अथवा

श्रियः कुरुणामधिपस्य पालनीं-
प्रजासु वृत्तिं यमयुङ्क्तवेदितुम् ।
स वर्णिलिङ्गी विदितः समाययौ-
युधिष्ठिरं द्वैतवने वनेचरः ।।

2019

Time - 3 hours

Full Marks - 80

*Answer **all** questions.*
Figures in the right hand margin indicate marks.

१ । महाकाव्यस्य उत्पत्तिं क्रमविकाशञ्च विवृणत । (१२

अथवा

चम्पूकाव्यस्य लक्षणं विलिख्य तस्य उत्पत्तिं क्रमविकाशञ्च आलोचयत ।

२ । द्वयोः संक्षिप्त टिप्पणी प्रदेया । (४ × २

(क) माघः

(ख) कालिदासः

(ग) बुद्धचरितम्

(घ) भारविः

३ । ''माघे सन्ति त्रयो गुणाः'' इत्युक्तेः याथार्थ्यं प्रतिपादयत । (१५

अथवा

नारदं प्रति श्रीकृष्णविहितं स्वागतमालोचयत ।

४। सप्रसङ्गं व्याख्या कार्या । (१०

नवानधोऽधो वृहतः पयोधरान्-
समूढ-कर्पूर-पराग-पाण्डुरम् ।
क्षणं क्षणोत्क्षिप्त गजेन्द्र-कृत्तिना-
स्फूटोपमं भूतिसितेन शम्भुना ।।

अथवा

स तप्तकार्तस्वरभास्वराम्वरः
कठोरताराधिपलाञ्छनच्छविः ।
विदिद्युते वाडवजातवेदसः-
शिखाभिराश्लिष्ट इवाम्भसां निधिः ।।

५। उत्कलभाषया आङ्ग्लोभाषया <u>वा</u> अनुवादः कार्यः । (५

हरत्यघं सम्प्रति हेतुरेष्यतः-
शुभस्य पूर्वाचरितैः कृतं शुभैः ।
शरीरभाजां भवदीयदर्शनं
व्यनक्ति कालत्रितयेऽपि योग्यताम् ।।

अथवा

श्रियः पाति श्रीमति शासितुं-
जगज्जगन्निवासः वसुदेव सद्मनि ।
वसन्ददर्शावतरन्तमम्वरात्-
हिरण्यगर्भाङ्गभुवं मुनिं हरिः ।।

६। युधिष्ठिरं प्रति द्रौपद्या उद्वोधनप्रकारम् आलोचयत । (१५

अथवा

सुशासकरूपेण सुयोधनस्य समीक्षणं कुरुत ।

७। सप्रसङ्गं व्याख्या कार्या । (१०

कृतप्रणामस्य महीं महीभुजे-
जितां सपत्नेन निवेदयिष्यतः ।
न विव्यथे तस्य मनो न हि प्रियं-
प्रवक्तृमिच्छन्ति मृषा हितैषिणः ।।

अथवा

स यौवराज्ये नवयौवनोद्धतं-
निधाय दुःशासनमिद्धशासनः ।
मखेष्वखिन्नोऽनुमतः पुरोधसा-
धिनोति हव्येन हिरण्यरेतसम् ।।

८। उत्कलभाषया आङ्ग्लोभाषया <u>वा</u> अनुवादः करणीयः । (५

विशङ्कमानो भवतः पराभवं-
नृपासनस्थोऽपि वनाधिवासिनः ।
दुरोदरच्छद्मजितां समीहते-
नयेन जेतुं जगतीं सुयोधनः ।।

४। अधोलिखितेषु त्रयाणां सूत्राणां व्याख्यां कुरुत । (८ × ३

(क) छन्दसि लुङ्लङ्लिटः ।

(ख) चतुर्थ्यर्थे बहुलं छन्दसि ।

(ग) प्रकृत्यान्तः पादमव्यपरे ।

(घ) व्यत्ययो बहुलम् ।

(ङ) आज्जसेरसुक् ।

(च) व्यवहिताश्च ।

५। वेदाङ्गानां स्वरूपं प्रतिपादयत । (१४

अथवा

सामवेदस्य महत्वं विवृणत ।

६। त्रयाणां टिप्पणीं लिखत । (४ × ३

(क) सायणाचार्यः

(ख) त्रयी

(ग) उपनिषद्

(घ) ब्राह्मणसाहित्यम्

(ङ) कृष्णयजुर्वेदः

2019

Time - 3 hours

Full Marks - 80

*Answer **all** questions.*
Figures in the right hand margin indicate marks.

१। ऋषिछन्ददेवतानिर्देशपुरःसरं मन्त्रद्वयं व्याख्यात । (८ × २

(क) सहस्रशीर्षापुरुषः सहस्राक्षः सहस्रपात् ।
स भूमिं सर्वतः स्पृत्वात्यतिष्ठद्दशाङ्गुलम् ।।

(ख) येनेदं भूतं भुवनं भविष्यत्परिं गृहीतममृतेन सर्वम् ।
येन यज्ञस्तायते सप्तहोता तन्मेमनः शिवसंकल्पमस्तु ।।

(ग) संगच्छध्वं संवदध्वं सं वो मनांसि जानताम् ।
देवाभागं यथापूर्वे संजानाना उपासते ।।

२। उत्कलभाषया आङ्ग्लोभाषया वा अनुवादः करणीयः । (४

ह्वयाम्यग्निं प्रथमं स्वस्तये-
ह्वयामि मित्रावरुणाविहावसे ।

अथवा

अहं रुद्रेभिर्वसुभिश्चराम्यहमादि त्यैरुतविश्वदेवैः ।

३। इन्द्रस्य अग्नेः वा स्वरूपं प्रतिपादयत । (१०

(घ) राज्ञः सृष्टिः कथमभूत् ? आलोचयत ।

(ङ) अविनयात् नृपस्य किं भवति ?

(च) प्रातः उत्थाय क्रमशः नराधिपः किं कुर्यात् ?

३ । उत्कलभाषया आङ्ग्लोभाषया वा अनुवादः कार्यः । (५ × २

(क) श्रुताध्ययनसंपन्ना धर्मज्ञाः सत्यवादिनः ।
राज्ञा सभासदः कार्या रिपौमित्रे च ये समाः ।।

अथवा

आध्यादीनां विहर्तारं धानिने दापयेद्धनम् ।
दण्डं च तत्समं राज्ञे शक्त्यपेक्षमथापि वा ।।

(ख) ब्राह्मं प्राप्तेन संस्कारं क्षत्रियेण यथाविधिः ।
सर्वस्यास्य यथान्यायं कर्त्तव्यं परिरक्षणम् ।।

अथवा

तं राजा प्रणयन् सम्यक् त्रिवर्गेणाभिवर्धते ।
कामात्मा विषमः क्षुद्रो दण्डेनैव निहन्यते ।।

2019

Time - 3 hours

Full Marks - 80

*Answer **all** questions.*
Figures in the right hand margin indicate marks.

१ । पञ्चानां प्रश्नानामुत्तरं प्रदेयम् । (७ × ५

(क) नृपः व्यवहारान् कथं पश्येत् ?

(ख) ''अर्थशास्त्रात्तु वलवद्धर्मशास्त्रमिति स्थितिः'' – प्रमाणीकुरुत ।

(ग) याज्ञवल्क्यस्मृत्यनुसारं व्यवहारः कीदृशः ?

(घ) ऋणदानविषये याज्ञवल्क्येन किम् उक्तम् ?

(ङ) साक्षिणः कानि कानि दुष्टलक्षणानि दृश्यन्ते ?

(च) आधिविषये कः विचारः विहितः स्मृतौ ?

२ । पञ्चानां प्रश्नानामुत्तरं प्रदेयम् । (७ × ५

(क) दण्डस्य उत्पत्तिः-प्रशंसा-निषेधप्रकारञ्च मनुस्मृत्यनुसारं विशदयत।

(ख) राजा सचिवैः सह कथं मन्त्रयेत् ?

(ग) राज्ञां व्यसनत्यागविषये मनुना किं कथितम् ?

४। अस्य गद्यांशस्य समुचितशीर्षकं लिखित्वा भावसंक्षेपीकरणं कुरु । (१०

कर्मसु कौशलं योग: कथ्यते । इदं जगत् कर्ममयम् अस्ति । अस्य जगत: अन्यनाम कर्मालय: अस्ति । कर्म द्विविधम् अस्ति। सत्कर्म असत्कर्म च । शास्त्रविहितं कर्म सत्कर्म अन्यथा असत् कर्म इत्युच्यते । एकं विधिकर्मं उच्यते । जगति केचित् सत्कर्म केचित् असत्कर्म च कुर्वन्ति । येसां यादृश: संस्कारो भवति तेसां तादृशं कर्म भवति । सुसंस्कारसम्पन्नो जन: सत्कर्म करोति । कुसंस्कारसम्पन्न: असत् कर्म करोति । सत्कर्मण: फलं पुण्यप्रदम्, असत्कर्मण: फलं पापप्रदमस्ति । पुण्येन सुखं पापेन च दु:खं लभ्यते । सत्कर्मणा शारीरिकं मानसिकं च सुखं प्राप्य जना: सहर्षं जीवनं यापयन्ति । सत्कर्मण धर्मार्थकाममोक्षा: अपि प्राप्यन्ते ।

५। तव ग्रामे अनुष्ठितोत्सवम् आश्रित्या मित्रं प्रति पत्रमेकं लिखत । (१०

अथवा

भवतां महाविद्यालये अनुष्ठित वार्षिकोत्सवम् आश्रित्य मित्रं प्रति पत्रमेकं लिखत ।

2019

Time - 3 hours

Full Marks - 80

*Answer **all** questions.*
Figures in the right hand margin indicate marks.

१। केषाञ्चित् दशप्रश्नानामुत्तरं देयम् । (२ × १०

(क) संस्कृतक्रियापदानां सम्पर्क: आंग्लभाषया कथमस्ति ? उदाहरत ।

(ख) साधारण शब्दानां सम्पर्क: आङ्ग्लसंस्कृतयो: मध्ये कथं वर्तते उदाहरत ।

(ग) आङ्ग्लभाषायां व्यवहृत तद्भवशब्दानामुदाहरणं देही ।

(घ) आङ्ग्लभाषाया सह संस्कृतभाषाया: सर्वनामगतमुदाहरणं प्रदेयम् ।

(ङ) फ्रांसभाषाया सह संस्कृतस्य सङ्गस्वागत: संबंध: लेखनीय: ।

(च) फ्रांसभाषाया सह संस्कृतस्य साधारणशब्दानां संबंध: प्रकटनीय: ।

(छ) क्रियापदेषु तमिलसंस्कृतयो: मध्ये भेद प्रदर्शनीय: ।

(ज) हिन्दीभाषायां तद्भवशब्दानां परिचयो देय ।

(झ) सर्वासु भाषासु यथवात् प्रयुक्ता: 'उ'कारान्त कतिपया: शब्दा देया: ?

(ञ) सर्वासु भाषासु के 'इ'कारान्त शब्दा: व्यवह्रियन्ते ?

(ट) बालानां आनन्दार्थं क्षुद्रगल्पमेकं लिखत ।

(ठ) आङ्गलभाषायां तत्समशब्दानां व्यवहारं प्रदर्शयत ।

२। दशप्रश्नानामुत्तरं प्रदातव्यम् । (२ × १०

(क) संख्यामाश्रित्य कतिपयानि वाक्यानि रचयत ।

(ख) कतिपयं नाट्यसंलापं लिखत ।

(ग) कतिपयाधातूनां परिचयो देय ।

(घ) वर्ग परिचय प्रदानकाले आलाप: कथं क्रियते ?

(ङ) सामान्यालापस्य उदाहरणं देहि ।

(च) बालानाम् अर्थ लघुकथाया: शीर्षकं किम् ?

(छ) बालानाम् अर्थ दीर्घकथाया: शीर्षकं किम् ?

(ज) संस्कृतमाध्यमेन भावविनिमयस्य उदाहरणं देहि ।

(झ) 'मासं' 'दिनाङ्क' च आश्रित्य कतिपयानि वाक्यानि लिखत ।

(ञ) 'अस्माकं ध्येयम्' इति गीतस्य सारं लिखत ।

(ट) वर्ष शब्दमाश्रित्य वाक्यद्वयं लिखत ।

(ठ) कतिपय निर्देशात्मकमालापं लिखत ।

३। दशप्रश्नानामुत्तरं दत्त । (२ × १०

(क) 'लङ्' लकारास्य प्रयोगेण कतिपयानि वाक्यानि रचयत ।

(ख) 'प्रवृत्ति', 'कृत्रिम', 'कोमलम्', 'प्रत्यक्षम्', 'निन्दा' – एतेषां विपरीतशब्दान् लिखत ।

(ग) संस्कृतस्य कतिपयानि सूक्तानि लिखत ।

(घ) संस्कृतशिक्षणक्षेत्रे कति पाठा: परिकल्पिता: ?

(ङ) अहं लिखामि । त्वमपि ..... ।
अहं बदामि । त्वमपि ..... ।

(च) अहं शिक्षकस्य आज्ञां पालयामि । त्वमपि ..... ।
अहं एतत् वातायनम् उद्घाटयामि । त्वमपि ..... ।

(छ) पुंलिङ्गे स्त्रीलिङ्गे

तेषाम् ..... , ... एतासाम्

एषाम् ..... , ... शिक्षिकाणाम्

(ज) ऋषि:, गुणिन्, पितृ, शिशु – एतेषां प्रातिपदिकानां षष्ठी बहुवचने रूपाणि लिखत ।

(झ) 'तमप्' प्रत्ययं प्रयुज्य कतिपया: शब्द: लिखितव्या: ।

(ञ) बालक:, नद्याम्, साधु, आश्रमे – एतै: पदै: सह सर्वनामपदानां संयोगं कुरुत ।

(ट) 'क्त्वा' प्रत्ययान्त कतिपया: शब्दा लिखितव्या: ।

2019

Time - 3 hours

Full Marks - 60

*Answer **both groups** as per instructions.*
Figures in the right hand margin indicate marks.
Draw labelled diagrams wherever necessary.

