

**F. Y. B. Sc. (CBCS – 2018 Course)**  
**Semester – II**  
**P – 21: Kinetic Theory & Thermodynamics**

**Total Credits: 03**

**Total Lectures: 45**

**Course Learning Outcomes:**

At the end of this course student will be able to have following learning outcomes:

1. Ability to explain the concept of ideal gas and real gas and their equations of state.
2. Basic understanding of Laws of Thermodynamics and its application to various physical processes in the system
3. Application of Kinetic theory of gases for calculating the transport properties of gases.
4. Ability to explain how an Engine works, its efficiency and comparison between different types of engines
5. Understanding of the concept of entropy, reversible and Irreversible processes.

**Course Content:**

**1. KINETIC THEORY OF GASES**

Review of kinetic model of an ideal gas, various equations of state, Behavior of real gases: Van-der-Waals model, Van-der-Waals equation of states, determination of Van der Waals constant, nature of Van-der-Waals forces, critical constants. Defect of Van der Waals equation, reduced equation of state, Boyle temperature.

**2. THERMODYNAMICS**

Concept of thermodynamic state, adiabatic and isothermal thermodynamic changes, indicator diagram, adiabatic transformation and relations, work done during isothermal and adiabatic changes, first law of thermodynamics, Second law of Thermodynamics reversible and irreversible processes and illustrations.

**3. HEAT ENGINES**

Conversion of Heat into Work and its converse, Carnot's theoretical heat engine, Carnot's cycle and its efficiency, Practical heat engines; Diesel engine-construction, working, Diesel cycle and its efficiency, Otto engine –Construction, Working, Otto cycle and its efficiency, comparison of Diesel engine and Otto engine, Refrigerator.

**4. ENTROPY**

Concept of entropy, definition of entropy, change in entropy in a reversible, irreversible and in natural processes, Determination of the change in entropy when substance heated and during change of state, temperature-entropy diagram, change of phase; First latent heat equation (Clausius-Clapeyron equation), Variation of melting point and boiling point.

**Text and Reference Books:**

1. W. Zemanasky, "Heat and Thermodynamics"
2. Saha and Shrivastava, "A Treatise on Heat"
3. Theory and experiment on Thermal physics; P. K. Chakrabarti, New Central Book Agency (P) Ltd.
4. A. B. Gupta, College Physics Volume 1, Book's and Allied (P) Ltd.

5. Heat and Thermodynamics: Brijlal, N. Subrahmanyam, S. Chand & Company Ltd, New Delhi
6. Heat and Thermodynamics: Mark. W. Zemansky, Richard H. Dittman, Seventh Edition,  
1. McGraw-Hill International Editions
7. Thermodynamics and Statistical Physics: J.K. Sharma, K.K. Sarkar, Himalaya Publishing House
8. Thermal Physics (Heat & Thermodynamics): A.B. Gupta, H.P. Roy Books and Allied (P) Ltd, Calcutta.

**F. Y. B. Sc. (CBCS – 2018 Course)**  
**Semester– II**  
**P – 22: Electricity & Magnetism**

**Total Credits: 03**

**Total Lectures: 45**

**Course Learning Outcomes:**

At the end of this course student will be able to have following learning outcomes,

1. Ability to demonstrate different laws of electrostatics such as Coulomb's law, Gauss's law etc. and their applications.
2. Understanding of dielectric properties of materials and polarization concept.
3. Ability to measure the magnetic forces acting on moving charges and the magnetic fields due to currents using the applications of Biot-Savart's and Ampere laws
4. Understanding of different parameters associated with magnetic field and their interrelations

**Course Content:**

**1. Electrostatics**

Revision of Coulomb's law, Superposition principle, Electric field due to an electric dipole, line and disc, Revision of Gauss's law, Coulomb's law from Gauss's law, Gauss's law applications in Cylindrical, planar and spherical symmetry

**2. Dielectrics**

Electric Dipole, Electric dipole and dipole moment, Electric potential and intensity at any point due to dipole, Torque on a dipole placed in an electric field, Polar and non-polar molecules, Electric polarization of dielectric material, Gauss' law in dielectric, Electric vectors and relation between them

**3. Magneto statics**

1. Revision of Biot-Savart's law with examples, Amperes' law, e.g. Solenoid and Toroid, Gauss law for magnetism

**4. Magnetic properties of materials**

1. Magnetic materials and Bohr magneton, Magnetization (M), magnetic intensity (H), magnetic

induction (B), magnetic susceptibility and permeability, Relation between B, M and H,

Hysteresis

**Text and Reference Books:**

1. Fundamentals of Physics: 8<sup>th</sup> Edition, Halliday Resnik and Walker
2. Electromagnetics: B. B. Laud
3. Ritz and Milford, "Electricity and Magnetism"
4. A. S. Mahajan and A. A. Rangawala, "Electricity and Magnetism"
5. Brijal and Subramanyarn, "Electricity and Electronics"
6. B. L. Tharej a, "Textbook of Electrical Technology"
7. S. S. Atwoods, "Electricity and Magnetism"
8. E. M. Pucell Ed, "Physics Course Vol. I, "Electricity and Magnetism"
9. D. Haliday and R. Resnick, "Physics Volume 2"

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**F. Y. B Sc. (CBCS – 2018 Course)**  
**Semester - II**  
**P - 23: Practical Course -II**

**Total Credits: 02**

**Course Learning Outcomes:**

At the end of this course student will be able to have following learning outcomes:

1. Study of spectrometer , thermocouple and determination of inversion temperature
2. Study of temperature coefficient of resistance
3. Measurement of specific heat of graphite by electrical method and Thermal conductivity by Lee's method
4. To understand fill factor of solar cell
5. To know how the diode can be used as a rectifier.

**Course Content**

1. Y by Flat spiral spring and  $\eta$  by Flat spiral spring
2. Y-by bending (rectangular thin bar)
3. Specific heat of graphite by electrical method
4. Study of temperature coefficient of resistance
5. Velocity of sound in air by Kund's tube
6. Study of thermocouple and determination of inversion temperature
7. Study of spectrometer (angle of prism, refractive index of glass material)
8. Calibration of spectrometer
9. LCR series resonance circuit and Q-factor
10. Frequency of A.C. using vibrating wire and magnet
11. Study of capacitive reactance
12. To determine fill factor of solar cell
13. Diode as a rectifier (Full wave and Bridge rectifier)
14. Thermal conductivity by Lee's method

Note: Any eight (8) experiments should be performed.

**Text and reference books:**

1. B. L. Worsnop and H. T. Flint, " Advanced Practical in Physics"
2. D. P. Khandewal, " Laboratory manual for Physics for Undergraduate students"
3. B. Saraf, " Physics through experiments, vol. II

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**F. Y. B.Sc. (CBCS-2018 COURSE)**  
**Semester – II**  
**C-21: Physical & Inorganic Chemistry-II**

**Total Credits: 03**

**Total Lectures: 45**

**Course Learning Outcomes:**

After completion of this course students should be able to:

1. Understand the physical properties of liquids.
2. Write Van der waal's equation and significance of the terms involved in it.
3. Inculcate the phenomenon of fluorescence and phosphorescence in the students and outside the scientific community.
4. Know the types of hybridization and their geometries

**SECTION – I (Physical Chemistry)**

**Course Content:**

**1. Liquid state**

Properties of liquid, Comparison between gaseous and solid state, Experimental determination of vapour pressure by isoteniscopic method and viscosity by Ostwald method, Liquid crystals and their applications.

[Ref. 8 Page No. 57-61 and Ref. 11]

**2. Gaseous State**

Introduction, Ideal and non-ideal gases, Effect of pressure, Effect of temperature, Vander Waals equations, Critical phenomena, The law of corresponding states and reduced equation of state, Liquefaction of gases, Joule Thomson effect, Numericals.

[Ref. 8 Page No. 5 -56]

**3. Photochemistry**

Introduction, Difference between photochemical and ordinary chemical reactions, Different laws of photochemistry, Quantum efficiency, Fluorescence, Phosphorescence, Experimental study of photochemical reactions, Numericals.

