $+_6$ and $\times_6$.

4. a) If $f : R \to R'$ be a homomorphism of R into R′ then show that Ker f is an ideal of R.

b) State and prove fundamental theorem of homomorphism of rings.

OR

5. a) Show that $f : R_1 \to R$ defined by $f\begin{pmatrix} a & 0 \\ 0 & 0 \end{pmatrix} = a, \forall \begin{pmatrix} a & 0 \\ 0 & 0 \end{pmatrix} \in R$ is an isomorphism where $R_1 = \left\{\begin{pmatrix} a & 0 \\ 0 & 0 \end{pmatrix} \Big/ a \in R\right\}$.

b) Prove that an ideal S of the ring of integers (z, +, .) is maximal if and only if S is generated by some prime integer.

PART – C

Answer **two full** questions : **(2×10=20)**

6. a) Prove that the surfaces $4x^2y + z^3 = 4$ and $5x^2 - 2yz - 9x = 0$ intersect orthogonally at the point (1, –1, 2).

b) If $\vec{F} = \text{grad}\,(2x^3y^2z^4)$ find $\text{div}(\vec{F})$ and $\text{curl}(\vec{F})$.

OR

7. a) Prove that $\nabla^2(r^n) = n\,(n + 1)r^{n-2}$ where n is a non-zero constant. Also show that r^n is harmonic if $n = -1$.

b) If the vector $\vec{F} = (3x + 3y + 4z)\,\hat{i} + (x - ay + 3z)\,\hat{j} + (3x + 2y - z)\,\hat{k}$ is Solenoidal find 'a'.

8. a) If $\vec{F} = (x + y + az)\,\hat{i} + (bx + 2y - z)\,\hat{j} + (x + cy + 2z)\,\hat{k}$. Find a, b, c such that $\vec{F}$ is irrotational then find ϕ such that $\vec{F} = \nabla\phi$.

b) If ϕ is a scalar point function and $\vec{F}$ is a vector point function then prove that $\text{div}\left(\phi\vec{F}\right) = \phi\left(\text{div}\vec{F}\right) + (\text{grad}\phi)\,.\,\vec{F}$.

OR

9. a) If $\vec{F} = x^2yz\,\hat{i} + xy^2z\,\hat{j} + xyz^2\hat{k}$ and $\phi = xyz$ find $\text{div}\left(\phi\vec{F}\right)$.

b) If $\vec{F} = x^2y\,\hat{i} - 2xz\,\hat{j} + 2yz\hat{k}$ find $\text{curl}\left(\text{curl}\,\vec{F}\right)$.

PART – D

Answer **two full** questions : (2×10=20)

10. a) Use the method of separation of symbols. Prove that

$$u_0 + u_1x + u_2x^2 + \ldots \text{ to } \infty = \frac{u_0}{(1-x)} + \frac{x\,\Delta u_0}{(1-x)^2} + \frac{x^2\Delta^2 u_0}{(1-x)^3} + \ldots \text{ to } \infty.$$

b) Find f(2.5) from the following data :

x	1	2	3	4	5	6
f(x)	1	8	27	64	125	216

OR

11. a) Find the cubic polynomial which takes the following values :

x	0	1	2	3
f(x)	1	2	1	10

b) Using Simpson's $\frac{1}{3}^{rd}$ rule evaluate $\int_0^{0.6} e^{-x^2}\,dx$.

12. a) Evaluate :

i) $\Delta(e^{2x}\log 3x)$ (take h = 1)

ii) $\Delta(\tan^{-1}x)$ (take h = 1).

b) Using Lagrange's interpolation formula find f(6) from the following data :

x	3	7	9	10
f(x)	168	120	72	63

OR

13. a) Using Newton's divided difference table find f(7) from the following data :

x	2	5	8	10	12
y	4.4	6.2	6.7	7.5	8.7

b) Evaluate $\int_1^5 \log_{10} x \, dx$ by Trapezoidal rule dividing the interval (1, 5) into 8 equal intervals.

QP – 174

V Semester B.A./B.Sc. Examination, March/April 2022
(CBCS 2016-17 and Onwards) (F+R)
MATHEMATICS
Mathematics (Paper – VI)

Time : 3 Hours | Max. Marks : 70

Instruction : *Answer **all** questions.*

PART – A

Answer **any five** questions. **(5×2=10)**

1. a) Show that the shortest distance between two points in a plane is a straight line.

b) Find the differential equation of the functional $I = \int_{x_1}^{x_2} \left[y^2 - (y')^2 - 2y\sin x \right] dx$.

c) Write Euler's equation when the function f is independent of x and y.

d) Evaluate $\int_C [xdy - ydx]$, where C is the curve $y = x^2$ from (0, 0) to (1, 1).

e) Evaluate $\int_0^a \int_0^b (x^2 + y^2)\, dxdy$.

f) Evaluate $\int_0^1 \int_0^2 \int_1^2 xyz^2\, dxdydz$.

g) State Stoke's theorem.

h) Show that the area of ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ is πab using Green's theorem.

