Dr. N.G.P.ARTS AND SCIENCE COLLEGE (Autonomous)

REGULATIONS 2019-20 for Post Graduate Programme

(Outcome Based Education model with Choice Based Credit System)

Master of Science (Biotechnology)

(For the students admitted during the academic year 2021-22 and onwards)

Programme: M.Sc. Biotechnology

Eligibility

A candidate who has passed in Higher Secondary Examination with any Academic Stream or Vocational Stream as one of the subjectsunder Higher Secondary Board of Examination and as per the norms set by the Government of Tamil Nadu or an Examination accepted as equivalent thereto by the Academic Council, subject to such conditions as may be prescribed thereto are permitted to appear and qualify for the **M.Sc. Biotechnology Examination** of this College after a programme of study of three academic years.

Programme Educational Objectives

The Curriculum is designed to attain the following learning goals which students shall accomplish by the time of their graduation:

1. This programme will enable students to acquire knowledge on the fundamentals of Biochemistry, Cell biology, Microbiology and Molecular biology. It helps them to understand emerging and advanced concept in modern biology and guide them to take up their carrier in this field.
2. This programme will facilitate the students to acquire knowledge in fields such as Genetic Engineering, Protein Engineering and Molecular Therapeutics.
3. The programme will aid the students to learn the recent developments in the field of Genomics, Proteomics, Stem cell biology and Tissue Engineering approach.

PROGRAMME OUTCOMES:

On the successful completion of the program, the following are the expected outcomes.

PO Number	PO Statement
PO1	Impart quality biotechnology education to students and to develop young minds as outstanding scholars/teachers/entrepreneurs and responsible citizens.
PO2	Apply their understanding of the commercialization processes to biotechnology products or services in future.
PO3	Graduates of the course will have strong background in the interface of biotechnology and be able to use the tools in industry and/or institutes wherever necessary.
PO4	Ability to design and carry out experiments (safely) and to interpret experimental data and apply the scientific method by developing valid hypotheses, designing experiments, gathering relevant data using current technology, and interpreting quantitative and qualitative data.
PO5	Develop an awareness of ethical issues in biochemical research and careers options along with understanding of the area of biotechnology chosen.

TOTAL CREDIT DISTRIBUTION

Courses	Credits	Total Marks		Credits	Cumulative Total credits
Core Theory	4	14 X 100 =	1400	56	78
Core Lab	3	2 X 100 =	200	06	
Core Lab	2	4 x100 =	400	08	
Project and Viva Voce	8	1 X 200=	200	08	
Elective	4	4X 100 =	400	12	12
		Total	**2600**	**90**	**90**

CURRICULUM

M.Sc. BIOTECHNOLOGY

Course Code	Course Category	Course Name	L	T	P	Exam (hours)	Max Marks			Credits
							CIA	ESE	Total	
First Semester										
193BT2A1CA	Core –I	Molecular Biology & Genetics	4	-	-	3	25	75	100	4
193BT2A1CB	Core –II	Biochemistry	4	-	-	3	25	75	100	4
193BT2A1CC	Core – III	Microbiology	4	-	-	3	25	75	100	4
203BT2A1CD	Core - IV	Biodiversity & Bioprospecting	4	-	-	3	25	75	100	4
193BT2A1CP	Core Practical-I	Core Practical- I: Molecular biology & Genetics and Biochemistry	-	-	5	6	40	60	100	2
203BT2A1CQ	Core Practical-II	Core Practical – II: Microbiology & Biodiversity & Bioprospecting	-	-	5	6	40	60	100	2
203BT2A1DA	DSE - 1	Forensic Biotechnology	3	1	-	3	25	75	100	3
193MB2A1DA		Microbial Nanotechnology								
193BC2A1DA		Cancer Biology, Diagnosis and Therapy								
Total			**19**	**1**	**10**	-	-	-	**700**	**23**

17/5/2021
BoS Chairman/HoD
Department of Biotechnology
Dr. N. G. P. Arts and Science College
Coimbatore – 641 048

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BoS- 11th	AC - 11th	GB - 15th
17.05.2021	09.08.2021	17.08.2021

Academic Council
Dr.V. Rajendran
CHAIRMAN
Dr.N.G.P. Arts and Science College

Course Code	Course Category	Course Name	L	T	P	Exam (h)	Max Marks			Credits
							CIA	ESE	Total	
Second Semester										
193BT2A2CA	Core V	Immunotechnology	4	-	-	3	25	75	100	4
193BT2A2CB	Core VI	Genetic Engineering	4	-	-	3	25	75	100	4
193BT2A2CC	Core VII	Bioprocess Technology	4	-	-	3	25	75	100	4
203BT2A2CD	Core VIII	Environmental Biotechnology	4	-	-	3	25	75	100	4
193BT2A2CP	Core Practical-III	Immunotechnology and Bioprocess Technology	-	-	5	6	40	60	100	2
203BT2A2CQ	Core Practical – IV	Genetic Engineering and Environmental biotechnology	-	-	5	6	40	60	100	3
203BT2A2DA	DSC -II	Protein Engineering	3	1		3	25	75	100	3
193MB2A2DA		Medical Laboratory Techniques								
193BC2A2DA		Biochemistry of Toxicology								
Total			**19**	**1**	**10**	-	-	-	**700**	**24**

Course Code	Course Category	Course Name	L	T	P	Exam (h)	Max Marks			Credits
							CIA	ESE	Total	
Third Semester										
203BT2A3CA	Core-IX	Plant Biotechnology	4	-	-	3	25	75	100	4
203BT2A3CB	Core X	Animal Biotechnology	4	-	-	3	25	75	100	4
193BT2A3CC	Core XI	Genomics& Proteomics	4	-	-	3	25	75	100	4
203BT2A3CD	Core XII	Research Methodology & IPR	4	-	-	3	25	75	100	4
203BT2A3CP	Core Practical - V	Plant&Animal Biotechnology	-	-	5	6	40	60	100	3
203BT2A3CQ	Core Practical VI	Genomics & Proteomics and Research Methodology& IPR	-	-	5	6	40	60	100	3
193BT2A3DA	DSE III	Molecular Therapeutics	3	1	-	3	25	75	100	3
193MB2A3DA		Molecular Diagnostics in Microbiology								
193BC2A3DA		Systems Biology								
193BT2A3CT	Internship	A toC								
Total			**19**	**1**	**10**	-	-	-	**700**	**25**

Course Code	Course Category	Course Name	L	T	P	Exam (h)	Max Marks			Credits
							CIA	ESE	Total	
Fourth Semester										
193BT2A4CA	Core XIII	Pharmaceutical Biotechnology	4	-	-	3	25	75	100	4
193BT2A4CP	Core Practical VII	Pharmaceutical Biotechnology			6	6	40	60	100	3
193BT2A4CV	Core XV Project	Project and Viva Voce	-	-	16	-	80	120	200	8
193BT2A4DA	DSE-IV	Stem Cell Technology	3	1	-	3	25	75	100	3
193MB2A4DA		Microbial Technology								
193BC2A4DA		Neurobiology								
Total			**13**	**1**	**16**	-	-	-	**500**	**18**
Grand Total									**2600**	**90**

DISCIPLINE SPECIFIC ELECTIVE

Students shall select the desired course of their choice in the listed elective course during Semesters I - IV

Semester I (Elective I)

List of Elective Courses

S. No.	Course Code	Name of the Course
1.	203BT2A1DA	Forensic Biotechnology
2.	193MB2A1DA	Microbial Nanotechnology
3.	193BC2A1DA	Cancer Biology, Diagnosis and Therapy

Semester II (Elective II)

List of Elective Courses

S. No.	Course Code	Name of the Course
1.	203BT2A2DA	Protein Engineering
2.	193MB2A2DA	Medical Laboratory Techniques
3.	193BC2A2DA	Biochemistry of Toxicology

Semester III (Elective III)

List of Elective Courses

S. No.	Course Code	Name of the Course
1.	193BT2A3DA	Molecular Therapeutics
2.	193MB2A3DA	Molecular Diagnostics in Microbiology
3.	193BC2A3DA	Systems Biology

Semester IV (Elective IV)

List of Elective Courses

S.No.	Course Code	Name of the Course
1.	193BT2A4DA	Stem Cell Technology
2.	193MB2A4DA	Microbial Technology
3.	193BC2A4DA	Practical-Neurobiology

EXTRA CREDIT COURSES

The following are the courses offered under self study to earn extra credits:

S. No.	Course Code	Course Title
1.	193BT2ASSA	Food Biotechnology
2.	193BT2ASSB	Developmental Biology

Regulation
(2019-2020)

PG Programme

Effective from the academic year 2019-20 and applicable to the students admitted to the Degree of Master of Arts/Commerce/Management/Science.

1. NOMENCLATURE

1.1 Faculty: Refers to a group of programmes concerned with a major division of knowledge. Eg. Faculty of Computer Science consists of Programmes like Computer Science, Information Technology, Computer Technology, Computer Applications etc.

1.2 Programme: Refers to the Master of Arts/Management/Commerce/Science Stream that a student has chosen for study.

1.3 Batch: Refers to the starting and completion year of a programme of study. Eg. Batch of 2015–2017 refers to students belonging to a 2-year Degree programme admitted in 2015 and completing in 2017.

1.4 Course: Refers to a component (a paper) of a programme. A course may be designed to involve lectures / tutorials / laboratory work / seminar / project work/ practical training / report writing / Viva voce, etc or a combination of these, to effectively meet the teaching and learning needs and the credits may be assigned suitably.

a) **Core Courses**

A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.

b) **Extra Departmental Course (EDC)**

A course chosen generally from a related discipline/subject, with an intention to seek exposure in the discipline relating to the core domain of the student.

c) **Discipline Specific Elective Course (DSE)**: DSE courses are the courses offered by the respective disciplinary/ interdisciplinary programme.

d) Project Work:

It is considered as a special course involving application of knowledge in problem solving/analyzing/exploring a real-life situation. The Project work will be given in lieu of a Core paper.

e) Extra credits

Extra credits will be awarded to a student for achievements in co-curricular activities carried out outside the regular class hours. The guidelines for the award of extra credits are given in section two, these credits are not mandatory for completing the programme.

e) Advanced Learner Course (ALC):

ALC is doing work of a higher standard than usual for students at that stage in their education. Research work carried out in University/ Research Institutions/ Industries of repute in India or abroad for a period of 15 to 30 days.

2. EXTRA CREDITS

- Earning extra credit is mandatory. However, it is not essential for programme completion.
- Extra Credits will be awarded to a student for achievement in co-curricular/ extracurricular activities carried other than the regular class-hours.
- A student is permitted to earn a maximum of 10 extra Credits during the programme duration of PG from I to IV Semester.
- Candidate can claim a maximum of 1 credit under each category listed.

The following are the guidelines for the award of Extra credits:

2.1 Proficiency in Foreign Language

Qualification	Credit
A pass in any foreign language in the examination conducted by an authorized agency	1

2.2 Proficiency in Hindi

Qualification	Credit
A pass in the Hindi examination conducted by Dakshin Bharat Hindi Prachar Sabha	1

Examination passed during the programme period only will be considered for extra credit

2.3 Self-study Course

Qualification	Credit
A pass in the self-study courses offered by the department	1

The candidate should register in the self-study course offered by the department only in the III semester

2.4 Typewriting/Short hand

A Pass in shorthand /typewriting examination conducted by Tamil Nadu Department of Technical Education (TNDTE) and the credit will be awarded.

Qualification	Credit
A pass in the type writing / short hand examination offered by TNDTE	1

2.5 Diploma / Certificate

Courses offered by any recognized University / NCVRT

Qualification	Credit
A pass in any Certificate /Diploma/PG Diploma Course	1

2.6 CA /ICSI/ CMA

Qualification	Credit
Qualifying foundation/Inter level/Final in CA/ICSI/CMA etc.	1

2.7 Sports and Games

The Student can earn extra credit based on their achievement in sports as given below:

Qualification	Credits
Achievement in University/State /National/ International	1

2.8 Online Courses

Pass in any one of the online courses

Qualification	Credit
SWAYAM/NPTEL/Spoken Tutorial etc.,	1

2.9 Publications / Conference Presentations (Oral/ Poster) /Awards

Qualification	Credit
Research Publications in Journals/oral/poster presentation in Conference	1

2.10 Innovation / Incubation / Patent / Sponsored Projects / Consultancy

Qualification	Credit
Development of model/ Products/ Prototype/ Process/App/Registration of Patents/ Copyrights/ Trademarks/Sponsored Projects/Consultancy	1

2.11 Representation

Qualification	Credit
Participation in State / National level celebrations such as Independence day, Republic day Parade, National Integration camp etc.,	1

3. EXAMINATIONS

The following are the distribution of marks for External and Internal i.e., Comprehensive examination and Continuous Internal Assessment and passing minimum marks for theory papers of PG programmes.

TOTAL MARKS	EXTERNAL		Internal Max. marks	Overall Passing Minimum for total marks (Internal + External)
	Max. marks	Passing Minimum for External alone		
100	75	38	25	50
50	50	25	----	25

The following are the Distribution of marks for the Continuous Internal Assessment in the theory papers of PG programmes.

S. No.	For Theory– PG courses	Distribution of Marks
1	TESTS I (2 hours)	5
2	TESTS II / End semester Model test (3 hours)	10
3	OBE- Rubrics	10
	TOTAL MARKS	**25**

The following are the distribution of marks for the External Assessment in PG Theory courses

S. No.	For Theory– PG courses	Distribution of Marks	
1	Comprehensive (Written) Examination	65	50
2	Online MCQ Examination	10	--
	TOTAL MARKS	**75**	**50**

The following are the distribution of marks for External examinations (CE) and Continuous Internal Assessment (CIA) and passing minimum marks for the practical courses of PG programmes.

TOTAL MARKS	EXTERNAL		Internal Max. marks	Overall Passing Minimum for total marks (Internal + External)
	Max. marks	Passing Minimum for External alone		
100	60	30	40	50
200	120	60	80	100

The following are the distribution of marks for the Continuous Internal Assessment (CIA) in PG practical courses

S. No.	For Theory – PG Practical courses	Distribution of Marks	
1	Tests: Two tests out of which one shall be during the mid semester and the other to be conducted as model test at the end of the semester.)	24	48
2	OBE- Rubrics	16	32
	TOTAL MARKS	**40**	**80**

The following are the distribution of marks for the External Assessment in PG practical courses

S. No.	For Theory – PG Practical courses	Distribution of Marks	
1	Experiment-I	25	50
2	Experiment-II	25	50
3	Record & Viva-Voce	10	20
	TOTAL MARKS	**60**	**120**

The following are the distribution of marks for Project and Viva voce examinations/Industrial Training and Continuous Internal Assessments and passing minimum marks for the project courses/Industrial Training of PG programmes

TOTAL MARKS	EXTERNAL		Internal Max. marks	Overall Passing Minimum for total marks (Internal + External)
	Max. marks	Passing Minimum for External alone		
100	60	30	40	50
200	120	60	80	100

The following are the distribution of marks for the Continuous Internal Assessment in PG Project/ Industrial Training courses.

S. No.	For- PG Project courses/ Industrial Training	Distribution of Marks	
1	Review-I	8	16
2	Review-II	8	16
3	Review-III	8	16
4	OBE- Rubrics	16	32
	TOTAL MARKS	**40**	**80**

The following are the distribution of marks for the External Examination (CE) in PG Project / /Industrial Training courses

S. No.	For- PG Project courses/ Industrial Training Courses	Distribution of Marks	
1	Record Work and Presentation	40	80
2	Viva-Voce	20	40
	TOTAL MARKS	**60**	**120**

- The end semester examinations shall normally be conducted after completing 90 working days for each semester.

- The maximum marks for each theory and practical course (including the project work and Viva-Voce examination in the final Semester) shall be 100 with the following breakup.

(i) **Theory Courses**

Continuous Internal Assessment (CIA) : 25 Marks

End Semester Exams (ESE) : 75 Marks

(Online Exam: 10 Marks &Written Exam: 65 Marks)

(ii) **For Practical Courses**

Continuous Internal Assessment (CIA) : 40 Marks

End Semester Exams (ESE) : 60 Marks

Continuous Assessment OBE Rubrics Score Sheet

Degree: _____ Branch: _____ Semester: _____

Course Code: _____ Course: _____

Max. Marks: Internal:_____ External: _____ Total: _____

S. No.	REG. NO.	THEORY / PRACTICAL & LIBRARY CLASS PARTICIPATION (15) (Compulsory)				RUBRICS ASSESSMENT (SELECT ANY ONE)									Total Marks out of : 30	Total Marks out of : 16 / 10 / 08 / 04
						PAPERS / REPORTS (15)			ASSIGNMENTS (15)			CLASS PRESENTATION (15)				
		Library	Integration of Knowledge	Interaction & Participation	Demonstration of Knowledge	Organization & Knowledge	Format & Spelling	Reference / Experiments	Demonstration of Knowledge	Format & Spelling	Reference	Content & Coherence	Creativity and Speaking Skills	Duration of Presentation		
		6	3	3	3	5	5	5	5	5	5	5	5	5		
1																

a) Utilization of Library

Marks will be awarded to the student based on the hours spent in the library after the working hours and submission of report by the student.

Hours spent in Library	Marks	Type of Document submitted
2	1	Report/ Assignment/ Class presentation
4	2	
6	3	
8	4	
10	5	
12	6	

- During the Library hour, the student must spend time in reading the articles, books, journals of their subject of interest
- Each student should borrow minimum three books during the semester

b) Class Participation

Active participation in classroom discussion by the student will be evaluated based on Integration of knowledge, Interaction and Participation and demonstration of knowledge.

c) Papers / Reports/ Assignments/ Class Presentation

The student will be evaluated based on his ability to do analysis of application of theory to real world problems or creative extension of class room learning and his/her ability to communicate the given topic effectively and clearly. The following are the distribution of marks for the continuous internal assessment in PG practical courses

4. FOR PROGRAMME COMPLETION

Programme Completion (for students admitted during the A.Y.2019-20 and Onwards)

Student has to complete the following:

i) Core, EDC, DSE, Project as mentioned in the scheme
ii) Internship / Industrial/ Institutional training as mentioned in the scheme

Students must undertake industrial / institutional training for a minimum of 15 days and not exceeding 30 days during the II semester summer vacation. The students will submit the report for evaluation during III semester.

Based on the performance Grade will be awarded as follows:

Marks Scored	Grade to be awarded
75 and above	A
60-74	B
50-59	C
< 50	Re-Appearance

Course Code	Course Name	Category	L	T	P	Credit
193BT2A1CA	MOLECULAR BIOLOGY & GENETICS	CORE	4	-	-	4

PREAMBLE

This course has been designed for students to learn and understand

- The Basic components of Cell
- At length the functions of Cells and its organelles
- The concept of gene expression and its regulation

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Appraise the mode of DNA replication and repair mechanisms	K3
CO2	Formulate transcriptional events and its role in gene regulation	K3
CO3	Infer translational events and its role in gene expression & protein targeting	K3
CO4	Integrate the human genetics and various genetic disorders	K4,K5
CO5	Generalize the inheritance pattern and population genetics	K4,K5

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	M	M	S
CO2	S	M	S	M	S
CO3	S	M	S	S	S
CO4	S	S	S	S	S
CO5	S	S	S	S	S

S Strong M Medium L Low

193BT2A1CA	MOLECULAR BIOLOGY AND GENETICS	SEMESTER I

Total Credits: 4

Total Instruction Hours: 48 h

Syllabus

Unit I DNA Replication 9 h

Over view of Central dogma & Experimental proof for Semiconservative method*. Enzymes & accessory proteins involved in DNA replication. Replication process in prokaryotic & Eukaryotic DNA. Regulations of Eukaryotic replication. Differences between Prokaryotic and eukaryotic replication. Other Replication models – Theta and Rolling circle model. DNA Repair mechanism- Nucleotide excision, Base excision, Mismatch repair, Photo-reactivation, SOS and recombination repair. Recombination: Homologous and site-specific recombination.

Unit II Transcription 10 h

Importance of DNA binding Proteins, RNA polymerase. Mechanism of Transcription in prokaryotes & Eukaryotes. Transcriptional Regulation-Regulatory elements and mechanisms of transcription regulation, Transcriptional and post-transcriptional gene silencing. Modifications in RNA- 5′ cap formation, transcription, 3′-end processing and polyadenylation, splicing, RNA Editing, Nuclear export of mRNA. r-RNA & t- RNA processing.

Unit III Translation 10 h

Overview of Genetic code, codon and anticodon concepts, wobble hypothesis*. The translation machinery, role of t RNA & ribosome. Mechanism of translation in Prokaryotes & Eukaryotes. Post translational modifications of proteins-Phosphorylation, Deformylation, Glycosylation, Acetylation, Amidation, Lipid attachment, S - Nitrosylation and Disulfide bond formation. Translation Regulation-Translational inhibitors, Control of gene expression at translational level. Protein targeting- Synthesis of Secretory and membrane proteins, import into nucleus, mitochondria and chloroplast.

