Khandesh College Education Society's

MooljiJaitha College, Jalgaon

An "Autonomous College" Affiliated to

KBC North Maharashtra University, Jalgaon

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SYLLABUS

Biotechnology

S.Y.B.Sc.
(Semester III & IV)

Under Choice Based Credit System (CBCS)

[w. e. f. Academic Year: 2020-21]

Course Structure: S.Y.B.Sc Biotechnology

Duration: The duration of B.Sc. (Biotechnology) degree program shall be three years.

Course Structure:

Semester	Course Module	Subject Code	Title of the paper	Credit	Hours per week
III	DSC	BT-231	Basic genetics and immunology	2	2
	DSC	BT-232	Cell biology and metabolism	2	2
	DSC	BT-233	Practical course based on BT-231 and BT-232	2	4
	SEC	BT-230	Bio inoculant development technique	2	2
IV	DSC	BT-241	Molecular biology	2	2
	DSC	BT-242	Industrial biotechnology	2	2
	DSC	BT-243	Practical course based on BT-241 and BT-242	2	4
	SEC	BT-240	Animal and plant tissue culture techniques	2	2

DSC : Discipline Specific Elective Core Course
SEC : Skill Enhancement Course
BT-YSC : Biotechnology (Y-year; S-Semester; C-Course number)

Examination Pattern for S.Y.B.Sc.

Examination	Marks
External Marks	**40**
Internal Marks	**10**
Total Marks	**50**

S.Y. B.Sc. (Biotechnology): Semester-III

BT-231: Basic genetics and immunology

Total hours: 30 **Credits: 2**

Course Objectives:

- To know the basic concepts of genetics
- To study basic of immunology
- To study immunological response

Course outcome:

Students will be able to:

- Understand basic concept of Gene, DNA.
- Study mutation and chromosomal variations
- Aware about history and development of immunology
- Understand concept of immunology eg. Antigen, antibody

Unit1: Mendelian and Non Mendelian inheritance **10h**

- Mendel's experimental design, monohybrid, di-hybrid and tri hybrid crosses, Law of segregation & Principle of independent assortment. Verification of segregates by test and back crosses, Chromosomal theory of inheritance, Allelic interactions: Concept of dominance, recessiveness, incomplete dominance, co-dominance, semi-dominance, pleiotropy, multiple allele, pseudo-allele, essential and lethal genes, penetrance and expressivity.
- Non-Mendelian inheritance – Evidences for Cytoplasmic factors, cytoplasmic inheritance, extranuclear inheritance (mitochondrial, chloroplast), non-chromosomal inheritance, maternal inheritance, uniparental inheritance.
- Linkages - Concept and Types of linkages (complete and incomplete).
- Crossing over – Characteristics Types of crossing over - simple, double and multiple, Mechanism of crossing over
- Sex linked inheritance: Types of sex linkage , X and Y linked inheritance

Unit II:Chromosome and gene mutations: **10h**

- Structure and characteristics of bacterial and eukaryotic chromosome, chromosome morphology, concept of euchromatin and heterochromatin, chromosome banding pattern, karyotype, giant chromosomes, one gene one polypeptide hypothesis, concept of cistron, exons, introns, genetic code, gene function.
- Definition and types of mutations, causes of mutations, Ames test for mutagenic agents, screening procedures for isolation of mutants and uses of mutants
- Variations in chromosomes structure - deletion, duplication, inversion and translocation (reciprocal and Robertsonian), position effects of gene expression, chromosomal aberrations in human beings, abonormalities– Aneuploidy and Euploidy

Unit III: Immunology **10h**

- Haematopoiesis; Cells of the Immune System; Primary and Secondary Lymphoid Organs.
- T & B cell subsets, effector cells, antigenpresentation,
- Innate Immunity & adaptive Immunity,
- Antigens –Types, factors affecting antigenicity, Structure & functions
- Antibodies –Types, Structure & functions, antibody diversity
- Antigen – Antibody interactions (epitope-paratope) principle, methods and applications of precipitation and agglutination
- Introduction to Vaccines: Active & Passive immunization, Types of Vaccines
- Hypersensitivity: types, significance

References:

1. Gardner, E. J. (1972). Principles of genetics (No. 4). London, UK, John Wiley & Sons, Inc.
2. Klug, W. S., & Cummings, M. R. (2006). Concepts of genetics, Pearson Education, NJ
3. Russell, D. W., Berman, D. M., Bryant, J. T., Cala, K. M., Davis, D. L., Landrum, C. P. &Wigley, W. C. (1994, January). The molecular genetics of steroid 5α-reductases. In Proceedings of the 1992 Laurentian Hormone Conference (pp. 275-284). Academic Press.
4. Griffiths, A. J., Wessler, S. R., Lewontin, R. C., Gelbart, W. M., Suzuki, D. T., & Miller, J. H. (2005). An introduction to genetic analysis, Macmillan.
5. Krebs, J. E., Goldstein, E. S., & Kilpatrick, S. T. (2009). Lewin's genes X. Jones & Bartlett Publishers.
6. Ruebelt, M. C., Lipp, M., Reynolds, T. L., Schmuke, J. J., Astwood, J. D., DellaPenna, D., &Jany, K. D (2006). Application of two dimensional gel electrophoresis to interrogate alterations in the proteome of gentically modified crops. Assessing unintended effects. Journal of Agricultural and Food Chemistry, 54(6), 2169-2177.
7. Snyder, L., Champness, W., &Champness, W. (1997). Molecular genetics of bacteria (Vol. 19). Washington, DC: Asm Press.

Proposed methods of teaching/ innovative teaching:

Classroom teaching - lecture method, Group discussion, seminars, moodle, Google Classrooms, audio-visuals (power point presentations), assignments, quiz, etc.

S.Y. B.Sc. (Biotechnology): Semester-III

BT-232: Cell biology and metabolism

Total hours: 30 **Credits: 02**

Course Objectives:

- To study the concepts of Cell Biology.
- To know the structure and function of cell and its organelles.
- To study the basics of metabolism.

Course outcome:

Students will be able to:

- Understand basic concept of cell biology.
- Learn about plant and animal cell and cell regulation.
- Learn Concept of metabolism and breakdown of carbohydrate.

Unit I: Basics of cell biology **10h**

- Idea of cell theory, Shape and Size
- Comparative account on plant and animal cell
- Cell wall and Plasma membrane: Morphology, Chemical Composition, Ultra structure and Function.
- The nucleus – Significance, Structure and Nucleolus
- Chromosome – Morphology, Chemical Composition, Ultra structure and Special type of chromosome.
- Mitochondria - Morphology, Chemical Composition, Ultra structure, Origin and Function.
- Plastids – Chloroplasts, ultra structure and function.

Unit II: Cytoskeleton, Membrane structure & transport **10h**

- Microtubules : Structure, Chemical Composition,
- Microtubules in cilia and flagella, role in cell division,
- Cytoplasm – Structure and Functions of ER, Ribosomes, Golgi complex, Lysosome, Centrosome.
- Cell division – Amitosis, Mitosis, Meiosis, Comparison: Mitosis and Meiosis.
- Models of membrane structure, Membrane lipids, proteins and carbohydrates; Solute transport by Simple diffusion, Facilitated diffusion and Active transport

Unit III: Carbohydrates Metabolism: **10h**

- Concept of Metabolism
- Carbohydrate Metabolism: Reactions, energetics and regulation.
- Glycolysis: Fate of pyruvate under aerobic and anaerobic conditions.
- Pentose phosphate pathway and its significance, Gluconeogenesis, Glycogenolysis and glycogen synthesis. TCA cycle, Electron Transport Chain, Oxidative phosphorylation.
- ß-oxidation of fatty acids.

References:

1. Nelson, D. L., Lehninger, A. L., & Cox, M. M. (2008). Lehninger principles of biochemistry, Macmillan.
2. Karp, G. (2009). Cell and molecular biology: concepts and experiments. John Wiley & Sons.
3. Pawar C B.(2010). Cell Biology. Himalaya Publishing House, New Delhi
4. Satyanarayan, U., &Chakrapani, U. (1999). Textbook of Biochemistry. Books & Allied Ltd
5. Verma P S and Agrawal V K. (2005) Cell Biology, Genetics, Molecular Biology, Evolution and Ecology. S. Chand and Company LTD. New Delhi

Proposed methods of teaching/ innovative teaching:
Classroom teaching - lecture method, Group discussion, seminars, moodle, Google Classrooms, audio-visuals (power point presentations), assignments, quiz, etc.