P.T.O.

PART – B

Answer **two full** questions. **(2×10=20)**

2. a) Derive the Euler's equation in the form $\frac{\partial f}{\partial y} - \frac{d}{dx}\left(\frac{\partial f}{\partial y'}\right) = 0$.

b) Find the geodesic on a surface of right circular cylinder.

OR

3. a) Find the extremal of the functional $I = \int_{x_1}^{x_2} \left[12xy + (y')^2\right] dx$.

b) Solve the variational problem $\int_1^2 \left[x^2(y')^2 + 2y(x+y)\right] dx = 0$ with the conditions $y(1) = 0$ and $y(2) = 0$.

4. a) Find the extremal of the functional $I = \int_0^{\pi} \left[(y')^2 - y^2\right] dx$ with $y(0) = 0$ and $y(\pi) = 1$ and subject to the constraint $J = \int_0^{\pi} y\, dx = 1$.

b) Show that the general solution of Euler's equation for the integral $I = \int_{x_1}^{x_2} \left(\frac{y'}{y}\right)^2 dx$ is $y = ae^{bx}$.

OR

5. a) Find the equation of the plane curve on which a particle in the absence of friction, will slide from one point to another in the shortest time under the action of gravity.

b) Find the extremal of the functional $I = \int_{x_1}^{x_2} \left[y^2 + (y')^2 + 2ye^x\right] dx$.

PART – C

Answer **two full** questions. **(2×10=20)**

6. a) Evaluate $\int_C (x+y+z)\, ds$, where 'C' is the line joining the points (1, 2, 3) and (4, 5, 6) whose equations are $x = 3t + 1$, $y = 3t + 2$, $z = 3t + 3$.

b) Evaluate $\int_C [(x+2y)\,dx + (4-2x)\,dy]$ along the curve $C: \frac{x^2}{9}+\frac{y^2}{4}=1$ in anticlockwise direction.

OR

7. a) Evaluate $\iint_A (4x^2-y^2)\,dxdy$, where 'A' is the area bounded by the lines $y=0$, $y=x$ and $x=1$.

b) Find the area of the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ by using double integration.

8. a) Evaluate $\int_{-a}^{a}\int_{-b}^{b}\int_{-c}^{c}(x^2+y^2+z^2)\,dxdydz$.

b) Evaluate $\int_0^\infty\int_0^\infty e^{-(x^2+y^2)}\,dxdy$ by changing to polar coordinates.

OR

9. a) Evaluate $\iiint_R xyz\,dxdydz$ over the positive octant of the sphere $x^2+y^2+z^2=a^2$ by transforming into cylindrical polar coordinates.

b) Find the volume of the sphere $x^2+y^2+z^2=a^2$ using triple integration.

PART – D

Answer **two full** questions. (2×10=20)

10. a) State and prove Green's theorem.

b) Evaluate using divergence theorem $\iint_S \vec{F}\cdot\hat{n}\,dS$, where $\vec{F}=2xy\hat{i}+yz^2\hat{j}+xz\hat{k}$ and S be the surface of the cube bounded by $x=0$, $x=1$, $y=0$, $y=1$, $z=0$, $z=1$.

OR

11. a) Verify Green's theorem in the plane for $\oint_C \left[xy + y^2\right] dx + x^2 dy$, where C is the closed curve bounded by y = x and $y = x^2$.

b) Evaluate $\iint_S \vec{F} \cdot \hat{n} dS$ using divergence theorem where $\vec{F} = x\hat{i} - y\hat{j} + (z^2 - 1)\hat{k}$ and S is the closed surface bounded by planes z = 0, z = 1 and the cylinder $x^2 + y^2 = 4$.

12. a) Evaluate by Stoke's theorem $\oint_C [yzdx + zxdy + xydz]$, where C is the curve $x^2 + y^2 = 1$, $z = y^2$.

b) Evaluate by using divergence theorem for $\iint_S \vec{F} \cdot \hat{n}\, dS$, where $\vec{F} = 2xy\hat{i} + yz^2\hat{j} + xz\hat{k}$ over the rectangular parallelepiped $0 \le x \le 1$, $0 \le y \le 2$, $0 \le z \le 3$.

OR

13. a) Evaluate by Stoke's theorem $\oint_C [\sin z dx - \cos x dy + \sin y dz]$, where C is the boundary of rectangle $0 \le x \le \pi$, $0 \le y \le 1$, $z = 3$.

b) Evaluate using Green's theorem in the plane for $\int_C \left[3x^2 - 8y^2\right] dx + [4y - 6xy] dy$, where C is boundary of the region enclosed by x = 0, y = 0 and x + y = 1.