[Ref. 8 Page No. 775-786]

**References:**

1. Physical Chemistry by G. M. Barrow, 5<sup>th</sup> Edition (McGraw-Hill) (2007).
2. Physical Chemistry by Robert G Mortimer, 3<sup>rd</sup> Edition, Elsevier (2008).
3. Physical Chemistry by Atkins and Paula 8<sup>th</sup> Edition (2008).
4. College Chemistry by Barua, Bijoy and Y. R. Sharma, Kalyani Publishers (1995).
5. Principles of Physical Chemistry by Puri, Sharma and Pathania (2008).
6. Physical Chemistry by Dr. S. Pahari, New Central book agency (P) Ltd. (2007).
7. Physical Chemistry by Ira N. Levine Fifth Edition Tata McgGaw-Hill (2004).
8. Principles of Physical Chemistry by Maron and Prutton, 4<sup>th</sup> Edition (2008), Oxford IBM Publishing Co. Pvt. Ltd.
9. Advanced Physical Chemistry by D. N. Bajpai, S. Chand (2011).
10. Essentials of Physical Chemistry by Arun Bahl, B. S. Bahl and G. D. Tuli, S. Chand (2012).
11. Mathematical Preparation of Physical Chemistry by F. Daniel's, McGraw Hill Book Comp.Inc.
12. Chemistry 9<sup>th</sup> edition ,8<sup>th</sup> edition 2010 by Raymond Chang. McGraw-Hill companies Inc. New York Published by Tata McGraw –Hill Education Private Limited, New Delhi. 9<sup>th</sup> edition, 8<sup>th</sup> reprint 2010.

13. Physical chemistry N. Kundu and S.K.Jain,S.Chand & company Ltd New Delhi. First edition 1984, reprint 1990.
14. Physical Chemistry, A Molecular approach.Donald A. Mc Quarrie and John D.Simon, Published by University Science Books CA, USA.First edition 1998, reprint 2006.

## SECTION – II (Inorganic Chemistry)

### 1. Chemical bonding

Attainment of stable configuration, Types of bonds ionic, covalent,

co-ordinate & metallic,Types of overlaps: s-s, p-p, s-p, p-d, d-d and their examples, Formation of sigma & pi bonds,Theories of bonding- a)valance bond theory, b) Heitler London theory and c) Pauling Slater

theory, Concept of hybridization: Definition & need of hybridization, steps involved in hybridization, explanation of covalency of atoms in the moles based on hybridization, types of hybridization involving s, p, & d orbitals.Applications of hybridization geometries of molecules like

- i)  $\text{BeH}_2$  ii)  $\text{BF}_3$  iii)  $[\text{MnCl}_4]^{2-}$  iv)  $[\text{Ni}(\text{CN})_4]^{2-}$  v)  $\text{Fe}(\text{CO})_5$   
vi)  $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$  vii)  $\text{IF}_7$

**VSEPR theory:** Assumptions, need of theory, application of theory to explain geometry of irregular molecules such as

- i) $\text{ClF}_3$  ii)  $\text{Cl}_2\text{O}$  iii)  $\text{BrF}_5$  iii)  $\text{TeCl}_4$  iv)  $\text{XeO}_3$  v)  $\text{XeOF}_4$

[Ref. 1,2,3]

#### References:

1. Inorganic Chemistry: Principles of Structure and Reactivity, J. E. Huheey, , R. L. Keiter, Prentice Hall; 4<sup>th</sup> Edition (1997) P 205,222.
2. New guide to Modern Valance Theory-G.I. Brown, Longman, 3rd
3. Edn. (1980).
4. Concise Inorganic Chemistry-J.D. Lee,Wiley-India,
5. Fifth Edition(2009)- Chapter-4, p 72-81
6. 4. Concept & model of Inorganic Chemistry-Douglas Mc Doniels,Wiley.

**F. Y. B.Sc. (CBCS-2018 COURSE)**  
**Semester – II**

**SECTION – I (Organic Chemistry)**  
**C-22: Organic & Inorganic Chemistry-II**

**Total Credits: 03**

**Total Lectures: 45**

**Course Learning Outcomes:**

After completion of this course students should be able to:

1. Expound conformational isomerism in alkanes
2. Distinguish between geometrical and optical isomerism.
3. Enumerate R/S and E/Z nomenclature.
4. Know synthesis and reactions of naphthalene and anthracene.
5. Describe position, electronic configuration, trends in properties and anomalous behaviour of P-block elements
6. Explain preparation and reactions of cycloalkanes & cycloalkenes.
7. Understand the Huckel's rule, synthesis, Resonance, molecular orbital structure and
8. reactions of Furan, Pyrrole & Thiophene.

**Course Content:**

**1. STEREOCHEMISTRY OF ORGANIC COMPOUNDS**

**Concept of Isomerism: -**

Types of isomerism, structural isomerism, chain, position, functional group and Tautomerism.

**Representation of organic molecules: -**

Projection formulae – Saw horse (Adrian), Newman, Fischer, Dotted – Wedge – Line formula.

**Conformational isomerism: -**

Conformational isomerism in alkanes, free rotation about Carbon – carbon single bond. Conformations of Ethane, propane and Butane. Relative stabilities of different conformations.

**Optical isomerism: -**

Tetrahedral Carbon atom, optical isomerism, polarimeter, specific rotation, Enantiomerism Diastereomerism, Chirality, Prediction of optical activity, plane of symmetry, centre of symmetry. Relative and Absolute Configuration – sequence rules, R and S system of nomenclature.

**Geometrical isomerism: -**

Geometrical isomerism restricted to carbon – carbon double (  $C = C$  ) bond and open chain compounds only. Conditions for geometrical isomerism, cis – trans and E / Z nomenclatures, Physical and chemical properties of geometrical isomerism.

[Ref. 1, Pages 125,126,135 to 146, 279 to 282, 1162 to 1164]

## 2. Polynuclear Aromatic Compounds

Fused ring aromatic compounds, Nomenclature of naphthalene derivative, Haworth synthesis of Naphthalene, Reactions of naphthalene - oxidation reduction, nitration, halogenation, sulphonation and Friedel Craft acylation. Haworth Synthesis of Anthracene, Reactions of anthracene-oxidation, reduction, nitration, halogenations and sulphonation.

[Ref. 1: Pages: - 1167-169, 1170-174, Ref.3: pages: - 710-713]

## 3. Cycloalkanes and cycloalkenes

**Cycloalkanes: -**

**Introduction.**

**Method of formation -** a) By addition of carbene to alkene

b) Action of metallic sodium on dihaloalkane

c) Diels - Alder reaction d) By reduction of aromatic compounds.

**Chemical properties-** a) Photohalogenation b) Catalytic halogenations

c) Catalytic hydrogenation d) Effect of heat e) Reaction with hydrogen halide

**Cycloalkenes :**

**Introduction.**

**Method of formation- From cyclic compounds:**

**Chemical Properties -** a) Hydrogenation b) Addition of Halogens and halogen acids c) Allylic halogenations

[Ref.1 , Pages:- 272 – 279; Ref.5 Pages:- 585-589]

## 4. Heterocyclic Compounds

Introduction, Huckel's rule for aromatic heterocyclic compounds, synthesis, Resonance, molecular orbital structure and reactions of Furan, Pyrrole & Thiophene.

[Ref.3 , Pages:- 836 – 850]

### References:

1. Organic Chemistry (Sixth Edition) by Robert Morrison and Robert Boyd. Prentice Hall of India Pvt. Ltd. New Delhi (1989).
2. Guide book to mechanism in organic chemistry (Sixth Edition) by Peter Sykes, Orient Longman (1981).
3. Textbook of Organic Chemistry (Fifth Edition ) by Raj K. Bansal - New Age International (P) Ltd. Publishers, Mumbai (2007)
4. Principles of modern Heterocyclic Chemistry By L.A. Paquette.
5. Text – book of Organic Chemistry by Arun Bhal , B.S.Bhal (18<sup>th</sup> Edition), S.Chand & company, Ltd. New Delhi (2006)
6. Stereochemistry of Organic Compounds by D. Nasipuri, (Second Edition), Wiley Eastern Ltd., New Delhi.(1999)
7. Stereochemistry of Carbon Compounds by Eliel, (Fourth Edition ), New Age International (P) Ltd. Publishers New Delhi (1997)



## SECTION – II (Inorganic Chemistry)

### 1. CHEMISTRY OF p-BLOCK ELEMENTS

Position of elements in periodic table, electronic configuration of elements trends in properties like atomic size, ionization potential, electronegativity, electron affinity, reactivity, oxidation states, anomalous behaviour of first member of each group.