S.Y. B.Sc. (Biotechnology): Semester-III
BT-233: Practical course based on BT-231 and BT-232

Total Hours: 60 **Credits: 02**

Course objective:
- To learn the practices skill in basic techniques of genetics,
- To learn the practices skill in basic Immunology
- To learn the practices skill in basic cell biology

Course outcomes:
Students will able to learn
- To solve different problems regarding genetics
- Various stages of cell division and understand the significance of each step in mitosis and meiosis
- The skills to perform basic immunological assay

Practicals
1. Problems set in: Mendelian inheritance
2. Problem set in linkage single and two point cross
3. Temporary mount and observation of mitosis in onion root tip
4. Temporary mount and observation of meiosis in *Tradescantia* flower
5. Karyotyping study with the help of photographs/database
6. Pedigree chart analysis for study of hereditary disorder
7. Blood group detection and Rh typing
8. Determination of RBC count from blood sample by haemocytometer
9. WBC staining by Leishman's staining
10. Total leucocyte count by Neubour haemocytometer
11. Study of antigen –antibody reaction by Widal assay
12. Quantitive estimation of protein by Lowry's method
13. Study of antigen antibody interaction: Ouchterlony double diffusion
14. Estimation of hemoglobin from blood.
15. Visit to local blood bank/pathology laboratory

References:

1. Aneja K.R. (1996) Experiments in Microbiology, Plant Pathology, Tissue Culture and Mushroom Cultivation, New Age International (P) Ltd, New Delhi.
2. Plummer D.T. (1992) An Introduction to Practical Biochemistry, 3rd Edition, Tata McGraw Hill, Delhi.
3. Sadasivam S. and Manikam A. (1996) Biochemical Methods, 2nd Edition, New Age International (P) Ltd., New Delhi.

4. Jayaraman J. (1999) Laboratory Manual in Biochemistry, New Age International (P) Ltd., New Delhi.
5. Wilson K. and Walker J. (2010) Practical Biochemistry: Principles and Techniques of Biochemistry and Molecular Biology, 5th Edition, Cambridge Uni. Press, Cambridge.
6. Sawhney S.K. and Singh Randhir (2000) Introductory Practical Biochemistry, Narosa Publisher, New Delhi.
7. Nigam, A. and Ayyagiri, A. (2007) Lab Manual in Biochemistry, Immunology and Biotechnology, Tata McGraw Hill, Kolkata

Proposed methods of teaching/ innovative teaching:
Demonstration methods, hands on experiments, virtual labs/e-content available online, Group discussion, audio-visuals (power point presentations)

S.Y. B.Sc. (Biotechnology): Semester-III
BT-230 Bio inoculant development technique

Total Hours: 30 **Credits: 02**

Course Objective:

- To know the scope of bio fertilizer
- To understand the basic acquaintance in bio inoculants
- To build a foundation for more advanced studies in Bio fertilizer Technology

Course Outcomes:
Students will be able to:

- Aware with screening of nitrogen fixing, cyanobacteria and phosphate solubilizing microorganisms
- Production, quality control and applications of different bio fertilizers
- Learn the concept and applications of mycorrhiza as biofertilizer

Unit I: Introduction to Bio fertilizers **10h**

- Structure and characteristic features of organism used as Bio fertilizers Bacteria: Azotobacter, Rhizobium. Cyanobacteria: Anabaena, Nostoc.
- Mechanism of phosphate solubilization and phosphate mobilization
- Nitrogen fixation - Free living and symbiotic
- Mycorrhiza - Ecto and endomycorrhizae and their importance in agriculture

Unit II: Production of Bacterial Biofertilizer **10h**

- Isolation and purification of Azotobacter, mass multiplication of Azotobacter, formulation of inoculum of Azotobacter, application of inoculants of Azotobacter.
- Isolation and purification of Rhizobium, mass multiplication and inoculum production of Rhizobium, Methods of application of Rhizobium inoculants.

- Isolation and Purification of phosphate solubilizers. Mass multiplication and field applications of phosphate solubilizers,
- Biofertilizers - Storage, shelf life, quality control and marketing.

Unit III: Production of Biofertilizer from Cyanobacteria and Mycorrhiza 10h

- Isolation and purification of Cyanobacteria.
- Mass multiplication of Cyanobacteria bio inoculants - Trough (Tank method, Pit method) Field method;
- Isolation of VAM fungi - Wet sieving method and sucrose gradient method. Mass production of VAM inoculants and field applications.