GROUP - A

1. Write notes on any five of following with two important sentences each. [2 × 5

   (a) DNA as viral infecting agent

   (b) Cot curves

   (c) Korberg's discovery

   (d) Degeneracy of Genetic code

   (e) Ribozymes

   (f) Fidelity of translation

   (g) Repressor gene

GROUP - B

*Answer **ALL** questions.*

2. Discuss "DNA as genetic material" and describe Griffith's experiment. [10

OR

Write notes on <u>any two</u> : [5 × 2

(a) RNA world

(b) Fraenkel Conrat's experiment

(c) Properties of DNA as genetic material

3. Describe the mechanism of replication of linear ds DNA. [10

OR

Write notes on <u>any two</u> : [5 × 2

(a) Nucleosome

(b) Heterochromatin

(c) RNA primimg

4. Describe the mechanism of transcription in Prokaryotes. [10

OR

Write notes on <u>any two</u> : [5 × 2

(a) Central Dogma.

(b) Splicing of RNA

(c) Genetic Code

5. Describe the mechanism of translation in Prokaryotes. [10

OR

Write notes on <u>any two</u> : [5 × 2

(a) Ribosome

(b) t-RNA

(c) Inhibitors of protein synthesis

6. Describe about the Lac-operon model. [10

OR

Write notes on <u>any two</u> : [5 × 2

(a) Gene concept

(b) Heat shock proteins

(c) Gene silencing

2019

Time - 3 hours

Full Marks - 60

*Answer **both groups** as per instructions.*
Figures in the right hand margin indicate marks.
Draw labelled diagrams wherever necessary.

GROUP - A

1. Write notes on any five of following with two important sentences each. [2 × 5

   (a) Water potential

   (b) Micro nutrient

   (c) Facilitated diffusion

   (d) Devernalization

   (e) Low Fluence Responses (LFRs)

   (f) Critical day length

   (g) Gibberella fujikuroi

GROUP - B

*Answer **ALL** questions.*

2. Describe the stomatal mechanism of transpiration of water. Explain the various factors affecting the rate of transpiration. [10

OR

Write short notes on <u>any two</u> : [5 × 2

(a) Apoplast and Symplast

(b) Active water absorption

(c) Root pressure theory

3. What is solution culture ? Describe different types of hydroponics and disadvantages of hydroponics. [10

OR

Write short notes on <u>any two</u> : [5 × 2

(a) Deficiency symptoms of Calcium and Magnesium

(b) Role of essential elements

(c) Application of chelating agents

4. Describe the different mechanism of uptake of nutrients from the soil and transport of ions across cell membrane. [10

OR

Write short notes on <u>any two</u> : [5 × 2

(a) Uniport and Uniporter

(b) Donnan equilibrium

(c) Active uptake of ions

5. Describe the chemical nature, bioassay and physical roles of auxin in plant growth and development. [10

OR

Write short notes on <u>any two</u> : [5 × 2

(a) Bioassay of cytokinin

(b) Physiological effects of Abscisic acid

(c) Jasmonic acid

6. What is vernalization ? Describe the sites of vernalization. How plants can be devernalized ? [10

OR

Write short notes on <u>any two</u> : [5 × 2

(a) Florigen concept

(b) Methods of breaking seed dormancy

(c) Role of phytochrome in photomorphogenesis

2019

Time - 3 hours

Full Marks - 60

*Answer **both groups** as per instructions.*
Figures in the right hand margin indicate marks.
Draw labelled diagrams wherever necessary.

GROUP - A

1. Write notes on any five of following within two sentences each. [2 × 5

   (a) Genetic erosion

   (b) Male sterility

   (c) Heterocyst in retrospect

   (d) Germ plasm collections

   (e) Significance of pollen culture

   (f) Centre of origin of Rice plant

   (g) Control of seed quality

GROUP - B

*Answer **ALL** questions.*

2. Discuss objectives, achievemnts and undesirable consequences of plant breeding. [10

OR

Write short notes on any two : [5 × 2

(a) Basis of crop improvement

(b) Significance of vegetative propagation

(c) Micropropagation

3. Discuss methods of selection and their significance in crop improvement. [10

OR

Write short notes on any two : [5 × 2

(a) Plant introduction

(b) Acclimatization

(c) Hybridization for crop improvement

4. Discuss concept and mechanism of quantitative inheritance. [10

OR

Write short notes on any two : [5 × 2

(a) Kernel colour of Wheat

(b) Inheritance of human skin colour

(c) Multiple factors hypothesis

5. Discuss mechanism and significance of Heterosis. [10

OR

Write short notes on any two : [5 × 2

(a) Inbreeding depression

(b) Techniques for detecting heterosis

(c) Fixation of heterosis

6. Discuss role of polyploidy in crop improvement. [10

OR

Write short notes on any two : [5 × 2

(a) Hazards of Mutation breeding

(b) Distant hybridization in crop improvement

(c) Role of Genetic Engineering in crop improvement

APV-KNJ-Sem-V-19-Bot(DSE-1)/40

2019

Time - 3 hours

Full Marks - 60

*Answer **both groups** as per instructions.*
Figures in the right hand margin indicate marks.
Draw labelled diagrams wherever necessary.

GROUP - A

1. Write notes on any five of following within two sentences each. [2 × 5

   (a) Economic Sustainability

   (b) Natural resources

   (c) Biodiversity

   (d) Soil erosion

   (e) Social forestry

   (f) Fossil fuel

   (g) Afforestation

GROUP - B

*Answer **ALL** questions.*

2. Discuss th economical, ecological and socio-cultural approaches for sustainable utilization of natural resources. [10

OR

Write short notes on any two : [5 × 2

(a) Soil management

(b) Difference between agriculture and horticulture

(c) Siviculture and its advantages

3. Describe the various management strategies for conservation of fresh water bodies and estuaries. [10

OR

Write short notes on any two : [5 × 2

(a) Agricultural use of wetland

(b) How does the aquifer work ?

(c) What is watershed and why is it important ?

4. Describe threat to biological resources and management strategies. [10

OR

Write short notes on any two : [5 × 2

(a) CBD

(b) National biodiversity action plan

(c) Major and minor forest product

5. How EIA, GIS and participatory resource appraisal practices help in resource management ? Explain. [10

OR

Write short notes on any two : [5 × 2

(a) Ecological footprint with emphasis on carbon footprint

(b) Non-renewable sources of energy

(c) Why renewable resources are important ?

6. Describe the various efforts at national and international level for the management of natural resources. [10

OR

Write short notes on any two : [5 × 2

(a) Types of wastes

(b) What is natural resources accounting ?

(c) Waste management

APV-KNJ-Sem-V-19-Bot(DSE-2)/40

2019

Time - 3 hours

Full Marks - 60

*Answer **both groups** as per instructions.*
Figures in the right hand margin indicate marks.
Draw labelled diagrams wherever necessary.

GROUP - A

1. Write notes on any five of following within two important sentences each. [2 × 5

   (a) Asymmetric cell division

   (b) Induction

   (c) Fate map

   (d) Gastrulation

   (e) Implantation of embryo

   (f) Regeneration

   (g) Significance of amniocentesis

GROUP - B

*Answer **ALL** questions.*

2. Describe mosaic and regulative development in embryology. [10

OR

Write short notes on the following : [5 × 2

(a) Cell-cell interaction

(b) Theory of epigenesis

3. Describe the process of fertilization. What is its significance. ? [10

OR

Write short notes on the following : [5 × 2

(a) Spermatogenesis

(b) Patterns of cleavage

4. Describe the structure, types and functions of human placenta. [10

OR

Write short notes on the following : [5 × 2

(a) Fate of germ layers

(b) Extra embryonic membranes in birds

5. Describe the process of metamorphosis in amphibians. [10

OR

Write short notes on the following : [5 × 2

(a) Regeneration

(b) Ageing

6. What is teratogenesis ? Discuss various teratogenic agets and their effects on embryonic development. [10

OR

Write short notes on the following : [5 × 2

(a) Stem cell culture

(b) In vitro fertilization

APV-KNJ-Sem-V-19-Zool(C-11)/40

2019

Time - 3 hours

Full Marks - 60

*Answer **both groups** as per instructions.*
Figures in the right hand margin indicate marks.
Draw labelled diagrams wherever necessary.

GROUP - A

1. Write notes on <u>any five</u> of following in one or two sentences each. [2 × 5

   (a) Dispersive DNA replication

   (b) Linear dsDNA

   (c) Purine

   (d) Nucleotides

   (e) mRNA

   (f) Peptide bond

   (g) Role of enzymes in replication

GROUP - B

*Answer **ALL** questions.*

2. Discuss briefly, semiconservative mode of replication with one experiment. [10

OR

Write short notes on the following : [5 × 2

(a) Role of RNA primer in DNA replication

(b) Ribosomal RNA (rRNA)

3. Give a brief account of the structure of transfer RNA (tRNA) and its role in protein synthesis. [10

OR

Write short notes on the following : [5 × 2

(a) RNA polymerase

(b) Central dogma

4. Discuss briefly, the regulation of gene expression in eukaryotes. [10

OR

Write short notes on the following : [5 × 2

(a) Promoter gene

(b) Activator and Co-activator

5. Discuss briefly, the concept of introns and exons. [10

OR

Write short notes on the following : [5 × 2

(a) Structure of globin mRNA

(b) Splicing mechanism

6. Give an account of genetic imprinting and riboswitches. [10

OR

Write short notes on the following : [5 × 2

(a) Transcription Complex and Activation

(b) Induction and Repression

APV-KNJ-Sem-V-19-Zool(C-12)/40

2019

Time - 3 hours

Full Marks - 60

*Answer **both groups** as per instructions.*
Figures in the right hand margin indicate marks.
Draw labelled diagrams wherever necessary.

GROUP - A

1. Write notes on any five of following within two important sentences each. [2 × 5

   (a) Types of Honey bees

   (b) Honey extraction

   (c) Quality assessment of silk fibre

   (d) Chawki rearing

   (e) Fishery by-products

   (f) Viral diseases of fishes

   (g) Intelligence

GROUP - B

*Answer **ALL** questions.*

2. Describe the process of culture methods of Honey bees. [10

OR

Write short notes on the following : [5 × 2

(a) Beneficial products from Honey bees

(b) Diseases of Honey bees

3. Describe the process of culture of silkworms in India. [10

OR

Write short notes on the following : [5 × 2

(a) Types of silk and silkworms in India

(b) Dieases of silkworm

4. Describe the process of culture of fishes. [10

OR

Write short notes on the following : [5 × 2

(a) Preparation and maintenance of aquarium

(b) Brood stock management

5. Write a note on 'Pearl Culture'. [10

OR

Write short notes on the following : [5 × 2

(a) Culture of air breething fishes

(b) Culture of crabs

6. Write an essay on 'Biological Clock'. [10

OR

Write short notes on the following : [5 × 2

(a) Pheromones

(b) Concept of learning behaviour

2019

Time - 3 hours

Full Marks - 60

*Answer **both groups** as per instructions.*
Figures in the right hand margin indicate marks.
Draw labelled diagrams wherever necessary.

GROUP - A

1. Write notes on <u>any five</u> of following in one or two sentences each. [2 × 5

   (a) Genetic engineering

   (b) DNA fingerprinting

   (c) Applications of bio-technology in environment

   (d) Plasmid DNA

   (e) Southern blotting technique

   (f) Palendromic nucleotide sequence

   (g) DNA library

GROUP - B

*Answer **ALL** questions.*

2. Discuss briefly the application of bio-technology in agriculture. [10

OR

Write short notes on the following : [5 × 2

(a) Scope of bio-technology

(b) Bio-technology in environment

3. Explain, the different steps of DNA-recombinant technology. [10

OR

Write short notes on the following : [5 × 2

(a) Western blotting technique

(b) Polymerase Chain Reaction (PCR)

4. Discuss in brief the applications of microbes in industries. [10

OR

Write short notes on the following : [5 × 2

(a) Bioreactor

(b) Down stream processing

5. Explain briefly, how to produce transgenic animals, the advantages and utility these animals. [10

OR

Write short notes on the following : [5 × 2

(a) DNA microinjection method

(b) Embryonic stem cell method

6. Discuss in brief, the concept of expressing cloned gene in mammalian cell. [10

OR

Write short notes on the following : [5 × 2

(a) Recombinant insulin

(b) Gene therapy

APV-KNJ-Sem-V-19-Zool(DSE-2)/40

2019

Time - 3 hours

Full Marks - 60

*Answer **both groups** as per instructions.*
Figures in the right hand margin indicate marks.

GROUP - A

1. Answer any five questions. [2 × 5

   (a) Discuss the amphoteric nature of amino acids.

   (b) What is electrophoresis ?

   (c) Explain the acid value of fats and oils.

   (d) What is calorific value ?

   (e) Explain denaturation of protein.

   (f) State Reformatsky reaction with example.

   (g) What is Wilkinson's catalyst ?

   (h) What is Critical Micellar Concentration ?

GROUP - B

*Answer **ALL** questions.*

2. (a) Describe DNA fingerprinting. [4

(b) Describe (i) Azalactone synthesis (ii) Gabriel synthesis for amino acids. [3 × 2

OR

Write notes on <u>any two</u> : [5 × 2

(a) Isoelectric point

(b) Zwitter ionic structure and its properties

(c) DCC

(d) Sulphaguanidine

3. Discuss the mechanism and any two synthetic applications of the following : (<u>any two</u>) [5 × 2

(a) Pinacole-Pinacolone Rearrangement

(b) Benzidine Rearrangement

(c) Dieckmann's Reactions

(d) Diels-Alder Reactions

OR

Discuss the synthetic application with mechanism of <u>any two</u> of the following : [5 × 2

(a) OsO_4

(b) $Pb(OAc)_4$

(c) PCC

4. (a) Define the terms oils and fats. How do you differentiate between them ? [5

(b) What is hydrogenation of oils ? Discuss its application. [5

OR

Discuss the synthesis of <u>any two</u> of the following. [5 × 2

(a) Paracetamol

(b) Sulphaguanidine

(c) Phenacetin

5. Discuss the cyclic structure of Glucose and confirm it by synthesis. [10

OR

(a) Explain Mutarotation and discuss its mechanism. [5

(b) Explain the formation of Glucoside. [5

6. Discuss the synthesis of : (<u>any two</u>) [5 × 2

(a) Methyl Orange

(b) Malachite Green

(c) Congo Red

OR

Discuss the structure elucidation of Alizarin and confirm it by synthesis. [7 + 3

2019

Time - 3 hours

Full Marks - 60

*Answer **both groups** as per instructions.*
Figures in the right hand margin indicate marks.