**Structure and properties of:** Borate, Halides of aluminium, Allotropes of carbon, Classification of silicates, Oxyacids of phosphorous and sulphur, Inter-halogen compounds.

[Ref. 1,2,3]

#### References:

1. Concise Inorganic Chemistry-J.D. Lee, Wiley-India 5<sup>th</sup> Edition(2011)  
-P 359-638pages.
2. Concept & model of Inorganic Chemistry-Douglas Mc Daniels, Wiley, 3<sup>rd</sup> Ed<sup>n</sup> (1994), p 789
3. Basic Inorganic Chemistry, F.A. Cotton, G. Wilkinson, P.L. Gaus Wiley-India, 3<sup>rd</sup> Ed(2008), p 319-483.

**F. Y. B.Sc. (CBCS-2018 COURSE)**  
**Semester – II**  
**C-23: Practical Course - II**

**Total Credits: 02**

**Course Learning Outcomes:**

After completion of this course students should be able to:

1. Determine equivalent weight of a given metal by Eudiometer.
2. Analyse hydrolysis of methyl acetate in presence of HCl.
3. Find out  $\Delta H$  and  $\Delta S$  for the chemical reactions.
4. Study specific and molar refractivities of methyl group.
5. Investigate the Loss/gm and percentage purity of given mixture of  $\text{NaHCO}_3$  and  $\text{Na}_2\text{CO}_3$ .
6. Calculate the number of water molecules of crystallization.
7. Elucidate the total hardness of the given sample of water by using EDTA.
8. Standardize 0.1N  $\text{KMnO}_4$  solution with 0.1 N sodium oxalate .
9. Estimate % purity of a given sample of sodium chloride

**Course Content:**

**PHYSICAL CHEMISTRY EXPERIMENTS (Any 2)**

1. Determination of equivalent weight of a given metal by Eudiometer.
2. To study the hydrolysis of methyl acetate in presence of HCl.
3. To study the reaction between  $\text{K}_2\text{S}_2\text{O}_8$  and KI (equal concentration).
4. To determine DH and DS for the following chemical reactions
  - i)  $\text{Zn(s)} + \text{CuSO}_4(\text{aq}) \longrightarrow \text{Cu(s)} + \text{ZnSO}_4(\text{aq})$
  - ii)  $3\text{Mg(s)} + 2\text{FeCl}_3(\text{aq}) \longrightarrow 2\text{Fe(s)} + 3\text{MgCl}_2(\text{aq})$
5. Determination of specific and molar refractivities of benzene, toluene and xylene.

**References:**

1. Systematic Experimental Physical Chemistry by Rajbhoj and Chondhekar, Anjali Publication. 1<sup>st</sup> Edition, 1990.
2. Experiments in Chemistry by D.V. Jahagirdar, Himalaya Publishing House. 1<sup>st</sup> Edition, 1994.

**INORGANIC CHEMISTRY EXPERIMENTS**

**A) Gravimetric Analysis:**

**(Any Two)**

- 1) To determine the Loss/gm and percentage purity of given mixture of  $\text{NaHCO}_3$  and  $\text{Na}_2\text{CO}_3$ .
- 2) To determine the number of molecules of water of crystallization from given  $\text{BaCl}_2$  sample by heating.
- 3) To determine the number of molecules of water of crystallization from given  $\text{MgSO}_4$  sample by heating.

**B) Volumetric Analysis:**

**(Any Two)**

- 1) To determine the total hardness of the given sample of water by using EDTA.
- 2) To prepare 0.1 N sodium oxalate solution and standardization of given 0.1N  $\text{KMnO}_4$  solution.

- 3) To standardize given NaOH solution and hence to find out the strength of the given HCl solution.
- 4) Estimation of % purity of a given sample of sodium chloride.

**References:**

- 1) Inorganic Qualitative Analysis.- by A.I. Vogel
- 2) Inorganic Quantitative Analysis. - by A.I. Vogel

**ORGANIC CHEMISTRY EXPERIMENTS**

**A) Volumetric estimations: (Any Two)**

- (i) Aniline (ii) Phenol (iii) Acetone

**B) Techniques: (Any Two)**

- a) Purification of an impure organic compound by crystallization/sublimation method and determination of melting point of purified sample.
- b) Student will report M.P. of organic compound before and after
  - a. crystallization/sublimation
- c) Solvents like water, alcohol water + alcohol can be selected for crystallization.

**References:**

1. Organic qualitative analysis by A.I. Vogel, (Fourth Edition), Longman group Ltd., England (1996)
2. Laboratory Manual of Organic Chemistry by R.K. Bansal,
3. (Second Edition), Wiley Eastern Ltd., New Delhi (1990)

**F.Y.B.Sc. (CBCS 2018 Course)**

**Semester-II**

**B-21: Plant Diversity and Utilization of Plants-II**

**Total Credits- 03**

**Total lectures- 45**

**Course Learning Outcomes:**

After the completion of this course, the learner will be able to:

1. The students will learn about the structure and reproduction of certain selected species.
2. of Angiosperm and Gymnosperm.
3. Know about the structure, life history and Economic importance of Angiosperm and Gymnosperm.
4. Enable to identify morphological and anatomical peculiarities
5. Apply skills to manage plant biodiversity
6. Conceptualize the role of plants in human welfare with special reference to India

**Course Content:**

**Angiosperms and Gymnosperms**

**1. Angiosperms**

Salient features of angiosperms, identification, nomenclature and classification according to Bentham and Hookers system, Primitive and advanced features, salient features of the International code of Botanical nomenclature, general account of morphology, flower structure and reproduction.

**2. Study of families**

According to Bentham and Hookers system of classification, with the reference to diagnostic characters, floral formulae, floral diagram and economic importance.

- a) Brassicaceae
- b) Malvaceae
- c) Papilionaceae
- d) Rubiaceae
- e) Liliaceae

**3. Utilization of some following angiosperms in the manufacture of industrial products.**

- i) Neem, ii) Tinospora, iii) Adulsa

**4. Gymnosperm**

Important characters and classification, evolutionary significance of gymnosperms, comparative study of Cycadales (e.g. *Cycas*), Coniferales (e.g. *Pinus*) and Gnetales (e.g. *Gnetum*), Ginkgoales (e.g. *Ginkgo*).

**5. Study of life history of *Pinus*.**

**6. Utilization of *Ginkgo biloba* in the manufacture of industrial products.**

**Reference books:**

1. Sporne, K.R. 1991. The Morphology of Gymnosperms. B.I. Publications Pvt., Mumbai, Calcutta, Delhi.
2. Coulter J.M. & Chamberlain C.J. Morphology of Gymnosperm.
3. P.C. Vashishta – Gymnosperm.
4. Cronquist, A. 1968. The evolution and classification of flowering plants. Thomas Nelson (Printers) Ltd.
5. Foster, A.S. and Gifford, A.E.M. Jr. 1967. Comparative morphology of vascular plants.
6. Spore, K.R. 1977. The morphology of Angiosperms.. B.I. Publication, Bombay.
7. B.R. Vashishta 1997. Taxonomy of Angiosperm.
8. Kar & Gangulee, 1996, College Botany.