Unit IV Mendelism and Non Mendelism 10 h

Overview on mendelian and non-mendelian inheritance.*

Human Genetics- Introduction to Human Genetics. Chromosomal changes resulting in abnormal phenotype: Numerical (Aneuploidy) changes resulting in genetic syndromes eg: Turner, Down & Klinefelter Syndromes. Structural changes resulting in genetic diseases: eg: Cri-du-chat syndrome.

Genetic Diseases and Inheritance Pattern: Autosomal inheritance – Dominant (Eg: Adult polycystic kidney, Achondroplasia); Autosomal inheritance – Recessive (Eg: Albinism, Sickle Cell Anemia, Phenyl Ketonuria); X-linked: Recessive (Eg: Duchenne muscular dystrophy – DMD); X-linked: Dominant (eg.Xg blood group); Y-linked inheritance (Holandric – eg. Testes determining factor); Mitochondria disorders like LHON, DAD, MERRF and MELAS. Cancer genetics.

Unit V Analysis of interitance pattern 9 h

Pedigree analysis; Diagnosis of disease: Molecular cytogenetics, DNA markers - VNTR, STR, microsatellite, SNP and their detection techniques - RFLP genotyping, RAPD, AFLP. Prevention of disease: Prenatal diagnosis; Genetic counseling. Population genetics: Organization and measure of genetic variation: Random mating population, Hardy-Weinberg principle. Sources responsible for changes in gene frequencies: Mutation, selection, migration and isolation; random genetic drift; insights into human migration, natural selection and evolution.

Note: * Self Study

Text Books

1. *Lodish, H. & Baltimore. D.* 1994. **Molecular cell Biology**. 2nd edition. American Scientific Books.
2. *Gardner, E.J.* 1991. **Principles of Genetics**. 8th edition. John Wiley and Sons Inc, New York.

References

1. *Freifelder, D. and Malacinski, G. M.* 1996. **Essential of Molecular Biology**, 2nd edition. Panima Publishing Co., New Delhi.
2. *Strickberger, M. W.* 2013. **Genetics.** 3rd edition. Prentice Hall College Division, New Delhi
3. *Lewin, B.* 2004. **Genes V.** Oxford University press.

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Course Code	Course Name	Category	L	T	P	Credit
193BT2A1CB	BIOCHEMISTRY	CORE	4	-	-	4

PREAMBLE

This course has been designed for students to learn and understand

- The Structure of Biomolecules
- The function and pathogenesis of the biomolecules
- The metabolism and their regulatory pathways.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Experiment the physical properties, Classification, metabolism and disorders of carbohydrates	K3
CO2	Interpret the concepts of structure and function, metabolism and disorders of lipid and fatty acid	K3, K4
CO3	Summarize the biosynthesis of amino acids and disorders related to amino acids	K3, K4
CO4	Integrate the mechanism, kinetics and inhibition of enzymes and coenzymes	K4, K5
CO5	Appraise the regulatory mechanism of different metabolic activities and their disorders of nucleic acid	K3, K4, K5

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	S
CO2	S	S	S	M	S
CO3	S	S	S	S	S
CO4	S	S	S	S	S
CO5	S	S	S	S	S

S Strong M Medium L Low

193BT2A1CB	BIOCHEMISTRY	SEMESTER I

Total Credits: 4

Total Instruction Hours: 48 h

Syllabus

Unit I Carbohydartes 08 h

*Classification and reactions: occurrence, properties and biological reactions. Structural features of carbohydrates, Glycolysis and TCA cycle; Glycogen breakdown and synthesis; Gluconeogenesis; interconversion of hexoses and pentoses. Carbohydrate metabolic disorders. Glycogen storage diseases. Lectins – characteristics and functions in biological system

Unit II Lipids 10 h

*Classification, Structure, functions and reactions of Lipids, Biosynthesis of fatty acids, Triglycerides, phospholipids and Sterols, Catabolism of Fatty acids - Oxidation(α, β and ω), Catabolism of triglycerides and phospholipids, Essential fattyacids and their physiological functions. Disorders associated with lipid metabolism and its therapeutic intervention - ketone bodies and ketosis; fatty liver, atherosclerosis.

Unit III Amino Acids 10 h

*Classification and Biosynthesis. Peptides, Classification of Protein, Primary structure of proteins, structural comparison at secondary and tertiary levels (Ramachandran Plot), quaternary and domain structure and architecture. Regulation of Protein metabolism. Protein metabolism in prolonged fasting. Disease related to protein folding – Alzheimer's and mad cow disease

Unit IV Enzymes and coenzymes 08 h

IUBMB classification of enzymes, active site, *Lock and key Model and induced fit hypothesis. Factors affecting enzyme activity, Mechanism of enzyme catalysis: Lysozyme, Enzyme kinetics- Michaelis – Menten (MM) equations, Transformations of MM equation and their significance, Enzyme inhibition: Reversible – Competitive, Noncompetitive, Uncompetitive, Irreversible inhibition, Kinetics of Enzyme inhibition. Isoenzymes, allosteric enzymes, ribozymes, abzymes and artificial enzymes. Diseases Caused By Deficiency Of Digestive Enzymes-Obesity, Galactosemia,Maple Syrup Urine Disease

Unit V Nucleic Acids 12 h

*Classification, structure, functions and reactions of nucleic acids, Conformation of

Nucleic acids: Structural characteristics of A, B and Z-DNA. 3D structure of t-RNA, ribozymes and riboswitches. Biosynthesis of Nucleotides –De nova and Salvage pathway, Regulations of Purines and Pyrimidine, Metabolism of Purine and Pyrimidine. Disorders of nucleic acids metabolism- Gout, Lesch-Nyhan syndrome, oroticaciduria, and xanthinuria.

(Note: * Self Study)

Text Books

1 Lehninger, A.L. and Cox, M.M., 2008, Principles of Biochemistry, 5th Edition. W H Freeman & Co, UK.

2 Murray, R.K., Granner,D.K., Mayes, P.A., Rodwell.V.W., 2006, Harper's Illustrated Biochemistry, 26th Edition, McGraw-Hill Medical Publishing Division, India.

References

1 Zubay, G.L., 1998, Biochemistry, 4th Edition, Brown (William C.) Co, U.S.A.

2 Voet, D. and Voet, J.G., Pratt, C.W., 1999, Fundamentals of Biochemistry, Wiley & sons Publication, USA.

3 Berg, J. M. Stryer, L., Tymoczko, J.L. and Gatto, G,.J., 2015. Biochemistry, 8th edition. Palgrave Macmillan Publications, India

4 Rastogi, C.S., 2003, Biochemistry, 3rd edition, Tata McGraw Hill Publication, India.

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Course Code	Course Name	Category	L	T	P	Credit
193BT2A1CC	MICROBIOLOGY	CORE	4	-	-	4

PREAMBLE

This course has been designed for students to learn and understand

- The microbial diversity and systematics
- The diverse microbial interactions
- The appropriate applications of microbes in industry

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Prioritize the about microbial biodiversity and systematics	K3
CO2	Categorize microbial growth and physiology	K3, K4
CO3	To analyze microbial interactions and infections	K3, K4
CO4	Design the role of microorganisms in diverse environment	K4, K5
CO5	Evaluate the applications of microbes in food processing technology	K4, K5

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	M	S
CO4	S	M	S	S	S
CO5	S	M	S	S	M

S Strong M Medium L Low

193BT2A1CC	MICROBIOLOGY	SEMESTER I

Total Credits: 4

Total Instruction Hours: 48 h

Syllabus

Unit I Microbial Diversity 8 h

Microbial Diversity: Concepts of species and hierarchical taxa – Bacterial nomenclature – Bergey"s system of classification: Family Enterobacteriaceae, Pseudomonadaceae, Bacillaceae, Chlamydiaceae, Flavobacteriaceae – Classification of Viruses and Fungi – Polyphasic taxonomy

Unit II Microbial Growth and Physiology 10 h

Ultrastructure of Archaea (Methanococcus); Eubacteria (E.coli); Unicellular Eukaryotes (Yeast) and viruses (Bacterial, Plant, Animal and Tumor viruses); Microbial growth: Batch, fed-batch, continuous, methods of growth estimation, stringent response, death of a bacterial cell. Microbial physiology: Physiological adoption and life style of Prokaryotes, Unicellular Eukaryotes

Unit III Microbial Interactions and Infection 10 h

Host–Pathogen interactions; Microbes infecting humans – Urinary tract infection, Sexually transmissible infection, Oral cavity and respiratory infection, Nosocomial infection. Diseases caused by Viruses: Chicken pox, Rabies virus, hepatitis, Dengue.

Case study: Emerging Diseases (Swine flu, Chikun gunya, Ebola)

Unit IV Microbes and Environment 10 h

Role of microorganisms in natural system and artificial system; Influence of Microbes on the Earth's Environment and Inhabitants; Ecological impacts of microbes; Symbiosis (Nitrogen fixation and ruminant symbiosis); Microbes and Nutrient cycles

Unit V Microbes in Food Processing 10 h

Fermented foods and beverages - Microbes and their use in pickling, producing colours and flavours, alcoholic beverages and other products; Process wastes-whey, molasses, starch substrates and other food wastes for bioconversion to useful products

Text Books

1 Pelczar MJ Jr., Chan ECS and Kreig NR., 1993, Microbiology, 5th Edition, Tata McGraw Hill, New Delhi

2 Maloy SR, Cronan JE Jr., and Freifelder D, 2006. Microbial Genetics, 3rd edition, Jones Bartlett Publishers, Sudbury, Massachusetts, USA

References

1 Casida, L.E. 1997. Industrial Microbiology. 6th edition. New Age International Publishers, India

2 Davies, J.E. and Demain, A.L., 2009, Manual of Industrial Microbiology and Biotechnology, 4th edition, ASM Publisher, USA

3 Vidhyasekaran , P., 2008, Fungal pathogenesis in plants and crops: molecular biology and host defense mechanisms, 2nd edition, CRC Press, USA

4 Presscott, L. M. Harley, J. P. and Klein, D. A. 1999. Microbiology, 4th edition, WCB Mc Graw-Hill, India

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BoS- 11th	AC - 11th	GB - 15th
17.05.2021	09.08.2021	17.08.2021

Course Code	Course Name	Category	L	T	P	Credit
203BT2A1CD	BIODIVERSITY & BIOPROSPECTING	CORE	4	-	-	4

PREAMBLE

This course has been designed for students to learn and understand

- The importance of biodiversity and various methods of conservation
- The Bioprospecting potentials of available natural resources
- The regulations related with biodiversity and bioprospecting

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Articulate the types of biodiversity, the threats to the biodiversity and Biodiversity hotspots	K3
CO2	Illustrate the management strategies for biodiversity and biodiversity mapping	K3
CO3	Infer the sustainable utilization of resources and benefit sharing	K3, K4
CO4	Report the screening process of various bioactive substances	K4,K5
CO5	Formulate regulations and laws for biodiversity	K4, K5

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	M	M	M
CO2	S	S	M	M	M
CO3	S	S	S	S	S
CO4	S	S	S	S	S
CO5	S	S	S	S	S

S Strong M Medium L Low

203BT2A1CD	BIODIVERSITY & BIOPROSPECTING	SEMESTER I

Total Credits: 4

Total Instruction Hours: 48 h

Syllabus

Unit I Biodiversity- Overview and Acts 10 h

Biodiversity- Facts about global & Indian biodiversity- Hot spots of Indian Biodiversity- Types of Biodiversity- Measures of Biodiversity(alpha, beta & gamma)-Threats to Biodiversity, Endemic, threatened, Red List of IUCN- National biodiversity strategy and action plan(Initiatives to conservation (international & national)- Organization involved in Biodiversity conservation and research(NBA,BSI,ZSI etc)- The biological diversity act 2002

Unit II Biodiversity Management 08 h

BMC-Biodiversity Management Committee (Roles & Responsibility,Functions) – Operationalisation of BMC- People's Biodiversity Registers- SBB- State Biodiversity Boards roles and responsibilities- Biodiversity informatics(Global &Indian perspectives)-Biodiversity mapping (History, techniques & uses)

Unit III Bioprospecting Overview & Products 10 h

Bioprospecting-Methods- Major areas- sustainable utilization of bio resource practices-types- Challenges- Access and Benefit sharing policies – INBio&Merck agreement- Kani tribes benefit sharing model-Economically valuable Products from plant, animals and other bioresources- Bio piracy issues

Unit IV Methods of screening for bioprospecting 10 h

Screening for different bioactivity- Antimicrobial activity- Enzymes- Plant growth promoting Activity- Antifouling & biofilm activity- anti cancer activity- Anti diabetic activity. High throughput screening- Drug discovery and development.

Unit V Bioprospecting Regulations 10 h

Regulations on bio-prospecting, access and benefit-sharing (National Environmental Management: Biodiversity act, 2004)- Bioprospecting case studies – Regulatory innovations for bioprospecting in India- Regulation of Bio-Prospecting and Related Intellectual Property Rights in India

Text Books

1 Bull, A.T., 2004, Microbial Diversity and Bioprospecting, 1st edition, ASM Press, USA

2 Jeffries, M.J., 2006, Biodiversity and Conservation, 2nd edition, Routledge, USA.

References

1 Jeffries, M.J., 2006, Biodiversity and Conservation, 2nd edition, Routledge, USA

2 Vanesha, S., 2010, Marine Bioprospecting and Natural Product Research, 1st edition, LAP Lambert Academic Publishing, Germany

3 Dubey, K.N. and Yadav, G.P., 2011, Biodiversity - Threats to Conservation, Axis Publication, 1st edition, Axis Publication, India.

4 Krishanmurthy, K.V. , 2018, An Advanced Textbook on Biodiversity, 1st edition, Oxford and IBH Publishing Co Pvt Ltd., India

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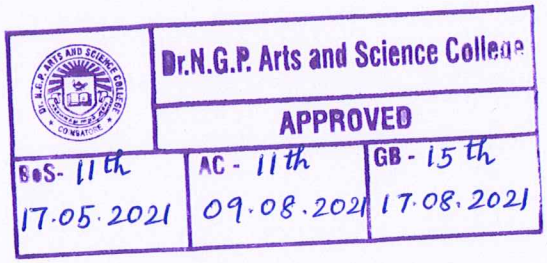
BoS- 11th	AC - 11th	GB - 15th
17.05.2021	09.08.2021	17.08.2021

193BT2A1CP	CORE PRACTICAL : MOLECULAR BIOLOGY, GENETICS AND BIOCHEMISTRY	SEMESTER I

Total Credits: 2
Total Instructions Hours: 60 h

S.No	List of Experiments
1	Isolation of genomic DNA from human blood sample
2	Bacterial conjugation
3	Bacterial Transformation
4	Molecular analysis using RAPD
5	RFLP analysis
6	Estimation of total Protein and albumin from serum
7	Estimation of glucose from serum
8	Estimation of Vitamin C from Citrus fruits
9	Estimation of total amino acids from serum
10	Estimation of DNA & RNA
11	Determination of blood cholesterol
12	Separation of amino acids from serum Paper Chromatography

Note: Out of the above 12 any 10 experiments will be carried out



References

1 Sambrook, J. and Green, M.R., 2012, Molecular Cloning: A Laboratory Manual, 4th edition, Cold Spring Harbor, USA

2 Mertens, T.R., and Hammersmith, R.L., 1997, Genetics Laboratory Investigations, 11th edition, Benjamin Cummings, USA

3 Sadasivam, S. and Manickam, A, 1996, Biochemical Methods, 4th edition, New Age International, India

4 Varghese, N., 2014, Microbiology Laboratory Manual, 1st edition, Aromatic and Medicinal Plant Research Station, India

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BoS- 11th	AC - 11th	GB - 15th
17.05.2021	09.08.2021	17.08.2021

203BT2A1CQ	CORE PRACTICAL: MICROBIOLOGY, BIODIVERSITY & BIOPROSPECTING	SEMESTER I

Total Credits: 2
Total Instructions Hours: 60 h

S.No	List of Experiments
1	Isolation of enzyme producing Bacteria from soil
2	Isolation of Fungi from spoiled food
3	Isolation of Antibiotic producing microorganisms against given pathogen
4	Observation of Bacterial growth rate
5	UV mutagenesis
6	Morphological Analysis of Microbes using stereomicroscope
7	Observation of fungal morphology using Phase contrast microscopy
8	Synthesis of agar using algal species
9	Phytochemical Analysis of same plant species grown in different geographic locations
10	Learning dissection and anatomy of marine species obtained from different water bodies (fish, oyster, crab)
11	To identify and classify 5 different types of pollen and note the observation under stereomicroscope
12	To run column chromatography of a single phytochemical (alkaloid, flavonoid, tannin) obtained from different sources (fruits, vegetables, leaves etc)

Note: Out of the above 12 experiments, any 10 will be carried out.

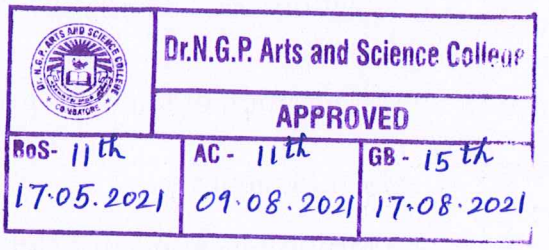
References

1 Sambrook, J. and Green, M.R., 2012, Molecular Cloning: A Laboratory Manual, 4th edition, Cold Spring Harbor, USA.

2 Mertens, T.R. and Hammersmith, R.L., 1997, Genetics Laboratory Investigations, 11th edition, Benjamin Cummings, USA.

3 Sadasivam, S. and Manickam, A. 1996. Biochemical Methods, 4th edition, New Age International, India.

4 Shagufta, A., 2008, Fish Anatomy, 1st edition, Aph Publishing Corporation, India



Course Code	Course Name	Category	L	T	P	Credit
203BT2A1DA	FORENSIC BIOTECHNOLOGY	DSE	3	1	-	3

PREAMBLE

This course has been designed for students to learn and understand

- Recent developments and emerging trends in Forensic Medicine
- Issues pertaining to medical ethics and legal regulations
- Interpret investigative reports for medico-legal purposes

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Distinguish the concepts of Forensic Serology and examine Forensic samples	K3
CO2	Estimate serogenetic markers and its significance in Forensic Science	K3, K4
CO3	Score the forensic evidence of DNA typing	K3, K4
CO4	Hypothesize the different methods of DNA profiling	K4, K5
CO5	Formulate data from DNA fingerprints and store	K4, K5

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	S	M
CO2	S	S	S	M	M
CO3	S	S	S	S	S
CO4	S	S	S	S	S
CO5	M	S	S	S	M

S Strong M Medium L Low

203BT2A1DA	FORENSIC BIOTECHNOLOGY	SEMESTER I

Total Credits: 3

Total Instruction Hours: 48 h

Syllabus

Unit I Forensic Serology 08 h

Nature of Blood, Blood Stain Pattern – Interpretation and Significance, Age of Blood Stains, Collection and Preservation of Blood, Semen, Saliva, Urine, Faeces and Milk Samples, Identification of Biological Stains by Chemical, Biochemical, Crystal-Chromatographic and Spectroscopic Methods.

Unit II Serogenetic Markers 10 h

Introduction of Blood Groups – Biochemistry and Genetics of ABO, MN and Rh systems, Serum proteins: Hp -Transferrin, LDH, Cellular Proteins: PGM, ADA, G6PD, Haemoglobin Variants: Hbf, Hbs, Hbc, HbA, Determination of Sex and Race from Blood, White Blood Group System – HLA and its Forensic Significance.

Unit III DNA Isolation from Specimen 10 h

Collection and Preservation of physical evidence for DNA typing, Forensic DNA Analysis- Isolation of DNA, Determination of quality and quantity of DNA, Slab Gel & Capillary Electrophoresis, DNA detection, Fluorescent dyes and silver staining

Unit IV DNA Typing 11 h

RFLP analysis, PCR amplification - Sequence polymorphism (HLA DQA1, Polymarker Amplitype PM6, Mitochondrial DNA), Length polymorphism (STRs, Gender identification, D1S80), Instrumentation for STR typing, STR Genotyping, Automated analysis system, DNA Barcoding, Applications of DNA profiling, Legal standards for admissibility of DNA profiling

Unit V Interpretation of DNA Typing Results 09 h

Determination of genetic concordance, Evaluation of results- Bayes theorem, Hardy Weinberg law, Frequency estimate calculations- Population sub structure-Likelihood rations.

Text Books

1 Saferstein, R. E, 2020, Forensic Science Handbook, (2nd edition, Prentice Hall, India.

2 Jamieson, A. and Bader, S. A., 2016, A Guide to Forensic DNA Profiling, 10th edition, John Wiley & Sons, UK.

References

1 Butler, J. M., 2005, Forensic DNA Typing - Biology, Technology, and Genetics of STR Markers, 2nd edition, Academic Press, USA.

2 Butler, J. M . , 2009, Fundamentals of Forensic DNA Typing, 1st edition, Academic Press, USA.

3 James, S. H and Author,W.E.G., 1993, Interpretation of blood stain evidence at Crime scenes, 2nd edition, CRC Press, USA.