GROUP - A

1. Answer any five questions. [2 × 5

   (a) What do you mean by inner orbital complex and outer orbital complex.

   (b) Give two factors which affect the magnitude of Δ_0.

   (c) What are the different types of electronic transitions ?

   (d) What are labile and inert complexes ?

   (e) What are the different types of organometallic compounds ?

   (f) Define and explain packing fraction.

   (g) Give two nuclear reactions induced by $_2He^4$.

GROUP - B

*Answer **ALL** questions.*

2. Describe the crystal field splitting of 'd' orbitals in octahedral field. What is crystal field stabilization energy ? Calculate the crystal field stabilisation energy of Fe^{2+} ion in weak field. [6 + 2 + 2

OR

What is John-Teller effect ? Explain by considering Cu^{2+} ion as an example. [3 + 7

3. What do you mean by magnetic susceptibility of a substance ? Explain. Describe Gouy's method for determining magnetic susceptibilty. [4 + 6

OR

Describe the various selection rules for d-d transition. Discuss Orgel energy level diagram for octahedral complexes of metal ion with d^1 configuration. [6 + 4

4. Describe the mechanism involved in the Nucleophilic Substitution in a square planar complex. How trans effect influences the rate of substitution reaction ? [7 + 3

OR

How is thermodynamically stability of a complex different from kinetically stability ? Explain the factors influencing the stability of complexes. [4 + 6

5. What are σ bonded organometallic compounds and π bonded organometallic compounds ? Explain with examples. [5 + 5

OR

Write notes on : [5 × 2

(a) Mononuclear and binuclear carbonyls

(b) Preparation, bonding and structure of $Ni(CO)_4$

6. What is nuclear fission ? Explain the liquid drop model for nuclear fission. How is nuclear fusion energy superior to fission energy ? [2 + 5 + 3

OR

Write notes on : [5 × 2

(a) Mass defect and binding energy

(b) Artificial radioactivity and different types of artificial transmutation

2019

Time - 3 hours

Full Marks - 60

*Answer **both groups** as per instructions.*
Figures in the right hand margin indicate marks.

GROUP - A

1. Answer any five questions. [2 × 5

   (a) What is meant by degree of polymerisation ?

   (b) Differentiate between thermosetting polymers and thermo-plastic polymers.

   (c) Wtite the monomers of Nylon-6 and PAN.

   (d) What is vinyl polymerisation ? Give one example.

   (e) What do you mean by the average molecular weight of a polymer ?

   (f) Define relative viscosity.

   (g) What is an acid number ? Find the molecular weight of polyester if its acid number is 2.8.

   (h) Why silicones are called inorganic polymers ?

   (i) Give the preparation of PVC.

   (j) Differentiate between plastic and fibre.

GROUP - B

*Answer **ALL** questions.*

2. Describe the basis of schemes of classifications of polymer with giving suitable examples in each case. [10

OR

Write notes on : [5 × 2

(a) Bulk polymerisation

(b) Co-polymerisation

3. Discuss the kinetics of step-growth polymerisation in presence and in absence of a catalyst. [10

OR

Discuss the mechanism and kinetics of condensation polymerisation. [10

4. Give an account of the principles of technique involved in the end-group analysis. [10

OR

(a) How can you determine the molecular weight of a polymer by viscosity method ? [5

(b) Explain : Number average molecular weight and weight average molecular weight. [5

5. Discuss the principles of management of plastics in the environment by biodegradation method. [10

OR

(a) Discuss oxidative stability of plastics. [5

(b) Describe the effect of radiation on polymer degradation. [5

6. Discuss the sunthesis and uses of : [5 × 2

(a) Polystyrene

(b) Bakelite

OR

Write notes on : [5 × 2

(a) Poly urethanes

(b) Nylon-6,6

2019

Time - 3 hours

Full Marks - 60

*Answer **both groups** as per instructions.*
Figures in the right hand margin indicate marks.

GROUP - A

1. Answer any five questions. [2 × 5

   (a) What are high technology ceramics ? Explain with an example.

   (b) Write the chemical composition of borosilicate glass.

   (c) What is carbon fibre ?

   (d) What is mixed fertilizer ?

   (e) What is saponification value ?

   (f) What are Zwitterionic detergents ?

   (g) Sizing and coloring of pulp

   (h) Flash point of petroleum

GROUP - B

*Answer **ALL** questions.*

2. Discuss a method for the manufacture and processing of glass. What is the composition of sodalime glass ? [4 + 4 + 2

OR

What are the raw materials required for manufacture of ceramics ? Describe the theory underlying the manufacture of ceramics. [5 + 5

3. Describe the process involved in the manufacture of cement and also explain its setting process. [6 + 4

OR

What are nitrogenous fertilizers ? Give three examples. Describe a method for the manufacture of urea. [2 + 2 + 6

4. What do you mean by hydrogenation of oil ? Describe any process of hydrogenation of oil. [2 + 8

OR

What is laundry soap ? What are the ingredients required for manufacture of laundry soap ? Explain the process of manufacture of this soap. [2 + 2 + 6

5. (a) Give the composition of molases and cane sugar juice. Discuss the crystallisation and refining of cane sugar. [1 + 1 + 4

(b) Write the different steps by which sucrose is obtained from cane sugar. [4

OR

Explain the process of manufacture of soda pulp. Describe in brief the manufacture of paper from pulp. [5 + 5

6. Give the approximate composition of petroleum. Explain the process of grading of petroleum. Describe the process of upgradation of petroleum by catalytic polymerisation and isomerisation. [3 + 3 + 4

OR

Write notes on <u>any two</u> : [5 × 2

(a) Rocket fuels

(b) Boiler oil

(c) Knocking and antiknocking agents

(c) Show that curl (grad f) = 0.

4. Show that $\int_0^1 \int_0^1 \left[\frac{y - x}{(x + y)^3} \right] dx\, dy$ and [12

$\int_0^1 \int_0^1 \frac{y - x}{(x + y)^3} dy\, dx$ have different values.

OR

Answer any two questions. [6 × 2

(a) Show that the function

$f(x, y, z) = (x^2 + y^2 + z^2)^{-\frac{1}{2}}$ is harmonic.

(b) Evaluate :

$\int_0^4 \int_0^3 xy(x + y)\, dx\, dy.$

(c) Find the area of the region between the two curves y = cos x and y = sin x, $0 \leq x \leq \frac{\pi}{4}$ using double integral.

5. Find the volume of the ellipsoid [12

$$\frac{x^2}{4} + \frac{y^2}{9} + \frac{z^2}{16} = 1$$

OR

Answer any two questions. [6 × 2

(a) Show that div(F × G) = G . curl F – F . curl G for any vector fields F and G.

2019

Time - 3 hours

Full Marks - 80

*Answer **both groups** as per instructions.*
Part of each question should be answered continuously.
Figures in the right hand margin indicate marks.
The symbols used have their usual meaning.

GROUP - A

1. Answer any ten questions. [2 × 10

(a) Find $\lim_{(x, y) \to (0, 0)} \frac{4xy^2}{x^2 + y^2}$.

(b) Test the continuity of

$f(x, y) = \frac{xy^3}{x^2 + y^6}$, f(0, 0) = 0 at origin.

(c) Find the equation of tangent plane and normal line to the surface

$z = \sin x + e^{xy} + 2y$ at (0, 1, 3).

(d) Find the directional derivative of f(x, y, z) = xyz at (1, –1, 2) in the direction of **a** = i – 2j + 3k.

(e) Define Laplacian operator.

(f) Show that the function $f(x, y) = x^2 - 2xy + y^2 + x^3 - y^3 + 2x^7$ has neither maximum nor minimum at (0, 0).

(g) Find the Jacobean $\frac{\partial(x, y)}{\partial(u, v)}$ where $x = u + 2v$, $y = 3u - 4v$.

(h) Verify the vector field

$F = (xy^2 + yz)i + (x^2y + xz + 3y^2z)j + (xy + y^3)k$ is conservative.

(i) Using Green's theorem, find the work done by the force

$F = (3y - 4x)i + (4x - y)j$,

if the object moves around the ellipse $4x^2 + y^2 = 4$ counter clockwise.

(j) State Divergence theorem.

(k) Find $\int_C (-y\,dx + x\,dy)$ where $C : y^2 = 4x^2$ from (–1, 4) to (0, 0).

(l) State Fundamental theorem of Line Integral.

(m) Evaluate : $\int_0^{\pi/2} \int_0^{a\cos\theta} r^2\,dr\,d\theta$.

GROUP - B

*Answer **ALL** questions.*

2. Let $f(x, y)$ be a differentiable function of x and y and let $x = x(t)$, $y = y(t)$ be two real valued differentiable function of t.

Then $z = f(x, y)$ is a differentiable function of t and

$$\frac{dz}{dt} = \frac{\partial z}{\partial x} \cdot \frac{dx}{dt} + \frac{\partial z}{\partial y} \cdot \frac{dy}{dt} \quad .$$ [12

Prove it.

OR

Answer any two questions. [6 × 2

(a) Find $\frac{\partial w}{\partial r}$ and $\frac{\partial w}{\partial t}$ where

$$w = \frac{x + y}{2 - z}, \; x = 2rs, \; y = \sin rt, \; z = st^2.$$

(b) Find all the points of $x + 2y + 3z = 4$ in first octant where $f(x, y, z) = x^2yz^3$ has a maximum value.

(c) Find the three positive numbers whose sum is 54 and whose product is as large as possible.

3. State and prove necessary and sufficient condition for extreme values of functions of two variables. [12

OR

Answer any two questions. [6 × 2

(a) Using Lagrange multiplier, maximize $f(x, y) = 16 - x^2 - y^2$ subject to $x + 2y = 6$.

(b) Find the maximum and minimum of $f(x, y, z) = x^2 - y^2$ on the surface $x^2 + 2y^2 + 3z^2 = 1$.

(b) Find the flux of $F(x, y, z) = xi + yj + zk$ outward across the portion of the cone $z = 1 – x^2 – y^2$ lies above the xy-plane of surface S given by $G(x, y, z) = z + x^2 + y^2 – 1$.

(c) Evaluate

$$\int_S \int (x^2 + y^2)ds$$

where $S = \{z = 4 – x – 2y, 0 \leq x \leq 4, 0 \leq y \leq 2\}$.

6. State and prove Stoke's theorem. [12

OR

Answer <u>any two</u> questions. [6 × 2

(a) Evaluate $\oint_C [(1 + y)z\,dx + (1 + z)x\,dy + (1 + x)y\,dz]$

for the closed path C, the boundary of the triangle with vertices (1, 0, 0), (0, 1, 0) and (0, 0, 1).

(b) Evaluate

$$\int_S \int F \cdot N\,ds \text{ where}$$

$F = \text{curl}(yi + xj – zk)$ and S is the hemisphere $z = \sqrt{4 – x^2 – y^2}$, $x^2 + y^2 \leq 4$.

(c) If $F = \nabla\phi$ and $\nabla^2\phi = 0$, then show that $\int F^2\,dv = \int \phi F \cdot N\,ds$.

[5]

(b) Find the flux of $F(x, y, z) = xi + yj + zk$ outward across the portion of the cone $z = 1 – x^2 – y^2$ lies above the xy-plane of surface S given by $G(x, y, z) = z + x^2 + y^2 – 1$.

(c) Evaluate

$$\int_S \int (x^2 + y^2)ds$$

where $S = \{z = 4 – x – 2y, 0 \leq x \leq 4, 0 \leq y \leq 2\}$.

6. State and prove Stoke's theorem. [12

OR

Answer <u>any two</u> questions. [6 × 2

(a) Evaluate $\oint_C [(1 + y)z\,dx + (1 + z)x\,dy + (1 + x)y\,dz]$

for the closed path C, the boundary of the triangle with vertices (1, 0, 0), (0, 1, 0) and (0, 0, 1).

(b) Evaluate

$$\int_S \int F \cdot N\,ds \text{ where}$$

$F = \text{curl}(yi + xj – zk)$ and S is the hemisphere $z = \sqrt{4 – x^2 – y^2}$, $x^2 + y^2 \leq 4$.

(c) If $F = \nabla\phi$ and $\nabla^2\phi = 0$, then show that $\int F^2\,dv = \int \phi F \cdot N\,ds$.

APV-KNJ-Sem-V-19-Math(C-11)/40

(d) Prove the following : [3 × 2

(i) Cov. (X + a, Y + b) = Cov. (X, Y)

(ii) Cov. (aX , bY) = ab Cov. (X, Y)

where a and b are some constants.

5. (a) For the stochastic variate X, prove that [6

$$V(X) = E(X)^2 - [E(X)]^2.$$

Hence deduce that $E(X^2) \geq [E(X)]^2$.

(b) Prove that the correlation coefficient $|r_{xy}| \leq 1$. [6

OR

(c) Find E(X) if a random variable X takes the values [6

$$x_k = \frac{(-1)k_2k}{k}$$

with probabilities $p_k = \frac{1}{2^k}$, k = 1, 2, ...

(d) A box contains a white and b black balls, c balls are drawn. Find the expectation of the number of white balls drawn. [6

6. (a) State and prove the law of large numbers for equal components. [6

(b) If x assumes two values i and –i with equal probabilities, show that the law of large numbers cannot be applied to the variables $x_1 , x_2 , x_3 , ... , x_n$. [6

2019

Time - 3 hours

Full Marks - 80

*Answer **both groups** as per instructions.*
Part of each question should be answered continuously.
Figures in the right hand margin indicate marks.
The symbols used have their usual meaning.

GROUP - A

1. Answer any ten questions. [2 × 10

(a) If the sample space is $S = C_1 \cup C_2$ and if $P(C_1) = 0.8$ and $P(C_2) = 0.5$, find $P(C_1 \cap C_2)$.

(b) Define Exhaustive events.

(c) How many possible outcomes are there when we roll a pair of dice ?

(d) Prove that the probability of null set is zero.

(e) Define conditional probability.

(f) Define random variable.

(g) What do you mean by Discrete distributions ?

(h) Find the mean of the exponential distribution.

(i) Define joint distribution of the two-dimensional random vector.

(j) State central limit theorem.