**F.Y.B.Sc. (CBCS 2018 Course)**  
**Semester-II**  
**B-22: Industrial Botany**

**Total Credits- 03**

**Total lectures- 45**

**Course Learning Outcomes:**

1. Gain thorough knowledge about various plant groups from primitive to highly evolved plants.
2. Become aware of applications of different plants in various industries.
3. To highlight the potential of these studies to become an entrepreneur.
4. To equip the students with skills related to laboratory as well as industries based studies.
5. To make the students aware about conservation and sustainable use of plants.
6. To address the socio-economic challenges related to plant sciences.
7. To Study the method of large scale production of biofertilizer & Organic farming
8. Get knowledge on Biopesticide - characteristics, physiology, mechanism of action and application.

**Course Content:**

**1. Introduction, scope and importance of Industrial Botany.**

**2. Biopesticide Industry-**

- a. Introduction, Definition and need, concept of biodegradable and non- residual effect.
- b. Environmental and health hazards due to pesticides and fungicides.
- c. Plant base chemical products-Azadirachtin, Neem Cake, Indiarina, Pyrethrins,
- b) Pheromones, Trichoderma, and Trichogramma.

**3. Bioenergy Industry -**

Introduction, definition, scope and importance of energy plantation – criteria for selecting plants its need and advantages. Utilization of industrial wastes, plant & animal waste for production of bioenergy.

**4. Plant tissue culture Industry**

Introduction, history of tissue culture scope & importance. Brief idea of tissue culture – plant propagation by tissue culture.

**5. Biofertilizer Industry**

Definition, types of culturing N<sub>2</sub> fixing blue green algae and their utilization in agriculture, culturing of *Rhizobium* and their utilization in agriculture. utilization in agriculture, culturing of *Rhizobium* and their utilization in agriculture.

**6. Mushroom Industry**

Introduction, edible and poisonous mushroom, genera used for cultivation, method of cultivation of *Agaricus*, *Pleurotus* and *Volvariella*, scope and commercial cultivation, food value.

**7. Non conventional Food Industry**

Introduction, definition, concept and need, advantages. Types with examples (listing) bacterial, fungal, algal and transgenic (GMO).

Algal biomass *Spirulina* – Morphology of thallus, merit of *Spirulina* cultivation, method of culture – small and large scale, harvesting, limiting factors, products, powder, tablets & biscuits.

**Reference books:**

1. Biofertilizer in Agriculture -N.S.Subbarao
2. Biotechnology – Keshav Trehans
3. Algae and Man - D.F. Jackson
4. Biofertilizer techniques (Marathi) -L.V.Gangawane
5. Biofertilizers -Somani
6. Cultivation of algae -G.S.Venkataraman
7. Role of blue green algae in Nitrogen fixation - R.N.Singh
8. A text book of plant Biotechnology -Dhumal et al, Nirali Prakashan
9. A text book of pharmacognosy by C.S.Shah, J.S. Quady, M/s. B.S.Shah publication, Ahmadabad.
10. Text book of pharmacognosy by Mohammed Ali – C.B.S. Publisher & distribution, Delhi-110032.
11. Phamacognosy -G.E.Treasc, W.C. Evans.
12. Hand book of mushroom -Dr.Mrs.Nita Bahh – Oxford & IBH, publishing Co. Delhi
13. Botany for degree student -B.R.Vashishta
14. A text book of Biotechnology - H.D.Kumar
15. 15. A text book of applied Botany More T.N. *et al*, Gaaj Prakash.
16. A text book of Applied Botany.- B.A. Patil *et. al.*-Sunny Prakashan.

**F.Y.B.Sc. (CBCS 2018 Course)**

**B-23: PRACTICAL COURSE-II**

**PTERIODOPHYTA, GYMNOSPERMS AND INDUSTRIAL BOTANY**

**Course Learning Outcome :**

Students should understand

1. Study of diversity of Pteridophyte and gymnosperm w.r.t systematic position and morphology.
2. Students learned application of organic fertilization
3. Realization and differentiation of various tissue system
4. Study of life cycle of *Agaricus* and their cultivation.
5. Cultivation of Mass culture of B.G.A. and *Pleurotus*.
6. Preparation of bio- pesticide Azadiractin, Squash and Ketchup.

**Course Content:**

1. Study of Pteridophyta – morphology and reproductive structure in e.g. *Psilotum*, *Lycopodium*, *Equisetum* & *Marsilea*
2. Study life history of *Selaginella*.
3. Study of Gymnosperms - morphology and reproductive structures in e.g. *Pinus*
4. Cultivation of Dhingri (Oyster) mushroom.
5. Isolation of *Rhizobium*, from root nodules and culturing of *Rhizobium* by using medium.
6. Isolation of B.G.A. from soil and culturing of B.G.A. by using BG – 11 medium.
7. To demonstrate plant based products and microbes used in biological control.
8. To Study a range of biofertilizers available in local market.
9. Visit to Plant Tissue Culture Lab
10. Filed Visit (Forest)
11. Revision

**F. Y. B.Sc. (CBCS 2018 Course)**

**Semester-II**

**Z- 21 : Functional Anatomy of Chordates-I**

**Total Credits : 03**

**Total lectures:45**

**Course Learning Outcomes:**

On completion of the course, students are able to:

1. Study and understand the phylum cephalochordata.
2. Study and understand the systemic position, external morphology and systems developed in Amphioxus.
3. Study primary, secondary and special characters of cephalochordata i.e. in Amphioxus.
4. Study and understand the systematic position, external morphology and sexual dimorphism in frog.
5. Study and understand various systems of frog like digestive system, circulatory system, excretory system, reproductive system, nervous system and sense organ-eye.
6. Understand and study metamorphosis and its significance in frog.

**Course Content :**

**UNIT I - Study of Amphioxus**

- i) Systematic position, habits and habitat.
- ii) External characters.
- iii) Digestive system - Alimentary canal, food and feeding and physiology of digestion
- iv) Circulatory system: Arterial and venous system.
- v) Nervous system and sense organs.
- vi) Affinities of Amphioxus - primitive characters, secondary characters and degenerate characters.

**UNIT II - Study of Frog**

- i) Systematic position, Habits and habitat
- ii) External characters and sexual dimorphism.
- iii) Structure of integument and its functions.
- iv) Digestive system - Alimentary canal, digestive glands, food, feeding mechanism and physiology of digestion.
- v) Blood vascular system: Blood and its functions, Heart - structure, Arterial and venous system.
- vi) Nervous system, Brain and its functions,
- vii) Sense organs - Eye - structure and working.
- viii) Reproductive system - Male and female reproductive system.
- ix) Metamorphosis.



**Reference books :**

1. Modern text book of Zoology - Vertebrates (1992) Kotpal, Agarwal and Khetarpal.
2. Chordate Zoology (1988) R.C. Dalela.
3. Text book of modern Zoology (1991) P.S. Verma and P.C. Shrivastava.
4. Chordate Zoology E.L. Jordan.
5. Chordate Zoology (1996) Kishor Pawar.
6. Non-chordates and chordate Zoology- II Kishor Pawar.
7. A Text book of Zoology - Animal systematics and diversity-II Marathe. Agarkar and Jos Joshi.

**F. Y. B.Sc. (CBCS 2018 Course)**  
**Semester-II**  
**Z- 22: Applied zoology (Vermiculture and Sericulture)**

**Total Credits:03**

**Total lectures: 45**

**Course Learning Outcomes:**

On completion of the course, students are able to:

1. Know the skills and knowledge in the field of vermiculture and sericulture.
2. Identify various methodology and perspectives of applied branches of zoology for the possibilities of self-employment.
3. Learn the basic principles involved in the culture of earthworms.
4. Apply the gained knowledge of vermiculture for the self- employment.
5. Study and understand basic principles involved in the moriculture i.e. mulberry cultivation.
6. Understand and study silkworm rearing techniques, various diseases-symptoms, control and prevention and raw silk production, its composition and uses.