4 Tilstone, W. J., Savage, K.A. and Clark, L.A., 2006, Forensic Science: An Encyclopedia of History, Methods and Techniques, 1st edition, Abc – Clinio Inc., USA

Course Code	Course Name	Category	L	T	P	Credit
193MB2A1DA	MICROBIAL NANOTECHNOLOGY	DSE	3	1	-	3

PREAMBLE

This course has been designed for students to learn and understand

- The role of microbes and other eukaryotes in the synthesis of nanoparticles
- Advanced methods of synthesis and designing of nano particles
- The potential applications of nano particles/ materials in a variety of areas.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Apply the basics of Nanosciences, able to differentiate particles at macro, micro and nano level	K2, K3
CO2	Know how to synthesize nanoparticles on a laboratory scale	K3
CO3	Understand the characterization techniques involved in nanotechnology	K3
CO4	Explore the interdisciplinary applications of nanotechnology	K2, K3
CO5	Learn the positive and negative aspects of nanotechnology and its present status in India	K2

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	S
CO2	S	M	M	M	M
CO3	M	M	M	M	M
CO4	M	M	M	M	M
CO5	M	M	M	M	M

S Strong M Medium L Low

193MB2A1DA	MICROBIAL NANOTECHNOLOGY	SEMESTER I

Total Credits: 3

Total Instruction Hours: 48 h

Syllabus

Unit I Introduction to Bionanotechnology 8 h

History – concept and future prospects – application in Life Sciences. Terminologies – nanotechnology, bionanotechnology, nanobiomaterials, biocompatibility, nanomedicine, nano tube, nanowires, quantum Dots, nanocomposite, nanoparticles, nanosensors. Emergnece of Bionanotechnology.

Unit II Synthesis of nanoparticles 10 h

Molecular nanotechnology – nanomachines – collagen. Applications of nanoparticles – cancer therapy – nanoparticles in manipulation of biomolecules and cells. Cytoskeleton and cell organelles. Types of nanoparticles production – physical, chemical and biological. Microbial synthesis of nanoparticles - bacteria, fungi and yeast – principle and mechanism of synthesis.

Unit III Types of nanoparticles and methods of characterization 10 h

Types of Nanoparticles – Silver, Gold and Titanium. Physical and chemical properties of nanoparticles. Characterization– UV-Vis spectroscopy, particle size analyzer, Electron Microscopy – HRTEM, SEM, AFM, EDS, XRD. Other tools and techniques required for bionanotechnology: X- Ray crystallography, NMR, rDNA technology, site directed mutagenesis, fusion proteins.

Unit IV Applications of Bionanotechnology 10 h

Drug and gene delivery – protein and nanoparticle mediated. Nanoparticles in drug targeting, MRI, DNA and Protein Microarrays. Nanotechnology in health sectors - Development of green chemistry – commercial viability of nanoparticles. Nanomedicines, Antibacterial activities of nanoparticles. Nanotechnology in agriculture. Toxicology in nanoparticles – Dosimetry. Advantages of nanoparticles – drug targeting, protein detection, MRI

Unit V Merits and demerits of Nanoparticles 10 h

Health and safety implications from Nanoparticles: Health issues – Environmental issues – Need for regulation – Societal implications - Possible military applications – Potential benefits and risks for developing countries – Intellectual property issues. Bioinformatics: molecular modeling, docking, computer assisted molecular design.

Text Books

1 Parthasarathy BK, 2007, "Introduction to Nanotechnology", Isha Publication, India

2 Elisabeth Papazoglou, Aravind Parthasarathy, 2007, "Bionanotechnology", 1st Edition, Morgan and Claypool Publishers, United States

References

1 Bernd Rehm, 2006, "Microbial Bionanotechnology: Biological Self-assembly Systems and Biopolymer-based Nanostructures", 1st Edition, Taylor & Francis Publishers, Oxfordshire, United Kingdom

2 David E Reisner, Joseph D Bronzino, 2019, "Bionanotechnology: Global Prospects", 1st Edition, CRC Press, Florida, United States

3 Ehud Gazit, 2006, "Plenty of Room for Biology at the Bottom: An Introduction to Bionanotechnology", 2nd Edition, Imperial College Press, London, United Kingdom

4 Mick Wilson , Kamali Kannangara , Geoff Smith , Michelle Simmons , Burkhard Raguse, 2005, "Nanotechnology: Basic science and Emerging Technologies", 1st Edition, Chapman and Hall / CRC, United Kingdom

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BoS- 11th	AC - 11th	GB - 15th
17.05.2021	09.08.2021	17.08.2021

Course Code	Course Name	Category	L	T	P	Credit
193BC2A1DA	CANCER BIOLOGY, DIAGNOSIS AND THERAPY	DSE	3	1	-	3

PREAMBLE

This course has been designed for students to learn and understand

- an overview of cancer, mutations causing cancer, and repair mechanisms.
- the basic principles of cancer development and available therapeutic options.
- the different diagnostic and treatment methods for cancer.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Compare and contrast benign and malignant tumors and the morphological characteristics of cancer cells.	K4 &K5
CO2	Justify the molecular basis of cancer. Distinguish interdisciplinary areas in cancer biology.	K4, K5 & K6
CO3	Evaluate the molecular mechanism of oncogenesis, tumor biology and the role of cell cycle in cancer.	K4, K5 & K6
CO4	Validate the role of tumor suppressor genes and apoptosis. Explain about epigenetics.	K5 & K6
CO5	Summarize on the choice of diagnosis and therapy available for cancer patients.	K5 & K6

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	M	S	S
CO2	S	S	M	S	S
CO3	S	S	S	S	S
CO4	S	S	M	S	S
CO5	S	S	S	S	S

S Strong **M** Medium **L** Low

193BC2A1DA	CANCER BIOLOGY, DIAGNOSIS AND THERAPY	SEMESTER I

Total Credits: 3

Total Instruction Hours: 48 h

Syllabus

Unit I Introduction 9 h

Introduction: Cancer cell-morphology and growth characteristics. Types of growth-hyperplasia, dysplasia, anaplasia and neoplasia. Types and prevalence of cancer. Nomenclature of neoplasms, classification based on origin/organ. Differences between benign and malignant tumors.

Unit II Carcinogenesis 9 h

Cancer epidemiology. Cancer endocrinology. Cancer causing agents-radiation, viruses, chemicals. Multistep carcinogenesis: Initiation, Promotion, Progression. Para-neoplastic syndromes. Mutation- definition, significance, rates and frequency. Mutagenic agents. Molecular basis of mutagenesis, induced and spontaneous mutations, crossing over and segregation. Various types of mutations- addition, deletion, inversion, reciprocal, translocation, insertional translocation and frame-shift mutations. Chemical carcinogenesis- genetic and epigenetic carcinogens, pro-carcinogens and co-carcinogens, promoters and initiators, testing for carcinogenecity, Ames test. Cancer biology and biochemistry-aberrant metabolism during cancer development.

Unit III Tumor Markers and Signal Transduction 10 h

Oncogenes- RNA and DNA tumor viruses, retroviruses and viral oncogenes. Src and Ras gene, mechanism and characteristic of cell transformation. Molecular mechanism of oncogenesis- protooncogenesis, oncogene, oncoproteins, tumour suppressor genes involved in cancer. Tumormarkers; cellular proto-oncogenes-oncogene activation. Radiation- effect of ionising radiations on DNA, chromosomal aberrations. Genetic basis of cancer, metastasis, use of tumor markers in detection and monitoring of cancer. Signal transduction in cancer: cell-cell interactions, celladhesion-invasion and metastasis - VEGF signaling and angiogenesis; role of transcription factors. Growth factors-EGF, TNF-α and TGF-β and growth factor receptors. Free radicals and antioxidants in cancer. Diet and cancer.

Unit IV Cell Cycle, Cell Death and Cancer 10 h

Cell Cycle Regulation cancer: control of the cell cycle-cyclins and CDKs, and tumor suppressor genes p53, p21 Rb, BRAC1 and BRAC2. Telomeres, and Immortality; Epigenetics- role of DNA methylation in gene silencing- epigenetic silencing of tumor-suppressor genes. Death-signaling pathways-mitochondrial and death receptor pathways, apoptosis and cancer (Intrinsic and extrinsic pathways). Mechanism of apoptosis. Impact of apoptosis on oncogenesis. Principles and methods of cancer diagnosis-biochemical, genetic, cytotoxic, cell growth and viability tests.

Unit V Cancer Diagnosis and Cancer Therapy, Stem Cells and Cancer 10 h

Diagnosis of cancer by histo-pathology, MRI scan, PET-scan, cytogenetics test, kariotype, FISH. Strategies of anticancer drug therapy–chemotherapy, gene therapy, immuno-therapy, radiotherapy and surgical therapy. Principles of cancer biomarkers and their applications. Stem Cells and Cancer.

Text Books

1. McKinnell R.G et al, 2012,"The Biological Basis of Cancer", 2ndedition, Cambridge University Press, London.
2. WeinbergR.A, 2014,"The Biology of Cancer", 2nd edition, Garland Science, New York &London

References

1. Vincent T.DeVita M.D et al, 2020,"Principles and Practice of Oncology: Primer of Molecular Biology in Cancer ",3rd edition, Lippincott Williams and Wilkins, Philadelphia
2. Pelengaris S and Khan M, 2010, "The Molecular Biology of Cancer - A bridge from bench to bedside", 2nd edition; Wiley Blackwell, London
3. Hesketh R, 2013, "Introduction to Cancer Biology", 1st edition, Cambridge University Press, London.
4. Pezzella F et al, 2019,"Oxford textbook of Cancer Biology", 1st edition, Oxford University Press, London

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BoS- 11th 17.05.2021 | AC - 11th 09.08.2021 | GB - 15th 17.08.2021

Course Code	Course Name	Category	L	T	P	Credit
193BT2A1CA	MOLECULAR BIOLOGY & GENETICS	CORE	4	-	-	4

PREAMBLE

This course has been designed for students to learn and understand

- The Basic components of Cell
- At length the functions of Cells and its organelles
- The concept of gene expression and its regulation

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Appraise the mode of DNA replication and repair mechanisms	K3
CO2	Formulate transcriptional events and its role in gene regulation	K3
CO3	Infer translational events and its role in gene expression & protein targeting	K3
CO4	Integrate the human genetics and various genetic disorders	K4,K5
CO5	Generalize the inheritance pattern and population genetics	K4,K5

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	M	M	S
CO2	S	M	S	M	S
CO3	S	M	S	S	S
CO4	S	S	S	S	S
CO5	S	S	S	S	S

S Strong M Medium L Low

193BT2A1CA	MOLECULAR BIOLOGY AND GENETICS	SEMESTER I

Total Credits: 4

Total Instruction Hours: 48 h

Syllabus

Unit I DNA Replication 9 h

Over view of Central dogma & Experimental proof for Semiconservative method*. Enzymes & accessory proteins involved in DNA replication. Replication process in prokaryotic & Eukaryotic DNA. Regulations of Eukaryotic replication. Differences between Prokaryotic and eukaryotic replication. Other Replication models – Theta and Rolling circle model. DNA Repair mechanism- Nucleotide excision, Base excision, Mismatch repair, Photo-reactivation, SOS and recombination repair. Recombination: Homologous and site-specific recombination.

Unit II Transcription 10 h

Importance of DNA binding Proteins, RNA polymerase. Mechanism of Transcription in prokaryotes & Eukaryotes. Transcriptional Regulation-Regulatory elements and mechanisms of transcription regulation, Transcriptional and post-transcriptional gene silencing. Modifications in RNA- 5′ cap formation, transcription, 3′-end processing and polyadenylation, splicing, RNA Editing, Nuclear export of mRNA. r-RNA & t- RNA processing.

Unit III Translation 10 h

Overview of Genetic code, codon and anticodon concepts, wobble hypothesis*. The translation machinery, role of t RNA & ribosome. Mechanism of translation in Prokaryotes & Eukaryotes. Post translational modifications of proteins-Phosphorylation, Deformylation, Glycosylation, Acetylation, Amidation, Lipid attachment, S - Nitrosylation and Disulfide bond formation. Translation Regulation-Translational inhibitors, Control of gene expression at translational level. Protein targeting- Synthesis of Secretory and membrane proteins, import into nucleus, mitochondria and chloroplast.

Unit IV Mendelism and Non Mendelism 10 h

Overview on mendelian and non-mendelian inheritance.*

Human Genetics- Introduction to Human Genetics. Chromosomal changes resulting in abnormal phenotype: Numerical (Aneuploidy) changes resulting in genetic syndromes eg: Turner, Down & Klinefelter Syndromes. Structural changes resulting in genetic diseases: eg: Cri-du-chat syndrome.

Genetic Diseases and Inheritance Pattern: Autosomal inheritance – Dominant (Eg: Adult polycystic kidney, Achondroplasia); Autosomal inheritance – Recessive (Eg: Albinism, Sickle Cell Anemia, Phenyl Ketonuria); X-linked: Recessive (Eg: Duchenne muscular dystrophy – DMD); X-linked: Dominant (eg.Xg blood group); Y-linked inheritance (Holandric – eg. Testes determining factor); Mitochondria disorders like LHON, DAD, MERRF and MELAS. Cancer genetics.

Unit V Analysis of interitance pattern 9 h

Pedigree analysis; Diagnosis of disease: Molecular cytogenetics, DNA markers - VNTR, STR, microsatellite, SNP and their detection techniques - RFLP genotyping, RAPD, AFLP. Prevention of disease: Prenatal diagnosis; Genetic counseling. Population genetics: Organization and measure of genetic variation: Random mating population, Hardy-Weinberg principle. Sources responsible for changes in gene frequencies: Mutation, selection, migration and isolation; random genetic drift; insights into human migration, natural selection and evolution.

Note: * Self Study

Text Books

1. *Lodish, H. & Baltimore. D.* 1994. **Molecular cell Biology**. 2nd edition. American Scientific Books.
2. *Gardner, E.J.* 1991. **Principles of Genetics**. 8th edition. John Wiley and Sons Inc, New York.

References

1. *Freifelder, D. and Malacinski, G. M.* 1996. **Essential of Molecular Biology**, 2nd edition. Panima Publishing Co., New Delhi.
2. *Strickberger, M. W.* 2013. **Genetics.** 3rd edition. Prentice Hall College Division, New Delhi
3. *Lewin, B.* 2004. **Genes V.** Oxford University press.

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BoS- 11th	AC - 11th	GB - 15th
17.05.2021	09.08.2021	17.08.2021

Course Code	Course Name	Category	L	T	P	Credit
193BT2A1CB	BIOCHEMISTRY	CORE	4	-	-	4

PREAMBLE

This course has been designed for students to learn and understand

- The Structure of Biomolecules
- The function and pathogenesis of the biomolecules
- The metabolism and their regulatory pathways.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Experiment the physical properties, Classification, metabolism and disorders of carbohydrates	K3
CO2	Interpret the concepts of structure and function, metabolism and disorders of lipid and fatty acid	K3, K4
CO3	Summarize the biosynthesis of amino acids and disorders related to amino acids	K3, K4
CO4	Integrate the mechanism, kinetics and inhibition of enzymes and coenzymes	K4, K5
CO5	Appraise the regulatory mechanism of different metabolic activities and their disorders of nucleic acid	K3, K4, K5

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	S
CO2	S	S	S	M	S
CO3	S	S	S	S	S
CO4	S	S	S	S	S
CO5	S	S	S	S	S

S Strong M Medium L Low

193BT2A1CB	BIOCHEMISTRY	SEMESTER I

Total Credits: 4

Total Instruction Hours: 48 h

Syllabus

Unit I Carbohydartes 08 h

*Classification and reactions: occurrence, properties and biological reactions. Structural features of carbohydrates, Glycolysis and TCA cycle; Glycogen breakdown and synthesis; Gluconeogenesis; interconversion of hexoses and pentoses. Carbohydrate metabolic disorders. Glycogen storage diseases. Lectins – characteristics and functions in biological system

Unit II Lipids 10 h

*Classification, Structure, functions and reactions of Lipids, Biosynthesis of fatty acids, Triglycerides, phospholipids and Sterols, Catabolism of Fatty acids - Oxidation(α, β and ω), Catabolism of triglycerides and phospholipids, Essential fattyacids and their physiological functions. Disorders associated with lipid metabolism and its therapeutic intervention - ketone bodies and ketosis; fatty liver, atherosclerosis.

Unit III Amino Acids 10 h

*Classification and Biosynthesis. Peptides, Classification of Protein, Primary structure of proteins, structural comparison at secondary and tertiary levels (Ramachandran Plot), quaternary and domain structure and architecture. Regulation of Protein metabolism. Protein metabolism in prolonged fasting. Disease related to protein folding – Alzheimer's and mad cow disease

Unit IV Enzymes and coenzymes 08 h

IUBMB classification of enzymes, active site, *Lock and key Model and induced fit hypothesis. Factors affecting enzyme activity, Mechanism of enzyme catalysis: Lysozyme, Enzyme kinetics- Michaelis – Menten (MM) equations, Transformations of MM equation and their significance, Enzyme inhibition: Reversible – Competitive, Noncompetitive, Uncompetitive, Irreversible inhibition, Kinetics of Enzyme inhibition. Isoenzymes, allosteric enzymes, ribozymes, abzymes and artificial enzymes. Diseases Caused By Deficiency Of Digestive Enzymes-Obesity, Galactosemia,Maple Syrup Urine Disease

Unit V Nucleic Acids 12 h

*Classification, structure, functions and reactions of nucleic acids, Conformation of

Nucleic acids: Structural characteristics of A, B and Z-DNA. 3D structure of t-RNA, ribozymes and riboswitches. Biosynthesis of Nucleotides –De nova and Salvage pathway, Regulations of Purines and Pyrimidine, Metabolism of Purine and Pyrimidine. Disorders of nucleic acids metabolism- Gout, Lesch-Nyhan syndrome, oroticaciduria, and xanthinuria.

(Note: * Self Study)

Text Books

1 Lehninger, A.L. and Cox, M.M., 2008, Principles of Biochemistry, 5th Edition. W H Freeman & Co, UK.

2 Murray, R.K., Granner,D.K., Mayes, P.A., Rodwell.V.W., 2006, Harper's Illustrated Biochemistry, 26th Edition, McGraw-Hill Medical Publishing Division, India.

References

1 Zubay, G.L., 1998, Biochemistry, 4th Edition, Brown (William C.) Co, U.S.A.

2 Voet, D. and Voet, J.G., Pratt, C.W., 1999, Fundamentals of Biochemistry, Wiley & sons Publication, USA.

3 Berg, J. M. Stryer, L., Tymoczko, J.L. and Gatto, G,.J., 2015. Biochemistry, 8th edition. Palgrave Macmillan Publications, India

4 Rastogi, C.S., 2003, Biochemistry, 3rd edition, Tata McGraw Hill Publication, India.

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BoS- 11th 17.05.2021 | AC - 11th 09.08.2021 | GB - 15th 17.08.2021

Course Code	Course Name	Category	L	T	P	Credit
193BT2A1CC	MICROBIOLOGY	CORE	4	-	-	4

PREAMBLE

This course has been designed for students to learn and understand

- The microbial diversity and systematics
- The diverse microbial interactions
- The appropriate applications of microbes in industry

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Prioritize the about microbial biodiversity and systematics	K3
CO2	Categorize microbial growth and physiology	K3, K4
CO3	To analyze microbial interactions and infections	K3, K4
CO4	Design the role of microorganisms in diverse environment	K4, K5
CO5	Evaluate the applications of microbes in food processing technology	K4, K5

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	M	S
CO4	S	M	S	S	S
CO5	S	M	S	S	M

S Strong M Medium L Low

193BT2A1CC	MICROBIOLOGY	SEMESTER I

Total Credits: 4

Total Instruction Hours: 48 h

Syllabus

Unit I Microbial Diversity 8 h

Microbial Diversity: Concepts of species and hierarchical taxa – Bacterial nomenclature – Bergey"s system of classification: Family Enterobacteriaceae, Pseudomonadaceae, Bacillaceae, Chlamydiaceae, Flavobacteriaceae – Classification of Viruses and Fungi – Polyphasic taxonomy

Unit II Microbial Growth and Physiology 10 h

Ultrastructure of Archaea (Methanococcus); Eubacteria (E.coli); Unicellular Eukaryotes (Yeast) and viruses (Bacterial, Plant, Animal and Tumor viruses); Microbial growth: Batch, fed-batch, continuous, methods of growth estimation, stringent response, death of a bacterial cell. Microbial physiology: Physiological adoption and life style of Prokaryotes, Unicellular Eukaryotes

Unit III Microbial Interactions and Infection 10 h

Host–Pathogen interactions; Microbes infecting humans – Urinary tract infection, Sexually transmissible infection, Oral cavity and respiratory infection, Nosocomial infection. Diseases caused by Viruses: Chicken pox, Rabies virus, hepatitis, Dengue.