(k) State generalized Chebycheff's inequality.

(l) State law of large numbers.

GROUP - B

*Answer **ALL** questions choosing*
either {(a), (b)} or {(c), (d)} from each question.

2. (a) Find the probability of getting 5 heads and 7 tails in 12 flips of balanced coin using binomial distribution. [6

(b) Find the mean and variance of a Poisson distribution. [6

OR

(c) If the probability of success on each trial is $\frac{1}{3}$, what is the average number of trials required for the first success ? [6

(d) Find the mean and variance of Poisson distribution. [6

3. (a) Let X have the pdf [6

$$f(x) = \begin{cases} \frac{x^2}{9} & ; 0 < x < 3 \\ 0 & ; \text{elsewhere.} \end{cases}$$

Then find pdf of $Y = X^2$.

(b) Let [6

$$F_x(x) = \begin{cases} \frac{1}{2} & ; -1 < x < 1 \\ 0 & ; \text{elsewhere} \end{cases}$$

be the pdf of random variable X. Let $Y = X^2$. Find pdf of Y.

OR

(c) If the pdf of X is $f(x) = 2xe^{-x^2}$, $0 < x < \infty$, zero elsewhere, determine the pdf of $Y = X^2$. [6

(d) Let X have the pdf [6

$$f(x) = \begin{cases} 1 & ; 0 < x < 1 \\ 0 & ; \text{elsewhere.} \end{cases}$$

Find the pdf of $Y = -2 \log X$.

4. (a) If X and Y are two random variables, then prove that [6

$$E(X + Y) = E(X) + E(Y).$$

(b) If n dice are tossed and X denotes the sum of the numbers on them, then find E(X). [6

OR

(c) If X and Y are two independent random variables, then prove that [6

$$E(XY) = E(X)\,E(Y).$$

OR

(c) State and prove the Chebycheff's inequality. [6

(d) If X is a random variable with E(X) = 3 and $E(X^2) = 13$, find a lower bound for P(–2 < x < 8) using Chebyshev's inequality. [6

[5]

OR

(c) State and prove the Chebycheff's inequality. [6

(d) If X is a random variable with E(X) = 3 and $E(X^2) = 13$, find a lower bound for P(–2 < x < 8) using Chebyshev's inequality. [6

APV-KNJ-Sem-V-19-Math(C-12)/40

2019

Time - 3 hours

Full Marks - 60

*Answer **both groups** as per instructions.*
Part of each question should be answered continuously.
Figures in the right hand margin indicate marks.
The symbols used have their usual meaning.

GROUP - A

1. Answer any five questions. [2 × 5

   (a) Write the Input and Output commands in C++.

   (b) What is the output of the following C++ code ?

```
x = 100 ;
y = 200 ;
if (x > 100 & y <= 200)
Cout << x << "  " << y << "  " x + y << endl ;
else
Cout << x << "  " << y << "  " << 2 * x – y << endl ;
```

   (c) What is do.....while loop ? Answer it with an example.

   (d) Write a For statement to add all the multiples of 3 between 1 and 100.

(e) Write the process of a string declaration and initialisation.

(f) Declare a 2-dimensional array of integer size 4 * 4.

(g) What is the use of streams in C++ programming ?

(h) Write down the types of pointer.

GROUP - B

*Answer **ALL** questions.*

2. (a) What are the different ways of constant declaration in C++ ? [4

(b) Write C++ statements that accomplish the following : [6

(i) Declare integer variables x and y, initialise x to 25 and y to 18.

(ii) Declare and initialise an integer variable temp. to 10 and a char variable ch to A.

(iii) Update the value of an int variable x by adding 5 to it.

(iv) Declare and initialise a double variable, pay rate to 12.50.

OR

Write a C++ program that prompts the user to input a decimal number and outputs the number rounded to the nearest integer. [10

3. (a) What is Switch Statement ? Describe it giving an example. [4

(b) Write a program to check a year is leap year or not. [6

OR

Write a program to reverse a number and check whether it is a palindrome or not. [10

4. (a) Differentiate between pyramid programs and series programs. [4

(b) Write a program to check a given number is prime or not. [6

OR

Write a program to calculate the value of $e^{0.5}$. [10

5. (a) Define Inheritance. Explain types of inheritance with syntax. [4

(b) Write a program to print first 50 members of Fibonacci series. [6

OR

Write a program to swap two numbers using call by reference. [10

6. (a) What is Function overloading ? Describe it. [4

(b) Explain the differences between a value and a reference parameter. [6

OR

Write a program to declare a two-dimensional array and print greatest and smallest element among the array. [10

5. (a) Prove that $(a + b)' = a' \cdot b'$ using laws of Boolean algebra. [6

(b) Prove the elements 0 and 1 are unique using laws of Boolean algebra. [6

OR

(c) Prove the complement of $(a \cdot b)$ is $a' + b'$ using laws of Boolean algebra. [6

(d) Using laws of Boolean algebra, obtain an equivalent expression for $[(x \cdot y)(z' + xy')]$. [6

6. (a) Prove that a simple graph with at least two vertices has at least two vertices of same degree. [6

(b) Show that the maximum number of edges in a simple graph with n vertices is $\frac{n(n-1)}{2}$. [6

OR

(c) Prove that in a non-directed graph, the number of odd degree vertices is even. [6

(d) Prove that the number of edges in a bipartite graph with n vertices is atmost $\frac{n^2}{4}$. [6

2019

Time - 3 hours

Full Marks - 80

*Answer **both groups** as per instructions.*
Part of each question should be answered continuously.
Figures in the right hand margin indicate marks.
The symbols used have their usual meaning.

GROUP - A

1. Answer any ten questions. [2 × 10

(a) Use truth table to show that

$$p \to q \equiv \sim p \vee q.$$

(b) Prove that product of two odd integers is an odd integer.

(c) Write the negation of the following conjunctions :

$2 + 4 = 6$ and $7 < 12$.

(d) Find the first four terms of the following recurrence relation :

$a_k = a_{k-1} + 3a_{k-2}$, $\forall$ integers $k \geq 2$, $a_0 = 1$, $a_1 = 2$.

(e) Define Generating function.

(f) Prove that the relation $\geq$ is a partial order on the set of integers Z.

(g) Prove that the set Z^+ of all positive integers under divisibility relation forms a poset.

(h) Prove that $a + a = a$, using Boolean Algebra.

(i) Prove that $a + (a \cdot b) = a$ using Boolean Algebra.

(j) Prove that the degree of a vertex of a simple graph G on n vertices cannot exceed n – 1.

(k) Define Subgraphs.

(l) Define Isomorphic graph.

GROUP - B

*Answer **ALL** questions choosing*
either {(a), (b)} or {(c), (d)} from each question.

2. (a) Show that [6

$$\frac{1}{1.2} + \frac{1}{2.3} + \ldots\ldots\ldots + \frac{1}{n(n+1)} = \frac{n}{n+1}$$

by mathematical induction.

(b) Out of 5 men and 2 women, a committee of 3 is to be formed. In how many ways can this be done so as to include (i) exactly one woman (ii) atleast one woman ? [6

OR

(c) Show that $n^2 > 2n + 1$ for $n \geq 3$ by mathematical induction. [6

(d) If ${}^nC_x = 56$ and ${}^nP_x = 336$, then find n and x. [6

3. (a) Solve the recurrence relation [6

$$a_n = a_{n-1} + 2,\ n \geq 2$$

subject to initial condition $a_1 = 3$.

(b) Solve the recurrence relations [6

$$a_n^2 - 2a_{n-1}^2 = 4 \text{ for } n \geq 1 \text{ and } a_0 = 3.$$

OR

(c) Solve $a_{n+2} - 5a_{n+1} + 6a_n = 2$ [6

with initial condition $a_0 = 1$ and $a_1 = -1$.

(d) Solve the recurrence relation [6

$$a_n = 7a_{n/3} + 5 \text{ where } n = 3^k \text{ and } a_1 = 1.$$

4. (a) Let $X = \{1, 2, 3, 4, 5, 6\}$, then / is a partial order on X. Draw the Hasse diagram of (X, /). [6

(b) Consider the poset $A = (\{1, 2, 3, 4, 6, 9, 12, 18, 36\}, /)$. Find the greatest lower bound and the least upper bound of the sets {6, 18} and {4, 6, 9}. [6

OR

(c) Draw the Hasse diagram for the poset $(P(S), \subseteq)$ where P(S) is the power set on $S = \{a, b, c\}$. [6

(d) Prove that the product of two lattices is a lattice. [6

2019

Time - 3 hours

Full Marks - 60

*Answer **both groups** as per instructions.*
Figures in the right hand margin indicate marks.

GROUP - A

1. Answer any five of the following. [2 × 5

   (a) Write the equation of motion for a free particle.

   (b) Show that Hermitian operators have real eigen value.

   (c) Write down the features of tunnel effect.

   (d) Define Larmor theorem.

   (e) Calculate the precession frequency of an electron orbit in a magnetic field of 5 Tesla.

   (f) Define Paschen Back effect.

   (g) What is anomalous Zeeman effect ?

GROUP - B

*Answer **ALL** questions.*

2. Define time dependent Schrodinger's wave equation. How it can be modified in terms of Hamiltonian operator ? [10

OR

(a) The wave functions ψ_i and ψ_j are said to be mutually orthogonal wave function if [5

$$\int_{-\infty}^{\infty} \psi_i \psi_j \, d\tau = 0 \text{ where } i \neq j. \text{ Prove it.}$$

(b) Normalise the wave function [5

$$\phi(x) = e^{-|x|} \sin ax.$$

3. Define wave packet. Describe matter waves in terms of wave packet using Fourier analysis and Fourier transforms. [2 + 8

OR

Write short notes on : [5 × 2

(a) Heisenberg's Uncertainty relation for position and momentum

(b) Find the expectation value of potential energy of a linear Harmonic oscillator.

4. What is tunneling effect ? Explain the tunneling effect for a finite rectangular potential Barrier. [3 + 7

OR

Write short notes on : [5 × 2

(a) Infinite potential well

(b) Zero point energy

5. Describe Stern Gerlach experiment. Discuss how it changes the concept of space quantization and electron spin. [3 + 7

OR

Write short notes on : [5 × 2

(a) Orbital magnetic moment

(b) Stark effect

6. Define Zeeman effect and Paschen-Back effect. How can you determine the value of specific charge (e/m) of electron with its help ? [2 + 2 + 6

OR

Write short notes on : [5 × 2

(a) Space quantization

(b) Gyromagnetic ratio

2019

Time - 3 hours

Full Marks - 60

*Answer **both groups** as per instructions.*
Figures in the right hand margin indicate marks.

GROUP - A

1. Answer any five of the following. [2 × 5

   (a) Define Miller indices of a plane.

   (b) Define atomic scattering factor.

   (c) What is Hysteresis loss ?

   (d) What is pumping action ?

   (e) Define London penetration depth.

   (f) Define coherence length.

   (g) Define Hall effect.

GROUP - B

*Answer **ALL** questions.*

2. Derive Bragg's law for X-ray diffraction by crystals. How this is experimentally verified ? [10

OR

(a) What are Miller indices ? Describe the general procedure for Miller indices. [5

(b) In a crystal, a lattice plane cuts intercepts 2a, 3b, and 6c along the three axes where a, b and c are primitive vectors of unit cell. Calculate the Miller indices of the given plane. [5

3. What is a linear diatomic chain ? Explain it. [2 + 8

OR

Write short notes on : [5 × 2

(a) Dulong and Petit's law

(b) Einstein's expression for Lattice specific heat

4. Describe Langevin theory of paramagnetism. How Weiss modified it ? [7 + 3

OR

Write short notes on : [5 × 2

(a) Hysteresis Loss

(b) Ferromagnetic Domain

5. Define molecular polarizability. Derive Clausius-Mossotti relation in dielectrics subject to static fields. [10

OR

What are Einstein's coefficients A and B ? Derive Einstein's relation between them. [10

6. Derive London's equation. Define London penetration depth and discuss the effect of temperature on penetration depth. [10

OR

What is the effect of periodic potential on the energy of electron in metal ? Explain it on the basis of Kronig-Penney model. [10

2019

Time - 3 hours

Full Marks - 60

*Answer **both groups** as per instructions.*
Figures in the right hand margin indicate marks.

GROUP - A

1. Answer any five of the following. [2 × 5

   (a) Define D'Alembert's principle.

   (b) Derive Newton's second law of motion from Hamilton's principle.

   (c) If the half-life of an elementary particle moving with speed 0.9 c in the laboratory frame is 5×10^{-8} s, then what is proper half-life ?

   (d) Write the advantages of using generalised coordinates.

   (e) What are Euler-Lagrange's differential equation.

   (f) What is Minkowski's space ?

   (g) Explain Four momentum.

GROUP - B

*Answer **ALL** questions.*

2. State Hamilton's principle. Derive Lagrangian equation of motion from Hamilton's principle for conservative system. [3 + 7

OR

(a) Find the equation of motion of one dimensional harmonic oscillator using Hamilton's principle. [5

(b) Using Hamilton's principle, obtain the equation of motion $mf = -\frac{\partial v}{\partial x}$ for a particle of mass 'm' moving with acceleration 'f' in a potential v. [5

3. Define generalized co-ordinates and obtain the expression for generalised acceleration and generalised force. [10

OR

Prove the laws of conservation of linear momentum, angular momentum and energy for a system of interacting particles. [4 + 3 + 3

4. (a) Derive Hamilton's Canonical equations of motion using variational principle. [5

(b) Show that if a given co-ordinate is cyclic in Lagrangian, it will also be cyclic in Hamiltonian. [5

OR

Write short notes on : [5 × 2

(a) Particle moving under a central force

(b) Time period of simple pendulum using Lagrange's equation of motion.

5. State the basic postulates of the special theory of relativity. Derive Lorentz transformation equation. [2 + 8

OR

Write short notes on : [5 × 2

(a) Valocities addition

(b) Simultaneity

6. Define a Four vector. What are velocity, momentum and acceleration four vectors. [10

OR

Write short notes on : [5 × 2

(a) Relativistic kinetic energy

(b) Mass-energy relation

2019

Time - 3 hours

Full Marks - 60

*Answer **both groups** as per instructions.*
Figures in the right hand margin indicate marks.

GROUP - A

1. Answer any five of the following. [2 × 5

   (a) Write down the properties of Nuclear forces.