**Course Content:**

**UNIT I - Vermiculture**

1. Introduction to vermiculture biotechnology
2. Living soil
3. Taxonomy and distribution of useful species of earthworms for vermiculture
4. Manure processing earthworm species
  - i) *Eudrilus eugenia* ii) *Eisenia foetida* iii) *Perionyx excavatus*
6. Soil processing earthworm species
  - i) *Pheretima posthuma* ii) *Pheretima elongata*
7. Earthworm culturing techniques and production of vermicompost
  - i) Vermiculturing in house garden (small scale method).
  - ii) Vermiculturing in the farm (Large Scale)
8. Usefulness of vermiculture
  - i) In agriculture: Advantage of vermiculture farming over chemical farming
  - ii) In sewage treatment
  - iii) In agro industries - Agroindustrial Waste treatment
  - iv) Methods of using vermiculture biotechnology in garden and farms
  - v) Vermiculture biotechnology: Solution of many problems facing the World
9. Economic importance of vermiculture
10. Factors influencing the culturing of earthworms.

**UNIT II - Sericulture**

1. Introduction to history of sericulture and sericulture industry in India
2. Taxonomy and distribution of silkworm species
3. Types of silk worm: *Bombyx mori* (Mulberry silkworm), Eri Silkworms, Tasar Silkworms and Muga Silkworms
4. External morphology and life-cycle of *Bombyx mori*
5. Cultivation and harvesting of mulberry

6. Silkworm rearing:
  - i) Requirements
  - iii) Rearing appliances
  - iv) Rearing techniques
7. Important diseases: Bacterial, viral, fungal and protozoan
8. Silkworm pests: Dermestid beetles, Uziflies and ants

**Reference Books:**

1. Biology of earthworms -Edwards and Lofty
2. Earthworm ecology -E. S & chell
3. Earthworm biology - J.A.Wallwark
4. Sustainable agriculture - J.P.Reganold
5. Earthworms - K.E.Lee
6. A Text book of Applied Zoology - Kishor Pawar and Desai
7. Waste management - Kharbonda and Stallworthy
8. Annelida. - R.L.Kotpal

**F. Y. B.Sc. (CBCS 2018 Course)**  
**Semester-II**  
**Z- 23: Zoology Practical Course –II**  
(Practical based on paper: Z-21, Z-22)

**Total Credits: 02**

**Contact hours per practical– 04 h**

**Course Learning Outcomes:**

On completion of the course, students are able to:

1. Understand different categories of chordates and general characters of chordates.
2. Study and understand chordate animals distinguishing characters and classification through slides and museum specimens.
3. Understand how organisms are classified and identified.
4. Study external characters, sexual dimorphism, digestive system, male and female reproductive system of frog with the help of charts and models.
5. Understand the methods of vermiculture and study different products.
6. Study and understand the different varieties of silk moth with the help of museum specimens, composition and uses of silk.
7. Study and understand the stages of life cycle of mulberry silk moth with the help of museum specimens and composition and uses of silk.

**Course Content:**

1. Study of general and distinguishing characters and classification of chordates up to order with one example of each order. **D**
  - a. Urochordata
  - b. Cephalochordata
  - c. Cyclostomata
  - d. Chondrichthyes
  - e. Osteichthyes
  - f. Amphibia
2. Study of Amphioxus – T. S. through pharynx, gonads, intestine and caudal region with the help of microprepared slide. **D**
3. Study of external characters, sexual dimorphism of frog with the help of model / chart.
4. Study of digestive system of Frog with the help of model / chart. **D**
5. Study of Male reproductive system of frog with the help of model / Chart. **D**
6. Study of Female reproductive system of frog with the help of model / Chart. **D**
7. Study of Brain of frog with the help of model / chart. **D**
8. Metamorphosis in frog with the help of larval forms. **D**
9. Study of taxonomy, external characters and distribution of useful species of earthworm for vermiculture. **D**
10. Earthworm culturing in garden (Small Scale). **D**
11. Study of taxonomy, external characters and distribution of useful species of silkworm for sericulture. **D**
12. Life cycle of mulberry silkworm – Eggs, larva, cocoon, adult (male & female), silk. **D**

**Study Tour:**

Compulsory visit to large water body / Vermiculture unit / Sericulture project / Biodiversity spot / ZSI / Any project

Students be introduced to learning dissections / anatomy adapting CDS / Web sources.

**\*E** – Experiments

**\*D** – Demonstration Practical

**Reference books:**

1. A manual of practical zoology Chordata Vol. 2 : P. K. G. Nair and K. P. Achar
2. Hand Book of Animal Husbandary and Dairy: Mudlyer
3. Advanced Practical zoology By J. Sinha, A. K. Chatterjee, P. Chattopadhyay

**F. Y. B. Sc. (CBCS – 2018 course)**  
**Semester II**  
**MB – 21: Microbial Nutrition, Growth and Control**

**Total credits: 03**

**Total Lectures: 45**

**Course Learning Outcomes:**

**After completion of the paper, students will be able to:**

1. Understand different media to be used for cultivation of microorganisms
2. Know different chemical methods for controlling microbial growth
3. Understand different physical methods for controlling microbial growth

**Course content:**

**(I) Microbial Nutrition**

1. Requirements for Growth
2. Physical and Chemical Requirement
3. The common Nutrient Requirements
4. Requirements for Carbon, Hydrogen and Oxygen
5. Nutritional types of Microorganisms
6. Requirements for Nitrogen, Phosphorous and Sulfur
7. Uptake of Nutrients by the cell.
8. Culture Media Chemically defined  
media Complex media  
Anaerobic Growth media and methods Special  
Culture techniques  
Selective and Differential media Enrichment  
Culture
9. Obtaining Pure cultures .Methods of purification: Streak plate, spread plate and  
pours plate technique. Methods of obtaining pure cultures of motile organisms
10. Preserving bacterial cultures .Methods of preservation: On Nutrient agar slants,  
agar overlay method, Cryopreservation, Freeze drying, Lyophilization.
11. Concept of culture collection center.

**(II) Microbial Growth**

1. The Growth of bacterial cultures
2. Bacterial Division
3. Generation time
4. Phases of Growth – The Growth curve
5. Measurement of Microbial Growth
  - a. Direct Measurement
  - b. Estimating bacterial numbers by indirect methods.
6. Microbial Growth in Natural Environments
7. The influence of Environmental factors on growth eg. Temperature, oxygen,  
pH, pressure, heavy metals, salts.

**(III) Control of Microbial Growth**

1. The Terminology of Microbial control
2. The rate of Microbial Death
3. Actions of Microbial control Agents. Alteration of Membrane permeability

Damage to proteins & Nucleic acids.

4. The pattern of Microbial Death
5. Physical methods of Microbial control E.g. Heat, Filtration, low temperatures, High Pressure, Desiccation, Osmotic Pressure, Radiation, Sonic waves
6. Chemical methods of Microbial control : Principles of Effective disinfection-Evaluation of a disinfectant types of disinfectants – Phenols & Phenolics, Alcohol, Halogen compounds, Heavy metals, Gaseous agents , Formaldehyde, Glutaraldehyde, Ethylene oxide, Hydrogen peroxide, Soaps, Detergents , Dyes Acids.
  - a) Microbial Characteristics and Microbial control.
  - b) Universal Precautions for Microbiology laboratory
  - c) Safety in Microbiology laboratory

### References:

1. Alcamo, Edward. I. (2007).Fundamentals of Microbiology, Eighth Edition, Jones and Bartlett Publishers, Sudbury, Massachusetts. (Chapter No.1,2,3.).
2. Dubey R. C., D. K. Maheshwari, Second Ed. (2010).A Textbook of Microbiology, S. Chand And Company.
3. Ingraham. J. L and C. A. Ingraham (2000) Introduction to Microbiology .Second Edition Thompson Learning Inc. (Chapter No2,3).
4. Hofkin Bruce V . (2011) Living in a Microbial World. Garland Science. . (Chapter No1,2,5,15,16).
5. Madigan , M. T. and J. M. Martinko (2006), Brock. Biology of Microorganisms 11<sup>th</sup> Edition, International Edition. Pearson , Prentice Hall. (Chapter No.4.)
6. Manoharachary K. and B.R. Tilak (2012).Principles of Microbiology, I. K. International Publishing House Pvt.Ltd
7. Pelczar M. J., Chan E. C. S., Krieg N.R. (2010),Microbiology, 39<sup>th</sup> Edition , Tata McGraw-Hill
8. Powar Daginwala Tenth Ed.(2010).General Microbiology Vol.2, Himalaya Publishing House.
9. Prescott, Lancing. M., John, P. Harley and Donald, A. Klein (2008) Microbiology, Eighth Edition McGraw Hill Higher Education. (Chapter No.2.)
10. Tortora, Gerard. J., Berdell, R. Funk and Case, Christine L. (2007) Microbiology: an Introduction, Ninth Edition, Pearson Education. (Chapter No. 3,5).