References:

1. Bagyaraj, D.J. and A. Manjunath.1990. Mycorrhizal symbiosis and plant growth, Univ. of Agricultural Sciences, Bangalore, India.
2. Purohit, J., Chattopadhyay, A., Biswas, M. K., & Singh, N. K. (2018). Mycoremediation of agricultural soil: bioprospection for sustainable development. In Mycoremediation and environmental sustainability (pp. 91-120). Springer, Cham.
3. Subba, R. (1993). Biofertilizers in agriculture and forestry (No.Ed. 3) International science publisher.
4. Wani, S. P., Rupela, O. P., & Lee, K. K. (1995). Sustainable agriculture in the semi-arid tropics through biological nitrogen fixation in grain legumes.In Management of biological nitrogen fixation for the development of more productive and sustainable agricultural systems (pp. 29-49). Springer, Dordrecht.
5. Somani, L.L., S.C. Bhandari, K.K. Vyas and S.N. Saxena. 1990. Biofertilizers, Scientific Publishers - Jodhpur.

Proposed methods of teaching/ innovative teaching:

Classroom teaching - lecture method, Group discussion, seminars, moodle, Google Classrooms, audio-visuals (power point presentations), assignments, quiz, etc.

S.Y. B.Sc. (Biotechnology): Semester IV

BT-241: Molecular biology

Total hours: 30 **Credits: 02**

Course Objectives:

- To know the basic concepts of molecular biology
- To study the structure of nucleic acid
- To know the mode of replication in nucleic acid

Course outcome:

Students will be able to:

- Understand Central dogma of molecular biology
- Understand the process of replication, transcription, translation.
- Learn regulation of molecular processes
-

Unit I: DNA structure and replication **10h**

- Central dogma of molecular biology.
- Structure of DNA, Types of DNA, Triple helix DNA.
- Organization of DNA in eukaryotes
- Replication of DNA in prokaryotes: General principle, Semiconservative replication, Replicon and origin of replication, Properties of DNA Polymerases, DNA replication in eukaryotes.
- Unique aspects of eukaryotic chromosome replication, Fidelity of replication.

Unit II: DNA damage, repair and recombination **10h**

- Types of DNA damage: Single-base alteration, Two-base alteration, chain breaks and crosslinkages
- Mutation: Definition, Mutagen, Type of mutation
- DNA repair: Base excision repair, Nucleotide excision repair, Mismatch repair, Double-strand Break repair , SOS repair mechanism, and Recombination repair.
- Recombination:
    - Homologous recombination: Holliday model, Meselson-Radding model, Double-strand break model,
    - Non homologus recombination: transposition

Unit III: Transcription and RNA processing, Translation and Regulations **10h**

- Concept of Genome, transcriptome and proteome
- Types, structure and function of RNA
- Prokaryotic transcription: RNA polymerase, promoter, process of transcription (initiation, elongation and termination)
- Eukaryotic transcription: Nuclear RNA polymerases, Eukaryotic promoter, transcription factors.
- RNA processing: 5' capping, polyadenylation and splicing of mRNA, Intron splicing
- Genetic code and its characteristics
- Translation: Ribosome structure and assembly, activation of amino acid, charging of tRNA, steps in translation (initiation, elongation and termination)
- Regulation of gene expression: Postive and negative gene regulation, constitutive gene and inducible gene, Onecistron one subunit concept, Operon concept, lac operon.

References:

1. Lewin, B., & Dover, G. (1994). Genes v (Vol. 1110). New York: Oxford University Press.
2. Berg, J. M., Tymoczko, J. L., & Stryer, L. (2012). Biochemistry, John Wiley & Sons Inc;
3. Nelson, D. L., Lehninger, A. L., & Cox, M. M. (2008). Lehninger principles of biochemistry. Macmillan.
4. Voet, D., Voet, J. G., & Pratt, C. W. (2013). Fundamentals of biochemistry: life at the molecular level, Willy International, Signapur

Proposed methods of teaching/ innovative teaching:
Classroom teaching - lecture method, Group discussion, seminars, moodle, Google Classrooms, audio-visuals (power point presentations), assignments, quiz, etc.