   (b) Calculate the energy equivalent to 1 a.m.u.

   (c) What is Geiger Nuttal law ?

   (d) What are the desired characteristics of a good neutron detector ?

   (e) A proton and an alpha particle enter at right angles into a uniform magnetic field applied in the cyclotron. Calculate the ratio of the radii of their paths when they enter the field with the same momentum.

   (f) Give one example each of the given particles.

      (i) Fermion

      (ii) Boson

      (iii) Hadron

      (iv) Lepton

(g) What are the disadvantages of semiconductor detector ?

GROUP - B

*Answer **ALL** questions.*

2. (a) What do you understand by mass defect ? [2½

(b) Show that the nuclear density is constant. [2½

(c) Write a short note on Parity of Nucleus. [2½

(d) Define Packing fraction. [2½

OR

(a) Plot a graph between binding energy per nucleon and mass number of nucleus. [3

(b) Write down the properties of nuclear forces. [3

(c) The nuclear radius of $_8O^{16}$ is 3×10^{-15} m. What nuclear radius do you expect for $_{82}Pb^{205}$? [4

3. Explain liquid drop model of Nucleus. What are the assumptions made in this model ? Give the significance of the various terms of semiempirical mass formula. [2½ + 2½ + 5

OR

Write short notes on : [5 × 2

(a) Magic numbers and their experimental evidence

(b) Spin-orbit coupling

4. Explain Gamow's theory of α-decay. [10

OR

Write short notes on <u>any two</u> : [5 × 2

(a) Q-value of nuclear reaction

(b) Kinematic of nuclear reaction

(c) Laws of Radioactive Decay

5. Explain the principle, construction and working of a GM counter. What are the limitations of GM counter ? [7 + 3

OR

Write short notes on : [5 × 2

(a) Crystal detector

(b) Mobility of particles

6. What is a Van de Graff accelerator ? Describe the principle, construction and working of it. [10

OR

Name four fundamental interactions. Explain each of them. [4 + 6

2019

Time - 3 hours

Full Marks - 80

*Answer **both groups** as per instructions.*
Figures in the right hand margin indicate marks.

GROUP - A

१ । (क) अधोलिखितेषु चतुर्णां सन्धिविच्छेदं कुरुत । (१ × ४

वपुरतितरा, वर्हेणेव, नुनयास्यत्यमरमिथुने
नाधमे, शापेनास्तं, रामगिर्य्याश्रमेषु

(ख) कस्यपि द्वयो: सविग्रहसमासार्थनामानि लिखत । (२ × २

लब्धकामा, मेघदूत, वर्षभोग्येण
नयनशुभगम्, प्रियसरव

(ग) कस्यापि त्रयाणां सकारणविभक्तिं निरूपयत । (२ × ३

आकैलाशात्, गुरुजा,
स्तनितसुभग:, मुध्ना, जग्ध्वा

(घ) कस्यापि त्रयाणां प्रकृतिप्रत्ययञ्च लिखत । (२ × ३

प्रेक्षणीयम्, सन्नद्धे, व्यवसेत्,
प्रमत्त:, संपत्स्त्यन्ते, आशसत्य:

GROUP - B

२। मेघदूतानुसारं हिमालयं वर्णयत । (१२

अथवा

मेघदूतमवलम्ब्य प्रकृतिचित्रणं कुरुत ।

३। केषुचिद् द्वयो: उत्तरं प्रदत्त । (६ × २

(क) ग्रन्थारम्भे कालिदासेन कथं यक्षस्य नामोल्लेखं न कृत: ?

(ख) मेघस्य यात्राकालीन शुभशकुनं आलोचयत ।

(ग) गङ्गावतरणप्रसङ्गेऽस्मिन् का पौराणिकी वार्त्ता आसीत् ?

(घ) ''स्त्रीणामाद्यप्रणयवचनं विभ्रमो हि प्रियेषु'' इत्यत्रं भावं प्रकटयत ।

४। कस्यापि एकस्य सप्रसङ्गं व्याख्या कार्या । (१२

(क) ''नक्षुद्वोऽपि प्रथमसुकृतापेक्षया संश्रयाय।
प्राप्तेमित्रो भवति विमूख: किं पुनर्यस्तथोच्चै ।।''

अथवा

(ख) ''आशबन्धं कुसुमसदृशं प्रायशो ह्यङ्गनानां ।
सद्यपाति प्रणयिहृदयं विप्रयोगे रुणद्धिं ।।''

५। गद्यकाव्यस्य लक्षणं विलिख्य तस्य वैशिष्ट्यं लिखत । (१२

अथवा

भर्तृहरे: शतकत्रयं विमर्शयत ।

६। केषांचित् त्रयाणां संक्षिप्तटिप्पणी प्रदेया । (४ × ३

(क) वृहत्कथा

(ख) पञ्चतन्त्रम्

(ग) नीतिशतकम्

(घ) दशकुमारचरितम्

(ङ) कथासरित्सागर

(च) वुद्धचरितम्

(খ) एकस्य संक्षिप्तटिप्पणी प्रदेया । (६

(i) उत्तमकाव्यम्

(ii) काव्यप्रयोजनम्

(iii) शृङ्गाररसः

UNIT – III

३। (क) अभिधा-लक्षणा-व्यञ्जनानां लक्षण सोदाहरणञ्च लिखत । (१०

अथवा

''लक्ष्यणातेन षड्विद्या'' इति प्रतिपादयत ।

(খ) एकस्य संक्षिप्तटिप्पणी प्रदेया । (६

(i) वाक्यम्

(ii) ध्वनि

(iii) अधमकाव्यम्

UNIT – IV

४। अधस्तनेषु केषुचिद् त्रयाणां अलङ्काराणां लक्षणसोदाहरणञ्च लिखत ।

(६ × ३

(क) यमकम्

(ख) श्लेष

(ग) रूपक

(घ) उत्प्रेक्षा

(ङ) विभावना

Sem-III-Arts-Sans-CC-6
(Reg&Back)

2019

Time - 3 hours

Full Marks - 80

*Answer **ALL** questions.*
Figures in the right hand margin indicate marks.

UNIT – I

१। अधोलिखितेषु केषुचिद् सूत्रचतुष्टयस्य व्याख्या कार्या । (७$\frac{१}{२}$ × ४

(क) इकोगुणवृद्धी:

(ख) आद्यन्तौ टकितौ

(ग) स्थानेऽन्तरतमः

(घ) तस्मादित्युत्तरस्य

(ङ) ङिच

(च) आदेपरस्य

UNIT – II

२। (क) ''वाक्यं रसात्मकं काव्यम्'' – विश्वनाथ काव्यलक्षणं विमर्शयत ।

(१०

अथवा

मम्मटस्य काव्यलक्षणं विश्वनाथेन कथं खण्डितं तद् आलोचयत ।

2019

Time - 3 hours

Full Marks - 80

*Answer **ALL** questions.*
Figures in the right hand margin indicate marks.

UNIT – I & II

१ । अधोलिखितेषु चतुर्णां सूत्राणां व्याख्या कार्या । (८ × ४

(क) प्रातिपदिकार्थलिङ्गपरिमाणवचनमात्रे प्रथमा

(ख) कारके

(ग) अनविहिते

(घ) अकथितञ्च

(ङ) हृक्रोरन्यतरस्याम्

(च) अधिशिङ्स्थासां कर्म

(छ) अभिनिविशश्च

UNIT – III

२ । सूत्रद्वयस्य व्याख्यां कुरुत । (८ × २

(क) साधकतमं करणम्

(ख) कतृकरणयोस्तृतीया

(ग) इत्थम्भूतलक्षणे

(घ) सहयुक्तेऽप्रधाने

UNIT – IV

३। सूत्रद्वयस्य व्याख्यां कुरुत । (८ × २

(क) रुच्यर्थानां प्रियमाण:

(ख) स्पृहेरिप्सित:

(ग) तुमर्थाच्चभाववचनात्

(घ) क्रुधद्रुहोरुपसृष्टयो: कर्म

UNIT – V

४। उत्कलभाषया आङ्गलोभाषया वा अनुवादं कुरुत । (१६

भारतीयभाषासु संस्कृतभाषा देवभाषारूपेण स्तुयते । भारतीयसंस्कृति संस्कृतभाषां समाश्रयति । इयं भाषा मातामिव सेवते । अस्यां भाषायां ज्ञानविज्ञानानि परिपूरितानि सन्ति । संस्कृतभाषायां वेदवेदान्तोपनिषद-पुराणेतिहासानां वर्णनं समुपलभ्यते । नीतिशास्त्रं-राजनीति-अर्थशास्त्र-चिकित्साशास्त्रं-हस्तिशास्त्रं च संस्कृते परिलक्ष्यते । संस्कृतभाषा भाषासु मधुरा मुख्या च वर्त्तते । अत: संस्कृतभाषा सर्वासु भाषासु जननी इति कथ्यते।

अथवा

कालिदासेन कुमारसम्भवनामाख्यं महाकाव्यं विरचितम् । कुमारसम्भवे कार्तिकेयस्य जन्मवृत्तान्तं वर्णित: भवति । तारकासुरविनाशाय अस्य शंकरात्मज कार्तिकेयस्य जन्म अभूत् । कुमारसम्भवस्य पञ्चमसर्गे देव्या: पार्वत्या: तपक्रम: वर्णित: भवति । भगवन्तं शंकरं पतिरूपेण वरयितुं पार्वतिस्तपश्चकार: । पार्वती यदाश्रमे स्थितवती तदानीं भगवान् शंकर: ब्रह्मचारीवेशेन आश्रमेऽस्मिन् प्रविष्टवान् । पार्वतीमपि तस्य ब्रह्मचारिण: आतिथ्यसत्कारं कृतवती । तदनन्तरं ब्रह्मचारि पार्वतीं कानिचिद् कुशलानि प्रश्नानि पृष्टवान् ।

2019

Time - 3 hours

Full Marks - 80

*Answer **both groups** as per instructions.*
Figures in the right hand margin indicate marks.

GROUP - A

१ । (क) चतुर्णां सन्धिविच्छेदं कुरुत । (१ × ४

मेघमाश्लिष्टसानुम्, प्रत्ययादारवसत्यः, द्रक्षत्यध्व,
वेत्रवत्याश्चलोर्मि, त्वयासन्ने, द्रक्षस्यपलविषमे

(ख) द्वयोः सविग्रहसमास च नामानि लिखत । (२ × २

राजराजस्य, कामार्त्ता, प्रियसखं. श्रवणशुभगं

(ग) केषुचिद् त्रयाणां सकारणविभक्तिं लिखत । (२ × ३

आकैलाशाद्, जायां, वेत्रवत्या, मुध्ना, स्तनितसुभगम्

(घ) त्रयाणां प्रकृतिप्रत्ययञ्च लिखत । (२ × ३

प्रत्यासन्ने, जानामि, प्रेक्षणीयम्, आश्वसत्यः,
सन्नद्धे, व्यवसेत्, संपत्स्त्यन्ते

GROUP - B

২। মেঘদূতানুসারং উজ্জয়িনীবর্ণনং কুরুত । (১২

অথবা

মেঘদূত খণ্ডকাব্য দূতকাব্য বা সযুক্ত্যা প্রতিপাদয়ত ।

৩। কেষুচিদ্ দ্বয়ো: উত্তরং প্রদত্ত । (৬ × ২

(ক) কশ্চিদ্পদেন কাব্যারম্ভস্য কিং কারণম্ ?

(খ) যক্ষ: মেঘং কথং স্বাগতং ব্যাজহার: ?

(গ) মেঘদূতস্য মঙ্গলপদ্যং উল্লিখত ।

(ঘ) 'অধম' ইতি পদস্য কিং তাত্পর্য্যম্ ?

৪। কস্যাপি একস্য সপ্রসঙ্গং সরলার্থং লিখত । (১২

(ক) ''ইত্যৌত্সুক্যাদপরিগণয়ন্গুহ্যকস্তং যযাচে ।
কামার্ত্তা হি প্রকৃতি কৃপণাশ্চেতনাশ্চেতনেষু ।।''

অথবা

(খ) ''নির্বিন্ধ্যায়া: পথিভবরসাভ্যন্তর: সন্নিপত্য: ।
স্ত্রীণামাদ্যং প্রণযবচনং বিভ্রমো হি প্রিযেষু ।।''

৫। গীতিকাব্যস্য স্বরূপং বৈশিষ্ট্যঞ্চ আলোচযত । (১২

অথবা

গীতগোবিন্দে বর্ণিতং দশাবতারং উপস্থাপযত ।

৬। ত্রযাণাং সংক্ষিপ্তটিপ্পণী প্রদেযা । (৪ × ৩

(ক) কথাসরিত্সাগর

(খ) নীতিশতকম্

(গ) মেঘদূতম্

(ঘ) বাণভট্ট

(ঙ) বেতালপঞ্চবিশতি

2019

Time - 3 hours

Full Marks - 60

*Answer **both groups** as per instructions.*
Figures in the right hand margin indicate marks.
Draw labelled diagrams wherever necessary.

GROUP - A

1. Write notes on any five of the following. [2 × 5

   (a) Plasmodesmata

   (b) Bicollateral vascular bundle

   (c) Porous and non-porous wood

   (d) Bulliform cells

   (e) Sunken stomata

   (f) Cuticle

   (g) Lysigenous cavity

GROUP - B

*Answer **ALL** questions.*

2. Give an account of complex permanent tissue and their functions. [10

OR

Write notes on : [5 × 2

(a) Anatomy of a typical dicot stem

(b) Parenchyma tissue

3. Give an account of various theories regarding organisation of root apex. [10

OR

Write notes on : [5 × 2

(a) Internal structure of monocot root

(b) Tunica corpus theory

4. Describe the organisation, function and seasonal activity of vascular cambium during secondary growth. [10

OR

Write notes on : [5 × 2

(a) Heart wood and Sap wood

(b) Extrastelar secondary growth in dicot stem

5. Give an account of anatomical adaptations of hydrophytes. [10

OR

Write notes on : [5 × 2

(a) Trichomes

(b) Adaptive features of Xerophytic leaves

6. Give an account of secretory tissue system in plants. [10

OR

Write notes on : [5 × 2

(a) Distribution of mechanical tissue in stem

(b) Mechanical tissue

2019

Time - 3 hours

Full Marks - 60

*Answer **both groups** as per instructions.*
Figures in the right hand margin indicate marks.
Draw labelled diagrams wherever necessary.

