

**DEPARTMENT OF MOLECULAR BIOLOGY
&
BIOTECHNOLOGY**



**COURSE STRUCTURES CHOICE BASED CREDIT SYSTEM
(CBCS)**

[B.Sc. (General) IN MOLECULAR BIOLOGY]

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LIST OF COURSES IN B.Sc. (General) IN MOL. BIOL. & BIOTECHNOLOGY**CORE COURSES**

Code	Course Category	Title of the paper
MBG 101	CC 1	BIOLOGICAL CHEMISTRY
MBG 102	CC 2	TO BE DETERMINED BY THE STUDENT
MBG 103	CC 3	TO BE DETERMINED BY THE STUDENT
MBG 201	CC 4	MICROBIOLOGY
MBG 202	CC 5	TO BE DETERMINED BY THE STUDENT
MBG 203	CC 6	TO BE DETERMINED BY THE STUDENT
MBG 301	CC 7	MOLECULAR BIOLOGY
MBG 302	CC 8	TO BE DETERMINED BY THE STUDENT
MBG 303	CC 9	TO BE DETERMINED BY THE STUDENT
MBG 401	CC 10	RECOMBINANT DNA TECHNOLOGY
MBG 402	CC 11	TO BE DETERMINED BY THE STUDENT
MBG 403	CC 12	TO BE DETERMINED BY THE STUDENT

DISCIPLINE SPECIFIC ELECTIVE (DSE) COURSE

Course category	Code	Title of the paper		Code	Title of the paper
DSE 1	MBG 501	CELL BIOLOGY	OR	MBG 502	BIOPHYSICAL TECHNIQUES
DSE 2	MBG 503	TO BE DETERMINED BY THE STUDENTS			
DSE 3	MBG 504	TO BE DETERMINED BY THE STUDENTS			
DSE 4	MBG 601	INHERITANCE BIOLOGY	OR	MBG 602	IMMUNOLOGY
DSE 5	MBG 603	TO BE DETERMINED BY THE STUDENTS			
DSE 6	MBG 604	TO BE DETERMINED BY THE STUDENTS			

SKILL ENHANCEMENT COURSES

Course category	Code	Title of the paper		Code	Title of the paper
SEC 1	MBG 304	BIOFERTILIZERS	OR	MBG 305	MUSHROOM CULTURE TECHNOLOGY
SEC 2	MBG 404	FLORICULTURE	OR	MBG 405	MICROBILA DIAGNOSI IN HEALTH CLINICS
SEC 3	MBG 505	APICULTURE	OR	MBG 506	SERICULTURE
SEC 4	MBG 605	ALCOHOL FERMENTATION	OR	MBG 606	INDUSTRIAL MICROPROPAGATION

ABILITY ENHANCEMENT COURSES

Course Category	Code	Title of the paper
AECC 1	MBG 104	ENVIRONMENTAL STUDIES
AECC 2	MBG 204	ENGLISH COMMUNICATION

First Year

Semester	Code	Course Cate-gory	Title of the Paper	No. of credits	HPW	Marks			Total Marks
						IA (C1)	IA (C2)	Sem-Endterm (C3)	
FIRST YEAR									
I	MBG 101(T)	CC 1 (Th)	BIOLOGICAL CHEMISTRY	4	4	5	5	40	50
	MBG 101(P)	CC 1 (Pr)		2	4		5	20	25
	MBG 102(T)	CC 2 (Th)	TO BE DETERMINED BY THE STUDENT	4	4	5	5	40	50
	MBG 102(P)	CC 2 (Pr)		2	4		5	20	25
	MBG 103(T)	CC 3 (Th)	TO BE DETERMINED BY THE STUDENT	4	4	5	5	40	50
	MBG 103(P)	CC 3 (Pr)		2	4		5	20	25
	MBG 104(T)	AECC 1	ENVIRONMENTAL STUDIES	2	4	5	5	40	50
	MBG 201(T)	CC4 (Th)	MICROBIOLOGY	4	4	5	5	40	50
MBG 201(P)	CC4 (Pr)	2		4		5	20	25	
II	MBG 202(T)	CC 5 (Th)	TO BE DETERMINED BY THE STUDENT	4	4	5	5	40	50
	MBG 202(P)	CC 5 (Pr)		2	4		5	20	25
	MBG 203(T)	CC6 (Th)	TO BE DETERMINED BY THE STUDENT	4	4	5	5	40	50
	MBG 203(P)	CC6		2	4		5	20	25
	MBG 204(T)	AECC 2	ENGLISH COMMUNICATION	2	4	5	5	40	50
	Total				40	56			

Second Year

Semester	Code	Course Cate-gory	Title of the Paper	No. of credits	HPW	Marks			Total Marks
						IA (C1)	IA (C2)	Sem-Endterm (C3)	
SECOND YEAR									
III	MBG 301(T)	CC7 (Th)	MOLECULAR BIOLOGY	4	4	5	5	40	50
	MBG 301(P)	CC7 (Pr)		2	4		5	20	25
	MBG 302(T)	CC8 (Th)	TO BE DETERMINED BY THE STUDENT	4	4	5	5	40	50
	MBG 302(P)	CC8 (Pr)		2	4		5	20	25
	MBG 303(T)	CC9 (Th)	TO BE DETERMINED BY THE STUDENT	4	4	5	5	40	50
	MBG 303(P)	CC9 (Pr)		2	4		5	20	25
	MBG 304 (T)/MBG 305(T)	SEC 1 (Th)	BIOFERTILIZERS/ MUSHROOM CULTURE TECHNOLOGY	2	4	5	5	40	50
	MBG 401(T)	CC10 (Th)	RECOMBINANT DNA TECHNOLOGY	4	4	5	5	40	50
MBG 401(P)	CC10 (Pr)	2		4		5	20	25	
IV	MBG 402(T)	CC11 (Th)	TO BE DETERMINED BY THE STUDENT	4	4	5	5	40	50
	MBG 402(P)	CC11 (Pr)		2	4		5	20	25
	MBG 403(T)	CC12 (Th)	TO BE DETERMINED BY THE STUDENT	4	4	5	5	40	50
	MBG 403(P)	CC12 (Pr)		2	4		5	20	25
	MBG 404 (T) /MBG 405 (T)	SEC 2 (Th)	FLORICULTURE/ MICROBIAL DIAGNOSIS IN HEALTH CLINICS	2	4	5	5	40	50
			Total	40	56				550