S.Y. B.Sc. (Biotechnology): Semester IV
BT 242: Industrial biotechnology

Total Hours: 30 **Credits: 2**

Course Objective:
- To know the scope of bioprocess technology
- To understand the basic knowledge in Fermentation Technology
- To build a foundation for more advanced studies in Bioprocess Technology

Course Outcomes:
Students will be able to:
- Developed an understanding of the various aspects of Bioprocess Technology.
- Aware with screening of Industrially Important Strains and culture collection centers.
- Understand principles underlying design of Fermenter, Fermentation Process, upstream and downstream processing.

Unit I: Introduction to Bioprocess Technology **10h**
- Concept and significance of bioprocess technology
- Range of bioprocess technology and chronological development
- Basic principal and components of fermentation technology
- Screening of industrially important microorganism-
  - Primary Screening: Crowded plate technique, Auxanography, Enrichment culture technique and use of an indicator dye.
  - Secondary Screening
- Strain Development
- Preservation of Microorganisms: serial subculture, overlaying culture with mineral oil, lyophilization or freeze drying, storage at low temperature, nitrogen storage, storage methods for fungi
- Culture collection centers:-National: NCIM, MTCC, International: ATCC

Unit II: Fermentor and Fermentation Processes **10h**
- Stirred Tank Fermentor- Basic Design; Parts of a Typical Industrial Fermentor.
- Fermentation Media: Components; Design and Optimization.
- Sterilization: Sterilization of Fermentor and Fermentation Media.
- Process Parameters: pH, Temperature, Aeration, Agitation, Foam, etc.
- Types of Fermentation: Surface and Submerged; Batch and Continuous, Aerobic and Anaerobic.
- Fermentation Processes: Outline of Penicillin and Ethanol Production by Fermentation along with a flow-diagram.

Unit III: Detection and assay of fermentation product **10h**
- Physical and chemical assays:
  - Titration and gravimetric method

- Turbidity analysis and cell yield determination
- Spectrophotometic assays
- Chromatographic partition assays
- Gas chromatographic assays
- Advance techniques: Infrared spectroscopy, NMR, MS

- Biological assays
  - Diffusion assay
  - Turbidimetric and growth assays
  - Endpoint determination assays
  - Metabolic response assays
  - Enzymatic assays

References:

1. Stanbury, P. F., Whitaker, A., & Hall, S. J. (2013). Principles of fermentation technology Elsevier.
2. Casida, L. E. (1968). Industrial microbiology, New Age International, New Delhi
3. Lledo, W., Hernandez, M., Lopez, E., Molinari, O. L., Soto, R. Q., Hernandez, E. &García-Rivera, E. (2009). Guidance for control of infections with carbapenem-resistant carbapenemase- producing Enterobacteriaceae in acute care facilities. Morbidity and Mortality Weekly Report, 58(10), 256-258.
4. Waites, M. J., Morgan, N. L., Rockey, J. S., &Higton, G. (2009). Industrial microbiology: an introduction. John Wiley & Sons
5. 5. Glaze, A.N. and Nikaido, H. (1995) Microbial Biotechnology: Fundamentals of applied Microbiology, 1st edn., W.H. Freeman Company
6. Dubey, R. C. (2014). A textbook of Biotechnology S. Chand Publishing.

Proposed methods of teaching/ innovative teaching:

Classroom teaching - lecture method, Group discussion, seminars, moodle, Google Classrooms, audio-visuals (power point presentations), assignments, quiz, etc.

S.Y. B.Sc. (Biotechnology): Semester IV

BT-243: Practical course based on BT-241 and BT-242

Total Hours: 60 **Credits: 02**

Course Outcome:

- To train the students with basic techniques of molecular biology
- To inculcate with basic technique used in industrial biotechnology
- To know the various technique used in molecular laboratories.

Course outcomes:

The students will able to

- Understand the chemical preparations of molecular biology techniques
- Practice the basic techniques of molecular biology
- Learn the basic techniques of microbial screening and isolation of industrially viable strains
- Aware and train the spectrophotometric estimation of metabolites

Practicals

1. Preparation of reagents for molecular biology
2. Isolation of DNA from bacterial/plant cell/animal /yeast cell
3. Estimation of DNA by DPA method
4. Isolation of RNA from bacterial/plant cell/animal /yeast cell
5. Estimation of RNA by orcinol method
6. Spontaneous mutation by fluctuation analysis
7. Repair of DNA damage due to UV by photo reactivation test
8. Screening of enzyme and organic acid producing microbes
9. Isolation of auxotroph by gradient plate assay
10. Validation of autoclave using bio-agent
11. Isolation of VAM spores from soil
12. Demonstration of laboratory scale fermenter and significance of its various parts
13. Industrial visit