GROUP - A

1. Write notes on any five of the following. [2 × 5

   (a) Importance of Legumes to ecosystem

   (b) Genetic diversity

   (c) Plant introduction

   (d) Write the Botanical name of two oil yielding plants

   (e) Propagation of Potato

   (f) Medicinal uses of Cinchona

   (g) Rubber tapping

GROUP - B

*Answer **ALL** questions.*

2. Discuss the origin, cultivation practices and economic importance of Wheat. [10

OR

Write notes on : [5 × 2

(a) Concept of centres of origin according to Vavilov's work

(b) Harvesting and uses of Rice

3. Discuss morphology, cultivation and uses of Sugarcane. [10

OR

Write notes on : [5 × 2

(a) Botany and uses of Potato

(b) Botanical name and uses of Groundnut

4. Write a note on morphology, processing and uses of Coffee. [10

OR

Write notes on : [5 × 2

(a) Uses and health hazard of Tobacco

(b) Family name and uses of Clove

5. What are oils ? Describe extraction methods of fatty oils and their uses. [10

OR

Write notes on : [5 × 2

(a) Botanical name of Coconut and its uses

(b) Uses of Linseed

6. Describe the cultivation methods and economic importance of Cotton. [10

OR

Write notes on : [5 × 2

(a) Timber yielding plants and uses of Teak

(b) Economic importance of Rubber

APV-KNJ-Sem-III-19-Bot(C-6)/50

2019

Time - 3 hours

Full Marks - 60

*Answer **both groups** as per instructions.*
Figures in the right hand margin indicate marks.
Draw labelled diagrams wherever necessary.

GROUP - A

1. Answer any five of the following. [2 × 5

   (a) What is pleiotropy ?

   (b) What are sex-chromosomes ?

   (c) State the law of dominance.

   (d) What are mutagens ?

   (e) Define sex-linkage.

   (f) What are genes ?

   (g) Define totipotency.

GROUP - B

*Answer **ALL** questions.*

2. Describe the double hellix structure of DNA molecule. [10

OR

Write notes on : [5 × 2

(a) Codominance

(b) Epistasis

3. Describe the steps of protein biosynthesis. [10

OR

Write notes on : [5 × 2

(a) Genetic code

(b) Central dogma

4. Describe the cytological basis of crossing over. [10

OR

Write notes on : [5 × 2

(a) Linkage

(b) Chromosome mapping

5. Describe the different types of variations in chromosome structure. [10

OR

Write notes on : [5 × 2

(a) Aneuploidy

(b) Gene mutation

6. Describe the basic steps of plant tissue culture technique. [10

OR

Write notes on : [5 × 2

(a) Germplasm conservation

(b) Organogenesis

APV-KNJ-Sem-III-19-Bot(C-7)/50

Sem-III-Sc-Bot-GE-A_2
(Reg&Back)

2019

Time - 3 hours

Full Marks - 60

*Answer **both groups** as per instructions.*
Figures in the right hand margin indicate marks.
Draw labelled diagrams wherever necessary.

GROUP - A

1. Answer any five questions briefly. [2 × 5

   (a) What is Capsid ?

   (b) Mention major methods of the virus transmission.

   (c) What is pathogenesis ?

   (d) Which pathogen causes “Blight of Rice” ?

   (e) What are the types of plastids ?

   (f) In which stage of mitosis, chromosomes are arranged on the equatorial plate ?

   (g) Who first discovered bacteria ?

GROUP - B

*Answer **ALL** questions.*

2. Describe the genetic recombination in bacteria. [10

OR

Write notes on : [5 × 2

(a) Gram stain

(b) Structure of bacteria

3. Describe the replication of bacteriophage. [10

OR

Write notes on : [5 × 2

(a) TMV

(b) Nomenclature of virus

4. Write a note on the symptoms, causal organism and control measures of powdery mildew of Pea. [10

OR

Write notes on : [5 × 2

(a) Necrosis

(b) Important symptoms of bacterial disease

5. Describe the structure and functions of Mitochondria. [10

OR

Write notes on : [5 × 2

(a) Characteristics of prokaryotic cell

(b) Fluid mosaic model

6. Describe the process of Meiosis-I. [10

OR

Write notes on : [5 × 2

(a) Endoplasmic Reticulum

(b) Anaphase

2019

Time - 3 hours

Full Marks - 60

*Answer **both groups** as per instructions.*
Figures in the right hand margin indicate marks.
Draw labelled diagrams wherever necessary.

GROUP - A

1. Answer any five of the following in 2–3 sentences each. [2 × 5

   (a) What is retrogressive metamorphosis ? Give example.

   (b) State any three advanced features of vertebrates over protochordates.

   (c) State the differences between Chondriochthyes and Osteochthyes with examples.

   (d) Write composition of snake venome.

   (e) State significance of migration in birds.

   (f) What are milk teeth ? Name them.

   (g) Name the living orders of class Amphibia with examples.

   (h) State Continental drift theory of Vertebrate distribution.

GROUP - B

*Answer **ALL** questions.*

2. Give an account on Origin of Chordates. [10

OR

Write notes on any two : [5 × 2

(a) Ascidian tadpole

(b) Retrogressive changes in Urochordates

(c) General characteristics of Cephalochordates

3. State general characters of Cyclostomes. Add classification of Cyclostomes upto order. [10

OR

Write notes on any two : [5 × 2

(a) Structural peculiarities of Petromyzon

(b) Affinities of Myxine

(c) Agnatha and its affinities

4. Write an essay on accessory respiratory organs in fishes. [10

OR

Write notes on any two : [5 × 2

(a) Neoteny

(b) Migration in fishes

(c) Origin of Tetrapoda

5. Describe flight adaptations in birds. [10

OR

Write notes on any two : [5 × 2

(a) Poison apparatus in snake

(b) Skull in Reptilia

(c) General characters of Reptilia

6. Give an account on Zoogeographical realms of the world. [10

OR

Write notes on any two : [5 × 2

(a) General characters of Mammals

(b) Affinities of Metatheria

(c) Dentition in Mammals

APV-KNJ-Sem-III-19-Zool(C-5)/50

2019

Time - 3 hours

Full Marks - 60

*Answer **both groups** as per instructions.*
Figures in the right hand margin indicate marks.
Draw labelled diagrams wherever necessary.

GROUP - A

1. Answer any five of the following in 2–3 sentences each. [2 × 5

   (a) State characteristics of epithelial tissues.

   (b) What is reflex arc ?

   (c) Define action potential.

   (d) What is sacromere ?

   (e) What is a motor unit ?

   (f) What do you mean by puberty ?

   (g) What is the function of thymus ?

   (h) Name the hormones that control gametogenesis.

GROUP - B

*Answer **ALL** questions.*

2. Give an account on different types of glands and their functions. [10

OR

Write notes on any two : [5 × 2

(a) Simple epithelial tissues

(b) Ossification of bones

(c) Glial cells

3. What is a synapse ? Describe synaptic transmission briefly. [10

OR

Write notes on any two : [5 × 2

(a) Structure of neuron

(b) Reflex action

(c) Physiology of vision

4. Describe ultrastructure of skeletal muscles. [10

OR

Write notes on any two : [5 × 2

(a) Cardiac muscles

(b) Summation

(c) Myosin

5. Explain different methods of contraception in men and women. [10

OR

Write notes on any two : [5 × 2

(a) Histology of female reproductive system

(b) Gonadal hormones

(c) Menstrual cycle

6. Explain signal transduction pathway of non-steroidal hormones. [10

OR

Write notes on any two : [5 × 2

(a) Hypothalamus

(b) Thyroid gland

(c) Adrenal gland

APV-KNJ-Sem-III-19-Zool(C-6)/50

Sem-III-Sc-Zool-CC-7
(Reg&Back)

2019

Time - 3 hours

Full Marks - 60

*Answer **both groups** as per instructions.*
Figures in the right hand margin indicate marks.
Draw labelled diagrams wherever necessary.

GROUP - A

1. Answer any five of the following in 2–3 sentences each. [2 × 5

   (a) What is axial skeleton ? Name its components.

   (b) State functions of air-sacs in fishes.

   (c) Name the different types of mammalian uteri.

   (d) What is archinephrous kidney ?

   (e) Name various photoreceptive cells and their functions.

   (f) What is the function of vagus nerve in mammals ?

   (g) What is primary data ?

   (h) State the empirical relation between mean, median and mode.

GROUP - B

*Answer **ALL** questions.*

2. Discuss the structure of alimentary canal of vertebrates. [10

OR

Write notes on any two : [5 × 2

(a) Air-sacs in fishes

(b) Pancreas

(c) Skin in vertebrates

3. Give an account on epidermal derivatives of epithelium. [10

OR

Write notes on any two : [5 × 2

(a) Skull in different vertebrates

(b) Functions of integument

(c) Jaw suspensorium

4. Give an account on evolution of urinogenital duct in vertebrates. [10

OR

Write notes on any two : [5 × 2

(a) General plan of circulation

(b) Metamorphous kidney

(c) Heart in reptiles

5. Discuss about comparative account of brain in vertebrates. [10

OR

Write notes on any two : [5 × 2

(a) Cranial nerves in mammals

(b) Visual receptors

(c) Autonomic nervous system

6. Calculate mean, median and mode of the haemoglobin (gm %) of 50 patients recorded on a particular day in a hospital as given below : [10

Hb (%)	No. of patients
10 – 11	3
11 – 12	8
12 – 13	7
13 – 14	9
14 – 15	10
15 – 16	8
16 – 17	3
17 – 18	2

OR

Write notes on any two : [5 × 2

(a) Histogram

(b) Classification of data

(c) Frequency distribution table

OR

(a) Write generating function for Legendre polynomials. [2

(b) Using generating function of Legendre polynomials, prove the following recurrence relations. [4 + 4

(i) $(2n + 1)xP_n(x) = (n + 1)P_{n+1}(x) + nP_{n-1}(x)$.

(ii) $nP_n(x) = x\frac{dP_n(x)}{dx} - \frac{dP_{n-1}(x)}{dx}$.

6. Write down Laplace equation $\nabla^2\psi = 0$ in cylindrical coordinate system and obtain its solution by using separation of variable method. [2 + 8

OR

An uncharged conducting sphere is placed in a region of uniform electric field. Derive expressions for electric potential and field at an outside point of the sphere. Also find surface charge density at any point on the surface of the sphere. [6 + 2 + 2

2019

Time - 3 hours

Full Marks - 60

*Answer **both groups** as per instructions.*
Figures in the right hand margin indicate marks.

GROUP - A

1. Answer any five questions. [2 × 5

(a) State Dirichlet conditions.

(b) Show that

$$2^n\,\Gamma\left(n + \tfrac{1}{2}\right) = 1 \cdot 3 \cdot 5 \ldots\ldots\ldots (2n - 1)\sqrt{\pi}.$$

(c) Show that $P_n(x) = (-1)^n P_n(-x)$ where $P_n(x)$ is the Legendre polynomial of nth order.

(d) Distinguish between Systematic errors and Random errors.

(e) Find the singular points of differential equation

$$(1 - x^2)\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + 6y = 0.$$

State whether these singular points are regular or irregular singular points.

(f) Show that $H_{2n}(0) = (-1)^n \frac{2n!}{n!}$.

GROUP - B

*Answer **ALL** questions.*

2. Solve Hermite differential equation [8 + 2

$$\frac{d^2y}{dx^2} - 2x\frac{dy}{dx} + 2ny = 0,$$ n being a positive integer.

Find its polynomial solution.

OR

(a) Show that the Hermite polynomials are generated by the function [6

$$f(x, z) = e^{2zx - z^2}.$$

(b) Prove that $H_n(x) = (-1)^n e^{x^2}\frac{d^n}{dx^n}(e^{-x^2})$, [4

where $H_n(x)$ is Hermite polynomial of nth order.

3. Find the series of sines and cosines of multiples of x which represent f(x) in the interval $-\pi < x < \pi$ where : [8 + 2

$f(x) = 0$ when $-\pi < x \leq 0$

$= \frac{\pi x}{4}$ when $0 < x \leq \pi$.

Hence show that $\frac{\pi^2}{8} = 1 + \frac{1}{3^2} + \frac{1}{5^2} + \frac{1}{7^2} + ...$

OR

(a) Obtain Fourier series expansion of the periodic function f(t) with period T and the form of which within the first period $0 \leq t \leq T$ is given by $f(t) = t(T - t)$. [8

(b) Can Fourier series represent a discontinuous function ? Justify your answer with example. [2

4. (a) Show that [5

$$\int_0^{\pi/2} \sin^p\theta \,.\, \cos^q\theta \, d\theta = \frac{\Gamma\left(\frac{p+1}{2}\right)\Gamma\left(\frac{q+1}{2}\right)}{2\Gamma\left(\frac{p+q+2}{2}\right)}.$$

(b) Starting with Gamma function defined by [5

$$\Gamma(z) = \int_0^{\infty} t^{z-1} e^{-t}\, dt \ (\text{Re } z > 0),$$ evaluate $\Gamma(\frac{1}{2})$.

OR

(a) Expand $f(x) = \cos x$ in a Fourier series in the interval $0 < x < \pi$. [6

(b) What is Persaval's identity for Fourier series ? Derive its expression. [4

5. (a) Write Rodrigue's formula for Legendre polynomials. [2

(b) Show that [8

$$\int_{-1}^{+1} P_m(x)\, P_n(x)\, dx = \frac{2}{2n+1}\, \delta_{mn}$$

where $P_n(x)$ is the Legendre polynomial of order n and δ_{mn} is the Kronecker delta function.

OR

What are transport phenomena in gases ? On the basis of kinetic theory, derive an expression of the coefficient of thermal conductivity of a gas and show that it is proportional to the square root of the absolute temperature of gas. [6 + 4

6. Derive Van der Waal's equation of state. Deduce expressions for the critical constants of a gas in terms of Van der Waal's constants. [6 + 4

OR

What is Joule-Thomson effect ? Deduce an expression for the Joule-Thomson cooling produced in a Van der Waal's gas. Show that the ratio of the temperature of inversion and critical temperature does not depend on the nature of gas. [2 + 6 + 2

2019

Time - 3 hours

Full Marks - 60

*Answer **both groups** as per instructions.*
Figures in the right hand margin indicate marks.