Third Year

Semester	Code	Course Cate-gory	Title of the Paper	No. of credits	HPW	Marks			Total Marks
						IA (C1)	IA (C2)	Sem-Endterm (C3)	
THIRD YEAR									
V	MBG 501 (T)/MBG 502 (T)	DSE 1 (Th)	CELL BIOLOGY/ BIOPHYSICAL TECHNIQUES	4	4	5	5	40	50
	MBG 501 (P)/MBG 502 (P)	DSE 1 (Pr)		2	4		5	20	25
	MBG 503 (T)	DSE 2 (Th)	TO BE DETERMINED BY THE STUDENT	4	4	5	5	40	50
	MBG 503 (P)	DSE2 (Pr)		2	4		5	20	25
	MBG 504 (T)	DSE 3 (Th)	TO BE DETERMINED BY THE STUDENT	4	4	5	5	40	50
	MBG 504 (P)	DSE3 (Pr)		2	4		5	20	25
	MBG 505 (T)/MBG 506 (T)	SEC 3 (Th)	APICULTURE/ SERICULTURE	2	4	5	5	40	50
	MBG 601 (T)/MBG 602 (T)	DSE 4 (Th)	INHERITANCE BIOLOGY/ IMMUNOLOGY	4	4	5	5	40	50
MBG 601 (P)/MBG 602 (P)	DSE4 (Pr)	2		4		5	20	25	
VI	MBG 603 (T)	DSE 5 (Th)	TO BE DETERMINED BY THE STUDENT	4	4	5	5	40	50
	MBG 603 (P)	DSE 5(Pr)		2	4		5	20	25
	MBG 604 (T)	DSE 6 (Th)	TO BE DETERMINED BY THE STUDENT	4	4	5	5	40	50
	MBG 604 (P)	DSE 6 (Pr)		2	4		5	20	25
	MBG 605 (T)/MBG 606 (T)	SEC 4 (Th)	ALCOHOL FERMENTATION/ INDUSTRIAL MICROPROPAGATION	2	4	5	5	40	50
				Total	40	56			

**B.Sc in Molecular Biology (General)
FIRST YEAR**

SEMESTER – I

Title of the Paper: BIOLOGICAL CHEMISTRY

Code: MBG 101(T)

Course Category: CC 1 (Th)

Theory 4- Credits

Total: 60 hrs (4hrs/week)

Each Unit: 15hrs (1hr/week)

UNIT – I: Carbohydrates

- 1.1. **Carbohydrates**-Importance, classification and physical and chemical properties of carbohydrates
- 1.2. Structure, configuration and biochemical importance of Monosaccharides (Glucose and Fructose) Oxidation, Reduction, Osazone formation, Aldose & Ketose, Glycosides (Streptomycin, Cardiac glycosides and Ouabain)
- 1.3. Structure, configuration and biochemical importance of Disaccharides and glycosidic bond, Mutarotation, Haworth projection (Sucrose, Trehalose, Lactose, Maltose, Isomaltose, Cellobiose)
- 1.4. Homopolysaccharides (Starch, Glycogen, Inulin, Cellulose and Chitin)
- 1.5. Heteropolysaccharides (Hyaluronic acid, Chondroitin sulfate, Heparin, Peptidoglycan)

UNIT – II: Proteins and Enzymes

- 2.1 Classification, structure and physical and chemical properties of amino acids & proteins
- 2.2 Lipids, Fatty acids - importance, properties and classification, Simple lipids - TAG, Complex lipids, Derived lipids, sterols, Fatty acids: Saturated and Unsaturated fatty acids with examples. Biosynthesis of Fatty acids - palmitoyl-CoA, Cholesterol
- 2.3 Enzymes - classification and nomenclature. Michaelis-Menten Equation - Factors influencing the enzyme reactions and Enzyme inhibition (Competitive and Non-competitive), role of co-enzymes and Enzyme Technology.
- 2.4 Hormones, mode of action (Thyroid gland)
- 2.5 Vitamins - classification, sources, functions and applications

UNIT – III: Bioenergetics of biomolecules

- 3.1 Glycolysis
- 3.2 Gluconeogenesis and its significance
- 3.3 TCA Cycle, electron transport, Oxidative phosphorylation
- 3.4 β -oxidation of fatty acid
- 3.5 Transamination and Oxidative deamination reactions of amino acids. Amino acid catabolism (Phenylketonuria, albinism)

UNIT – IV: Intermediary Metabolism

- 4.1 Urea cycle and regulation
- 4.2 Biosynthesis and regulation of purine and pyrimidine nucleotides, de novo and salvage pathways
- 4.3 Photosynthesis – Light reaction and photophosphorylation,
- 4.4 Photosynthesis – Carbon Assimilation

Title of the Paper: BIOLOGICAL CHEMISTRY**Code: MBG 101(P)****Course Category: CC 1 (Pr)****PRACTICAL- 2 Credits****Total: 60 hrs (4hrs/week)**

1. Preparation of normal, molar and molal solutions
2. Preparation of buffers (acids, basic and neutral)
3. Qualitative tests of Sugars, amino acids and lipids
4. Estimation of proteins by Biurate method
5. Estimation of total sugars by Anthron method
6. Reducing sugars DNS method
7. Separation of protein by SDS – PAGE.
8. Separation of amino acids by paper chromatography, TLC

SUGGESTED READING

1. Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments. 6th Edition. John Wiley & Sons. Inc.
2. De Robertis, E.D.P. and De Robertis, E.M.F. 2006. Cell and Molecular Biology. 8th edition. Lippincott Williams and Wilkins, Philadelphia.
3. Cooper, G.M. and Hausman, R.E. 2009. The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
4. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. 2009 The World of the Cell. 7th edition. Pearson Benjamin Cummings Publishing, San Francisco.