**F.Y.B.Sc. (CBCS – 2018 course)**  
**Semester II**  
**MB-22: The Diversity of Microbial World**

**Total credits: 03**

**Total Lectures: 45**

**Course Learning Outcomes:**

**After completion of the paper, students will be able to,**

1. Understand significance of microorganisms in soil, water and air
2. Know different methods for controlling drug resistant bacteria
3. Understand spread and control of deliberately spread pathogenic
4. microorganisms

**Course content:**

**(I) Ecological Groups of Microorganisms**

1. Soil Microorganisms
2. Microflora of soil
  - Interaction among soil microorganisms.
  - Mutualism Commensalism Antagonism
  - Microorganisms as fertilizers.
  - Microorganisms in plant protection *Bacillus thuringiensis Pseudomonas fluorescens*
3. Aquatic Microorganisms

**(II) Distribution of microorganisms in aquatic environment**

1. Microorganisms in sewage
2. Oxidation lagoons
3. Bioluminescence of the marine bacteria and its significance
4. in aquatic ecosystem.
5. Waterborne transmission of diseases.
6. Aquatic microbes for controlling 'oil spill'

**(III) Air Microorganisms**

1. Distribution of air microflora
2. Significance of microorganisms in air.
3. Laboratory control of 'air contaminant'
  - a. Laminar air flow
  - i. Ultraviolet radiation

**(IV) Extremophiles: Definition, examples and significance based on Temperature**

1. Psychrophiles
2. Mesophiles
3. Thermophiles
  - i) Based on pH
    - Acidophiles, Alkalophiles
  - ii) Halophiles (Based on salt conc.)
  - iii) Barophiles (Based on pressure)

**(V) New horizons in Microbiology**

1. Viruses that kill superbug (ESKAPE Therapy)
2. Microbes in 'Bioterrorism'



**Reference:**

1. Rubina Lawrence (Ed.), (2013) Antimicrobial Resistance, a cause of global concern, Narosa Publishing House. (Topic No.III).
2. Dubey R.C., D.K.Maheshwari, Second Ed. (2010). A Textbook of Microbiology, S. Chand And Company. (Topic No. I, II, III).
3. Powar Daginwala 10<sup>th</sup> Ed. (2010), General Microbiology Vol.2, Himalaya Publishing House (Topic No. I).
4. Alcamo, Edward. I. (2001). Fundamentals of Microbiology, Sixth Edition, Jones and Bartlett Publishers, Sudbury, Massachusetts. (Topic No-I and II).
5. Prescott, Lancing. M., John, P. Harley and Donald, A. Klein (2006) .Microbiology, Sixth Edition McGraw Hill Higher Education. (Topic No I, II).
6. Pelczar M.J., Chan E.C.S., Krieg N.R. (2010) Microbiology, 39<sup>th</sup> Edition, Tata McGraw-Hill. ( Topic I).
7. Manoharachary K. and B.R. Tilak (2012), Principles of Microbiology, I.K. International Publishing House Pvt. Ltd. ( Topic No. I, II)

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**F. Y. B. Sc. (CBCS 2018 course)**  
**Semester-II**  
**Practical Course MB-23 (Based on MB21, MB 22)**

**Course Learning Outcomes:**

**After completion of the paper, students will be able to:**

1. Understand different methods for cultivation of bacteria
2. Understand different methods of sterilization
3. Know effect of environmental factors on the growth of bacteria

**Course Contents:**

- 1) Preparation and sterilization of common laboratory media.**
  - i) Peptone Water, ii) Nutrient Broth, iii) Nutrient agar,
  - ii) Mac Conkey's Agar. V) Sabaroud's Agar
- 2) Motility by 'Hanging drop method'**  
**Demonstration of swarming growth.**
- 3) Pure Culture Techniques**
  - i) Streak plate method,
  - ii) Spread plate method
  - iii) Pour plate method,
- 4) Isolation, Colony characteristics, Gram staining and Motility of following microorganisms**
  - i) *Escherichia coli*
  - ii) *Bacillus spp.*
  - iii) *Staphylococcus spp.*
  - iv) *Micrococcus spp.*
- 5) Demonstration of Algae, fungi and protozoa using permanent slides / cultures /sample source**  
*Amoeba sp, Paramoecium sp, Nostoc sp, Chlorella sp, Aspergillus sp, Mucor sp, Penicillium sp*
- 6) Effect of environmental factors on growth of Bacteria.**
  - i) pH
  - ii) Temperature
  - iii) Heavy Metals
  - iv) salt

**References:**

1. Bradshaw L. Jack ( 1979) Laboratory Microbiology, Third Edition W.B. Saunders co Philadelphia, London ,Toronto.
2. Benson H.J. ( 1990) Microbiological Applications A Laboratory Manual in General Microbiology, Fifth Edition Wm.C Brown Publisher.
3. Cappuccino J.G. and N. Sherma( 2004 ) Microbiology A Laboratory Manual Sixth Edition, Pearson Education.
4. Cruickshank R and J.P. Duguid( 1980 ) Medical Microbiology Volume II, 12<sup>th</sup> Edition. The Practice of Medical Microbiology , Churchill Livingstone Edinburgh, London and New York..
5. Pelzar M.J. and E.C. Schan( 1972) laboratory Exercise in Microbiology Third Edition ( Practical Manual Tata Macgraw Hill Edition New Delhi. 6.Sharma K. ( 2005 ) Manual of Microbiology Tools & Techniques Ane
6. Books New Delhi.

**F. Y. B. Sc. (CBCS 2018 Course)**  
**Semester-II**  
**M-21: Analytical Geometry**

**Total Credit :03**

**Total Lectures :45**

**Course Learning Outcomes:**

At the end of this course students are expected to be able to:

1. Understand translation and rotation of equations of general equation of second degree in  $x$  and  $y$ .
2. Equations of sphere, tangent plane and normal to sphere.
3. Equations of cone and cylinder.

**Course content:**

**Unit 01: Analytical Geometry of Two Dimensions:**

- 1.1 Translation of axes.
- 1.2 Rotation of axes.
- 1.3 Conic section: General equation of second degree in  $x$  and  $y$ . Centre of conic, nature of conic. Reduction to standard form. Length of the axes.

**Unit 02: Planes in co-ordinate Geometry of 3 – Dimensions:**

- 2.1 First degree equation in  $x, y, z$  represents a plane. Transformation to the normal form. Equation of plane in intercept form. Equation of plane passing through three given points.
- 2.2 System of planes.
- 2.3 Length of the perpendicular from a point to a plane.
- 2.4 Joint equation of two planes. Angle between planes.

**Unit 03: Lines in co-ordinate Geometry of 3-Dimension:**

- 3.1 Equations of a line, Equations of line in terms of direction cosines and the point on it, equations of lines through two points. Equations of line in symmetrical form. Angle between line and Plane.
- 3.2 The shortest distance between two skew lines, the length and equations of the line of shortest distance.

**Unit 04: Sphere:**

- 4.1 Definition and equation of the sphere in various forms
- 4.2 Plane section of a sphere, intersection of two spheres.
- 4.3 Equation of a circle, sphere through a given circle, intersection of a sphere and a line.
- 4.4 Equation of a tangent plane and normal to sphere

**Unit 05: Cones and Cylinders:**

- 5.1 Definition of cone. Equation of cone with vertex at the origin and  $(\alpha \beta \gamma)$
- 5.2 Quadratic cone and some properties of quadratic cone
- 5.3 The right circular cone and equation of right circular cone.
- 5.4 Definition of cylinder, Right circular cylinder and equation of a right circular cylinder.