GROUP - A

1. Answer any five questions. [2 × 5

   (a) A Carnot engine has efficiency 50% when its sink temperature is 7^0 C. By how many degrees should the temperature of source be increased so that the efficiency becomes 70% ?

   (b) State and explain third law of thermodynamics.

   (c) Name four thermodynamic potentials. Write their mathematical expressions.

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

   (e) Discuss affect of pressure on melting point of solids.

   (f) The critical temperature of hydrogen is -240^0 C and the critical pressure is 12.8×10^5 N/m^2. Compute the critical volume of 1 mole of hydrogen.

GROUP - B

*Answer **ALL** questions.*

2. (a) State and prove Carnot's theorem. [2 + 5

   (b) What is a heat pump ? Write down expression of its efficiency. Can the efficiency of heat pump be more than 100% ? [1 + 1 + 1

OR

   (a) Write Kelvin-Planck statement and Clausius' statement of second law of thermodynamics. Show that these two statements are equivalent to each other. [1 + 1 + 4

   (b) Distinguish between reversible and irreversible processes with examples. [4

3. (a) Show that the entropy of the universe remains constant in a reversible cycle but increases in an irrevesible cycle. [6

   (b) State and explain the principle of increase in entropy. [4

OR

   (a) What is T-S diagram ? Obtain the slopes of (i) isobaric and (ii) isochoric curve in T-S diagram of an ideal gas. [1 + 2 + 2

   (b) Represent Carnot's cycle in T-S diagram and derive the expression for efficiency of Carnot's engine. [1 + 4

4. (a) Derive the first and second TdS equations given by [3 + 3 + 2

   (i) $TdS = C_V dT + T\left(\frac{\partial P}{\partial T}\right)_V dV.$

   (ii) $TdS = C_P dT - T\left(\frac{\partial V}{\partial T}\right)_P dP.$

   Show that a reversible adiabatic increase of pressure will produce an increase of temperature in any substance with a positive expansivity and a decrease of temperature in any substance with a negative expansivity.

   (b) Calculate the heat transfer when the pressure on 15 cm^3 of mercury at 20^0 C is increased reversibly and isothermally from 0 to 1000 atm. [2

OR

   (a) Distinguish between first order and second order phase transitions. [2 + 2

   (b) Derive the Clausius-Clapeyron equation. To which order phase transition, this equation can be applied ? [5 + 1

5. (a) Derive Maxwell Boltzmann speed distribution function. Hence calculate the rms speed of an ideal gas molecule at temperature T. (Assume molecule has three degrees of freedom.) [6 + 2

   (b) Calculate the rms speed of Nitrogen (N_2) molecule at 27^0 C. (Take molar mass of nitrogen as 28 gm and Boltzmann constant k = 1.38×10^{-23} J/K.) [2

2019

Time - 3 hours

Full Marks - 60

*Answer **both groups** as per instructions.*
Figures in the right hand margin indicate marks.

GROUP - A

1. Answer any five questions. [2 × 5

   (a) How many Transistors and Gates are integrated in LSI and VLSI ?

   (b) Convert the decimal number $(732)_{10}$ to its equivalent Binary number.

   (c) Convert the octal number $(11001)_8$ to its equivalent decimal number.

   (d) Write the truth table for AND and OR gates.

   (e) Explain commutative law obeyed by OR and AND operations.

   (f) Construct a Karnaugh map for two variables.

   (g) Write a short note on binary addition and add 10110 + 1011.

(h) Write short notes on RAM and ROM.

GROUP - B

*Answer **ALL** questions.*

2. Write down the advantages and drawbacks of ICs with discrete circuits. [5 + 5

OR

(a) Explain the classifications of ICs fabrication. [5

(b) Write the mode of operation of Linear IC and Digital IC. [5

3. (a) Obtain X-NOR gate using NAND gates only. [4

(b) Distinguish between X-OR and X-NOR gates. [6

OR

Realise AND and OR operators using transistors. [5 + 5

4. State and explain the laws of Boolean Algebra. [4 + 6

OR

Describe a 4-bit binary parallel adder and subtractor. [5 + 5

5. With block diagram, describe the construction and working of a cathode ray oscilloscope. [10

OR

(a) Explain multiplexer with block diagram. [3

(b) Describe functions of a four-two-one multiplexer. [7

6. (a) Describe the input and output devices of a computer. [4

(b) Write short notes on memory interfacing and memory map. [3 + 3

OR

What is ring center ? Explain the working of a 4-bit ring counter with diagram. [2 + 8

2019

Time - 3 hours

Full Marks - 60

*Answer **both groups** as per instructions.*
Figures in the right hand margin indicate marks.

GROUP - A

1. Answer any five questions. [2 × 5

   (a) Calculate the r.m.s. speed of nitrogen at 27^0 C. Given

   $N = 6 \times 10^{23}$ molecules/mole

   $K = 1.38 \times 10^{-16}$ erg/K.

   (b) Define second law of thermodynamics. What is its expression in term of entropy ?

   (c) Define Planck's law for black body radiation. Write its formula.

   (d) Give two characteristics of Huygen's eye-piece.

   (e) How circularly and elliptically polarised lights are produced ?

   (f) Compute the rest-mass energy of an electron.

   (g) Calculate the de-Broglie wavelength of an electron of energy 10,000 eV.

(h) State group velocity and write the relationship between group velocity and particle velocity.

GROUP - B

*Answer **ALL** questions.*

2. Define Root mean square speed (V_{rms}). Find out its expression. Establish a relation between most probable speed, average speed and rms speed. [2 + 4 + 4

OR

(a) Define entropy. Show that in any reversible cycle, the net charge in entropy is zero. [2 + 6

(b) When 1 gram of ice at 0^0 C is given 79.6 calories of heat, it just melts without any change in temperature. Calculate the change of entropy in this process. [2

3. Define coefficient of thermal conductivity. Discuss the result of Ingen-Hausz experiment with experimental observation. [2 + 8

OR

(a) Discuss the construction and working of Huygen's eye-piece with a neat digram. [3 + 3

(b) Explain how chromatic and spherical aberration is minimum in Huygen's eye-piece. [2 + 2

4. (a) What is double refraction ? Explain it. [3

(b) Explain plane, circularly and elliptically polarised light. [1 + 1 + 1

(c) Explain how polarisation of light is occuring by reflection. [4

OR

Discuss the construction, theory and working of a linear accelerator. [3 + 4 + 3

5. What is de-Broglie hypothesis ? Verify it on the basis of Davisson and Germer experiment. [2 + 8

OR

State and prove Ehrenfest's theorem. [2 + 8

6. (a) Using time dependent Schrodinger equation, obtain the 3-D-time independent Schrodinger equation. [7

(b) State and explain eigen values and eigen functions. [1½ + 1½

OR

Consider a particle incident on a potential step of height V_0 with energy E greater than V_0. Calculate the coefficient of reflection and transmission. [10

2019

Time - 3 hours

Full Marks - 60

*Answer **both groups** as per instructions.*
Figures in the right hand margin indicate marks.

GROUP - A

1. Answer any five questions. [2 × 5

   (a) Write two limitations of Ellingham diagram.

   (b) What is Electrolytic Kroll process ?

   (c) Why carbon shows a covalency of four ?

   (d) Which is more acidic among hydrogen halides and why ?

   (e) Write the characteristics of soft acids.

   (f) What are pseudo halogens ?

   (g) Why noble gases are inert ? Explain.

GROUP - B

*Answer **ALL** questions.*

2. (a) Discuss the useful features of Ellingham diagram. [7

   (b) What is parting process ? [3

OR

Write short notes on : [5 × 2

(a) Van-Arkel de-Boer process

(b) Electrochemical principle in the extraction of metals

3. Explain the hydrogen bridge structure of diborane. [10

OR

Write short notes on : [5 × 2

(a) Carboranes

(b) Silanes

4. (a) Explain the diagonal relationship of Li and Mg. [8

(b) How basic beryllium acetate is prepared ? [2

OR

(a) Explain the diagonal relationship of Boron and Silicon. [8

(b) Explain the complex formation tendency of alkaline earths. [2

5. Describe the valence bond and molecular orbital treatment of XeF_2. [10

OR

Write short notes on : [5 × 2

(a) Clathrates

(b) Lewis concept of acids and bases

6. (a) Give a comparison between organic polymers and inorganic polymers. [5

(b) Write a note on Silicones. [5

OR

Write short notes on : [5 × 2

(a) Polysulphates

(b) Silicates

OR

(a) How will you prepare methyl lithium ? How can you prepare acetic acid from it ? [5

(b) Write a short note on keto-enol tautomerism. [5

2019

Time - 3 hours

Full Marks - 60

*Answer **both groups** as per instructions.*
Figures in the right hand margin indicate marks.

GROUP - A

1. Answer any five questions. [2 × 5

(a) Phenol is acidic, but alcohol is neutral. Explain.

(b) What happens when ethyl chloride is treated with $AgNO_2$?

(c) Formaldehyde does not undergo Aldol condensation reaction. Explain.

(d) Give one test to distinguish ethyl alcohol and ethanoic acid.

(e) What happens when Cl_2 is passed through boiling Toluene in presence of light ?

(f) Ethylene glycol is more viscous than ethyl alcohol. Why ?

(g) Diethyl ether does not react with Sodium. Explain.

(h) Acyl derivatives do not give characteristic reactions of carbonyl group. Explain.

GROUP - B

*Answer **ALL** questions.*

2. (a) Give the mechanism and stereochemistry of SN^1 and SN^2 reaction for the hydrolysis of alkyl halides. [4 + 4

   (b) Explain the low reactivity of vinyl chloride for nucleophilic substitution reaction. [2

   OR

   (a) How chlorobenzene is prepared by – [4

   (i) Sandmeyer's reaction

   (ii) Gattermann reaction ?

   (b) Discuss the bimolecular displacement mechanism in aryl halide. [3

   (c) What is the effect of substituents on the reactivity of aryl halides ? [3

3. How can you prepare 1^0, 2^0 and 3^0 alcohols using Grignard's reagent ? How can they be distinguished by Lucas reagent ?[6 + 4

   OR

   Explain the following reactions with mechanism : [5 × 2

   (a) Reiman-Tiemann reaction

   (b) Kolbe's-Schmidt reaction

4. Discuss the mechanism of the following reactions : [5 × 2

   (a) Aldol condensation

   (b) Clemensen reduction

   OR

   Discuss the mechanism of Wittig reaction and Michael addition reaction. [5 + 5

5. (a) How monocarboxylic acid is prepared from – (i) alkyl nitriles and (ii) organometallic compounds ? [4

   (b) How ethyl thiol reacts with acetic acid and NaOH ? [4

   (c) What happens when Tartaric acid is heated with dil. H_2SO_4 acid ? [2

   OR

   (a) Discuss the mechanism of acidic hydrolysis of ester. [5

   (b) Discuss the mechanism of curtius rearrangement reaction. [5

6. How can you prepare diethyl malonate ? How can you synthesize the following from it ? [4 + (2 × 3)

   (i) Succinic acid

   (ii) Crotonic acid

   (iii) Barbituric acid

2019

Time - 3 hours

Full Marks - 60

*Answer **both groups** as per instructions.*
Figures in the right hand margin indicate marks.

GROUP - A

1. Answer any five questions. [2 × 5

   (a) What is protolytic reaction ? Give one example.

   (b) What is pseudo unimolecular reaction ? Give one example.

   (c) What is autocatalysis ? Give one example.

   (d) Why is heat of chemisorption more than physical adsorption ?

   (e) How graphical method helps to determine the order of reaction ?

   (f) Write Clausius-Clapeyron equation for solid-vapour equilibrium.

   (g) What is meant by adsorption isobar ?

GROUP - B

*Answer **ALL** questions.*

2. (a) Define phase, component and degrees of freedom. [3

   (b) Derive Gibb's phase rule thermodynamically. [7

OR

   (a) Discuss phase diagram of Lead-Silver system. [7

   (b) Explain Pattinson's process for desilverisation of Lead. [3

3. Discuss the following reactions in liquid SO_2 :

   (a) Acid-base reaction [4

   (b) Precipitation reaction [3

   (c) Solvolytic reaction [3

OR

   (a) What are the advantages and disadvantages of liquid NH_3 as a solvent ? [5

   (b) Explain solution of alkali metals in liquid NH_3. [5

4. (a) Derive an expression for rate constant of first order reaction. [7

   (b) A first order reaction is 50% complete in 100 minutes. How long will it take for 90% completion ? [3

OR

Write short notes on : [5 × 2

   (a) Activation energy

   (b) Consecutive reaction

5. (a) Explain homogeneous and heterogeneous catalysts with examples. [4

   (b) What are promoters ? Give examples. [3

   (c) Explain catalytic poisoning with examples. [3

OR

   (a) Derive Michaelis-Menten equation in enzyme catalysis. [5

   (b) Explain Acid-Base catalysis. [5

6. Derive an expression for Langmuir adsorption isotherm. What are its limitations ? [8 + 2

OR

Write short notes on : [5 × 2

   (a) Electrokinetic potential

   (b) Chemisorption

2019

Time - 3 hours

Full Marks - 60

*Answer **both groups** as per instructions.*
Figures in the right hand margin indicate marks.

GROUP - A

1. Answer any five questions. [2 × 5

   (a) What is the difference between dissociation energy and bond dissociation energy ?

   (b) What happens to the concentration of the different reactants and products after the establishmnet of equilibrium ?

   (c) Why ΔG^0 obtained from K_P and K_C has different values ?

   (d) Define hydrolysis with an example.

   (e) Although benzene is highly unsaturated, it does not undergo addition reaction. Explain.

   (f) Phenol is an acid but does not react with sodium bicarbonate solution. Why ?

   (g) What is saponification ? Give one example.

   (h) Explain Rosenmund's reaction.