SEMESTER – II**Core Courses:-****Title of the Paper: MICROBIOLOGY****Code: MBG 201(T)****Course Category: CC4(Th)****Theory 4- Credits****Total: 60 hrs (4hrs/week)**

Each Unit: 15hrs (1hr/week)

UNIT I :History of microbiology and an overview of bacterial structure

1.1 The Discovery of Microorganisms and contributions of Louis Pasteur, and Edward Jenner, Leeuwenhoek, the Conflict over spontaneous generation, Koch's postulates, the Scope and relevance of Microbiology

1.2 An overview of procaryotic cell structure; procaryotic cell membranes; the cytoplasmic matrix (inclusion bodies), ribosomes, the nucleoid, the procaryotic cell wall (gram positive & gram negative), the mechanism of gram staining; Components external to the cell wall (capsules, slime layers, and s-layers; pili and fimbriae), flagella and motility (flagellar ultrastructure, mechanism of flagellar movement, chemotaxis); the bacterial endospore

UNIT II: Microbial nutrition, growth and control

2.1 Nutrient req.

requirement for bacterial growth (macro- and micronutrients, purines, pyrimidines, amino acids, vitamins), iron Uptake and Siderophores Nutritional Types of Microorganisms; types of media (synthetic, complex, differential media)

2.2 Isolation of Pure Cultures (The Spread Plate and Streak Plate, The Pour Plate); the Growth Curve, the mathematics of growth Measurement of Microbial Growth (Cell Numbers, Cell Mass), The Continuous Culture of Microorganisms (Chemostat, Turbidostat

2.3 The Influence of Environmental Factors on Growth (extremophiles, Halophiles), effect of pH, Temperature (Psychrophiles, Mesophiles, thermophiles, hyperthermophiles) Pressure; Quorum Sensing and Microbial Populations

2.4 The physical Methods used to control bacteria (Heat, Low Temperatures, Filtration, Radiation), The chemical Methods used to control bacteria (Phenolics, Alcohols, Halogens

UNIT III: The Virology

3.1 General Properties of Viruses, cultivation of Viruses, Viral multiplication, Attachment, entry, un-coating, replication, assembly, release, Cell transformations, Cultivation of viruses-Assay techniques

3.2 The Structure of Viruses (Virion Size, General Structural Properties, Helical Capsids) types of viral nucleic Acids, Viral Envelopes and Enzymes

3.3. Animal viruses-Virus-Host interactions-Viral infections, plant viruses, bacteriophages,

3.4 host response and antiviral agents immune responses to viruses, interferon and other cytokines, antiviral therapy.

UNIT IV: Food and Industrial Microbiology

4.1 Microbial Growth and Food Spoilage, Controlling Food Spoilage, Removal of Microorganisms (Low Temperature, High Temperature, Pasteurization) Chemical-Based Preservation, Radiation, bacteriocins

4.2 Food-Borne Diseases, Food-Borne Infection, Food-Borne Intoxications, Detection of Food-Borne Pathogens

4.3 Production of Fermented Milks (buttermilk, sour cream, and yogurt); Cheese Production; Production of Alcoholic Beverages (Wines and Champagnes, Beers and Ales, Distilled Spirits), Production of Breads, a brief concept on probiotics.

Title of the Paper: MICROBIOLOGY
Code: MBG 201(P)
Course Category: CC 4 (Pr)
Practical 2- Credits

Total: 60 hrs (4hrs/week)

1. Demonstration, use and care of microbiological equipments.
2. Preparation of media, sterilization and isolation of bacteria.
3. Simple staining of bacteria
4. Gram staining of Bacteria
5. Endospore staining.
6. Demonstration of starch hydrolysis by bacterial cultures.
7. Growth of fecal coliforms on selective media.
8. Isolation of pure culture by streak plate method.
9. Antibiotic sensitivity assay.

SUGGESTED READING

1. Alexopoulos CJ, Mims CW, and Blackwell M. (1996). *Introductory Mycology*. 4 th edition. John and Sons, Inc.
2. Jay JM, Loessner MJ and Golden DA. (2005). *Modern Food Microbiology*. 7th edition, CBS Publishers and Distributors, Delhi, India.
3. Kumar HD. (1990). *Introductory Phycology*. 2nd edition. Affiliated East Western Press.
4. Madigan MT, Martinko JM and Parker J. (2009). *Brock Biology of Microorganisms*. 12th edition. Pearson/Benjamin Cummings.
5. Pelczar MJ, Chan ECS and Krieg NR. (1993). *Microbiology*. 5th edition. McGraw Hill Book Company.
6. Stanier RY, Ingraham JL, Wheelis ML, and Painter PR. (2005). *General Microbiology*. 5th edition. McMillan.
7. Tortora GJ, Funke BR, and Case CL. (2008). *Microbiology: An Introduction*. 9 th edition. Pearson Education.
8. Willey JM, Sherwood LM, and Woolverton CJ. (2008). *Prescott, Harley and Klein's Microbiology*. 7th edition. McGraw Hill Higher Education.

SECOND YEAR SEMESTER -III

Title of the Paper: MOLECULAR BIOLOGY

Code: MBG 301(T)

Course Category: CC7 (Th)

Total: 60 hrs (4hrs/week)

Each Unit: 15hrs (1hr/week)

Theory 4- Credits

UNIT I : Structure of Nucleic Acids

- 1.1 DNA as the genetic material – Griffiths experiments, Avery, McLeod and McCarty's experiments, Hershey – Chase experiments.
- 1.2 RNA as genetic material – Tobacco Mosaic Virus
- 1.3 Structure and chemistry of DNA – Watson and Crick Model
- 1.4 Forms of DNA – A, B and Z forms of DNA, Super coiled and relaxed DNA – Role of DNA topoisomerases.
- 1.5 Structure of Cytoplasmic DNA – chloroplast DNA and Mitochondrial DNA.

UNIT II: Functions & Mechanisms of Nucleic Acids

- 2.1 DNA Replication – Models of DNA replication (Semi-conservative, non-conservative models)
- 2.2 Mechanisms of DNA replication – Linear and circular – Rolling circle and theta mechanism of replication. Enzymes involved in DNA replication.
- 2.5 DNA Recombination

UNIT III: Gene expression

- 3.1 Transcription in prokaryotes: Enzymatic Synthesis of RNA, Basic features of RNA synthesis, E.coli RNA polymerase, Classes of RNA molecules, Transcription mechanism in prokaryotes- Promoter, initiation, elongation, proof reading and Rho dependent and Rho independent termination.
- 3.2 Transcription in Eukaryotes: Polymerases of eukaryotes, Promoters of eukaryotes,
- 3.3 Synthesis of hn RNA, Splicing mechanisms-Self splicing, protein mediated splicing, alternative splicing, Capping and polyadenylation.
- 3.4 The Genetic Code, properties of genetic code, Wobble hypothesis.
- 3.5 Translation mechanism in prokaryotes and eukaryotes

UNIT IV: Regulation of Gene expression

- 4.1. Regulation in Prokaryotes: General aspects of Regulation
 - 4.2. Transcription level regulation-positive, negative, auto and coordinated regulation
 - 4.3. Operon concept – lac, trp operons.
 - 4.4. Transcriptional Control through Transcription factors.
 - 4.5 Translation regulation in Eukaryotic and prokaryotic organism
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Title of the Paper: MOLECULAR BIOLOGY**Code: MBG 301(P)****Course Category: CC7 (Pr)****Total: 60 hrs (4hrs/week)****Practical 2- Credits**