Case study: Emerging Diseases (Swine flu, Chikun gunya, Ebola)

Unit IV Microbes and Environment 10 h

Role of microorganisms in natural system and artificial system; Influence of Microbes on the Earth's Environment and Inhabitants; Ecological impacts of microbes; Symbiosis (Nitrogen fixation and ruminant symbiosis); Microbes and Nutrient cycles

Unit V Microbes in Food Processing 10 h

Fermented foods and beverages - Microbes and their use in pickling, producing colours and flavours, alcoholic beverages and other products; Process wastes-whey, molasses, starch substrates and other food wastes for bioconversion to useful products

Text Books

1 Pelczar MJ Jr., Chan ECS and Kreig NR., 1993, Microbiology, 5th Edition, Tata McGraw Hill, New Delhi

2 Maloy SR, Cronan JE Jr., and Freifelder D, 2006. Microbial Genetics, 3rd edition, Jones Bartlett Publishers, Sudbury, Massachusetts, USA

References

1 Casida, L.E. 1997. Industrial Microbiology. 6th edition. New Age International Publishers, India

2 Davies, J.E. and Demain, A.L., 2009, Manual of Industrial Microbiology and Biotechnology, 4th edition, ASM Publisher, USA

3 Vidhyasekaran , P., 2008, Fungal pathogenesis in plants and crops: molecular biology and host defense mechanisms, 2nd edition, CRC Press, USA

4 Presscott, L. M. Harley, J. P. and Klein, D. A. 1999. Microbiology, 4th edition, WCB Mc Graw-Hill, India

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BoS- 11th	AC - 11th	GB - 15th
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Course Code	Course Name	Category	L	T	P	Credit
203BT2A1CD	BIODIVERSITY & BIOPROSPECTING	CORE	4	-	-	4

PREAMBLE

This course has been designed for students to learn and understand

- The importance of biodiversity and various methods of conservation
- The Bioprospecting potentials of available natural resources
- The regulations related with biodiversity and bioprospecting

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Articulate the types of biodiversity, the threats to the biodiversity and Biodiversity hotspots	K3
CO2	Illustrate the management strategies for biodiversity and biodiversity mapping	K3
CO3	Infer the sustainable utilization of resources and benefit sharing	K3, K4
CO4	Report the screening process of various bioactive substances	K4,K5
CO5	Formulate regulations and laws for biodiversity	K4, K5

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	M	M	M
CO2	S	S	M	M	M
CO3	S	S	S	S	S
CO4	S	S	S	S	S
CO5	S	S	S	S	S

S Strong M Medium L Low

203BT2A1CD	BIODIVERSITY & BIOPROSPECTING	SEMESTER I

Total Credits: 4

Total Instruction Hours: 48 h

Syllabus

Unit I Biodiversity- Overview and Acts 10 h

Biodiversity- Facts about global & Indian biodiversity- Hot spots of Indian Biodiversity- Types of Biodiversity- Measures of Biodiversity(alpha, beta & gamma)-Threats to Biodiversity, Endemic, threatened, Red List of IUCN- National biodiversity strategy and action plan(Initiatives to conservation (international & national)- Organization involved in Biodiversity conservation and research(NBA,BSI,ZSI etc)- The biological diversity act 2002

Unit II Biodiversity Management 08 h

BMC-Biodiversity Management Committee (Roles & Responsibility,Functions) – Operationalisation of BMC- People's Biodiversity Registers- SBB- State Biodiversity Boards roles and responsibilities- Biodiversity informatics(Global &Indian perspectives)-Biodiversity mapping (History, techniques & uses)

Unit III Bioprospecting Overview & Products 10 h

Bioprospecting-Methods- Major areas- sustainable utilization of bio resource practices-types- Challenges- Access and Benefit sharing policies – INBio&Merck agreement- Kani tribes benefit sharing model-Economically valuable Products from plant, animals and other bioresources- Bio piracy issues

Unit IV Methods of screening for bioprospecting 10 h

Screening for different bioactivity- Antimicrobial activity- Enzymes- Plant growth promoting Activity- Antifouling & biofilm activity- anti cancer activity- Anti diabetic activity. High throughput screening- Drug discovery and development.

Unit V Bioprospecting Regulations 10 h

Regulations on bio-prospecting, access and benefit-sharing (National Environmental Management: Biodiversity act, 2004)- Bioprospecting case studies – Regulatory innovations for bioprospecting in India- Regulation of Bio-Prospecting and Related Intellectual Property Rights in India

Text Books

1 Bull, A.T., 2004, Microbial Diversity and Bioprospecting, 1st edition, ASM Press, USA

2 Jeffries, M.J., 2006, Biodiversity and Conservation, 2nd edition, Routledge, USA.

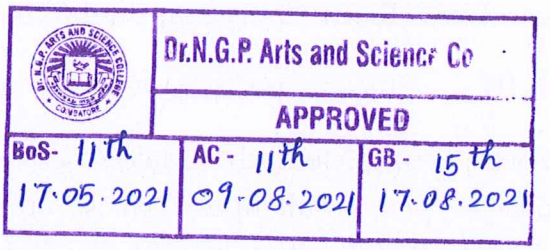
References

1 Jeffries, M.J., 2006, Biodiversity and Conservation, 2nd edition, Routledge, USA

2 Vanesha, S., 2010, Marine Bioprospecting and Natural Product Research, 1st edition, LAP Lambert Academic Publishing, Germany

3 Dubey, K.N. and Yadav, G.P., 2011, Biodiversity - Threats to Conservation, Axis Publication, 1st edition, Axis Publication, India.

4 Krishanmurthy, K.V. , 2018, An Advanced Textbook on Biodiversity, 1st edition, Oxford and IBH Publishing Co Pvt Ltd., India



193BT2A1CP	CORE PRACTICAL : MOLECULAR BIOLOGY, GENETICS AND BIOCHEMISTRY	SEMESTER I

Total Credits: 2
Total Instructions Hours: 60 h

S.No	List of Experiments
1	Isolation of genomic DNA from human blood sample
2	Bacterial conjugation
3	Bacterial Transformation
4	Molecular analysis using RAPD
5	RFLP analysis
6	Estimation of total Protein and albumin from serum
7	Estimation of glucose from serum
8	Estimation of Vitamin C from Citrus fruits
9	Estimation of total amino acids from serum
10	Estimation of DNA & RNA
11	Determination of blood cholesterol
12	Separation of amino acids from serum Paper Chromatography

Note: Out of the above 12 any 10 experiments will be carried out

References

1 Sambrook, J. and Green, M.R., 2012, Molecular Cloning: A Laboratory Manual, 4th edition, Cold Spring Harbor, USA

2 Mertens, T.R., and Hammersmith, R.L., 1997, Genetics Laboratory Investigations, 11th edition, Benjamin Cummings, USA

3 Sadasivam, S. and Manickam, A, 1996, Biochemical Methods, 4th edition, New Age International, India

4 Varghese, N., 2014, Microbiology Laboratory Manual, 1st edition, Aromatic and Medicinal Plant Research Station, India

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BoS- 11th	AC - 11th	GB - 15th
17.05.2021	09.08.2021	17.08.2021

203BT2A1CQ	CORE PRACTICAL: MICROBIOLOGY, BIODIVERSITY & BIOPROSPECTING	SEMESTER I

Total Credits: 2
Total Instructions Hours: 60 h

S.No	List of Experiments
1	Isolation of enzyme producing Bacteria from soil
2	Isolation of Fungi from spoiled food
3	Isolation of Antibiotic producing microorganisms against given pathogen
4	Observation of Bacterial growth rate
5	UV mutagenesis
6	Morphological Analysis of Microbes using stereomicroscope
7	Observation of fungal morphology using Phase contrast microscopy
8	Synthesis of agar using algal species
9	Phytochemical Analysis of same plant species grown in different geographic locations
10	Learning dissection and anatomy of marine species obtained from different water bodies (fish, oyster, crab)
11	To identify and classify 5 different types of pollen and note the observation under stereomicroscope
12	To run column chromatography of a single phytochemical (alkaloid, flavonoid, tannin) obtained from different sources (fruits, vegetables, leaves etc)

Note: Out of the above 12 experiments, any 10 will be carried out.

References

1 Sambrook, J. and Green, M.R., 2012, Molecular Cloning: A Laboratory Manual, 4th edition, Cold Spring Harbor, USA.

2 Mertens, T.R. and Hammersmith, R.L., 1997, Genetics Laboratory Investigations, 11th edition, Benjamin Cummings, USA.

3 Sadasivam, S. and Manickam, A. 1996. Biochemical Methods, 4th edition, New Age International, India.

4 Shagufta, A., 2008, Fish Anatomy, 1st edition, Aph Publishing Corporation, India

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BoS - 11th	AC - 11th	GB - 15th
17.05.2021	09.08.2021	17.08.2021

Course Code	Course Name	Category	L	T	P	Credit
203BT2A1DA	FORENSIC BIOTECHNOLOGY	DSE	3	1	-	3

PREAMBLE

This course has been designed for students to learn and understand

- Recent developments and emerging trends in Forensic Medicine
- Issues pertaining to medical ethics and legal regulations
- Interpret investigative reports for medico-legal purposes

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Distinguish the concepts of Forensic Serology and examine Forensic samples	K3
CO2	Estimate serogenetic markers and its significance in Forensic Science	K3, K4
CO3	Score the forensic evidence of DNA typing	K3, K4
CO4	Hypothesize the different methods of DNA profiling	K4, K5
CO5	Formulate data from DNA fingerprints and store	K4, K5

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	S	M
CO2	S	S	S	M	M
CO3	S	S	S	S	S
CO4	S	S	S	S	S
CO5	M	S	S	S	M

S Strong M Medium L Low

203BT2A1DA	FORENSIC BIOTECHNOLOGY	SEMESTER I

Total Credits: 3

Total Instruction Hours: 48 h

Syllabus

Unit I Forensic Serology 08 h

Nature of Blood, Blood Stain Pattern – Interpretation and Significance, Age of Blood Stains, Collection and Preservation of Blood, Semen, Saliva, Urine, Faeces and Milk Samples, Identification of Biological Stains by Chemical, Biochemical, Crystal-Chromatographic and Spectroscopic Methods.

Unit II Serogenetic Markers 10 h

Introduction of Blood Groups – Biochemistry and Genetics of ABO, MN and Rh systems, Serum proteins: Hp -Transferrin, LDH, Cellular Proteins: PGM, ADA, G6PD, Haemoglobin Variants: Hbf, Hbs, Hbc, HbA, Determination of Sex and Race from Blood, White Blood Group System – HLA and its Forensic Significance.

Unit III DNA Isolation from Specimen 10 h

Collection and Preservation of physical evidence for DNA typing, Forensic DNA Analysis- Isolation of DNA, Determination of quality and quantity of DNA, Slab Gel & Capillary Electrophoresis, DNA detection, Fluorescent dyes and silver staining

Unit IV DNA Typing 11 h

RFLP analysis, PCR amplification - Sequence polymorphism (HLA DQA1, Polymarker Amplitype PM6, Mitochondrial DNA), Length polymorphism (STRs, Gender identification, D1S80), Instrumentation for STR typing, STR Genotyping, Automated analysis system, DNA Barcoding, Applications of DNA profiling, Legal standards for admissibility of DNA profiling

Unit V Interpretation of DNA Typing Results 09 h

Determination of genetic concordance, Evaluation of results- Bayes theorem, Hardy Weinberg law, Frequency estimate calculations- Population sub structure-Likelihood rations.

Text Books

1 Saferstein, R. E, 2020, Forensic Science Handbook, (2nd edition, Prentice Hall, India.

2 Jamieson, A. and Bader, S. A., 2016, A Guide to Forensic DNA Profiling, 10th edition, John Wiley & Sons, UK.

References

1 Butler, J. M., 2005, Forensic DNA Typing - Biology, Technology, and Genetics of STR Markers, 2nd edition, Academic Press, USA.

2 Butler, J. M . , 2009, Fundamentals of Forensic DNA Typing, 1st edition, Academic Press, USA.

3 James, S. H and Author,W.E.G., 1993, Interpretation of blood stain evidence at Crime scenes, 2nd edition, CRC Press, USA.

4 Tilstone, W. J., Savage, K.A. and Clark, L.A., 2006, Forensic Science: An Encyclopedia of History, Methods and Techniques, 1st edition, Abc – Clinio Inc., USA

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Course Code	Course Name	Category	L	T	P	Credit
193MB2A1DA	MICROBIAL NANOTECHNOLOGY	DSE	3	1	-	3

PREAMBLE

This course has been designed for students to learn and understand

- The role of microbes and other eukaryotes in the synthesis of nanoparticles
- Advanced methods of synthesis and designing of nano particles
- The potential applications of nano particles/ materials in a variety of areas.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Apply the basics of Nanosciences, able to differentiate particles at macro, micro and nano level	K2, K3
CO2	Know how to synthesize nanoparticles on a laboratory scale	K3
CO3	Understand the characterization techniques involved in nanotechnology	K3
CO4	Explore the interdisciplinary applications of nanotechnology	K2, K3
CO5	Learn the positive and negative aspects of nanotechnology and its present status in India	K2

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	S
CO2	S	M	M	M	M
CO3	M	M	M	M	M
CO4	M	M	M	M	M
CO5	M	M	M	M	M

S Strong M Medium L Low

193MB2A1DA	MICROBIAL NANOTECHNOLOGY	SEMESTER I

Total Credits: 3

Total Instruction Hours: 48 h

Syllabus

Unit I Introduction to Bionanotechnology 8 h

History – concept and future prospects – application in Life Sciences. Terminologies – nanotechnology, bionanotechnology, nanobiomaterials, biocompatibility, nanomedicine, nano tube, nanowires, quantum Dots, nanocomposite, nanoparticles, nanosensors. Emergnece of Bionanotechnology.

Unit II Synthesis of nanoparticles 10 h

Molecular nanotechnology – nanomachines – collagen. Applications of nanoparticles – cancer therapy – nanoparticles in manipulation of biomolecules and cells. Cytoskeleton and cell organelles. Types of nanoparticles production – physical, chemical and biological. Microbial synthesis of nanoparticles - bacteria, fungi and yeast – principle and mechanism of synthesis.

Unit III Types of nanoparticles and methods of characterization 10 h

Types of Nanoparticles – Silver, Gold and Titanium. Physical and chemical properties of nanoparticles. Characterization– UV-Vis spectroscopy, particle size analyzer, Electron Microscopy – HRTEM, SEM, AFM, EDS, XRD. Other tools and techniques required for bionanotechnology: X- Ray crystallography, NMR, rDNA technology, site directed mutagenesis, fusion proteins.

Unit IV Applications of Bionanotechnology 10 h

Drug and gene delivery – protein and nanoparticle mediated. Nanoparticles in drug targeting, MRI, DNA and Protein Microarrays. Nanotechnology in health sectors - Development of green chemistry – commercial viability of nanoparticles. Nanomedicines, Antibacterial activities of nanoparticles. Nanotechnology in agriculture. Toxicology in nanoparticles – Dosimetry. Advantages of nanoparticles – drug targeting, protein detection, MRI

Unit V Merits and demerits of Nanoparticles 10 h

Health and safety implications from Nanoparticles: Health issues – Environmental issues – Need for regulation – Societal implications - Possible military applications – Potential benefits and risks for developing countries – Intellectual property issues. Bioinformatics: molecular modeling, docking, computer assisted molecular design.

Text Books

1 Parthasarathy BK, 2007, "Introduction to Nanotechnology", Isha Publication, India

2 Elisabeth Papazoglou, Aravind Parthasarathy, 2007, "Bionanotechnology", 1st Edition, Morgan and Claypool Publishers, United States

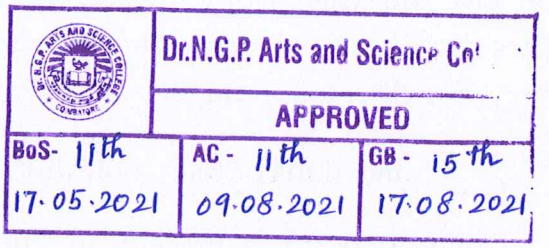
References

1 Bernd Rehm, 2006, "Microbial Bionanotechnology: Biological Self-assembly Systems and Biopolymer-based Nanostructures", 1st Edition, Taylor & Francis Publishers, Oxfordshire, United Kingdom

2 David E Reisner, Joseph D Bronzino, 2019, "Bionanotechnology: Global Prospects", 1st Edition, CRC Press, Florida, United States

3 Ehud Gazit, 2006, "Plenty of Room for Biology at the Bottom: An Introduction to Bionanotechnology", 2nd Edition, Imperial College Press, London, United Kingdom

4 Mick Wilson , Kamali Kannangara , Geoff Smith , Michelle Simmons , Burkhard Raguse, 2005, "Nanotechnology: Basic science and Emerging Technologies", 1st Edition, Chapman and Hall / CRC, United Kingdom



Course Code	Course Name	Category	L	T	P	Credit
193BC2A1DA	CANCER BIOLOGY, DIAGNOSIS AND THERAPY	DSE	3	1	-	3

PREAMBLE

This course has been designed for students to learn and understand

- an overview of cancer, mutations causing cancer, and repair mechanisms.
- the basic principles of cancer development and available therapeutic options.
- the different diagnostic and treatment methods for cancer.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Compare and contrast benign and malignant tumors and the morphological characteristics of cancer cells.	K4 &K5
CO2	Justify the molecular basis of cancer. Distinguish interdisciplinary areas in cancer biology.	K4, K5 & K6
CO3	Evaluate the molecular mechanism of oncogenesis, tumor biology and the role of cell cycle in cancer.	K4, K5 & K6
CO4	Validate the role of tumor suppressor genes and apoptosis. Explain about epigenetics.	K5 & K6
CO5	Summarize on the choice of diagnosis and therapy available for cancer patients.	K5 & K6

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	M	S	S
CO2	S	S	M	S	S
CO3	S	S	S	S	S
CO4	S	S	M	S	S
CO5	S	S	S	S	S

S Strong M Medium L Low

193BC2A1DA	CANCER BIOLOGY, DIAGNOSIS AND THERAPY	SEMESTER I

Total Credits: 3

Total Instruction Hours: 48 h

Syllabus

Unit I Introduction 9 h

Introduction: Cancer cell-morphology and growth characteristics. Types of growth-hyperplasia, dysplasia, anaplasia and neoplasia. Types and prevalence of cancer. Nomenclature of neoplasms, classification based on origin/organ. Differences between benign and malignant tumors.

Unit II Carcinogenesis 9 h

Cancer epidemiology. Cancer endocrinology. Cancer causing agents-radiation, viruses, chemicals. Multistep carcinogenesis: Initiation, Promotion, Progression. Para-neoplastic syndromes. Mutation- definition, significance, rates and frequency. Mutagenic agents. Molecular basis of mutagenesis, induced and spontaneous mutations, crossing over and segregation. Various types of mutations- addition, deletion, inversion, reciprocal, translocation, insertional translocation and frame-shift mutations. Chemical carcinogenesis- genetic and epigenetic carcinogens, pro-carcinogens and co-carcinogens, promoters and initiators, testing for carcinogenecity, Ames test. Cancer biology and biochemistry-aberrant metabolism during cancer development.

Unit III Tumor Markers and Signal Transduction 10 h

Oncogenes- RNA and DNA tumor viruses, retroviruses and viral oncogenes. Src and Ras gene, mechanism and characteristic of cell transformation. Molecular mechanism of oncogenesis- protooncogenesis, oncogene, oncoproteins, tumour suppressor genes involved in cancer. Tumormarkers; cellular proto-oncogenes-oncogene activation. Radiation- effect of ionising radiations on DNA, chromosomal aberrations. Genetic basis of cancer, metastasis, use of tumor markers in detection and monitoring of cancer. Signal transduction in cancer: cell-cell interactions, celladhesion-invasion and metastasis - VEGF signaling and angiogenesis; role of transcription factors. Growth factors-EGF, TNF-α and TGF-β and growth factor receptors. Free radicals and antioxidants in cancer. Diet and cancer.

Unit IV Cell Cycle, Cell Death and Cancer 10 h

Cell Cycle Regulation cancer: control of the cell cycle-cyclins and CDKs, and tumor suppressor genes p53, p21 Rb, BRAC1 and BRAC2. Telomeres, and Immortality; Epigenetics- role of DNA methylation in gene silencing- epigenetic silencing of tumor-suppressor genes. Death-signaling pathways-mitochondrial and death receptor pathways, apoptosis and cancer (Intrinsic and extrinsic pathways). Mechanism of apoptosis. Impact of apoptosis on oncogenesis. Principles and methods of cancer diagnosis-biochemical, genetic, cytotoxic, cell growth and viability tests.

Unit V Cancer Diagnosis and Cancer Therapy, Stem Cells and Cancer 10 h

Diagnosis of cancer by histo-pathology, MRI scan, PET-scan, cytogenetics test, kariotype, FISH. Strategies of anticancer drug therapy-chemotherapy, gene therapy, immuno-therapy, radiotherapy and surgical therapy. Principles of cancer biomarkers and their applications. Stem Cells and Cancer.