References:

1. Aneja K.R. (1996) Experiments in Microbiology, Plant Pathology, Tissue Culture and Mushroom Cultivation, New Age International (P) Ltd, New Delhi.
2. Plummer D.T. (1992) An Introduction to Practical Biochemistry, 3rd Edition, Tata McGraw Hill, Delhi.
3. Sadasivam S. and Manikam A. (1996) Biochemical Methods, 2nd Edition, New Age International (P) Ltd., New Delhi.
4. Jayaraman J. (1999) Laboratory Manual in Biochemistry, New Age International (P) Ltd., New Delhi.
5. Wilson K. and Walker J. (2010) Practical Biochemistry: Principles and Techniques of Biochemistry and Molecular Biology, 5th Edition, Cambridge Uni. Press, Cambridge.
6. Sawhney S.K. and Singh Randhir (2000) Introductory Practical Biochemistry, Narosa Publisher, New Delhi.
7. Nigam, A. and Ayyagiri, A. (2007) Lab Manual in Biochemistry, Immunology and Biotechnology, Tata McGraw Hill, Kolkata

Proposed methods of teaching/ innovative teaching:

Demonstration methods, hands on experiments, virtual labs/e-content available online, Group discussion, audio-visuals (power point presentations)

S.Y. B.Sc. (Biotechnology): Semester IV

BT-240 Animal and plant tissue culture techniques

Total Hours: 30 **Credits: 02**

Course Objective:

- To understand the basic knowledge in animal and plant tissue culture
- To Inoculate the knowledge of media types and their preparation various culture.
- To understand the correlation of tissue culture with industrial application.

Course Outcomes:
Students will be able to:

- Develop and understanding of the various aspects of plant and animal tissue culture Technology.
- Aware with screening of Industrially Important methods and culture collectioncenters.
- Understand structure, function and production methods of stem cell culture

Unit-I Plant Tissue Culture **10h**

- History and concept of PTC; Explant callus, differentiation, redifferentiation and totipotency.
- Lab organization of PTC
- Culture media: types and component, techniques used for sterilization in PTC
- Factor affecting growth in PTC (physical and chemical)
- Types of culture: embryogenesis, organogenesis
- Micropropogation
- Application of PTC

Unit -II Animal cell and Tissue Culture **10h**

- History and concept of ATC
- Lab organization of ATC
- ATC media : types (natural and artificial media)
- Physiochemical properties of culture media
- Factor affecting ATC
- Characterization of culture of cells
- Advantage and disadvantage of animal tissue culture.

Unit -III Scale up in ATC **10h**

- Types of cell culture: Primary and secondary
- Types of cell lines
- Standard nomenclature of cell line.
- Scale up in suspension: stirrer culture and continuous culture
- Scale up in monolayer: roller bottle culture and multi surface culture
- Monitoring of cell in scale up: suspension and monolayer culture
- Cell viability assay by dye exclusion method, calorimetric assay.

References:

1. Smith, M. A. L., &Spomer, L. A. (1995). Vessels, gels, liquid media, and support systems. In Automation and environmental control in plant tissue culture (pp. 371-404). Springer, Dordrecht.
2. Razdan, M. K. (2003). Introduction To Plant Tissue Culture, 2/E. Oxford and IBH publishing.
3. Peirce, G. J. (1993). A Text-book of Plant Physiology, Nabu Presss
4. Sambrani Seema A (2015) Plant and Animal Tissue Culture, Vision Publications, Pune

5. Atala, A., Lanza, R., &Lanza, R. P. (Eds.). (2002). Methods of tissue engineering. Gulf Professional Publishing.
6. Satyanarayan, U., &Chakrapani, U. (1999). Textbook of Biochemistry. Book and Allied (P) Ltd. Kolkata.
7. https://iopscience.iop.org/chapter/978-0-7503-1347-6/bk978-0-7503-1347-6ch1.pdf

Proposed methods of teaching/ innovative teaching:

Classroom teaching - lecture method, Group discussion, seminars, moodle, Google Classrooms, audio-visuals (power point presentations), assignments, quiz, etc.