1. Isolation of DNA from plant, animal/bacterial cells
2. Isolation of plasmid DNA
3. Identification of different topological forms of plasmid DNA
4. Analysis of DNA by agarose gel electrophoresis
5. Demonstration of PCR
6. Competent cell preparation, transformation and selection.
7. Study of induction β -Galactosidase Activity in *E.coli*

SUGGESTED READING

1. Karp, G. (2010). Cell and Molecular Biology: Concepts and Experiments. VI Edition. John Wiley & Sons. Inc.
2. De Robertis, E.D.P. and De Robertis, E.M.F. (2006). Cell and Molecular Biology. VIII Edition. Lippincott Williams and Wilkins, Philadelphia.
3. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. (2009). The World of the Cell. VII Edition. Pearson Benjamin Cummings Publishing, San Francisco.
4. Watson, J. D., Baker T.A., Bell, S. P., Gann, A., Levine, M., and Losick, R., (2008) Molecular Biology of the Gene (VI Edition.). Cold Spring Harbour Lab. Press, Pearson Pub.

Title of the Paper: BIOFERTILIZERS/ MUSHROOM CULTURE TECHNOLOGY**Code: MBG 304(T)****Course Category: SEC 1****Theory-2 credits****Total: 30 hrs (2hrs/week)****Each Unit: 15hrs (1hr/week)****BIOFERTILIZERS****Unit 1:**

General account about the microbes used as biofertilizer – Rhizobium – isolation, identification, mass multiplication, carrier based inoculants, Actinorrhizal symbiosis. *Azospirillum*: isolation and mass multiplication – carrier based inoculant, associative effect of different microorganisms. *Azotobacter*: classification, characteristics – crop response to *Azotobacter* inoculum, maintenance and mass multiplication. Cyanobacteria (blue green algae), *Azolla* and *Anabaena azollae* association, nitrogen fixation, factors affecting growth, blue green algae and *Azolla* in rice cultivation.

Unit II:

Mycorrhizal association- types of mycorrhizal association, taxonomy, occurrence and distribution, phosphorus nutrition, growth and yield – colonization of VAM – isolation and inoculum production of VAM, and its influence on growth and yield of crop plants. Organic farming – Green manuring and organic fertilizers,

Recycling of biodegradable municipal, agricultural and Industrial wastes – biocompost making methods, types and method of vermicomposting – field Application.

Suggested Readings

1. Dubey, R.C., 2005 A Text book of Biotechnology S.Chand& Co, New Delhi.
2. Kumaresan, V. 2005, Biotechnology, Saras Publications, New Delhi.
3. John JothiPrakash, E. 2004. Outlines of Plant Biotechnology.Emkay _Publication, New Delhi.
4. Sathe, T.V. 2004 Vermiculture and Organic Farming. Daya publishers.
5. Subha Rao, N.S. 2000, Soil Microbiology, Oxford & IBH Publishers, New _Delhi.
6. Vayas,S.C, Vayas, S. and Modi, H.A. 1998 Bio-fertilizers and organic _Farming Akta Prakashan, Nadiad

OR

Title of the Paper: Mushroom Culture Technology

Code: MBG 305(T)

Course Cate-gory: SEC 1

Theory-2 credits

Total: 30 hrs (2hrs/week)

Each Unit: 15hrs (1hr/week)

Unit 1:

Introduction, history. Nutritional and medicinal value of edible mushrooms; Poisonous mushrooms. Types of edible mushrooms available in India - *Volvariella volvacea*, *Pleurotus citrinopileatus*, *Agaricus bisporus*. Cultivation Technology : Infrastructure: substrates (locally available) Polythene bag, vessels, Inoculation hook, inoculation loop, low cost stove, sieves, culture rack, mushroom unit (Thatched house) water sprayer, tray, small polythene bag. Pure culture: Medium, sterilization, preparation of spawn, multiplication. Mushroom bed preparation - paddy straw, sugarcane trash, maize straw, banana leaves. Factors affecting the mushroom bed preparation Low cost technology, Composting technology in mushroom production.

UNIT 2

Storage and nutrition : Short-term storage (Refrigeration - upto 24 hours) Long term Storage (canning, pickles, papads), drying, storage in saltsolutions. Nutrition - Proteins - amino acids, mineral elements nutrition - Carbohydrates, Crude fibre content – Vitamins, Food Preparation:Types of foods prepared from mushroom.Research Centres - National level and Regional level. Cost benefit ratio - Marketing in India and abroad, Export Value.

Suggested Readings

1. Marimuthu, T. Krishnamoorthy, A.S. Sivaprakasam, K. and Jayarajan. R (1991) Oyster Mushrooms, Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore.
2. Swaminathan, M. (1990) Food and Nutrition. Bappco, The Bangalore Printing and Publishing Co. Ltd., No. 88, Mysore Road, Bangalore - 560018.
3. Tewari, Pankaj Kapoor, S.C., (1988). Mushroom cultivation, Mittal Publications, Delhi.
4. Nita Bahl (1984-1988) Hand book of Mushrooms, II Edition, Vol. I & Vol. II

SEMESTER – IV

Title of the Paper: RECOMBINANT DNA TECHNOLOGY

Code: MBG 401(T)

Course Category: CC10 (Th)

Total: 60 hrs (4hrs/week)

Each Unit: 15hrs (1hr/week)

Theory 4- Credits

UNIT I:

Cutting and Joining DNA Fragments:

- 1.1 Host-controlled restriction and modification, Different types of restriction enzymes and their characteristic features
- 1.2 Viewing DNA Fragments, principle of gel electrophoresis, Southern, Northern and Western Blotting
- 1.3 Transformation of *E. coli*, Joining DNA molecules

UNIT II:

Cloning of genes:

- 2.1 Different types of Plasmid vectors and their characteristic features, Concept and the use of selective markers
- 2.2 Bacteriophage vectors, Cosmid vectors
- 2.3 Expression vectors
- 2.4 Cloning vectors for eukaryotes, Yeast artificial chromosomes (YACs), Bacterial artificial chromosomes (BACs), Ti plasmid

UNIT III:

Finding Genes

- 3.1 Creating a genomic and cDNA library, Screening DNA libraries
- 3.2 Chromosome walking, Cloning Strategies
- 3.3 Polymerase Chain Reaction to Amplify DNA, DNA Foot printing, site-directed mutagenesis, Knockout mice

UNIT IV:

Applications of Recombinant DNA Technology

- 4.1 Pharmaceuticals
 - 4.2 Specialized Bacteria
 - 4.3 Agricultural Products
 - 4.4 Oligonucleotide Drugs
 - 4.5 Genetic Testing; Gene Therapy, Gene Mapping, DNA Fingerprinting
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Title of the Paper: RECOMBINANT DNA TECHNOLOGY**Code: MBG 401(P)****Course Category: CC10 (Pr)****Total: 60 hrs (4hrs/week)****Practical- 2Credits**

1. Artificial transformation of *E.coli* with plasmid.
2. Primer design for PCR amplification
3. Agarose gel electrophoresis of DNA
4. SDS – PAGE electrophoresis.
5. Restriction digestion of DNA and Restriction mapping.
7. Isolation of RNA

SUGGESTED READING

1. Brown TA. (2006). Gene Cloning and DNA Analysis. 5th edition. Blackwell Publishing, Oxford, U.K.
2. Clark DP and Pazdernik NJ. (2009). Biotechnology-Appling the Genetic Revolution. Elsevier Academic Press, USA.
3. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington
4. Primrose SB and Twyman RM. (2006). Principles of Gene Manipulation and Genomics, 7th edition. Blackwell Publishing, Oxford, U.K.
5. Sambrook J, Fritsch EF and Maniatis T. (2001). Molecular Cloning-A Laboratory Manual. 3rd edition. Cold Spring Harbor Laboratory Press.

Title of the Paper: FLORICULTURE**Code: MBG 404(T)****Course Category: SEC 2 (Th)****Total: 30 hrs (2hrs/week)**

Each Unit: 15hrs (1hr/week)

Theory 2- Credits**FLORICULTURE****Unit 1:**

Introduction: History of gardening; Importance and scope of floriculture and landscape gardening. Nursery Management and Routine Garden Operations: Sexual and vegetative methods of propagation; Soil sterilization; Seed sowing; Pricking; Planting and transplanting; Shading; Stopping or pinching; Defoliation; Wintering; Mulching; Topiary; Role of plant growth regulators. Ornamental Plants: Flowering annuals; Herbaceous perennials; Divine vines; Shade and ornamental trees; Ornamental bulbous and foliage plants; Cacti and succulents; Palms and Cycads; Ferns and Selaginellas; Cultivation of plants in pots; Indoor gardening; Bonsai.

Unit 2:

Principles of Garden Designs: English, Italian, French, Persian, Mughal and Japanese gardens; Features of a garden (Garden wall, Fencing, Steps, Hedge, Edging, Lawn, Flower beds, Shrubbery, Borders, Water garden. Some Famous gardens of India. Landscaping Places of Public Importance: Landscaping highways and Educational institutions. Commercial Floriculture: Factors affecting flower production; Production and packaging of cut flowers; Flower arrangements; Methods to prolong vase life; Cultivation of Important cut flowers (Rose, Carnation, Chrysanthemum, Gerbera, Gladiolous, Orchids). Diseases and Pests of Ornamental Plants.

Suggested Readings

1. Randhawa, G.S. and Mukhopadhyay, A. 1986. Floriculture in India. Allied Publishers.

OR

Title of the Paper: MICROBIAL DIAGNOSIS IN HEALTH CLINICS

Code: MBG 405(T)

Course Category: SEC 2 (Th)

Unit 1 Importance of Diagnosis of Diseases

Bacterial, Viral, Fungal and Protozoan Diseases of various human body systems, Disease associated clinical samples for diagnosis. How to collect clinical samples (oral cavity, throat, skin, Blood, CSF, urine and faeces) and precautions required. Method of transport of clinical samples to laboratory and storage. Examination of sample by staining - Gram stain, Ziehl-Neelson staining for tuberculosis, Giemsa stained thin blood film for malaria; Preparation and use of culture media - Blood agar, Chocolate agar, Lowenstein-Jensen medium, MacConkey agar, Distinct colony properties of various bacterial pathogens.

Unit 2: Methods of Diseases Diagnosis

Serological Methods - Agglutination, ELISA, immunofluorescence, Nucleic acid based methods - PCR, Nucleic acid probes; Kits for Rapid Detection of Pathogens- typhoid, Dengue and HIV, Swine flu. Testing for Antibiotic Sensitivity in Bacteria- Importance, Determination of resistance/sensitivity of bacteria using disc diffusion method, Determination of minimal inhibitory concentration (MIC) of an antibiotic by serial double dilution method

SUGGESTED READING

1. Ananthanarayan R and Paniker CKJ (2009) Textbook of Microbiology, 8th edition, Universities Press Private Ltd.
2. Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A. (2013) Jawetz, Melnick and Adelberg's Medical Microbiology. 26th edition. McGraw Hill Publication
3. Randhawa, VS, Mehta G and Sharma KB (2009) Practicals and Viva in Medical Microbiology 2nd edition, Elsevier India Pvt Ltd
4. Tille P (2013) Bailey's and Scott's Diagnostic Microbiology, 13th edition, Mosby
5. Collee JG, Fraser, AG, Marmion, BP, Simmons A (2007) Mackie and McCartney Practical Medical Microbiology, 14th edition, Elsevier.

THIRD YEAR

SEMESTER - V

Title of the Paper: CELL BIOLOGY

Code No. 501(T)

Course Category: DSE 1 (Th)

CELL BIOLOGY THEORY 4- CREDITS

Total: 60 hrs (4hrs/week)

Each Unit: 15hrs (1hr/week)

UNIT- I: Introduction to the study of cell biology

- 1.1 The discovery of cells
- 1.2 Basic properties of cells (complexity of cells, genetic programme, reproduction, carrying out chemical reactions, mechanical activities, respond to stimuli, Capability of Self-Regulation)
- 1.3 Two fundamentally different classes of cells (characteristic features of pro- & eukaryotic cells; types of prokaryotic and eukaryotic cells; the sizes of Cells and their components)
- 1.4 Viruses (structural diversity; viroids; properties distinguishes a virus from a bacteria)

UNIT- II : The Structure and Function of the Plasma Membrane

- 2.1 An overview of membrane functions (Compartmentalization, permeable barrier, transporting solutes, responding to external signals)
- 2.2 The chemical composition of membranes (Membrane Lipids, the Nature and Importance of the Lipid Bilayer, membrane carbohydrates)
- 2.3 the structure and functions of membrane proteins (Integral proteins, Peripheral proteins, Lipid-anchored proteins)
- 2.4 The dynamic nature of the plasma membrane
- 2.5 The movement of substances across cell membranes (diffusion of solutes, water and ions; Facilitated diffusion, active transport)