Text Books

1. McKinnell R.G et al, 2012,"The Biological Basis of Cancer", 2ndedition, Cambridge University Press, London.
2. WeinbergR.A, 2014,"The Biology of Cancer", 2nd edition, Garland Science, New York &London

References

1. Vincent T.DeVita M.D et al, 2020,"Principles and Practice of Oncology: Primer of Molecular Biology in Cancer ",3rd edition, Lippincott Williams and Wilkins, Philadelphia
2. Pelengaris S and Khan M, 2010, "The Molecular Biology of Cancer - A bridge from bench to bedside", 2nd edition; Wiley Blackwell, London
3. Hesketh R, 2013, "Introduction to Cancer Biology", 1st edition, Cambridge University Press, London.
4. Pezzella F et al, 2019,"Oxford textbook of Cancer Biology", 1st edition, Oxford University Press, London

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Course Code	Course Name	Category	L	T	P	Credit
193BT2A2CA	IMMUNOTECHNOLOGY	CORE	4	-	-	4

PREAMBLE

This course has been designed for students to learn and understand

- the mechanism of immune system.
- various detection methods of antigen-antibody interaction.
- To impart knowledge in vaccine development

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand about basic of immune response.	K3
CO2	Know the antigen – antibody related test.	K3
CO3	Learn about new generation of antibody production techniques.	K3,K4,K5
CO4	Awareness on vaccine immunological types and its role in immune system	K3,K4,K5
CO5	Know about allergic reaction, tumour immunology and its effect on immune system.	K3,K4,K5

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	M	M	M
CO2	S	M	M	S	S
CO3	S	S	S	S	M
CO4	S	S	S	S	S
CO5	S	S	S	S	S

S Strong M Medium L Low

Course Code	Course Category	Course Name	L	T	P	Exam (h)	Max Marks			Credits
							CIA	ESE	Total	
Second Semester										
193BT2A2CA	Core V	Immunotechnology	4	-	-	3	25	75	100	4
193BT2A2CB	Core VI	Genetic Engineering	4	-	-	3	25	75	100	4
193BT2A2CC	Core VII	Bioprocess Technology	4	-	-	3	25	75	100	4
203BT2A2CD	Core VIII	Environmental Biotechnology	4	-	-	3	25	75	100	4
193BT2A2CP	Core Practical-III	Immunotechnology and Bioprocess Technology	-	-	5	6	40	60	100	2
203BT2A2CQ	Core Practical – IV	Genetic Engineering and Environmental biotechnology	-	-	5	6	40	60	100	3
203BT2A2DA	DSE -II	Protein Engineering	3	1		3	25	75	100	3
193MB2A2DA		Medical Laboratory Techniques								
193BC2A2DA		Biochemistry of Toxicology								
Total			**19**	**1**	**10**	-	-	-	**700**	**24**

193BT2A2CA	IMMUNOTECHNOLOGY	SEMESTER II

Total Credits: 4

Total Instruction Hours: 48 h

Syllabus

Unit I Cells and Organs of Immune system 8 h

History and scope of immunology. Types of Immunity: Passive, Active and Acquired immunity. Humoral, Cell Mediated immunity. Cells and organs of immune response and their functions. Antigens - Types, haptens, epitopes and Factors influencing antigenicity. Antibody – Structure, types, properties and functions. Immunoglobin gene rearrangements.

Unit II Antigen Antibody Reactions 10 h

Antigen – Antibody interaction, affinity, cross reactivity, specificity, epitope mapping; Agglutination reactions and Precipitation reactions. Immuno assays – Immuno Diffusion and Immunoelectrophoresis, RIA, ELISA, Western blotting, ELISPOT assay, immunofluorescence, Surface plasmon resonance, Biosensor assays for assessing ligand –receptor interaction.

Unit III New Generation Antibodies 10 h

Antibody engineering; Hybridoma and monoclonal antibody (MCAb) techniques, Production of murine hybridoma, Production of MCAbs in cultures and animal (Ascites), Purification of MCAbs. Characterization of MCAbs/ and Labelling of antibodies. Phage display libraries; Antibodies as in vitro and in vivo probes.

Unit IV Vaccine Technology 10 h

Rationale vaccine design based on clinical requirements: Active immunization, live, killed, attenuated, Sub unit vaccines; Recombinant DNA and protein based vaccines, plant-based vaccines and reverse vaccinology; Peptide vaccines, conjugate vaccines; Passive Immunization; Antibody, Transfusion of immuno- competent cells, Stem cell therapy, Cell based vaccines.

Unit V Hypersensitivity and Transplantation 10 h

Hypersensitivity– Mechanism and Types. Auto immune disorders - Type I diabetes, Rheumatoid arthritis. Tumor immunology: tumor antigens, oncogenes, immune responses, detection of cancers and therapy- chemotherapy and radiation therapy. Transplantation Immunology.

Text Books

1 Rao CV, 2006, "Immunology A Textbook", 2nd Edition, Narosa Publishing House Pvt. Ltd, New Delhi.

2 Khan FH, 2009, "The Element of Immunology" , 1st Edition, Pearson Education, New Delhi

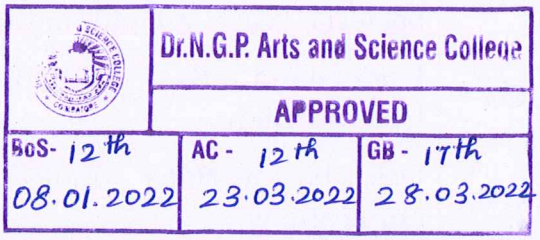
References

1 Kuby J, 1997, "Immunology", 3rd Edition, W.H. Freeman and Company, New York

2 Riot and Ivan, 1988, "Essentials of Immunology", 6th Edition, Blackwell Scientific Publications, London.

3 Hay FC, 2002, "Practical immunology", 4th Edition, Blackwell Scientific Publications, London.

4 Harlow E, 1988, "Antibodies Laboratory Manual", 2nd Edition, Cold Spring Harbor Laboratory Press, United States.



Course Code	Course Name	Category	L	T	P	Credit
193BT2A2CB	GENETIC ENGINEERING	CORE	4	-	-	4

PREAMBLE

This course has been designed for students to learn and understand

- To learn various types of vector host systems
- To learn steps in creating rDNA molecule
- To gain knowledge on various recombinant DNA techniques and their applications

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand the steps in recombinant DNA preparation and labeling	K3, K4
CO2	Explain the features of various types cloning vectors for bacteria, yeast , animals and plants.	K3, K4
CO3	Understand the methods of gene transfer and hybridization	K3, K4
CO4	Describe various molecular techniques and its applications	K4, K5
CO5	Knowing different types of sequencing and gene therapy	K4, K5

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	M
CO2	S	S	S	M	M
CO3	S	S	S	M	S
CO4	S	S	S	S	M
CO5	S	S	S	S	S

S Strong M Medium L Low

193BT2A2CB	GENETIC ENGINEERING	SEMESTER II

Total Credits: 4

Total Instruction Hours: 48 h

Syllabus

Unit I Basics concepts 9 h

Genetic engineering – Overview and scope. Steps involved in recombinant DNA constructions, enzymes involved in genetic engineering, role of linkers, adaptors and Homopolymer tailing. Selectable and Screenable markers. Labeling of DNA - Radioactive and non-radioactive probes.

Unit II Cloning Vectors 10 h

Plasmids –pBR322 and pUC vectors, Bacteriophage vectors - M13 vectors, Lambda vectors (Insertion and Replacement vectors), Phagemids, Cosmids, Yeast vectors, Shuttle vectors, Animal Viral vectors - SV-40, baculo& retroviral vectors, Expression vectors – pMal, GST and pET-based vectors, Plant vectors -Ti and Ri Plasmids

Unit III Cloning Methodologies 10 h

Introduction of cloned genes into cell – transformation, particle bombardment, liposome mediated transfer, electroporation, microinjection and calcium phosphate mediated transfer. Construction of cDNA and genomic libraries. Hybridization techniques - *Northern, Southern and Colony hybridization

Unit IV PCR and Its Applications 9 h

Primer design; Fidelity of thermostable enzymes, *DNA polymerases, PCR and Types – multiplex, nested, reverse transcriptase, real time PCR, touchdown PCR, hot start PCR, colony PCR, cloning of PCR products, PCR in molecular diagnostics, PCR based mutagenesis.

Unit V Gene silencing and Therapy 10 h

DNA sequencing- Chain termination method and NGS. Gene silencing techniques - Introduction to siRNA technology, Micro RNA Principle and application of gene silencing. Gene knockouts and Gene Therapy - Creation of knockout mice, Disease model, Gene targeting. Gene Editing.

Text Books

1 Brown TA, 1998,"Introduction to Gene Cloning", 3rd Edition, Stanley Thornes Publishing Ltd, United Kingdom.

2 Primrose SB, 2003, "Principles of Gene Manipulation", 6th Edition, Blackwell Science Ltd, United States.

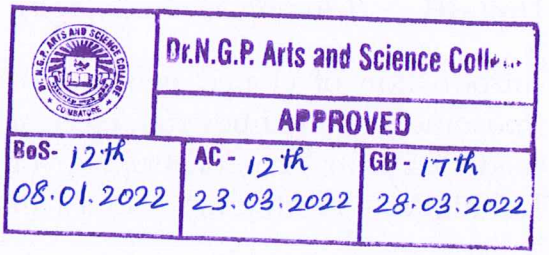
References

1 Bernard Glick R and Jack Pasternak J, 2010, "Molecular Biotechnology: Principles and Applications of Recombinant DNA" 4th Edition, ASM press, United States.

2 Singh BD, 2008, "Text book of Biotechnology", 4th Edition, Kalyani Publishers, New Delhi.

3 Sambrook J and Russel DW, 2001, " Molecular Cloning: A Laboratory Manual", 3rd Edition, CSHL, United States.

4 James Watson D, 2001, "Recombinant DNA technology". 2nd Edition, WH Freeman and company, United Kingdom.



Course Code	Course Name	Category	L	T	P	Credit
193BT2A2CC	BIOPROCESS TECHNOLOGY	CORE	4	-	-	4

PREAMBLE

This course has been designed for students to learn and understand

- To recognize the fundamentals of Fermentation Technology
- To analyze the bioprocess paradigm
- Development of Fermentation products and their regulations

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand the concepts microbial culture collection and preservation	K3,K4
CO2	Acquire information about types of Media and Fermentation	K3,K4
CO3	Concept and mechanism of different types of fermenters	K4, K5
CO4	Learning about the purification of fermentation products	K4, K5
CO5	Recent development in microbial product production	K4, K5

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	M	M	M
CO2	S	M	S	M	M
CO3	S	S	S	M	M
CO4	S	S	S	S	S
CO5	S	S	S	S	S

S Strong M Medium L Low

193BT2A2CC	BIOPROCESS TECHNOLOGY	SEMESTER II

Total Credits: 4

Total Instruction Hours: 48 h

Syllabus

Unit I Introduction to various field opted for bioprocess 09 h

Fermentation process - Microbial culture; Screening and selection for fermentation processes; Improvement of industrially important microorganisms; Preservation of cultures after strain improvement programme. Inoculum production for bacterial and fungal processes.

Unit II Raw material and media formulation for fermentation process 09 h

Fermentation media - Natural media; synthetic media. Sources of Carbon; Nitrogen and vitamins; antifoams and optimization; Aerobic and anaerobic fermentation, Types of Fermentation: Solid Substrate fermentation and submerged fermentation, Batch, Continuous and Fed -Batch. Process parameters: measurement of temperature; pressure and pH; dissolved Oxygen; foam etc.

Unit III Bioreactor configurations and types 10 h

Bubble column, airlift reactor, packed bed, fluidized bed, trickle bed, Membrane reactor, Photobioreactor, Solid state fermenter, Animal and plant cell bioreactors. Scale up and Scale down studies of bioreactors. Rheological properties of fermentation broths, Factors affecting broth viscosity, Mixing in Fermenters.

Unit IV Downstream Processing 10 h

Biomass separation by centrifugation; filtration; flocculation and other methods; Cell disintegration: Physical; chemical and enzymatic methods; Separation of solid and liquid phases; isolation and purification techniques for proteins and other products; Principles of bioprocess control; bioprocess automation and application of computers in bioprocessing

Unit V Fermentation Products 10 h

Pharmaceutical Products – Enzyemes (Protease and amylase), Antibiotics (penicillins, tetracycline), vitamins (B2, B12), Aminoacids (lysine, glutamic acid), Organic acids (acetic acid, lactic acid). Food Products - Baker's yeast, cheese, Lab grown meat. Agricultural Products - Biofertilizer (Rhizobium, Pseudomonas) and Biopesticides (Bacillusthruingiensis). Algal biofuel.

Text Books

1 Pelczar MJ, 1993," Microbiology", 5th Edition, Tata McGraw Hill, New Delhi.

2 Patel AH, 2008, "Industrial Microbiology", 3rd Edition, PB Books, New Delhi.

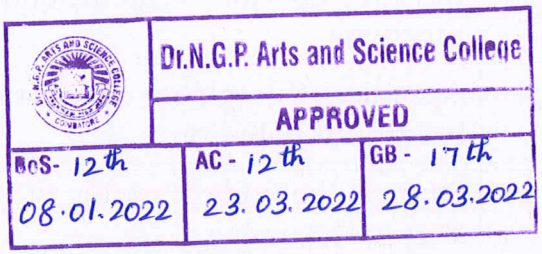
References

1 Casida LE, 1997, "Industrial Microbiology", 4th Edition, New Age International Private Limited, New Delhi.

2 PrescottL, 1999, " Microbiology", 4th Edition, WCB Mc Graw-Hill, New Delhi.

3 Crueger A, 1990, "Biotechnology: A textbook of Industrial Microbiology", 2nd Edition, Sinauer Associates Inc, United States.

4 Michael L Shuler and FikretKargi, 2002,"Bioprocess Engineering: Basic Concepts", 2nd Edition, PearsonPublishers, USA



Course Code	Course Name	Category	L	T	P	Credit
203BT2A2CD	ENVIRONMENTAL BIOTECHNOLOGY	CORE	4	-	-	4

PREAMBLE

This course has been designed for students to learn and understand

- Basic vocabulary of environmental biology
- Hazards of industrial pollutants on environment
- Effect of pollution on biodiversity

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Review on the organization of ecosystem and its functions	K3
CO2	Appraise the global environment problems and the hazards of pollution	K3,K4
CO3	Support the understanding of waste water treatment and Vermicomposting	K3,K4,K5
CO4	Compile Xenobiotics and bioremediation methods	K4,K5
CO5	Grade the awareness on environmental monitoring and environmental laws	K4, K5

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	M	S
CO2	M	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	M	M
CO5	S	S	M	S	S

S Strong M Medium L Low

203BT2A2CD	ENVIRONMENTAL BIOTECHNOLOGY	SEMESTER II

Total Credits: 4

Total Instruction Hours: 48 h

Syllabus

Unit I Ecosystem structure and functions 9 h

Abiotic and biotic components, Energy flow, food chain, food web and tropic levels, Ecological pyramids, N,P,C and S cycles in nature. Threats to environment (Pollutions, waste materials and Xenobiotics). Bioaccumulation and Biomagnification

Unit II Hazards of Pollution 10 h

Types of pollution (Water, Land, Air, Noise and Nuclear), Methods for the measurement of pollution, Global environmental problems: ozone depletion, green house effect and acid rain.

Unit III Waste water Treatment 10 h

Physical, Chemical, Biological treatment system and Solid waste pollution and its management: composting systems, vermicomposting. Biomedical waste management: Current status of biomedical waste management.

Unit IV Xenobiotics and Bioremediation 10 h

Xenobiotics in Environment - Biodegradation of Hydrocarbons, Pesticides, Lignin, Synthetic dyes. Bioremediation & Phytoremediation: Applications of bioremediation. Bioabsorption and Bioleaching of heavy metals (Mercury and Lead), advantages and disadvantages of bioleaching.

Unit V Environmental Monitoring and Impact Assessment 9 h

Biological monitoring program, bioindicators and environmental monitoring, environmental management. Environmental Laws: Problems in making and implementing environmental laws, Indian environmental laws, national environmental policy.

Text Books

1 Prohit SS, 2003, "Ecology and environment and pollution", 1st edition, Agrobios publications, India.

2 Varma PS, 1998, "Concept of ecology", 1st edition, Chand & Co Ltd, India.

References

1 Dash MC, 1998, "Fundamentals of Ecology", 2nd edition, Tata McGraw Hill, India.

2 Scragg A, 2007, "Environmental biotechnology", 2nd edition, Oxford University Press, India.

3 Kumar R, 2017, "Advances in Environmental Biotechnology", 3rd edition, Springer, USA.

4 Singh RL, 2016, "Principles and Applications of Environmental Biotechnology for a Sustainable Future", 1st edition, Springer, USA.

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BoS- 12th	AC - 12th	GB - 17th
08.01.2022	23.03.2022	28.03.2022

193BT2A2CP	CORE PRACTICAL: III IMMUNOTECHNOLOGY AND BIOPROCESS TECHNOLOGY	SEMESTER-II

Total Credits: 2
Total Instructions Hours: 60 h

S.No	List of Experiments
1	Purification of IgG antibodies using affinity chromatography.
2	Ouchterlony Double diffusion
3	Rocket Immunoelectrophoresis
4	Single Radial Immuno diffusion
5	Latex agglutination test.
6	Blood grouping
7	Immobilization of yeast cells
8	Production & estimation of biomass (SCP)
9	Wine production and estimation of alcohol content.
10	Demonstration of acetic acid oxidation (vinegar production).

Note: 8 is Mandatory out of 10

References

1. Frank C Hay, Olwyn MR and Westwood, 2002, "Practical Immunology", 4th edition, Blackwell Publication, USA.
2. James G Cappucino and Natalie Sherman, 2014,"A Laboratory Manual on Microbiology", 1st edition, Pearson Publication, USA.
3. Dubey RC and Maheswari DK, 2002, " Practical Microbiology", 2nd edition. Chand Publications, India.
4. Delves PJ, Artin ISJ, Burton IDR and Roitt IIM, 2006, Essential Immunotechnology, 12th Edition, Wiley & Blackwell, USA.

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BoS- 12th	AC - 12th	GB - 17th
08.01.2022	23.03.2022	28.03.2022

203BT2A2CQ	CORE PRACTICAL IV: GENETIC ENGINEERING & ENVIRONMENTAL BIOTECHNOLOGY	SEMESTER-II

Total Credits: 3
Total Instructions Hours: 60 h

S.No	List of Experiments
1	Isolation of bacterial DNA
2	Restriction Digestion of bacterial DNA
3	Ligation of restricted DNA
4	Plasmid DNA isolation
5	Host E.coli cell preparation
6	Metagenomic DNA extraction from agricultural soil sample.
7	Isolation of RNA
8	Sketch pedigree chart and conduct genetic counseling
9	Water quality Analysis – color, pH and acidity
10	Total Hardness by EDTA titrimetric method
11	Estimation of total alkalinity, carbonate and bicarbonate
12	Determination of chemical oxygen demand
13	Estimation of chloride

Note: Any 10 out of 13 experiments will be conducted.

References

1 Alan Scragg, 2007, "Environmental Biotechnology", 2nd edition, Oxford university press, UK.

2 Tyler Miller G, Scott JR, Spoolman E, 2010, "Environmental Science", 13th edition, Yolanda cossio publisher, USA.

3 Mount D, 2004,"Bioinformatics: Sequence and Genome Analysis", 2nd edition, University of Tuscan Press, Tuscan, Arizona.

4 Ouellette BFF and Baxevanais AD, 2004,"Bioinformatics: A practical Guide to the Analysis of Genes and Proteins", 3rd edition, Wiley, John & sons, USA.

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BoS- 12th	AC - 12th	GB - 17th
08.01.2022	23.03.2022	28.03.2022

Course Code	Course Name	Category	L	T	P	Credit
203BT2A2DA	PROTEIN ENGINEERING	DSC	3	1	-	3

PREAMBLE

This course has been designed for students to learn and understand

- To study the function of proteins
- To study the application of proteins
- To analyze folding of proteins, protein engineering and designing

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand the bond formation and modification of protein	K3, K4
CO2	Acquire knowledge on Protein Architecture	K3, K4
CO3	Impart knowledge on various electromagnetic radiation in protein structure prediction	K3, K4, K5
CO4	Focus on DNA binding factors	K4, K5
CO5	In depth understanding of designing of protein and its applications, Documentation, Inspection and Certification Procedure	K4, K5

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	S	S
CO5	S	S	S	S	S

S Strong M Medium L Low

203BT2A2DA	PROTEIN ENGINEERING	SEMESTER II

Total Credits: 3

Total Instruction Hours: 48 h

Syllabus

Unit I Bonds and Energies in Protein Makeup 10 h

Covalent, Ionic, Hydrogen, Co ordinate,Hydrophobic and Vanderwaals interactions in protein structure. Amino acids - characteristics, molecular properties (size, solubility, charge, pKa), chemical reactions (involving amino, carboxyl, hydroxyl, thiol, imidazole groups)

Unit II Protein Architecture 10 h

Primary structure - peptide mapping, peptide sequencing - Edman method. Secondary structures - super secondary structure, nucleotide binding folds, prediction of substrate binding sites. Tertiary structure - Domains, folding, denaturation and renaturation. Quaternary structure - Modular nature, formation of complexes. Ramachandran Plot.

Unit III Elucidation and characterization of Proteins 8 h

Interaction with electromagnetic radiation (radio, micro,infrared, X-ray, visible, ultraviolet) - elucidation of protein structure. Characterization of protein using NMR spectroscopy, X ray crystallography, spectroscopic and colorimetric methods.