**Reference Books:-**

1. S. L. Loney, The Elements of Co-ordinate Geometry, Macmillan and Company, London.
2. Gorakh Prasad and H.C.Gupta. Textbook on Co-ordinate Geometry, Pothishala Pvt., Ltd., Allahabad.
3. R. J. T. Bill, Elementary Treatise on Co-ordinate Geometry of Three dimensions, Macmillan India, Ltd., 1994
4. P. K. Jain and Khalil Ahmed, A textbook of Analytical Geometry of two dimensions, Wiley Eastern Ltd. 1994.
5. Shanti Narayan: Analytical Solid geometry, S-Chand & Co.
6. Patil, Bhamere, Bhagat, Waingade, Phatangre, Masalkar: Algebra & Geometry; Nirali Prakashan

**F. Y. B. Sc. (CBCS 2018 Course)**  
**Semester-II**  
**M-22: Integral Calculus and Differential Equations**

**Total Credit :03**

**Total Lectures :45**

**Course Learning Outcomes:**

At the end of this course students are expected to be able to

1. Solve the integrals by partial fractions and reduction methods.
2. Obtain lengths of the curves, volumes and surfaces of solids obtained by revolving the curves.
3. Solve the differential equations of first order and first degree and their applications.

**Course content:**

**Unit 1: Integration:**

1.1 Integration by method of substitution and integration by parts.

1.2 Integration by partial fractions:

- a) Denominator contains non-repeated linear factors.
- b) Denominator contains repeated linear factors
- c) Denominator contains one linear and one irreducible quadratic form.

1.3 Integration of the following form

$$(i) \int \frac{dx}{a+b\cos x} \quad (ii) \int \frac{dx}{a+b\sin x} \quad (iii) \int \frac{dx}{a+b\cos x+c\sin x}$$

1.4  $\int \frac{x^2 \pm 1}{x^4 + 1} dx$

1.5 (i)  $\int (Ax+B)\sqrt{ax^2+bx+c}$  (ii)  $\int \frac{Ax+B}{\sqrt{ax^2+bx+c}} = dx$

1.6 Reduction formulae

$$(i) \int \sin^n x dx \quad (ii) \int \cos^n x dx \quad (iii) \int_0^{\pi/2} \sin^n x dx$$

$$(iv) \int_0^{\pi/2} \cos^n x dx \quad (v) \int \sec^n x dx \quad (vi) \int \operatorname{cosec}^n x dx$$

$$(vii) \int \tan^n x dx \quad (viii) \int \cot^n x dx \quad (ix) \int_0^{\pi/2} \sin^n x \cos^m x dx$$

(σ)

**Unit 2: Applications of Integration:**

2.1 Quadrature, Rectification – Lengths of plane curves

2.2 Volumes and Surfaces of solids obtained by revolving the curves about the co-ordinate axes.

### **Unit 3: Differential Equations of first order and first Degree:**

- 3.1 Differential equations, order and degree of differential equations, formation of differential equations.
- 3.2 General and particular solutions of differential equations.
- 3.3 Methods of finding solution of differential equations of first order and first degree
  - a) Variables separable form
  - b) Homogeneous differential equations.
  - c) Differential equations reducible to homogeneous form.
  - d) Exact differential equations.
  - e) Differential equations reducible to exact differential equations, Integrating factors and rules (without proof) for obtaining integrating factors.
  - f) Linear differential equations. Bernoulli's differential equations.

### **Unit 4: Applications of Differential Equations:**

- 4.1 Orthogonal trajectories of one parameter family of curves in Cartesian co-ordinates

### **Reference Books:-**

1. Robert G Bartle and Donald R Sherbert; Introduction to Real Analysis, John Wiley & Sons.
2. Shantinayakan: Integral Calculus, S. Chand & Co.
3. R. Courant and F. John, Introduction to Calculus and Analysis, Springer-Verlag, New York 1999.
4. Rainville and Bedient: Elementary Differential Equations, Macmillin Publication.
5. Gorakh Prasad; Integral Calculus, Pothishala Pvt. Ltd. Alahabad
6. D. A. Murray, Introductory course in Differential Equations; Orient Longman (India 1967)
7. G. F. Simmons: Differential Equations, Tata McGraw Hill (1972)
8. Patil, Bhamere, Bhagat, Waingade, Phatangre, Masalkar: Calculus and Differential Equations; Nirali Prakashan

**F. Y. B. Sc. (CBCS 2018 Course)**  
**Semester-II**  
**M-23: Mathematics Practical Course -II**

**Total Credit :02**

**(Practicals based on the applications and Problems of articles in M-21 and M-22)**

**Course Learning Outcomes:**

At the end of this course students are expected to be able to:

1. Knowledge of solving problems on Integration, application of integration.
2. Solving the problems on translation and rotation.
3. Finding equations of following conics: Parabola, Hyperbola, Ellipse.
4. Finding equations of plane in 3-D and line in 3-D.
5. Finding Solution of differential equations of first order and first degree (Homogenous, Non-homogenous, Exact and linear)
6. Finding different types of equations of Cones, Cylinders and Sphere.

**Course content**

**List of Practical:**

1. Integration
2. Applications of Integration
3. Change of axes; translation and rotation
4. Conic Section
5. Planes in three dimensions
6. Lines in three dimensions
7. Solution of differential equations of first order and first degree
8. (Homogenous, Non-homogenous, Exact and linear)
9. Applications of differential equations
10. Cones and cylinders
11. Spheres.

**F. Y. B. Sc.: (CBCS 2018 Course)**

**Semester-II**

**S-21: Descriptive Statistics – II**

**Total Credit: 03**

**Total Lectures: 45**

**Course Learning Outcomes:**

After completion of this course students will acquire:

1. Knowledge to bi-variable data, their organization and evaluation.
2. Knowledge of scatter diagram and their interpretations.
3. Knowledge of correlation coefficients, types of correlation and rank correlation coefficient.
4. Concept of regression, regression line and their utility.
5. Knowledge of non-linear regression and different types of curves.
6. Concept of index number, their different types and uses.

**Course content:**

**Unit 1. Correlation**

- 1.1 Bivariate data, Scatter diagram and interpretation.
- 1.2 Concept of correlation between two variables, positive correlation, negative correlation, no correlation.
- 1.3 Covariance between two variables (m11) : Definition, computation, effect of change of origin and scale.
- 1.4 Karl Pearson's coefficient of correlation (r) : Definition, computation for ungrouped data and interpretation. Properties: (i)  $-1 \leq r \leq 1$  (with proof), (ii) Effect of change of origin and scale (with proof).
- 1.5 Spearman's rank correlation coefficient: Definition, derivation of formula, computation and interpretation (without ties). In case of ties, compute Karl Pearson's correlation coefficient between ranks. (Spearman's rank correlation coefficient formula with correction for ties not expected.)
- 1.6 Examples

**Unit 2. Fitting of curves to the bivariate data**

- 2.1 Fitting of line ( $Y = a + b X$ ),
- 2.2 Fitting of second degree curve ( $Y = a + b X + c X^2$ ),
- 2.3 Fitting of exponential curves of the type  $Y = a b^X$  and  $Y = aX^b$ . In all these curves parameters are estimated by the method of least squares.
- 2.4 Examples

**Unit 3. Linear Regression Model**

- 3.1 Meaning of regression, difference between correlation and regression,
- 3.2 Concept of error in regression, error modeled as a continuous random variable. Simple linear regression model:  $Y = a + b X + \epsilon$ , where  $\epsilon$  is a continuous random variable with  $E(\epsilon) = 0$ ,  $V(\epsilon) = \sigma^2$ . Estimation of a, b by the method of least squares. Interpretation of parameters. Statement of the estimator of  $\sigma^2$ .
- 3.3 Concept of residual, plot of residual against X, concept of coefficient of determination.

**Unit 4 Index Numbers**

- 4.1 Introduction.
- 4.2 Definition and Meaning.