UNIT- III : Cellular reproduction

- 3.1 The nucleus of eukaryotic cell (the Nuclear Envelope, nuclear Pore Complex and its role in exchange, nuclear lamina, nuclear matrix, chromosome and chromatin); packaging the genome (Nucleosomal organization of chromatin, *Higher Levels of Chromatin Structure*); Heterochromatin (constitutive and facultative) and Euchromatin; telomere & centromere
- 3.2 The cell cycle (control, the Role of Protein Kinases, Cyclin Binding, Cdk Phosphorylation/dephosphorylation, Cdk Inhibitors, Controlled Proteolysis, Subcellular Localization; Checkpoints, Kinase Inhibitors, and Cellular Responses)
- 3.3 Mitosis & Meiosis (different stages and their significance)

UNIT- IV: Cell organelles

- 4.1 Mitochondrial structure and function (mitochondrial Membranes, mitochondrial Matrix); An overview of carbohydrate metabolism in eukaryotic cells.
- 4.2 Chloroplast structure and function; The endoplasmic reticulum (ER) (smooth & rough); the Golgi complex

(From the ER to the Golgi Complex:

The First Step in Vesicular Transport, a brief idea on the types of vesicle transport and their functions, protein sorting);Lysosome,

4.3The Cytoskeleton and Cell Motility (properties, structural and compositional features of microtubules, microfilaments and intermediate filaments) Anoverview of the major functions of the cytoskeleton.

Title of the Paper: CELL BIOLOGY

Code: MBG 501(P)

Course Category: DSE 1 (Pr)

CELL BIOLOGY PRACTICAL 2- Credits

Total: 60 hrs (4hrs/week)

1. Cell Observation after methylene blue staining of Cheek cell preparation and identify the following cell structures: a. Nucleus/nuclear membrane b. Cytoplasm c. Cell membrane
2. Cell counting by Haemocytometer (Plant/animal)
3. Cell viability assessment by Evan's blue / trypan blue exclusion method
4. Study of vegetative and reproductive structures of Spirogyra/ Oedogonium/ Chara (any one)
5. Demonstration of unicellular, coenocytic/septate mycelium of any fungus.
5. Study of plant cell structure with the help of epidermal peel mount of Onion/Rhoeo/Crinum.
6. Preparation of different stages of Mitosis
7. Effect of Colchicine on chromosome disjunction
8. Demonstration of chromosomal behaviour during meiosis through permanent slides.

SUGGESTED READING

1. Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments. 6th Edition. John Wiley & Sons. Inc.
2. De Robertis, E.D.P. and De Robertis, E.M.F. 2006. Cell and Molecular Biology. 8th edition. Lippincott Williams and Wilkins, Philadelphia.
3. Cooper, G.M. and Hausman, R.E. 2009. The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
4. Becker, W.M., Kleinsmith, L.J., Hardin, J. and Bertoni, G. P. 2009. The World of the Cell. 7th edition. Pearson Benjamin Cummings Publishing, San Francisco.

OR

Title of the Paper: BIOPHYSICAL TECHNIQUES**Code: MBG 502(T)****Course Category: DSE 1 (Th)****THEORY 4- CREDITS**

Each Unit: 15hrs (1hr/week)

Total: 60 hrs (4hrs/week)

Each Unit: 15hrs (1hr/week)

UNIT I: Biophysical Principles:

- 1.1 Thermo dynamics (Basic Principle)
- 1.2 Diffusion in liquids : Osmosis, Viscosity, Centrifugation, Sedimentation Velocity, Sedimentation equilibrium, Density gradient Centrifugation .
- 1.3 Light absorption : Beer- Lambert law.
- 1.4 Gel electrophoresis and Gel chromatography.
- 1.5 X-ray Production and Properties, basic principles of diffraction , medical application s.

UNIT II: Optical and electron microscopy:

- 2.1 Compound and light microscope : Basic working principles, bright and d ark field microscope. Resolving power, limit of resolution,
- 2.2 Physical basis of electron microscopy. Transmission electron microscope, ray diagram, basic working principle, preparation of biological samples – sectioning, staining and shadow-casting (in brief).
- 2.3 Scanning electron microscope.

UNIT III: Radiation Biology :

- 3.1 Different types of radiation – ionizing and non-ionizing radiations. Radioactivity – type of radiation from radioactive substances (α , β , γ - radiation), Radioactive decay equation,
- 3.2 Physical and biological half- lives, Radiation units, Radiation counting systems – G.M. Counter and Scintillation Counter (Working Principle) only.
- 3.3 Interaction of radiation with matter. Biological effects of different types of radiation s.
- 3.4 Application of radioactive material in Biology and medicine, Radiation Protection.

UNIT IV: Physics of Nuclear Medicine:

- 4.1 Radioisotope as tracer, Organ scan as examples of tracing, Isotope dilution analysis, Radioimmuno assay, Thyroid function test by radioiodine,
- 4.2 Basic Principle of autoradiography, Gamma camera, Magnetic resource imaging, LASER in medicine (brief qualitative treatment).

Title of the Paper: BIOPHYSICAL TECHNIQUES**Code: MBG 502(P)****Course Category: DSE 1 (Th)****Total: 60 hrs (4hrs/week)****Practical 2- Credits**

1. To determine the absorption spectrum of hemoglobin/chlorophyll/ cytochrome C solution by a colorimeter.
2. To determine the refractive index of different solutions using a travelling microscope.
3. To measure the viscosity/fluidity of a solution by Oswald Viscometer.
4. Blood Pressure Measurement (Demonstration & interpretation)
5. E.C.G. (Demonstration & interpretation)
6. Interpretation of X-ray Photographs
7. Interpretation of ultra-sonograms
8. Interpretation of EEG

SUGGESTED READING

1. Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments. 6th Edition. John Wiley & Sons. Inc.
2. De Robertis, E.D.P. and De Robertis, E.M.F. 2006. Cell and Molecular Biology. 8th edition. Lippincott Williams and Wilkins, Philadelphia.
3. Cooper, G.M. and Hausman, R.E. 2009. The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
4. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. 2009 The World of the Cell. 7th edition. Pearson Benjamin Cummings Publishing, San Francisco.