Unit IV Structure-function relationship of Proteins 10 h

DNA-binding proteins: prokaryotic transcription factors, Helix-turn-Helix motif in DNA binding, trp repressor, Eukaryotic transcription factors, Zn fingers, helix- turn - helix motifs in homeodomain, Leucine zippers. Membrane proteins - characteristics, transmembrane segments. Bacteriorhodopsin and photosynthetic reaction center.

Unit V Protein engineering and Designing 10 h

Protein engineering – advantages - principles with specific examples: thermal stability, T4- lysozyme, recombinant insulin. Strategies for design of novel protein, De novo protein design. Computer methods in protein modeling.Understanding catalytic design by engineering trypsin, chymotrypsin and elastase, substrate-assisted catalysis and other commercial applications.

Text Books

1 Walsh G, 2014, "Proteins: Biochemistry and biotechnology", 2nd edition. Wiley Blackwell, USA.

2 Wiliamson MP, 2012, "How Proteins Work", Garland Science", USA.

References

1 Voet D and Voet G, 2001,"Biochemistry", 3rd Edition, John Wiley and Sons, USA.

2 Branden C and Tooze J, 1999,"Introduction to Protein Structure", 2nd edition. Garland Publishing, USA.

3 Moody PCE and Wilkinson AJ, 1990, "Protein Engineering", IRL Press, UK.

4 Craik CS, Cleland JL, 1996, "Protein Engineering: Principles and Practice", Wiley Blackwell, USA.

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BoS- 12th	AC - 12th	GB - 17th
08.01.2022	23.03.2022	28.03.2022

Course Code	Course Name	Category	L	T	P	Credit
193MB2A2DA	MEDICAL LABORATORY TECHNIQUES	DSE	3	1	-	3

PREAMBLE

This course has been designed for students to learn and understand

- The Laboratory principle and organization.
- The processing of blood, urine, stool and sputum.
- The importance of laboratory maintenance.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand the laboratory principle and organization of clinical laboratory.	K2
CO2	Apply the knowledge on antiseptics and disinfectants.	K3
CO3	Understand the collection and processing of blood.	K3
CO4	Explain the methods involved in collection and processing of urine, stool and sputum.	K4
CO5	Impart the responsible of maintaining laboratory Equipments and Biomedical waste management.	K3

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	M	S
CO2	M	S	S	S	S
CO3	S	S	M	S	S
CO4	S	S	M	M	M
CO5	S	S	M	M	S

S Strong M Medium L Low

193MB2A2DA	MEDICAL LABORATORY TECHNIQUES	SEMESTER II

Total Credits: 3

Total Instruction Hours: 48 h

Syllabus

Unit I Introduction to Clinical laboratory 9 h

Basic laboratory principles - Organization of clinical laboratory - Biosafety in containment laboratory - National and International GLP (Good laboratory Practices) - Role of medical laboratory technician - personnel hygiene and safety measures –Nosocomial infection.

Unit II Antiseptics & Disinfectants 9 h

Definition -Types - Mode of Action – Uses. Antimicrobial agents and Antibiotics: Introduction, mechanism of action, classification and uses, Antibiotic susceptibility testing - Stokes, Kirby-Bauer method, Minimal Inhibitory Concentration and Minimal Bactericidal Concentration.

Unit III Collection and processing of blood 10 h

Collection and processing of blood sample- separation of serum and plasma - Sampling errors - Preservation of samples. Determination of Total Count, Differential Count, Erythrocyte Sedimentation Rate, Hemoglobin concentration (Hb), Bleeding Time & Clotting Time. ABO Blood group system. Determination of blood glucose, Urea, Cholesterol and Bilirubin. Profiling - Liver function test, Renal function tests. Hormones - T3, T4, TSH, FSH, LH, Prolactin, Insulin.

Unit IV Processing of Urine, Stool and Sputum sample 10 h

Collection, transport and Storage of Urine, Stool and Sputum sample. Macroscopic and Microscopic examination - Urine: sugar, albumin, bile salts, bile pigments and ketone bodies - Pregnancy Test. Stool – Cyst, Ova, Mucus, Pus, RBC, Reduced sugar, Occult blood. Sputum – Petroff's method, AFB staining, Culture and sensitivity.

Unit V Maintenance of Laboratory 10 h

Maintenance of Laboratory Equipment's – Centrifuge, calorimeter, microscope, incubator, autoclave. Laboratory Certification process – National Accreditation Board for Laboratories, Indian Standard Organization - Standard Operating Procedure - Clinical Laboratory records. Biomedical waste management – Danger sign.

Text Books

1 Ananthanarayanan R and CK Jayaram Panicker, 2019, "Textbook of Microbiology", 10th Edition, Orient Longman, Delhi.

2 Monica Cheesbrough, 2018, "District Laboratory Practice in Tropical Countries", 2nd Edition, Cambridge University Press, USA.

References

1 Bailey and Scotts, 2018, "Diagnostic Microbiology", 14th Edition, Baron and Finegold CV Mosby Publications, New Delhi..

2 Jawetz E Melnic JL and Adel berg EA, 2010, "Review of Medical Microbiology", 25th Edition, Lange Medical Publications, USA.

3 Mackie and McCatney, 1996, "Medical Microbiology", 14th Edition, Church will Livingston, New Delhi..

4 Patrick K Murray, 2012, "Medical Microbiology", 4th Edition, Mosboy Publishers, USA..

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APPROVED

BoS- 12th	AC - 12th	GB - 17th
08.01.2022	23.03.2022	28.03.2022

Course Code	Course Name	Category	L	T	P	Credit
193BC2A2DA	BIOCHEMISTRY OF TOXICOLOGY	DSE	3	1	-	3

PREAMBLE

This course has been designed for students to learn and understand

- The biochemical basis of toxicology.
- The effects & metabolism of toxins.
- General toxicology, methods of toxicity testing, toxins from microbes, carcinogenic & teratogenic toxins, pesticide, metal and chemical toxicology.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Value the importance of toxicology.	K5
CO2	Distinguish and evaluate the biochemical effects of toxic agents on cellular macromolecules and tissues.	K4 & K5
CO3	Compare and perceive different genetic methods used for testing toxicity.	K4 & K5
CO4	Examine the effects and metabolism of various microbial toxins, teratogens and carcinogens.	K4
CO5	Justify the mode of action of toxic pesticides, heavy metals, chemicals and air pollutants.	K5

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	M	S	S
CO2	S	S	M	S	S
CO3	S	S	S	S	S
CO4	S	S	M	S	S
CO5	S	S	M	S	S

S Strong **M** Medium **L** Low

193BC2A2DA	BIOCHEMISTRY OF TOXICOLOGY	SEMESTER II

Total Credits: 3

Total Instruction Hours: 48 h

Syllabus

Unit I Introduction to Toxicology 9 h

Definition and scope of toxicology, Classification of toxic agents. Dose-response relationship: Synergism and Antagonism, Determination of ED50 and LD50. Acute and chronic exposures, Factors influencing toxicity - Abiotic and Biotic factors, Chemical interactions - Bioaccumulation and Bio-magnification.

Unit II Biochemical basis of Toxicology 9 h

Mechanisms of Toxicity, Interaction of toxicant with target molecules - Disturbance of excitable membrane function. Altered calcium homeostasis. Covalent binding to cellular macromolecules. Tissue specificity of toxicity - Metabolism of haloalkanes, haloalkenes and their toxic effects on tissues.

Unit III Principles and procedures of testing for acute toxic effects 10 h

Toxicity testing - Genetic toxicity testing and mutagenesis assays - In-vitro test systems - Bacterial mutation tests: Reversion test and Fluctuation tests. In-vivo mammalian mutation tests - Host mediated assay and Dominant lethal test. Use of drosophila in toxicity testing. DNA Repair assays, Chromosome damage test. Toxicity testing in animals.

Unit IV Effects and Metabolism of toxins 10 h

Fungal toxins, Mycotoxins - Aflatoxins, Bacterial toxins - Exotoxins (types-I, -II and -III) and Endotoxins, Viral toxins, Algal toxins, Teratogens, Carcinogens, Mutagens, Snake venom toxin, Spider, Scorpion and Jellyfish toxins, Antivenom. Xenobiotic metabolism: Phase 1– III reactions, Cytochrome-P450.

Unit V Pesticide toxicology, Metal toxicology, Chemical toxicology, Air and water pollutants 10 h

Mechanism and site of action of Chlorinated organics (DDT, BHC), organophosphates and carbamates. Mode of action of toxic heavy metals - arsenic, mercury, cadmium and lead. Biochemical effects of ozone, peroxyacetyl nitrate (PAN), carbon monoxide, nitrogen oxides, sulphur dioxide and cyanide. Common air pollutants, water pollutants and their sources, air pollution due to methyl-isocyanate (MIC) and asbestos. Case studies.

Text Books

1 Klaassen Curtis D, 2019, "Casarett and Doull's Toxicology - The basic Science of Poisons", Ninth edition, McGraw Hill Education, London.

2 Cockerham L.G and Shane B.S, 2019, "Basic Environmental Toxicology", First edition, CRC Press, New York.

References

1 Robert S.M and James R.C, 2015, "Principles of Toxicology: Environmental and Industrial Applications", Third Edition, John Wiley and Sons, New York.

2 De A.K, 2017, "Environmental Chemistry", Eighth Edition, Newage International Publishers, NewDelhi.

3 Gupta P.K, 2016, "Fundamentals of Toxicology – Essential concepts and Applications", First edition, Academic Press, Cambridge, USA.

4 Gupta R, 2019, "Biomarkers in Toxicology", Second Edition, Academic Press, Cambridge, USA.

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CHAIRMAN
Dr. N.G.P. Arts and Science College

Course Code	Course Category	Course Name	L	T	P	Exam (h)	Max Marks			Credits
							CIA	ESE	Total	
Third Semester										
203BT2A3CA	Core-IX	Plant Biotechnology	4	-	-	3	25	75	100	4
203BT2A3CB	Core X	Animal Biotechnology	4	-	-	3	25	75	100	4
193BT2A3CC	Core XI	Genomics& Proteomics	4	-	-	3	25	75	100	4
203BT2A3CD	Core XII	Research Methodology & IPR	4	-	-	3	25	75	100	4
203BT2A3CP	Core Practical - V	Plant&Animal Biotechnology	-	-	5	6	40	60	100	3
203BT2A3CQ	Core Practical VI	Genomic&Proteomics and Research Methodology& IPR	-	-	5	6	40	60	100	3
193BT2A3DA	DSE III	Molecular Therapeutics	3	1	-	3	25	75	100	3
193MB2A3DA		Molecular Diagnostics in Microbiology								
193BC2A3DA		System Biology								
193BT2A3CT	Internship		A toC							
Total			**19**	**1**	**10**	-	-	-	**700**	**25**

Course Code	Course Name	Category	L	T	P	Credit
203BT2A3CA	PLANT BIOTECHNOLOGY	CORE	4	-	-	4

PREAMBLE

This course has been designed for students to learn and understand

- Various in vitro culture techniques
- Gene transferring mechanisms
- Applications of gene transfer technologies and bioprospecting

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Explain plant culture media types and the role of different media constituents	K3
CO2	Gain insight on plant genome organisation	K3
CO3	Infer knowledge on Agrobacterium biology and transgenic technology	K3,K4
CO4	Compile various types of resistance and green house technology concepts	K4, K5
CO5	Analyse bioprospecting aspects of plants	K3,K4,K5

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	M	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	M	S	S
CO5	S	S	M	M	S

S Strong M Medium L Low

203BT2A3CA	PLANT BIOTECHNOLOGY	SEMESTER III

Total Credits: 4

Total Instruction Hours: 48 h

Syllabus

Unit I Plant Tissue culture 10 h

Media, plant growth regulators: Callus and suspension culture, somoclonal variation, somatic embryogenesis: Embryo culture, micropropagation protoplast isolation and somatic hybridization; Haploid plants, Artificial seeds and hardening. Germplasm preservation- cryopreservation.

Unit II Genome organization 08 h

Nuclear genome, chloroplast genome, mitochondrial genome, CMS, Protein targeting to chloroplast and mitochondria, Heat shock proteins, seed storage proteins.

Unit III Plasmids, Vectors and Nuclear Transformation 10 h

Features of Ti and Ri plasmids, uses of Ti and Ri as vectors, binary vectors, use of 35S and other promoters, viral vectors, use of reporter genes, Transgenic biology - methods of nuclear transformation – physical, chemical and biological gene transfer methods in plants.

Unit IV Plant Resistance 10 h

Engineering of plants for herbicide resistance, insect resistance, disease resistance, antifungal proteins, nematode resistance, stress tolerant plants, Molecular Breeding, Genome editing techniques for crop improvement - Long shelf life of fruits and flowers – antisense RNA technology, Green house technology.

Unit V Bioprospecting aspects of Plant Biotechnology 10 h

Extraction & purification of phyto- chemicals. Industrial phytochemical products from plants- Alkaloids, Biodegradable Plastics, Therapeutic proteins, plantibodies, plant vaccines, herbal drugs, bioethanol and biodiesel.

Text Books

1 Singh, B. D., 2006, "Plant Biotechnology", 1st Edition, Kalyani Publishers.

2 Chawla, H. S., 2013, "Introduction to Plant Biotechnology", 3rd Edition, Oxford & IBH publishing company.

References

1 Grierson, D and Covey, S.V., 1988, "Plant Molecular Biology", 2nd Edition, Blackie Publishers

2 Bhojwan, S. S., 1996, "Plant tissue culture - Theory and Practice", 1st Edition, Elsevier Publishers

3 Gamborg, Oluf, Phillips, Gregory (Eds.), 1995, " Plant Cell, Tissue and Organ Culture - Fundamental Methods", Springer-Verlag Berlin Heidelberg

4 Slater, A., Scott, N. and Fowler, M., 2003, "Plant biotechnology: the genetic manipulation of plants", Oxford University Press

Course Code	Course Name	Category	L	T	P	Credit
203BT2A3CB	ANIMAL BIOTECHNOLOGY	CORE	4	-	-	4

PREAMBLE

This course has been designed for students to learn and understand

- Various in vitro culture techniques
- Preservation techniques of samples from animals
- Gene transfer and applications of cell cultures

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand the culture media and its role in growth	K2, K3
CO2	Infer knowledge about the different cell and organ culture	K3
CO3	Gain knowledge on genetic engineering in animal cells	K3
CO4	Understand Techniques used for scaling up of animal cells	K4
CO5	Gain knowledge on Tissue culture and its applications	K5

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	M	M
CO5	S	S	S	M	S

S Strong M Medium L Low

203BT2A3CB	ANIMAL BIOTECHNOLOGY	SEMESTER III

Total Credits: 4

Total Instruction Hours: 48 h

Syllabus

Unit I Animal cell culture media and its constituents 9 h

Structure and organization of Animal cells - Culture media; Balanced saltsolutionsandsimplegrowthmedium,Physical,chemicalandmetabolicfunctionsofd ifferentconstituentsofculturemedium;Roleofcarbondioxide, serum, growth factors, glutamine in cell culture; Serum and proteinfreedefinedmediaandtheirapplications.

Unit II Cell culture techniques and cryopreservation 9 h

Primary cell culture techniques-mechanical disaggregation, enzymatic disaggregation, separation of viable and non-viable cells. Mass culture ofcells - manipulation of cell line selection - types of cell lines -maintenance ofcell lines - immobilization of cells and its application - synchronization ofcellculturesandcelldivision.cryopreservation-germplasmconservation.

Unit III Tissue and organ culture 10 h

AdvantagesandlimitationsofTissueandorganculture-
medical/pharmaceuticalproductsofanimalcellculture-geneticengineering of animal cells and their applications. Risks in a tissue culturelaboratoryandsafety-biohazards.Facilitiesforanimalcellculture-infrastructure,equipment,culturevessels.

Unit IV Animal cell culturescaleup 10 h

Scale up in suspension-stirrer culture, continuous flowculture,air-lift fermentor culture; Scaleup in monolayer-Rollerbottle culture, multisurface culture, multiarray disks,spiral sand tubes-monitoring of cell growth. Organ culture - whole embryo culture- specialized culture techniques –measurement of cell death.

Unit V Tissueengineering 10 h

Design and engineering of tissues-tissue modeling. Embryonic stem cell engineering-ES cell culture to produce differential cells-Human embryonic stem cell research. Transgenic animals-transgenic animals in xenotransplantation.

Text Books

1 Ranga, M.M., 2000, "AnimalBiotechnology ", 2nd Edition, Agrobios,India.

2 Satyanarayana,U.,2006, "Biotechnology", BooksandAllied(P)Ltd.

References

1 Darling, D.C.andMorgan,S.J., 1994, "AnimalCellsCultureandMedia", 1st Edition, BIOS, ScientificPublishersLimited.

2 Mathur, J.P.andBarnes,D. , 1998, "MethodsinCellBiology", 7th Edition, AnimalCellCultureMethods,AcademicPress.

3 Harris, A., 1996, "EpithelialCellCulture" , 2nd Edition, CambridgeUniversityPress

4 Ian Freshney R, 2015, "Culture of Animal Cells", 7th Edition, Wiley Blackwell.

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08.01.2022	23.03.2022	28.03.2022

Course Code	Course Name	Category	L	T	P	Credit
193BT2A3CC	GENOMICS AND PROTEOMICS	CORE	4	-	-	4

PREAMBLE

This course has been designed for students to learn and understand

- The scope of Bioinformatics
- Focus on Protein and Genome analysis using Bioinformatics tools
- Importance of gene sequencing

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Summarize about Bioinformatics and Databases	K3, K4
CO2	Design Data interpretation using Alignment Algorithms	K3, K4
CO3	Evaluate Genome Analysis and Principles of Docking	K3, K4,K5
CO4	Formulate Proteome analysis, tools & databases available	K4,K5
CO5	Compos concept of proteomics & with their applications	K3, K4,K5

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	M	S
CO2	M	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	M	S	S
CO5	S	S	M	M	S

S Strong M Medium L Low

193BT2A3CC	GENOMICS AND PROTEOMICS	SEMESTER III

Total Credits: 4

Total Instruction Hours: 48 h

Syllabus

Unit I Bioinformatics and Databases 9 h

Bioinformatics – Introduction and History. Biological Databases. Primary and secondary databases with examples. Data generation - large scale molecular biology data, BIOSEQ. Nucleic acid sequence databases: Gene bank, Protein sequence databases - Swiss-Prot, PDB, PIR. Rasmol - Molecular modeling. Steps to retrieve sequence and structure of a protein. Applications of Bioinformatics.

Unit II Genomics 9 h

Introduction and classification of genomics- Functional genomics, structural genomics. Sequencing of genomes and sequencing methods (next- generation sequencing). Structure, organization and composition of prokaryotic genomes. Microbial genomics and genome epidemiology. Metagenomics and methods of Metagenomics.

Unit III Genome Analysis and Docking 10 h

Genome analysis of Microbes, plants and animals; Accessing and retrieving genome project information from web; Comparative genomics, Identification and classification using molecular markers-16S rRNA typing/sequencing, Fragment Assembly- ESTs, Next Generation Sequencing, Gene predictions. Codon optimization tools and its advantages. Microarray and its applications. GeneExpression Profiling. GENSCAN. Molecular docking principles.

Unit IV Tools in Proteomics 10 h

Protein analysis - Proteomics classification. 1D-SDS- PAGE and 2D-SDS PAGE. Detection and quantitation of proteins in gels. Pros and cons of various staining methods. Basics of mass spectrometry. MALDI - TOF and ESI and their application in proteomics. UPLC and its applications. Tandem MS/MS spectrometry - Peptide sequencing by tandem mass spectrometry - Affinity purification of protein - TAP tag.

Unit V Pharmacogenomics and other omics 10 h

High content screening in genome for drug discovery- identification of gene targets Pharmacogenetics; Pharmacogenomics - classical and non- classical. Pharmacogenomics of genetic diseases e.g. hypertension andCancer. Metabolomics - techniques involved. Nutrigenomics and its applications. Otheromics - lipidomics, transcriptomics, metagenomics, toxicogenomics, venomics and its applications. Basics of CADD, its importance.

Text Books

1 Rao, S. D., 2010, " Bioinformatics", 2nd Edition, Biotech Pharma Publications, India.

2 Pevsner, J., 2015,"Bioinformatics and Functional Genomics", 3rd Edition, Wiley Blackwell Publications.

References

1 Campbell, A.M. and L. J. Heyer, 2007,"Discovering Genomics, Proteomics and Bioinformatics", 2nd Edition, Pearson Education.