- 4.3 Problems/considerations in the construction of index numbers.
- 4.4 Simple and weighted price index numbers based on price relatives.
- 4.5 Simple and weighted price index numbers based on aggregates.
- 4.6 Laspeyre's, Paasche's and Fisher's Index numbers.
- 4.7 Consumer price index number: Considerations in its construction. Methods of construction of consumer price index number - (i) family budget method(ii) aggregate expenditure method.
- 4.8 Examples

**Recommended Books:**

1. Agarwal, B. L. (2003). Programmed Statistics, Second Edition, New Age International Publishers, New Delhi.
2. Draper, N. R. and Smith, H. (1998). Applied Regression Analysis Third Edition, John Wiley and Sons
3. Goon, A. M., Gupta, M. K. and Dasgupta, B. (1983). Fundamentals of Statistics, Vol. 1, Sixth Revised Edition, The World Press Pvt. Ltd., Calcutta.
4. Gupta, S. C. and Kapoor, V. K. (1983). Fundamentals of Mathematical Statistics, Eighth Edition, Sultan Chand and Sons Publishers, New Delhi.
5. Gupta, S. C. and Kapoor, V. K. (1997). Fundamentals of Applied Statistics, Third Edition, Sultan Chand and Sons Publishers, New Delhi.
6. Freund, J. E. (1977). Modern Elementary Statistics. Fourth Edition, Prentice Hall of India Private Limited, New Delhi.
7. Montgomery, D. C; Peck, E. A.; Vining, G. G. (2006). Introduction to Linear Regression Analysis, John Wiley and Sons
8. Hanagal David D.(2009). Introduction to Applied Statistics: A non –calculus based approach. Narorse Publishing House. New Delhi
9. approach. Narorse Publishing House. New Delhi

**F. Y. B. Sc.: (CBCS 2018 Course)**

**Semester-II**

**S- 22: Discrete Probability and Probability Distributions –II**

**Total Credit: 03**

**Total Lectures: 45**

**Course Learning Outcomes:**

After completion of this course students will acquire:

2. Knowledge of important discrete distributions such as Poisson distribution and geometric distribution.
3. Acumen to apply standard discrete probability distributions to different situations.
4. Knowledge related to concept of discrete bivariate data, discrete bivariate probability distributions including expectations and moments.
5. Knowledge of correlation, regression for discrete probability distributions.

**Course content:**

**Unit 1. Some Standard Discrete Probability Distributions - II**

1.1 Poisson distribution: Notation :  $X \sim P(m)$ .

$$p(x) = \frac{e^{-m} m^x}{x!} \quad 1, 2, \dots, m > 0$$

= 0 otherwise

m.g.f. and c.g.f. Moments, mean, variance, skewness and kurtosis.

Situations where this distribution is applicable.

1.2 Geometric distribution: Notation:  $X \sim G(p)$ ,

Geometric distribution on support  $(0, 1, 2, \dots)$  with p.m.f.  $p(x) = pq^x$ .

Geometric distribution on support  $(1, 2, \dots)$  with p.m.f.  $p(x) = pq^{x-1}$ .

$0 < p < 1, q = 1 - p$ .

Mean, variance, m.g.f. and c.g.f. Situations where this distribution is applicable.

**Unit 2. Bivariate Discrete Probability Distribution**

2.1 Definition of two-dimensional discrete random variable, its joint p.m.f. and its distribution function and their properties, concept of identically distributed r.v.s.

2.2 Computation of probabilities of events in bivariate probability distribution.

2.3 Concepts of marginal and conditional probability distributions.

2.4 Independence of two discrete random variables based on joint and marginal p.m.f.s

2.5 Examples

**Unit 3. Mathematical Expectation (Bivariate Random Variable)**

3.1 Definition of raw and central moments, m.g.f, c.g.f.

3.2 Theorems on expectations of sum and product of two jointly distributed random variables.

- 3.3 Conditional expectation.
- 3.4 Definitions of conditional mean and conditional variance.
- 3.5 Definition of covariance, coefficient of correlation, independence and uncorrelatedness of two variables.
- 3.6 Variance of linear combination of variables  $\text{Var}(aX + bY)$ .
- 3.7 Additive property for binomial and Poisson distributions.
- 3.8 Conditional distribution of X given (X+Y) for binomial and Poisson distributions.
- 3.9 Examples

**Recommended Books:**

1. Agarwal B. L. (2003). Programmed Statistics, second edition, New Age International Publishers, New Delhi.
2. Gupta, S.C. and Kapoor, V. K. (1983). Fundamentals of Mathematical Statistics, Eighth Edition, Sultan Chand and Sons Publishers, New Delhi.
3. Hoel P. G. (1971). Introduction to Mathematical Statistics, John Wiley and Sons, New York.
4. Hogg, R. V. and Craig R. G. (1989). Introduction to Mathematical Statistics, Ed. MacMillan Publishing Co., New York.
5. Mayer, P. (1972). Introductory Probability and Statistical Applications, Addison Wesley Publishing Co., London.
7. Mood, A. M. and Graybill, F. A. and Boes D.C. (1974). Introduction to the Theory of Statistics, Ed. 3, McGraw Hill Book Company.
8. Ross S. (2002). A First Course in Probability, Sixth Edition, Pearson Education, Inc. & Dorling Kindersley Publishing, Inc.
9. Hanagal David D.(2009). Introduction to Applied Statistics: A non –calculus based approach. NarorsePublishing House. New Delhi

**F. Y. B. Sc.: (CBCS 2018 Course)**  
**Semester-II**  
**S-23: Statistics Practical Course –II**

**Total Credits: 02**

**Course Learning Outcomes:**

After completion of this course students will acquire:

1. Concept of different types of correlation using scatter diagram.
2. Knowledge of computing of correlation coefficient and regression lines for ungrouped and grouped data.
3. Knowledge of fitting of second degree curve and exponential curve & computation of different types of Index numbers.

**Course content**

**List of Practicals**

Sr.No	Title of the Experiment
1	Testing consistency of data, computation of coefficient of association.
2	Scatter diagram, computation of correlation coefficient for ungrouped data.
3	Computation of correlation coefficient for grouped data.
4	Computation of Spearman's rank correlation coefficients.
5	Fitting of lines of regression for ungrouped data and grouped data.
6	Fitting of second degree curve, exponential curve of type $y = ab^x$
7	Fitting of Poisson distribution and computation of expected frequencies
8	Applications of Poisson and geometric distributions
9	Problems on Bivariate Probability distributions
10	Index numbers

**F.Y.B.Sc. (CBCS-2018 Course)**  
**Semester: II**  
**UG SEC-21: Renewable energy and energy harvesting**

**Total credits: 02**

**Total Lectures: 23**

**Course Learning Outcomes:**

By the end of this course student will be able to have following learning outcomes,

1. Student will be able to understand the different renewable resources available in the nature.
2. Understanding of advantages of renewable energy.
3. Understanding of conversion of solar energy, ocean energy, wind energy and hydro energy to usable energy
4. Understanding of harvesting the renewable energy resources

**Course content:**

**1. Fossil fuels and alternative sources of energy:**

Fossil fuels, need of renewable energy, non-conventional energy sources, An overview of developments in offshore wind energy, tidal energy, wave energy system, ocean thermal energy conversion, solar energy, biomass, biochemical conversion, biogas generation, hydroelectricity.

**2. Solar energy:**

Solar energy and its importance, storage of solar energy, solar water heater, flat plate collector, solar oscillation, solar cooker, solar cell, need and characteristics of photovoltaic (PV) systems, PV models and equivalent circuits and sun tracking systems.

**3. Wind energy harvesting:**

Fundamentals of wind energy, wind turbines and different electrical machines in wind turbines, power electronic interfaces and grid interconnection technologies.

**4. Ocean energy:**

Ocean energy potential against wind and solar, wave characteristics and statistics, wave energy devices, tidal energy technologies, ocean thermal energy.

**5. Hydro energy:**

Hydropower resources, hydropower technologies, environmental impact of hydropower sources.

**• Demonstrations and experiments:**

Demonstrations of training modules on solar energy, wind energy etc. Conversion of thermal energy into voltage using thermoelectric modules.