Title of the Paper: APICULTURE/ SERICULTURE**Code: MBG 505(T)****Course Category: SEC 3 (Th)****Total: 30 hrs (2hrs/week)**

Each Unit: 15hrs (1hr/week)

Theory 2- Credits**APICULTURE****Unit 1: Biology of Bees**

History, Classification and Biology of Honey Bees, Social Organization of Bee Colony
 Rearing of Bees-Artificial Bee rearing (Apiary), Beehives – Newton and Langstroth
 Bee Pasturage Selection of Bee Species for Apiculture Bee Keeping Equipment
 Methods of Extraction of Honey (Indigenous and Modern)

Unit 2: Bee Diseases and Enemies, Control and Preventive measures; products of Apiculture Industry and its Uses (Honey, Bees Wax, Propolis), Pollen etc. Entrepreneurship in Apiculture- Bee Keeping Industry – Recent Efforts, Modern Methods in employing artificial, Beehives for cross pollination in horticultural gardens

SUGGESTED READINGS

- Prost, P. J. (1962). *Apiculture*. Oxford and IBH, New Delhi.

- Bisht D.S., *Apiculture*, ICAR Publication.
- Singh S., *Beekeeping in India*, Indian council of Agricultural Research,

OR

Title of the Paper: SERICULTURE
Code: MBG 506(T)
Course Category: SEC 3 (Th)

Total: 30 hrs (2hrs/week)
 Each Unit: 15hrs (1hr/week)

Theory 2- Credits

Unit 1:

Sericulture: Definition, history and present status; Silk route, Types of silkworms, Distribution and Races Exotic and indigenous races, Mulberry and non-mulberry Sericulture; Life cycle of *Bombyx mori* Structure of silk gland and secretion of silk; Rearing of Silkworms-Selection of mulberry variety and establishment of mulberry garden. Rearing house and rearing appliances; Disinfectants: Formalin, bleaching powder, RKO Silkworm rearing technology: Early age and Late age rearing, Types of mountages, Spinning, harvesting and storage of cocoons

Unit 2:

Pests and Diseases- Pests of silkworm: Uzi fly, dermestid beetles and vertebrates, Pathogenesis of silkworm diseases: Protozoan, viral, fungal and bacterial Control and prevention of pests and diseases; Entrepreneurship in Sericulture- Prospectus of Sericulture in India: Sericulture industry in different states, employment, potential in mulberry and non-mulberry sericulture. Visit to various sericulture centres.

SUGGESTED READINGS

- Handbook of Practical Sericulture: S.R. Ullal and M.N. Narasimhanna CSB, Bangalore
- Appropriate Sericultural Techniques; Ed. M. S. Jolly, Director, CSR & TI, Mysore.
- Handbook of Silkworm Rearing: Agriculture and Technical Manual-1, Fuzi Pub. Co. Ltd., Tokyo, Japan 1972.
- Manual of Silkworm Egg Production; M. N. Narasimhanna, CSB, Bangalore 1988.
- Silkworm Rearing; Wupang—Chun and Chen Da-Chung, Pub. By FAO, Rome 1988.
- A Guide for Bivoltine Sericulture; K. Sengupta, Director, CSR & TI, Mysore 1989.
- Improved Method of Rearing Young age silkworm; S. Krishnaswamy, reprinted CSB, Bangalore, 1986.

SEMESTER - VI

Title of the Paper: INHERITANCE BIOLOGY

Code: MBG 601(T)

Course Category: DSE 4 (Th)

Theory 4- Credits

Total: 60 hrs (4hrs/week)

Each Unit: 15hrs (1hr/week)

UNIT I :Mendelism

1.1 Introduction, Mendel's experiment, Monohybrid and Dihybrid crosses, Genotypic and phenotypic ratio, Law of Dominance, Law of segregation and Law of independent Assortment, Back cross and test cross.

1.2 Modifications of Mendelian ratios: Co-dominance, Incomplete dominance, Interaction of complementary genes, supplementary gene, inhibitory gene, epistasis, X & Y linked inheritance, dosage compensation. Sex determination with examples

UNIT II :Genetic Linkage and Chromosome Mapping

2.1 Linkage – Definition, types of linkage, significance of linkage. Crossingover– theories, types and mechanism.

2.2 Gene Mapping – physical map and genetic map (by two point test crosses), Mapping by tetrad analysis – the analysis of unordered and ordered Tetrads.

UNIT III :Extra chromosomal inheritance and alleles

3.1 Maternal inheritance & Maternal effect, Genetic system in mitochondria, chloroplast, and plasmid.

3.2 Definition of Alleles. Multiple alleles – ABO blood groups in human, fur colour in rabbit, self-incompatibility in plants, and eye colour in *Drosophila*. Pseudo alleles, Complementation test.

UNIT IV :The Genetics of Bacteria

4.1 The Genetic Organization of Bacteria (folded fiber model),

4.2 Bacterial Recombination – transformation, conjugation and transduction. F Plasmids

Title of the Paper: INHERITANCE BIOLOGY**Code: MBG 601(P)****Course Category: DSE 4 (P)****Total: 60 hrs (4hrs/week)****Practical 2- Credits**

1. Problems related with monohybrid & dihybrid crosses
2. Testing goodness of fit.
3. Pedigree analysis of some human common characters like blood group & color blindness
4. Nucleolus staining of *Allium cepa*
5. Study of Translocation in *Rhoeo*
6. Study of Barr body in squamous tissue
6. Effect of toxic chemicals on chromosomes

SUGGESTED READING

1. Gardner, E.J., Simmons, M.J., Snustad, D.P. (2006). Principles of Genetics. VIII Edition John Wiley & Sons.
2. Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics. V Edition. John Wiley and Sons Inc.
3. Klug, W.S., Cummings, M.R., Spencer, C.A. (2009). Concepts of Genetics. IX Edition. Benjamin Cummings.
4. Russell, P. J. (2009). Genetics- A Molecular Approach. III Edition. Benjamin Cummings.
5. Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B. IX Edition. Introduction to Genetic Analysis, W. H. Freeman & Co.

OR**Title of the Paper: IMMUNOLOGY****Code: MBG 602(T)****Course Category: DSE 4 (Th)****Theory 4- Credits****Total: 60 hrs (4hrs/week)****Each Unit: 15hrs (1hr/week)****UNIT I :**

Immune system, Organs and cells of immune system Immunity, innate immune mechanism Acquired immune mechanism, Antigen, Antigenicity (factors affecting antigenicity) Humoral immunity, main pathways of complement system.

UNIT II:

Antibody structure and classes, Antibody diversity, Genes of antibodies, Theories of formation of antibodies.

UNIT III

Cell mediated immunity: TC mediated immunity, NK cell mediated immunity, ADCC, delayed type hypersensitivity, cytokines and brief idea of MHC.