2 Tramontano, A., 2005,"The Ten Most Wanted Solutions in Protein Bioinformatics", 1st Edition, CRC Press.

3 Womble, D. D. and Krawetz, S. A., 2003,"Introduction to Bioinformatics", 4th Edition, Humana Press.

4 Heyer, L. J. and Campbell,A. M., 2002,"Discovering Genomics, Proteomics and Bioinformatics", BenjaminCummings Publisher

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Course Code	Course Name	Category	L	T	P	Credit
203BT2A3CD	RESEARCH METHODOLOGY&IPR	CORE	4	-	-	4

PREAMBLE

This course has been designed for students to learn and understand

- Theimportanceofresearchandvalidatedata
- Thevalueofresearchinthecourse
- Patentingandlicensingexpertise

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Comprehend the concepts of research	K3
CO2	Inculcate the importance of scientific validation	K3, K4
CO3	Strategies of reporting the research findings	K3,K4,K5
CO4	Deliverables of Intellectual Property Rights	K4, K5
CO5	Understand filing and licensing of Patents	K3,K4,K5

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	M	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	M	S	S
CO5	S	S	M	M	S

S Strong M Medium L Low

203BT2A3CD	RESEARCH METHODOLOGY&IPR	SEMESTER III

Total Credits: 4

Total Instruction Hours: 48 h

Syllabus

Unit I Research Concepts and Data Collection 09 h

Definition of Research, Qualities of Researcher, Components of Research Problem,Various Steps in Scientific Research, Types of Research; - Research Design. Sampling- Types of sampling - design - procedure - Data : Meaning - Source

Unit II Scientific Communication 10 h

Scientific writing skills - Importance; Plagiarism; Scientific publication writing:Elements of a scientific paper including Abstract, Introduction, Materials &Methods, Results, Discussion, References; Drafting titles and framing abstracts;Publishing scientific papers - the peer review process and problems

Unit III Research Reports 10 h

Structure and Components of Research Report, Types of Reports, Styles of reporting,Steps in drafting reports, editing and evaluation of final draft, evaluating the finaldraft. Pictures and Graphs; Research proposal/ Grant- definition, structure, budgetallocation, specific aims, background and significance. Hierarchy of fundingagencies in India and their operations.

Unit IV Intellectual Property Rights 10 h

Types of IP; Importance of IPR; Patents, Trademarks, Copyright and Related rights,Industrial Design; Traditional knowledge; Geographical indications; Patent life,Legal protection of biotechnological inventions; World Intellectual Property RightsOrganization (WIPO); Protection of GMOs; Relevance of IP in Biotechnology.

Unit V Patents 09 h

History of Indian Patent System and Law; Patent file procedures; Types of Patent;Status of the patent applications; Precautions during patenting; Patentable and Non-Patentable items; Patent cooperation treaty (PCT); Patent and compulsory licensing.Indian Patent Act 1970 and Recent Amendments; GATT and TRIPS agreement;WIPO Treaties.

Text Books

1 Ranjit Kumar, 2019,"Research Methodology: A Step-by-Step Guide forBeginners", 5th Edition, SAGE Publishers

2 Kothari, C.R., 2010,"Research Methodology: Methods and Techniques", 2ndEdition. New Age International

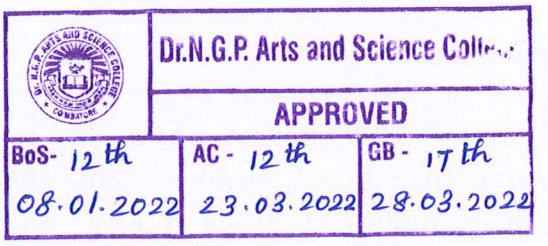
References

1 Gurumani, N., 2006,"Research Methodology for Biological Science", MJPPublishers, Chennai

2 Holmes, D., Moody, P., Dine, D. et al., 2017,"ResearchMethods for the Biosciences", 3rd Edition, Oxford University Press

3 Glass, D.J., 2014,"Experimental Design for Biologists", 2nd Edition, ColdSpring Harbor Laboratory Press

4 Daniel, P.S., Sam, A.G., 2011, "Research Methodology", 1st Edition, Gyan Publishing House



203BT2A3CP	CORE PRACTICAL :PLANT AND ANIMAL BIOTECHNOLOGY	SEMESTER III

Total Credits: 3
Total Instructions Hours: 60h

S.No	Contents
1	In vitro Seed Germination
2	Micropropagation
3	Meristem culture
4	Artificial Seed production
5	Embryo culture
6	Protoplast Isolation
7	Media Preparation for animal cell lines
8	Propagation of animal cell lines
9	Preparation of primary cell culture & trypsinizing
10	Determining cell number and viability with a haemocytometer and trypan blue staining

Note: Any 8 out of 10 experiments will be done.

References

1. Satish Kumar Sinha, 2012, "Plant tissue culture: Theory and Practice", 1st Edition, Oxford University Press.
2. Choudhary, S. S, Choudhary, P. and Choudhary, S.K, 2005, "Laboratory guide in biosciences", 2nd Edition, Kalyani publishers.
3. Jennie P. Mathur and David Barnes, 1998, "Animal Cell Culture Methods", 3rd Edition, Academic Press
4. Ian Freshney R, 2015, "Culture of Animal Cells", 7th Edition, Wiley Blackwell

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203BT2A3CQ	CORE PRACTICAL: GENOMICS & PROTEOMICS & RESEARCH METHODOLOGY & IPR	SEMESTER III

Total Credits: 3
Total Instructions Hours: 60 h

S.No	Contents
1	Retrieving articles using PubMed.
2	Retrieving a sequence of nucleotide
3	Retrieving structural data of a protein using PDB database
4	Pairwise alignment using BLAST
5	Alignment of multiple sequences using ClustalW
6	Construction of a phylogenetic tree
7	Visualizing secondary structure of a protein.
8	Retrieving details of a drug molecule
9	Simple Regression and Correlation.
10	Represent data using bars, rectangles, circles and pie diagrams.
11	Concept of Test of hypothesis. Applications of t test statistics: chi square
12	Filling forms relating to IPR.

Note: Any 10 out of 12 experiments will be conducted.

References

1. Tramontano, A., 2005,"Ten Most Wanted Solutions In Protein Bioinformatics", 1st Edition, CRC Press. USA
2. Lesk, A.M., 2014, Introduction to Bioinformatics, 4th Edition, Oxford Publications.
3. Gurumani, N., 2006, "Research Methodology for Biological Science", 1stEdition,MJPPublishers.
4. Sam,D.P.andSam,A.G.,2011,"ResearchMethodology",1stEdition,Gyan Publishing House.

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GB - 17th 28.03.2022

Course Code	Course Name	Category	L	T	P	Credit
193BT2A3DA	MOLECULAR THERAPEUTICS	DSE	3	1	-	3

PREAMBLE

This course has been designed for students to learn and understand

- The types of PCR and its applications in diagnosis
- The importance about the human genome project
- The interaction of molecules based on given therapy

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Sketch the process of drug targeting and gene therapy	K3
CO2	Estimate the current techniques of gene delivery and other therapeutic products	K3,K4
CO3	Summarize recombinant gene therapy	K3,K4,K5
CO4	Integrate pathogenic diseases and metabolic disorders	K4, K5
CO5	Design concept of immunotherapy and its applications	K3,K4,K5

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	M	S	S
CO5	S	S	M	M	S

S Strong M Medium L Low

193BT2A3DA	MOLECULAR THERAPEUTICS	SEMESTER III

Total Credits: 3

Total Instruction Hours: 48 h

Syllabus

Unit I Concepts of Gene Therapy and Drug Delivery 09 h

Gene Therapy, Drug targeting and drug delivery system. Intracellular barriers to gene delivery, overview of inherited and acquired diseases for gene therapy, virus mediated gene transfer. Liposome and Nanoparticles mediated gene delivery

Unit II Stem cells and Tissue Engineering 10 h

Cellular therapy; Stem cells: definition, properties and potency of stem cells; Sources: embryonic and adult stem cells; Concept of tissue engineering; Role of scaffolds; Role of growth factors; Role of adult and embryonic stem cells; Clinical applications; Ethical issues.

Unit III Recombinant Gene therapy 10 h

Recombinant therapy, Clinical application of recombinant technology, Erythropoietin, insulin analogs and its role in diabetes, Recombinant human growth hormone, streptokinase and urokinase in thrombosis. Recombinant coagulation factors

Unit IV Microbial Pathogenicity 10 h

Factors predisposing to microbial pathogenicity, types of infectious diseases. General concept of infectious disease, Progression of Infection and Disease - Entrance (Portal of entry), Colonization (Adherence; Adhesion; Attachment), Prevention of Host Defenses, Antigenic Variation, Penetration into Host Cytoskeleton, Damage to Host Cells, Production of Toxins

Unit V Immunotherapy 09 h

Phage and their application, Immunotherapy, Monoclonal antibodies and their role in cancer, role of recombinant interferons, Immunostimulant and Immunosupressors in organ transplants, role of cytokine therapy in cancer. Vaccines: types, recombinant vaccines and clinical applications

Text Books

1 Palsson, B. and Bhatia, S. N. 2004. Tissue Engineering. 2nd Edition. Prentice Hall. USA

2 Greenwell, P. and McCulley, M. 2008. Molecular Therapeutics: 21st century medicine. 1st Edition. Wiley-Blackwell. USA

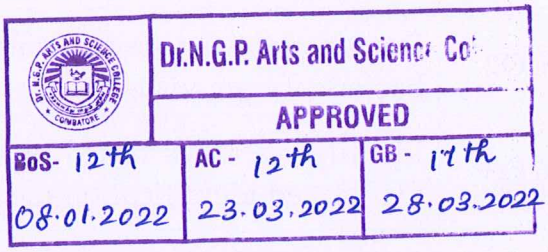
References

1 Coleman, W.B. and Tsongalis, G.J. 2006. Molecular Diagnostics for the Clinical Laboratory. 2nd Edition. Humana Press. USA

2 Leonard, DGB. 2016. Molecular Pathology in Clinical Practice. 2nd Edition. Springer International Publishers. USA

3 Whitehouse, D. and Rapley, R. 2012. Molecular and Cellular Therapeutics. 1st edition. Wiley – Blackwell Publications. USA

4 Quesenberry, P.J. , Stein, G.S. et al. 1998. Stem Cell Biology and Gene Therapy. 1st edition. John Wiley and Sons Publications. USA



Course Code	Course Name	Category	L	T	P	Credit
193MB2A3DA	MOLECULAR DIAGNOSTICS IN MICROBIOLOGY	DSE	3	1	-	3

PREAMBLE

This course has been designed for students to learn and understand

- Microbes and its involvement in causing life threatening diseases
- The identification of microbes through traditional methods
- The identification and characterization of microbes using different molecular techniques

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Recall the concept of molecular diagnostics of microorganism.	K2, K3
CO2	Demonstrate the traditional methods of identification of bacteria, fungi, virus, protozoans, and parasites	K3
CO3	Identify microbes based on nucleic acid sequencing and PCR based identification methods	K2, K3
CO4	Illustrate the microbial identification based on proteins and different blotting techniques.	K4
CO5	Develop the hybridization techniques to identify and confirm the type of microbe	K5

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	M
CO2	S	S	S	S	M
CO3	S	S	S	S	M
CO4	S	S	S	S	M
CO5	S	S	S	S	M

S Strong M Medium L Low

193MB2A3DA	MOLECULAR DIAGNOSTICS IN MICROBIOLOGY	SEMESTER III

Total Credits: 3

Total Instruction Hours: 48 h

Syllabus

Unit I Introduction 10 h

History and Transcending of diagnostics over time – Traditional and molecular diagnostics – Significance of molecular diagnostics – Scope for Molecular diagnostics - Rise of diagnostic industry in Indian and global scenario. Diseases - Infection – mode of transmission in infections, factors predisposing to microbial pathogenicity, types of infectious diseases - bacterial, viral, fungal, protozoans and other parasites. Host-Parasite Interactions.

Unit II Traditional disease diagnosis methods and tools 10 h

Diagnosis of infection caused by Bacteria - Streptococcus, Salmonella, and Mycobacterium. Diagnosis of fungal infections - Dermatophytosis, Candidiasis and Aspergillosis. Diagnosis of viruses - Adenoviruses, Rhabdo Viruses, and Retroviruses. Diagnosis of Protozoans: Malaria, Trypanosomiasis, Leishmaniasis. Study of helminthic diseases - Fasciola hepatica and Ascaris lumbricoides.

Unit III Molecular Diagnosis using Immunoglobins 10 h

Introduction - antigen-antibody binding interactions and assays - monoclonal, and polyclonal antibodies. Agglutination - RIA, ELISA's, chemiluminescence, immunofluorescence, Western blots - Bioluminescence. Proteins and Amino acids, Qualitative and quantitative techniques: Protein stability, denaturation; amino acid sequence analysis.

Unit IV Molecular Diagnosis using Nucleotides 9 h

Automated DNA sequencing- Principles, Methods and Instrumentation- Advances in DNA sequencing - New Generation sequencing Methods, Pyrosequencing, BLAST, FASTA, Microarrays, SAGE. Nucleic acid amplification methods and types of PCR: Reverse Transcriptase-PCR, Real-Time PCR, Inverse PCR, Ligase Chain Reaction. RACE, RNA fingerprinting.

Unit V Hybridization and Sequencing 9 h

Southern, Northern, in-situ (including FISH), microarrays – types and applications; Protein extraction and analysis (including PAGE and its variations); Western Blot, Southern, northern, dot/slot blot; electrophoresis, nucleic acid probe preparation

Text Books

1 Thomas J Kindt, Barbara A Goldsby, Richard Osborne 2006, "Kuby's Immunology", W. H. Freeman Publishers, New York.

2 William B Coleman, Gregory J Tsongalis, 2005, "Molecular Diagnostics: For the Clinical Laboratorian", 2nd Edition, Hanuma Publishers, New Delhi.

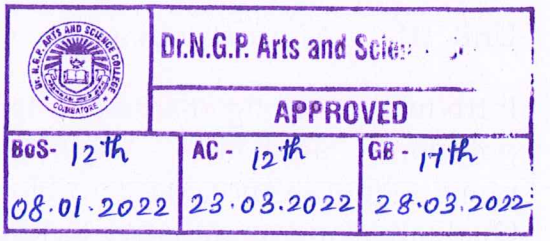
References

1 Upadhya and Nath, 2016, "Biophysical Chemistry: Principles and Techniques", 4th Edition, Himalaya Publishing House Pvt. Ltd. New Delhi.

2 Keith Willson and Kenneth H. Goulding. 1991, "A Biologist's Guide to Principles and Techniques of Practical Biochemistry", 3rd Edition, Cambridge University Press, USA.

3 Keith Willson and John Walker, 2010, " Principles and Techniques of Biochemistry and Molecular Biology", 7th Edition, Cambridge University Press, US.

4 Lele Buckingham and Maribeth L. Flaws, 2019, "Molecular Diagnostics: Fundamentals, Methods & Clinical applications", 3rd Edition, F. A. Davis Company, Philadelphia.



Course Code	Course Name	Category	L	T	P	Credit
193BC2A3DA	SYSTEMS BIOLOGY	DSE	3	1	-	3

PREAMBLE

This course has been designed for students to learn and understand

- The structure, dynamics and basic design principles of biological systems
- The transformation of biology from a descriptive to a predictive science
- The systems biology of evolution

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Distinguish designed and evolved systems	K2 & K3
CO2	Elucidate structures of any networks in the biological systems	K2 & K3
CO3	Elucidate mechanisms of dynamics of any networks in the biological systems	K3 & K4
CO4	Relate systems dynamics with organism evolution	K4 & K5
CO5	Design and create synthetic biological networks for various applications	K5 & K6

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	M	M	M
CO2	S	S	M	M	M
CO3	S	S	S	M	M
CO4	S	S	S	S	S
CO5	S	S	S	S	S

S Strong M Medium L Low

193BC2A3DA	SYSTEMS BIOLOGY	SEMESTER III

Total Credits: 3
Total Instruction Hours: 48 h

Syllabus

Unit I Introduction to Systems Biology 10 h

System biology concept: designed and evolved systems. Biological Networks: elements (Nodes-Gene, Edges-Protein, Receptor, Ligand, Morphogens, Field, Metabolites, Neurotransmitters), interaction, motifs, circuits, modularity, switch, dynamics, regulation, superimposed networks. Examples for biological networks: transcriptional, developmental, signal transduction, metabolic and neuronal networks. Emergent property. Random networks, Scale-free networks, small-world networks. Degree distribution, Clustering coefficient. Self-organizing (SOM) and connectivity maps, and its uses.

Unit II Systems Structure-I 9 h

Transcription Networks: Recurring Network Motifs-Regulation-Auto-regulation: positive auto-regulation (PAR) and negative auto-regulation (NAR). Feed Back Loop (FBL)- Positive Feed Back Loop, Negative Feed Back Loop. Feed Forward Loop (FFL), coherent-FFL and incoherent-FFL. Interlocked FFL. Lactose (simple), Arabinose (C-FFL), Flagella (C-FFL), Galactose (I-FFL) systems in E. coli and B.subtilis Sporulation Network.

Unit III Systems Structure-II 9 h

Transcription Networks: Sensory Transcription Networks-Regulation: Single-Input Module (SIM)-Last-In-First-Out (LIFO) and First-In-First-Out (FIFO). Multi-Output Forward Loop: Bi-Fans and Dense Overlapping Regulons (DOR). Arginine (LIFO), Flagella production (FIFO) and CRP (cAMP Response Protein) (DOR) system in E. coli. Double-Positive Feedback Loop and Double-Negative Feedback Loop. Regulating Feed Back and Regulated Feed Back.

Unit IV Systems Dynamics and Evolution 10 h

Stochasticity, Robustness (cancer-HIF-1 VEGF, uPAR), Fragility (Diabetes mellitus) and Organisms Diversity. Robustness Trade-offs. Robustness and evolvability-environmental and genetic perturbation. e.g. λ-phage life cycle (genetic switch), Bacterial chemotaxis, Developmental plasticity (patterning in fruit fly development) and tumor resistance against therapies (EGFR).

Unit V Mechanism of Systems Dynamics 10 h

Principle of Robustness: System control-Negative feedback loop-stable system dynamics (Bacterial chemotaxis). Positive feedback loop-bistability (λ-phage life cycle). Redundancy, Modular design (liver-glucose and lung-oxygen physiology) and Decoupling (protein folding-Hsp90). Self-extending symbiosis: horizontal gene transfer, serial endosymbiosis and oocyte-mediated vertical transfer of symbionts.

Text Books

1 Uri Alon, 2020, "An Introduction to Systems Biology: Design Principles of Biological Circuits" 2nd Edition, Chapman & Hall/CRC, Taylor and Francis group, New York, USA

2 Edda Klipp, Wolfram Liebermeister, Christoph Wierling, Axel Kowald, Hans Lehrach, and Ralf Herwig, 2009, "Systems Biology A Text Book", 1st Edition, WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim, Germany.

References

1 Michael T. Madigan, John M. MarTinko, Kelly S. Bender, Daniel H. Buckley and David A. Stahl, 2015, "Brock Biology of Microorganisms", 4th Edition, Pearson Education Inc, Illinois, USA.

2 John E. Hall, 2016, "Guyton and Hall Textbook of Medical Physiology", 13th Edition, ELSEVIER Inc, Philadelphia, USA

3 Scott F. Gilbert, 2010, "Developmental Biology", 9th Edition, Sinauer Associates, Inc, Massachusetts USA

4 Robert A. Weinberg, 2014,"The Biology of Cancer", 2nd Edition, Garland Science, Taylor & Francis Group, New York, USA

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193BT2ASSA	SELF STUDY - FOOD BIOTECHNOLOGY	SEMESTER III

Total Credit: 1

Syllabus

Unit I Food Biotechnology

Introduction and Scope; Production of Single cell protein and Baker's yeast; Mushroom cultivation. Food and dairy products: Cheese, bread and yogurt. Fermented vegetables – Saurkraut; Fermented Meat – Sausages.

Unit II Novel Microorganisms

LAB (Probiotics), Cyanobacteria, methylotrophs enzyme biotransformations. Role of Plant tissue culture for improvement of food additives; color and flavor. Genetic modifications of microorganisms; detection and rapid diagnosis. Genetically modified foods and crop

Unit III Food Borne Infections And Intoxications

Food borne infections and intoxications; with examples of infective and toxic types – Clostridium, Salmonella, Staphylococcus. Mycotoxins in food with reference to Aspergillus species. Food preservation: canning, dehydration, ultrafiltration, sterilization, irradiation. Chemical and naturally occurring antimicrobials; Biosensors in food industry

Unit IV Types of beverages and their importance

Synthetic beverages- carbonated, low-calorie and dry beverages; isotonic and sports drinks; soft drinks.

Unit V Quality assurance

Microbiological quality standards of food, Intellectual property rights and animal welfare. Government regulatory practices and policies. FDA, EPA, HACCP, ISI. Risk analysis; consumer and industry perceptions

Text Books

1 Lee B.H.V., 1996, Fundamentals of Food Biotechnology, 1st Edition, C H Publishers, Inida

2 Roger, A., 1989, Food Biotechnology, 1st edition, Elsevier Applied Sci. Pub., USA

References

1 Goldberg I., 1994, Functional Food, . 1st edition. Chapman & Hall Publishers, India

2 Anthony P. et al, 2005. Food Biotechnology. 2nd edition. CRC Publication, USA.

3 Casida, L.E. 1997. Industrial Microbiology. 6th edition. New Age International Publishers, India

4 Presscott, L. M. Harley, J. P. and Klein, D. A. 1999. Microbiology, 4th edition, WCB Mc Graw-Hill, India

193BT2ASSB	SELF STUDY - DEVELOPMENTAL BIOLOGY	SEMESTER III

Total Credit: 1

Syllabus

Unit I Concepts of Development

Potency, commitment, specification, induction, competence, determination and differentiation; morphogenetic gradients; cell fate and cell lineages; stem cells; genomic equivalence and the cytoplasmic determinants; imprinting; mutants and transgenics in analysis of development

Unit II Gametogenesis

Fertilization and early development: Production of gametes, cell surface molecules in sperm-egg recognition in animals; embryo sac development and double fertilization in plants; zygote formation, cleavage, blastula formation, embryonic fields, gastrulation and formation of germ layers in animals; embryogenesis, establishment of symmetry in plants; seed formation and germination.