GROUP - B

*Answer **ALL** questions.*

2. State and explain Le-Chatelier's principle with suitable examples. [10

OR

(a) Discuss the variation of enthalpy of a reaction with temperature. [6

(b) Define integral and differential enthalpies of a solution. [4

3. Write notes on : [5 × 2

(a) Solubility product

(b) Strong, moderate and weak electrolytes

OR

What is salt hydrolysis ? Find out the hydrolysis constant, degree of hydrolysis and pH of a salt of strong acid and weak base with an example. [2½ × 4

4. (a) Discuss the point of differences between SN^1 and SN^2 reactions. [7

(b) Discuss the lust test to distinguish 1^0, 2^0 and 3^0 alcohols. [3

OR

Explain the following :

(a) Williamson's ether synthesis [3

(b) Oxidation of alcohol with PCC [3

(c) Ester hydrolysis [4

5. (a) Explain Benzyne mechanism. [4

(b) Explain Gattermann reaction and Sandmeyer reaction with example. [3 + 3

OR

(a) Discuss sulphonation and acylation reactions of benzene. [4

(b) What happens when ethyl benzene is treated with alkaline $KMnO_4$? [2

(c) Discuss the reactivity of benzyl halide and aryl halide. [4

6. Write notes on : [5 × 2

(a) Aldol condensation

(b) Wolff Kishner reduction

OR

(a) How acetaldehyde and acetone are prepared from CH_3COCl ? [5

(b) Why formaldehyde does not respond aldol condensation ? [2

(c) Discuss the sulphonation reaction of Phenol. [3

2019

Time - 3 hours

Full Marks - 80

*Answer **both groups** as per instructions.*
Part of each question should be answered continuously.
Figures in the right hand margin indicate marks.
The symbols used have their usual meaning.

GROUP - A

1. Answer any ten questions. [2 × 10

   (a) Find the limit of $\{n/(n+1) : n \in N\}$.

   (b) Give an example of two sets A and B such that $A \subset B$ and $A^0 = B^0$.

   (c) Find the closure of the set (a, ∞).

   (d) Find the value of $\lim_{x \to 0+} \frac{|x|}{x}$.

   (e) Find y_n if $y = \sin x \cos x$.

   (f) Define uniform continuity of a function.

   (g) Give an example of a function which is continuous but not differentiable at a point.

   (h) State intermediate value theorem.

(i) State the necessary condition for a function has maximum or minimum at x = c.

(j) Find maximum value of $\frac{\log x}{x}$.

(k) Find the value of $\lim_{x \to 0} \frac{(e^x - x - 1)}{x^2}$.

GROUP - B

*Answer **ALL** questions.*

2. Answer any two questions. [6 × 2

(a) Prove that the intersection of a finite number of open sets is open.

(b) If S and T are any two sets, then prove that

$$(S \cap T)^0 = S^0 \cap T^0.$$

(c) Prove that $S \cup D(S)$ is always a closed set.

3. Answer any two questions. [6 × 2

(a) Discuss the continuity of the following

$$f(x) = \begin{cases} x \sin\left(\frac{1}{x}\right) & , x \neq 0 \\ 0 & , x = 0. \end{cases}$$

(b) Let X be a closed and bounded subset of R and $f : X \to R$ be continuous. Then f attains its maximum and minimum. Prove it.

(c) Let S be closed and bounded subset of R. If $f : S \to R$ is continuous, then it is uniformly continuous on S. Prove it.

4. Answer any two questions. [6 × 2

(a) If $f(x) = x^2 \sin \frac{1}{x}$, $x \neq 0$ and $f(0) = 0$, show that f is derivable for every value of x but the derivative is not continuous at x = 0.

(b) Show that $f(x) = | x + 2 |$ is continuous at x = –2 but not differentiable at that point.

(c) Verify Lagrange's Mean Value Theorem for the function $f(x) = \sqrt{x^2 - 4}$ defined on [2, 4].

5. Answer any two questions. [6 × 2

(a) Find the maximum and minimum value of

$$f(x) = \sin x + \cos x.$$

(b) Show that $\frac{x}{1 + x} < \log (1 + x) < x$, for all $x > 0$.

(c) Find the value of $\lim_{x \to \frac{\pi}{2}} (\sin x)^{\tan x}$.

6. Answer any two questions. [6 × 2

(a) State and prove Rolle's theorem.

(b) Using Taylor's theorem, show that

$$\cos x \geq 1 - \frac{x^2}{2} \text{ , for all } x \in R.$$

(c) Find nth derivative of $e^{2x} \sin 3x$.

2019

Time - 3 hours

Full Marks - 80

*Answer **both groups** as per instructions.*
Part of each question should be answered continuously.
Figures in the right hand margin indicate marks.
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GROUP - A

1. Answer any ten questions. [2 × 10

(a) Prove that the set of all odd integers is not a group under multiplication.

(b) In a group G, prove that a and a^{-1} have the same order.

(c) How many generators does a cyclic group of order 12 have ?

(d) Prove that the group {1, –1, i, –i} is cyclic and find its generators.

(e) If A = (1 2 3 4 5) and B = (2 3) (4 5), find AB.

(f) Let G be a group and $f : G \to G$ such that $f(x) = x^{-1}$ be a homomrphism. Show that G is abelian.

(g) Give an example of two subgroups H, K which are not normal, but HK is a subgroup.

(h) Define Alternating Group.

(i) Show that $\phi(x^{-1}) = (\phi(x))^{-1}$ for all $x \in G$.

(j) Write all the subgroups of $G = \{0, 1, 2, 3\} + 4$

(k) Prove that H itself is a right coset as well as a left coset.

GROUP - B

*Answer **ALL** questions.*

2. Answer any two questions. [6 × 2

(a) Prove that if G is an abelian group, then for all $a, b \in G$ and all integers n, $(ab)^n = a^n b^n$.

(b) A nonempty finite subset H of the multiplicative group G is a subgroup iff H is closed under multiplication. Prove it.

(c) Prove that subgroup of a cyclic group is itself a cyclic group.

3. Answer any two questions. [6 × 2

(a) Prove, the center Z of a group of G is a normal subgroup of G.

(b) If H is a subgroup of G, then there exists one-to-one correspondence between any two right cosets of H in G. Prove it.

(c) If G is a group of prime order, then G is cyclic group. Prove it.

4. Answer any two questions. [6 × 2

(a) If ϕ is a hommorphism of G into $\bar{G}$ with kernel K, then K is a normal subgroup of G. Prove it.

(b) Suppose that N and M are two normal subgroups of G such that $N \cap M = (e)$. Show that for $n \in N$, $m \in M$, $nm = mn$.

(c) State and prove Fundamental theorem of homomorphism.

5. Answer any one question. [12

(a) Suppose G is a finite abelian group and $p \mid O(G)$, where p is a prime number. Then there is an element $a \neq e$ in G such that $a^p = e$. Prove it.

(b) If G is an abelian group of order O(G) and p is a prime number such that $p^\alpha \mid O(G)$, $p^{\alpha+1} \mid O(G)$, then G is a subgroup of order p^α. Prove it.

6. Answer any two questions. [6 × 2

(a) Find the product of two permutations and show that it is not commutative

$$f = \begin{pmatrix} 1 & 2 & 3 & 4 \\ 2 & 1 & 4 & 3 \end{pmatrix}, \; g = \begin{pmatrix} 1 & 2 & 3 & 4 \\ 3 & 2 & 1 & 4 \end{pmatrix}.$$

(b) Prove, every group G is isomorphic to a permutation group.

(c) (i) Find the inverse of the permutation $\begin{pmatrix} 1 & 2 & 3 & 4 & 5 \\ 2 & 3 & 1 & 5 & 4 \end{pmatrix}$

(ii) Show that the permutation $\begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 5 & 6 & 2 & 4 & 1 & 3 \end{pmatrix}$ is odd and the permutation $\begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 6 & 3 & 4 & 5 & 2 & 1 \end{pmatrix}$ is even.

2019

Time - 3 hours

Full Marks - 60

*Answer **both groups** as per instructions.*
Part of each question should be answered continuously.
Figures in the right hand margin indicate marks.
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GROUP - A

1. Answer any five questions. [2 × 5

   (a) Write the two sets of multipliers for finding out the integral curves of the equation

   $$\frac{dx}{z-y} = \frac{dy}{x-z} = \frac{dz}{y-x}.$$

   (b) Write the necessary and sufficient condition that the Paffian differential equation $\mathbf{X} \cdot d\mathbf{r} = 0$ is integrable.

   (c) Find out the primitive of the equation

   $$(2xyz + z^2)dx + x^2z\,dy + (xz + 1)dz = 0.$$

   (d) Form a partial differential equation by eliminating arbitrary constants a and b from the equation

   $$z = (x - a)^2 + (y - b)^2.$$

(e) Give an example of a first order partial differential equation which is linear and also give an example which is non-linear.

(f) Find out the complete integral of the equation

$$p^2 - q^2 = 1.$$

(g) Solve $(D^2 - 2DD' - 15D'^2)z = 0$ by writing the complementary function.

(h) Find out a particular integral of the equation

$$(D^2 - 3DD' + 2D'^2)z = e^{2x-y}.$$

GROUP - B

*Answer **ALL** questions.*

2. Find out the general solution of the equation [10

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

OR

Solve the equation [10

$$2yz\,dx - 2xz\,dy - (x^2 + y^2)(z - 1)dz = 0.$$

3. Find out the complete integral of the equation [10

$$(p^2 + q^2)y = qz.$$

OR

Solve : $z = px + qy + p^2 + q^2$. [10

4. Verify that the following differential equation is integrable and find out its solution. [10

$$(y^2 - z^2)dx + (x^2 - z^2)dy + (x + y)(x + y + 2z)dz = 0.$$

OR

Find out the complete integral of [10

$$p^2x^2 = z(z - qy).$$

5. Solve the equation [10

$$(D^3 - 7DD'^2 - 6D')^3 z = \sin(x + 2y) + e^{3xy}.$$

OR

Solve : $(D^3 - DD'^2 - D^2 + DD')z = \frac{x + 2}{x^3}$. [10

6. Solve the equation [10

$$(x^2D^2 - xyDD' - 2y^2D'^2 + xD - 2yD')z = \log\left(\frac{x}{y}\right).$$

OR

Solve the equation [10

$$x^2r - y^2t + xp - yq = \log x.$$

(b) Find the inverse of the matrix [12

$$\begin{bmatrix} 1 & 1 & 0 \\ 1 & -1 & 1 \\ 1 & -1 & 2 \end{bmatrix}$$

5. (a) A nonempty subset H of the group G is a subgroup of G iff

(i) $a, b \in H \Rightarrow ab \in H$ [6

(ii) $a \in H \Rightarrow a^{-1} \in H$

(b) The relation $a \approx b \bmod H$ is an equivalnce relation. Prove it. [6

OR

(c) Let ϕ be a homomorphism of G on to $\bar{G}$ with kernel K.

Then $\frac{G}{K} \approx \bar{G}$. [6

(d) If G is a group and H is a subgroup of index 2 in G, then prove that H is a normal subgroup of G. [6

6. (a) A finite Integral domain is a field. Prove it. [12

OR

(b) The homomorphism ϕ of R into R' is an isomorphism if and only if $I(\phi) = (0)$. Prove it. [12

2019

Time - 3 hours

Full Marks - 80

*Answer **both groups** as per instructions.*
Part of each question should be answered continuously.
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GROUP - A

1. Answer any ten questions. [2 × 10

(a) What is the span of x-axis and y-axis in V_3 ?

(b) Define direct sum and find xy-plane $\oplus$ z-axis.

(c) Define Row-reduced Echelon form.

(d) Evaluate det A, if A is a nilpotent matrix.

(e) $T : U \to V$ is defined by $T(u) = O_v$ for all $u \in U$. Then verify T is linear or not.

(f) If an inverse of a matrix A exists, then show that it is unique.

(g) Extend the set $\{(3, -1, 2)\}$ to be the basis of V_3.

(h) Let U and W be two distinct (n – 1) dimensional subspaces of an n-dimensional vector space V. Then find dimension of $U \cap W$.

(i) If G is a group, then prove that for every a, b $\in$ G then $(a \cdot b)^{-1} = b^{-1} \cdot a^{-1}$.

(j) Define Subgroup with example.

(k) Give an example of a commutative ring with unity.

(l) Write Second Isomorphism theorem of Rings.

(m) If U is an ideal of ring R with unity and 1 $\in$ U, prove that U = R.

GROUP - B

*Answer **ALL** questions.*

2. (a) Let U and W be two subspaces of a vector space V and Z = U + W. Then Z = U $\oplus$ W iff the following condition is satisfied. Any vector z $\in$ Z can be expressed uniquely as the sum z = u + w, u $\in$ U, w $\in$ W. [6

(b) In V_2 show that (3, 7) belongs to $[(1, 2), (0, 1)]$ but does not belongs to $[(1, 2), (2, 4)]$. [6

OR

(c) In a vector space V, suppose $\{v_1 , v_2 , \ldots\ldots , v_n\}$ is an ordered set of vectors with $v_1 \neq 0$. The set is LD if one of the vectors $v_2 , v_3 , \ldots\ldots , v_n$, say v_k belongs to the span of $v_1 , \ldots\ldots , v_{k-1}$ i.e. $v_k \in [v_1 , v_2 , \ldots\ldots , v_{k-1}]$ for some k = 2, 3, ... , n. [6

(d) In a vector space V let $B = \{v_1 , v_2 , \ldots\ldots , v_n\}$ span V. Then the following two conditions are equivalent. [6

(i) $\{v_1 , v_2 , \ldots\ldots , v_n\}$ is linearly independent set.

(ii) If v $\in$ V, then the expression

$$V = \alpha_1 v_1 + \alpha_2 v_2 + \ldots\ldots + \alpha_n v_n \text{ is unique.}$$

3. (a) A linear transformation T is completely determined by its values on the elements of a basis. Precisely if $B = \{u_1 , u_2 , \ldots\ldots, u_n\}$ is a basis for U and $v_1 , v_2 , \ldots\ldots\ldots\ldots , v_n$ be n vectors (not necessarily distinct) in V, then there exists a unique linear transformation $T : U \to V$ such that $T(u_i) = v_i$ for i = 1, 2, ... , n. [12

OR

(b) Let $T : U \to V$ be a linear map. Then prove that [12

(i) R(T) is a subspace of V.

(ii) N(T) is a subspace of U.

4. (a) Find the rank and nullity of the matrix [12

$$\begin{bmatrix} 3 & 1 & 4 & 0 \\ 0 & 2 & 2 & 0 \\ 1 & -1 & 0 & 0 \end{bmatrix}$$

OR