UNIT IV

Hypersensitivity and vaccination : General features of hypersensitivity, various types of hypersensitivity, Vaccination: Discovery, principles, significance. Concept of autoimmunity.

Title of the Paper: IMMUNOLOGY**Code: MBG 602(P)****Course Category: DSE 4 (P)****Total: 60 hrs (4hrs/week)****Practical 2- Credits**

1. Antigen –antibody reaction assessment by (i) immunodiffusion / immunoblot / immunoelectrophoresis.
2. Electrophoretic separation of serum protein.
3. Lymphoid organs and their microscopic organization.
4. Immunization, collection of serum
5. Ouchterloney immunodiffusion
6. Radial immuno diffusion.

SUGGESTED READING

1. Abbas AK, Lichtman AH, Pillai S. (2007). Cellular and Molecular Immunology. 6 th edition Saunders Publication, Philadelphia.
2. Delves P, Martin S, Burton D, Roitt IM. (2006). Roitt's Essential Immunology. 11th edition Wiley-Blackwell Scientific Publication, Oxford.
3. Goldsby RA, Kindt TJ, Osborne BA. (2007). Kuby's Immunology. 6th edition W.H. Freeman and Company, New York.
4. Murphy K, Travers P, Walport M. (2008). Janeway's Immunobiology. 7th edition Garland Science Publishers, New York.
5. Peakman M, and Vergani D. (2009). Basic and Clinical Immunology. 2nd edition Churchill Livingstone Publishers, Edinberg.
6. Richard C and Geiffrey S. (2009). Immunology. 6th edition. Wiley Blackwell Publication.

Title of the Paper: ALCOHOL FERMENTATION**Code: MBG 605(T)****Course Category: SEC 4(Th)****Total: 30 hrs (2hrs/week)**

Each Unit: 15hrs (1hr/week)

Theory 2- Credits**UNIT I:**

History of alcohol production, classical method of ethanol production -Starch Containing Raw Materials (potato, wheat, barley); amylolysis- Enzymatic Starch Liquefaction, enzymatic starch Liquefaction and saccharification (malt), Glucoamylase starch saccharification by using *Aspergillu*, *Rhizopus*; autoamyolytic enzyme from wheat, Mashing Processes & equipment, washing, grinding, Dispersing, mash tubs (specification), use of heat exchanger, Pressure Boiling Processes, Pressureless Breakdown of Starch (Infusion Processes), Recycling Processes, Fermentation- Batch and continuous Fermentation, Suppression of Contaminants,

UNIT 2:

Distillation- Distillation of Raw Spirit from Mash, Rectification of Product Spirit from Raw Spirit, combined distillation and rectification, Stillage; Analysis of Raw Materials- Starch Content of Potatoes, grain, Determination of Fermentable Substance in Grain (FS), Autoamyolytical Quotient (AAQ); Analysis of Mash- Mash Hydrosizing, pH of Mash, Content of Ethanol in Mash and Distillates, Microexamination, Analysis of Stillage- Content of Ethanol in Stillage, Energy Consumption and Energy Balance in Classical Processes, Industrial ethanol product by yeast and bacteria, immobilized cell system, substrates for industrial alcohol production.

Suggested Reading

1. The Biotechnology of Ethanol: Classical and Future Applications (2001) Edited by M. Roehr, WILEY Publication
1. Casida LE. (1991). Industrial Microbiology. 1st edition. Wiley Eastern Limited.
2. Crueger W and Crueger A. (2000). Biotechnology: A textbook of Industrial Microbiology. 2nd edition. Panima Publishing Co. New Delhi.
3. Patel AH. (1996). Industrial Microbiology. 1st edition, Macmillan India Limited.
4. Stanbury PF, Whitaker A and Hall SJ. (2006). Principles of Fermentation Technology. 2nd edition, Elsevier Science Ltd.
5. Salisbury, Whitaker and Hall. Principles of fermentation Technology,

OR**Title of the Paper: INDUSTRIAL MICROPROPAGATION****Code: MBG 606(T)****Course Category: SEC 4(Th)****Total: 30 hrs (2hrs/week)**

Each Unit: 15hrs (1hr/week)

Theory 2- Credits**Industrial Micropropagation****UNIT I:**

Propagation of plants- seed propagation, vegetative propagation, micropropagation, History of micropropagation industry, demand and need of micropropagation industries in India, minimum infrastructure needed to develop a micropropagation industry; Laboratory design, equipment, glassware and chemicals, designing a green-house for micropropagation; culture media preparation- composition of basal medium, media preparation from stock solution preparation to sterilization, use of different plant growth regulators in different stages of propagation, filter sterilization process of heat labile chemical solution, storage; explant preparation surface sterilization process of suitable explant, cleaning and sterilization of laminar hood, inoculation,

UNIT II

Different stages of micropropagation, the principal methods of micropropagation, effect of physical environment, Problems Inherent with Micropropagation contamination during culture inoculation, incubation and hardening, Hyperhydration, Oxidative Browning cleaning of plantlets, cleaning and sterilization of glass wares; Hardening of plantlets- primary and secondary hardening, controlling of light, temperature, humidity in hardening chamber, soil media preparation and sterilization before primary and secondary hardening, watering, fertigation, pest and disease control;

Micropropagation protocol for *Musa accuminata*; Protocol for micropropagation of the orchid—*Phalaenopsis*, Micropropagation protocol for *Gladiolus*; Techniques for detection of off types or somaclonal variants by molecular marker, virus free plant detection, packaging and transportation; advantages and disadvantages micropropagation, market demand and marketing strategies of micropropagated plants.

Suggested reading:

1. Bhojwani, S.S. and Razdan 2004 Plant Tissue Culture and Practice.
2. Raven, P.H., Johnson, G.B., Losos, J.B. and Singer, S.R. 2005 Biology. Tata MC Graw Hill.
3. Reinert, J. and Bajaj, Y.P.S. 1997 Applied and Fundamental Aspects of Plant Cell, Tissue and Organ Culture. Narosa Publishing House.
4. Sambrook & Russel. Molecular Cloning: A laboratory manual. (3rd edition)
5. Slater, A., Scott, N.W. & Fowler, M.R. 2008 Plant Biotechnology: The Genetic Manipulation of Plants, Oxford University Press.
6. Edwin F. George, Michael A. Hall, Geert-Jan De Klerk 2008, Plant Propagation by Tissue Culture
7. Sant Saran Bhojwani Prem Kumar Dantu 2012. Plant Tissue Culture: An Introductory Text