Unit III Morphogenesis and Organogenesis in Animals

Cell aggregation and differentiation in Dictyostelium; axes and pattern formation in Drosophila, amphibia and chick; organogenesis – vulva formation in Caenorhabditis elegans; eye lens induction, limb development and regeneration in vertebrates; differentiation of neurons, post embryonic development - larval formation, metamorphosis; environmental regulation of normal development; sex determination. Programmed cell death and aging

Unit IV Morphogenesis and Organogenesis in Plants

Organization of shoot and root apical meristem; shoot and root development; leaf development and phyllotaxy; transition to flowering, floral meristems, floral development and senescence in Arabidopsis and Antirrhinum

Unit V Techniques for the Study of Development

Techniques for the study of development: Microscopy - Study of gene expression by biochemical methods – Study of gene expression by in situ methods – Microinjection – Cell-labeling methods – Cell sorting

Text Books

1 Jonathan, MW, 2006, Essential developmental biology, Wiley-Blackwell, USA

2 Schatten GP, 2006, Current topics in developmental biology, Academic press, USA

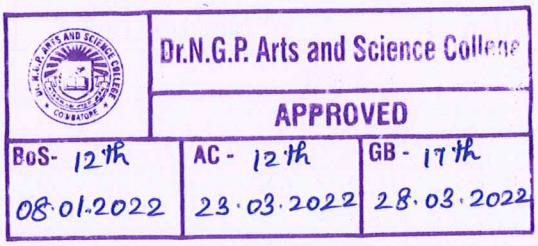
References

1 Wallace A., 2000, The origin of animal body plans: a study in evolutionary developmental biology, Cambridge university press, UK

2 Werner A. Muller. 1997. Developmental biology. Springer

3 Lodish, H. & Baltimore D, 1994, Molecular Cell Biology, 2nd edition, American Scientific Books, USA

4 Alberts, B., 1998, Essential Cell Biology, 1st edition. Garland Publishers, USA



Course Code	Course Category	Course Name	L	T	P	Exam (h)	Max Marks			Credits
							CIA	ESE	Total	
Fourth Semester										
193BT2A4CA	Core XIII	Pharmaceutical Biotechnology	4	-	-	3	25	75	100	4
193BT2A4CP	Core Practical	Pharmaceutical Biotechnology	-	-	6	6	40	60	100	3
193BT2A4CV	Core XV Project	Project and Viva Voce	-	-	16	-	80	120	200	8
193BT2A4DA	DSE-IV	Stem Cell Technology	3	1	-	3	25	75	100	3
193MB2A4DA		Microbial Technology								
193BC2A4DA		Neurobiology								
Total			**7**	**1**	**22**	-	-	-	**500**	**18**
Grand Total									**2600**	**90**

Course Code	Course Name	Category	L	T	P	Credit
193BT2A4CA	PHARMACEUTICAL BIOTECHNOLOGY	CORE	4	-	-	4

PREAMBLE

This course has been designed for students to learn and understand

- To evaluate pharmaceutical parameters of current biotechnology products.
- To determine parameters related to stability and formulation.
- The applications of bioprospecting in relation to pharma industry.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Imparts knowledge on importance of enzymes and applications in drugs	K3, K4,K5
CO2	Provide in-depth understanding of active constituents	K4,K5
CO3	Focus on natural sources for synthesis of drugs	K4,K5
CO4	To gain knowledge vaccine types and production	K4,K5
CO5	To analyze the toxicity levels and measurement	K4,K5

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	M	M	M
CO2	S	M	S	M	M
CO3	S	M	S	S	M
CO4	S	S	S	S	M
CO5	S	S	S	S	M

S Strong M Medium L Low

193BT2A4CA	PHARMACEUTICAL BIOTECHNOLOGY	SEMESTER IV

Total Credits: 4

Total Instruction Hours: 48 h

Syllabus

Unit I Enzymes in Pharmaceutical Biotechnology 8 h

Properties - dynamics of enzymatic activity, sources, extraction and purification: Applications pharmaceutical, therapeutic and clinical. Production of amyloglucosidase, glucose isomersase, amylase and trypsin. Immobilization - applications - perspective of enzyme engineering.

Unit II Active Drug Constituents 10 h

Introduction to active constituents - isolation, classification, properties. Systematic pharmacognostic study of a) Carbohydrates and derived products: agar, guar gumm acacia, Honey, Isabgol, pectin, Starch and sterculia b) Lipids: Bees wax, Castor oil, Cocoa butter, Cod~liver oil, Kokum butter, Lard, Rice, Bran oil, Shark liver oil and Wool fat.

Unit III Plant and Animal Sources 12 h

Herbal Medicines - Characteristics, Efficacy, importance, allergic reactions. Principles - Ayurveda, Unani, Siddha, Homepathy. Drugs derived from Animal - Gelatin, Glycerin, Heparin, Lanolin, Premarin, Animal vaccines. Pharmaceutics from Marine source - Cytarabine, Zicomotide, Omega - 3- acid ethyl ester, Trabectodin, Brentuximab vadotin.

Unit IV Vaccines and Related Products Production 8 h

DNA Vaccine construction and immunology, DNA vaccine expression, plasmid delivery of DNA vaccines. Bacterial vaccines and preparation. Peptide vaccine. Antitoxins. Serum-immune blood derivatives and immunity related products. Gene Pharming.

Unit V Immunogenicity 10 h

Estimation of toxicity LD 50 and ED 50. Immunogenicity of biopharmaceuticals: Immunogenicity; Factors contributing to immunogenicity (product-related factors, host- related factors), Measurement of immunogenicity. Consequence of immunogenicity to biopharmaceuticals. Neutraceuticals. Biopharmaceuical. Economics of drug development.

Text Books

1. Crommelin D, Sindelar R and Meibohn B, 2008, "Pharmaceutical Biotechnology – Fundamentals and Applications", 3rd edition, Informa Press, USA.
2. Kokate J and Hurakadle, 2011, "Textbook of Pharmaceutical Biotechnology, 1st edition, Elsevier Pres, USA.

References

1. Kayser O and Müller RH, 2005, "Pharmaceutical Biotechnology: Drug Discovery and Clinical Applications", 1st Edition, Wiley Publishers, USA.
2. Rho J and Louie, SG, 2003, "Hand book of Pharmaceutical Biotechnology", 1st Edition, CRC Press, USA
3. Goodman and Gilman, 2006, " The Pharmacological Basis of Therapeutics", 11th Edition, Mc Graw Hill Medical Publishing Division, India.
4. Heinrich Klefenz, 2002, "Industrial Pharmaceutical Biotechnology", 1st Edition, WILEY-VCH Publication, USA.

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193BT2A4CP	CORE PRACTICAL VII: PHARMACEUTICAL BIOTECHNOLOGY	SEMESTER IV

Total Credits: 3
Total Instructions Hours: 72 h

S.No	List of Experiments
1	Isolation of Animal Tissues: Intestinal Muscle Preparations.
2	Isolation of Animal Tissues: Skeletal Muscle Preparations, Cardiac Muscle Preparations
3	In-Vitro Evaluation of Hepatoprotective Drugs
4	Evaluation of Antioxidant Activity Using Cell Based Assay Method
5	Sterility Testing of Pharmaceutical Drugs
6	In-Vitro Genotoxicity Assay
7	Mouse Lymphoma Assay (L5178Y TK+/− mouse lymphoma cells)
8	Evaluation the extent of DNA damage by In-Vitro Comet assay
9	In-Vitro Teratogenicity Testing of the drug
10	Pathological Condition Analysis of Animal Tissues by Histopathology

Note: Any 8 out of 10 experiments will be carried out

References

1 Patra Jayanta Kumar, Das Swagat Kumar, Das Gitishree, Thatoi Hrudayanath, 2019, "A Practical Guide to Pharmacological Biotechnology", 1st edition, Springer Nature Pvt Ltd., Singapore.

2 Prasad GS, Sailam KS, 2019, "Pharmaceutical Microbiology: A Laboratory Manual", 1st edition, PharmaMed Press, India.

3 Crommelin Daan JA, Sindelar Robert, Meibohm Bernd, 2019, "Pharmaceutical Biotechnology; Fundamentals and Applications", 5th edition, Springer International Publishing, USA.

4 Groves, 2018, "Pharmaceutical Biotechnology", Routlegde Taylor and Francis Group, USA

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BoS- 12th	AC - 12th	GB - 17th
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Course Code	Course Name	Category	L	T	P	Credit
193BT2A4DA	STEM CELL TECHNOLOGY	DSE	3	1	-	3

PREAMBLE

This course has been designed for students to learn and understand

- The types of Stem cells
- Characteristics of different stem cells in animals and plants.
- Applications of stem cells in various dimensions.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Know the process of stem cell and storage	K2,K3
CO2	Understand the stem cell importance in plants	K3, K4
CO3	Imparts knowledge on the stem cells in animals	K3,K4,K5
CO4	In depth understanding of haemopoietic stem cell	K4,K5
CO5	Focus on stem cell therapies and its application	K4,K5

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	S	S
CO2	S	S	S	S	S
CO3	S	M	S	S	S
CO4	S	S	M	M	M
CO5	S	S	S	S	S

S Strong M Medium L Low

193BT2A4DA	STEM CELL TECHNOLOGY	SEMESTER IV

Total Credits: 3

Total Instruction Hours: 48 h

Syllabus

Unit I Stem Cells and Cellular Pedigrees 11 h

Scope of stem cells – definition of stem cells – concepts of stem cells – differentiation , maturation , proliferation , pluripolericy, self – maintainance and self – renewal – problems in measuring stem cells – preservation protocols.

Unit II Stem Cell Concept in Plants 9 h

Stem cell and founder zones in plants – particularly their roots – stem cells of shoot meristems of higher plants.

Unit III Stem Cell Concept in Animals 10 h

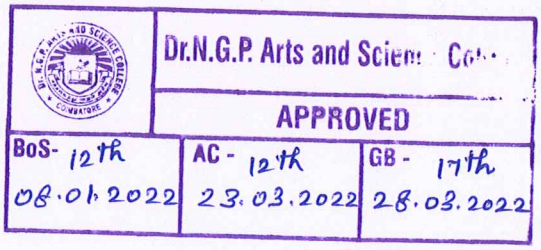
Skeletal muscle stem cell – Mammary stem cells – intestinal stem cells – keratinocyte stem cells of cornea – skin and hair follicles –Tumour stem cells, Embryonic stem cell biology - factors influencing proliferation and differentiation of stem cells – hormone role in differentiation.

Unit IV Haemopoietic Stem Cell 9 h

Biology – growth factors and the regulation of haemopoietic stem cells.

Unit V Potential Uses of Stem Cells 9 h

Cellular therapies – vaccines – gene therapy – immunotherapy – tissue engineering – blood and bone marrow – Fc cells.



Text Books

1 Potten CS, 1997, "Stem cells", Elsevier, USA.

2 Robert Paul Lanza , 2006, "Essentials of stem cell biology", 2nd edition, Academic Press, USA.

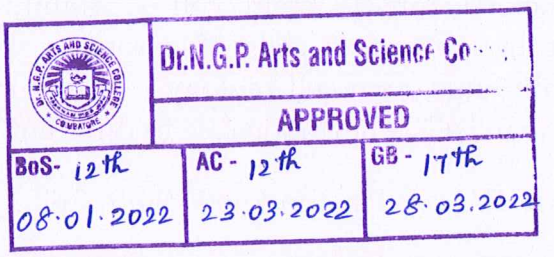
References

1 Song Li, Nicolas L'Heureux, Jennifer Elisseeff, 2011, "Stem Cell and Tissue Engineering", 1st Edition, World Scientific Publishers, Singapore.

2 Robert Lanza, John Gearhart, Brigid Hogan, 2006, "Essentials of Stem Cell Biology", 2nd Edition, Macmillan Publishing Solutions, USA.

3 Low WC and Verfaillie CM, 2007, "Stem Cell and Regenerative Medicine", 1st Edition, World Scientific Publishers, Singapore.

4 Lanza R and Atala A, 2007, "Essential of Stem Cell Biology", 3rd Edition, Academic Press, USA.



Course Code	Course Name	Category	L	T	P	Credit
193MB2A4DA	MICROBIAL TECHNOLOGY	DSE	3	1	-	3

PREAMBLE

This course has been designed for students to learn and understand

- The production of Sustainable products using Microorganisms.
- The importance of Microorganisms in Pharmaceutical sector.
- How to explore the ideas in commercial level.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Inculcate the knowledge about microbial products.	K3
CO2	Exemplify the ideas about the production and uses of Biofuel and Biofertilizer.	K4
CO3	Demonstrate the commercial production of Biopolymers using Microorganisms.	K3
CO4	Understand the way cells and enzymes were immobilised for industrial uses.	K4
CO5	Explore the production of vaccines and toxoids.	K4

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	S	S
CO2	S	S	M	S	S
CO3	S	M	S	S	S
CO4	S	M	S	M	S
CO5	S	S	M	S	S

S Strong M Medium L Low

193MB2A4DA	MICROBIAL TECHNOLOGY	SEMESTER IV

Total Credits: 3

Total Instruction Hours: 60 h

Syllabus

Unit I Microbial products 12 h

Single Cell Protein and its Economic Aspects: Bacterial, Actinomycetous, Yeast, Fungal and Algal Proteins – Brewer's and Baker's yeast – Food and Fodder yeast – Mushroom (Agaricus, Oyster) and Products from Higher fungi (Ganoderma lucidum).

Unit II Production of Biofuel & Biofertilizer 12 h

Production, Methods and Uses of Bioethanol (S cerevisiae) – Biodiesel (Chlorella) – Biohydrogen (Chlamydomonas) – Biogas (Methanobacteria) . Biofertilizer -Types , Mass production and Applications.

Unit III Biopolymer production 12 h

Production and Uses of Polyhydroxybutyrate (PHB) – Xanthan – Alginate – Cellulose – Cyanophycin – Levan - Melanin -Adhesive Protein - Rubber - Polyhydroxyalkanoates - Hyaluronic acid.

Unit IV Immobilization of Cells & Enzymes 12 h

Cells – Surface attachment of cells – Entrapment within porous matrices: Hydrogel Entrapment method, Preformed support materials – Containment behind a barrier: Microencapsulation, Immobilization using membranes – Self aggregation of cells – Enzymes: Methods for Enzyme immobilization – Carrier binding method, Intermolecular cross linking – Applications of Immobilized cells and Enzymes.

Unit V Microbial products with pharmaceutical importance 12 h

Vaccines – Steps of Manufacturing – Growing the microbes and separation – Preparation of Live and killed vaccine – Standardization of vaccine – Preparation of Toxoid and uses – BCG Vaccine – Cholera vaccine – Rabies vaccine – Diptheria toxoid.

Text Books

1 Patel A H, 2012, "Industrial Microbiology", 2nd Edition, Trinity Press, New Delhi.

2 El-Mansi E M T, Bryce C F A, Dahhou B, Sanchez S, Demain A L, Allman A R, 2012, "Fermentation Microbiology and Biotechnology", 3rd Edition, CRC Press, USA.

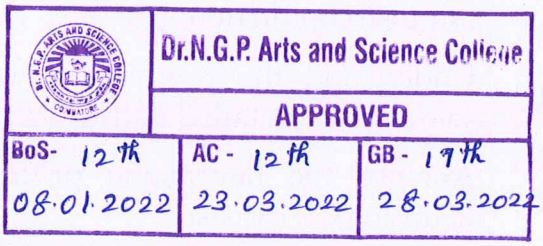
References

1 Bernard R Glick, Jack J Pasternek, Cheryl L Patten, 2010, " Molecular Biotechnology - Principles and Applications of Recombianant DNA", 4th Edition, ASM Publishers, USA.

2 Nidhi Goel, 2013, "Pharmaceutical Microbiology", 1st Edition, Narosa Publishing House, New Delhi.

3 Puvanakrishnan R, Sivasubramanian S, Hemalatha T, 2012, "Microbial Technology - Concepts amd Applications", 1st Edition, MJP Publishers, New Delhi.

4 https://agritech.tnau.ac.in/org_farm/orgfarm_biofertilizertechnology.html



Course Code	Course Name	Category	L	T	P	Credit
193BC2A4DA	NEUROBIOLOGY	DSE	3	1	-	3

PREAMBLE

This course has been designed for students to learn and understand

- Overview of nervous system organisation and function.
- Neuronal transmission in the body.
- Pathways and mechanisms of neuronal disorders.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand the morphogenesis of the central nervous system and histology of the nervous system.	K4 & K5
CO2	Examine the functioning of the components of the nervous system	K4 & K5
CO3	Elucidate the role of different neurotransmitters in nerve impulse conduction	K4 & K5
CO4	Understand the process of vision, olfaction and taste sensation in detailed pathways	K4 & K5
CO5	Analyse the neurologic process behind the different neurological diseases	K4 & K5

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	M	M	M
CO2	S	S	S	M	M
CO3	S	S	S	M	M
CO4	S	S	M	M	M
CO5	S	S	S	M	S

S Strong M Medium L Low

193BC2A4DA	NEUROBIOLOGY	SEMESTER IV

Total Credits: 3

Total Instruction Hours: 48 h

Syllabus

Unit I Morphogenesis of central nervous system and Histology of the Nervous System 11 h

Morphogenesis of central nervous system:Early aspects of development, The spinal cord, The brain (Myelencephalon, Metencephalon, Mesencephalon, Prosencephalon, Diencephalon, Telencephalon, Basal Ganglia, Commissures).

Histology of the Nervous System: The neuron: nerve cell body, nucleus, cytoplasm, dendrites, axon. Axonal Transport:fast anterograde, slow anterograde and fast retrograde transport.Types of neurons:multipolar, bipolar, pseudo-unipolar, and unipolar. Neuroglia: astrocytes, oligodendrocytes, microglia, and ependymal cells. Myelinated axons.

Unit II Design and functioning of the Nervous System 11 h

Neuron, Sensory Receptors, Effectors, information processing, memory. Major Levels of Central Nervous System Function: spinal cord level, lower brain level and higher brain level. Structure and permeability of neuronal membrane: membrane transport proteins, mode of transport, synapse: types (chemical and electrical), Physiologic Anatomy of the Synapse: Presynaptic Terminals, Action Potential and propagation, equilibrium membrane potential, resting membrane potential, ReceptorProteins, Ion Channels (properties and classification), Second Messenger system, Excitation/inhibition in post synaptic membrane.

Unit III Neurotransmitters 10 h

Neurotransmitters: definition, properties, classes, mechanism of neurotransmitter release. Synthesis, release, physiological and clinical considerations of acetyl choline, GABA, dopamine, norepinephrine, epinephrine, serotonin, histamine, nitric oxide. Receptors: nicotinic acetyl choline, NMDA and opioid receptors.Mechanisms of Regulation of Receptors: Desensitization and Down-Regulation.

Unit IV Visual, Olfaction and Taste system 8 h

Visual system: components of eye, different layers of retina, photoreceptors, phototransduction, processing of signals by retinal cells,color vision, visual and retinal fields, visual pathways, visual reflex.

Olfaction and Taste: organisation, receptors, sensory transduction, central pathways for olfaction and taste.

Unit V Neurological diseases 8 h

Description, neurochemistry, pathology and clinical intervention of neurological diseases: Parkinson's disease, schizophrenia, Huntington's disease, Alzheimer's disease, epilepsy and depression disorder.

Text Books

1. Allan Siegel, Hreday N. Sapru, 2018, "Essential Neuroscience", 4th Edition, Lippincott Williams & Wilkins, a Wolters Kluwer business, United States.
2. John E. Hall, Arthur C. Guyton, 2021, "Guyton and Hall Textbook of Medical Physiology", 14th edition, Saunders, an imprint of Elsevier Inc., United States.

References

1. Alan Longstaff, 2011, "Instant notes. Neuroscience", 3rd edition, Taylor & Francis Group, United Kingdom.
2. Dale Purves, George J. Augustine, David Fitzpatrick, William C. Hall, Anthony-Samuel lamantia, James O. Mcnamara, S. Mark Williams, 2017, " Neuroscience", 6th edition, Sinauer Associates, Inc.USA
3. Kim E. Barrett, Susan M. Barman, Scott Boitano, William F. Ganong, Heddwen L. Brooks, 2019, "Ganong's Review of Medical Physiology", 26th edition, McGraw Hill Education, United States.
4. Harald Sontheimer, 2015, "Diseases of the Nervous System", 1st Edition, Academic Press, United States.

BoS Chairman/HOD 8/1/22
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