

**M. Phil.**  
**BIOTECHNOLOGY**  
**SYLLABUS - 2018**



**St. JOSEPH'S COLLEGE (Autonomous)**

Special Heritage Status Awarded by UGC  
Accredited at 'A' Grade (3<sup>rd</sup> cycle) by NAAC  
College with Potential for Excellence Conferred by UGC  
DBT-STAR & DST-FIST Sponsored College  
**TIRUCHIRAPPALLI - 620 002, INDIA**

## GUIDELINES FORM.PHIL. PROGRAMME

### 1. Duration

The programme runs for one year of two semesters. The Semester- I is from August to February and the Semester- II runs from March to August, of the following year.

### 2. Course Work

Semester-I			Semester-II		
Course	Title	Cr	Course	Title	Cr
C1	Professional Skills for Teaching - Learning	4	C5	Dissertation (Topic selected should be relevant to the topic of the Guide Paper)	8
C2	Research Methodology	4			
C3	Core Course	4			
C4	Guide Paper	4			
<b>Total</b>		<b>16</b>	<b>Total</b>		<b>8</b>

- A) Each Course should contain 5 units, covering the subject requirements of the courses offered. **Marks for CIA and SE are in the ratio 25: 75.**

CIA & SE	Tentatively on
Mid Semester Test	December 2 <sup>nd</sup> week
End Semester Test	February 2 <sup>nd</sup> week
Semester Examinations	February 4 <sup>th</sup> week

*A candidate shall be declared to have passed Course I, II, III and IV, if he / she secures not less than 40% of the marks in both CIA and the University Examination and 50% of the marks in the aggregate (i.e. continuous internal assessment and the written Examination taken together.*

- B) In course C1 on ‘**Professional Skills for Teaching– Learning**’ the first three units are common to all the Departments of the College. The first three unit titles are **Soft Skills, E-teaching, E-learning, Elements of Technology of Teaching and Learning**. The remaining two units are department specific to make use of the above mentioned skills & techniques to teach the Core Course.

The C1 Course is (to be) designed to explore the various Teaching – Learning – Research Skills to be imbibed / cultivated to make the research

scholars to be fit for the profession they are likely to acquire in the Education Sector.

Departments will be permitted to offer either paper 2 or paper 3 as Open Online Course to the M.Phil. students. The evaluation method will be the same for both C2 and C3 Courses.

### C) Evaluation:

#### C.1:

For CIA and SE there will be a 2 hour test only from the first THREE units. The CIA components are Mid Semester Test (35), End Semester Test(35) and Assignment (15) and Practical Component(15). The total mark 100 will be converted into **25** marks.

#### C.2, C.3 & C.4:

The CIA components for C-2, C-3 and C-4 are Mid Semester Test (25), End Semester Test (25), Seminar (30), Objective Type test /Assignment (20). *(The marks of Mid semester test (75), End semester test (75) will be converted into 25 each.)*

The total mark 100 will be converted into 25 marks. The tests and Semester Examination are centrally conducted by COE for 3 hours.

- Question papers for C1, C2 & C3 are set by External Examiners.
- Question paper for C4 will be set and valued by the Research Advisor only.
- The evaluation method will be the same for both C2 and C3 Courses.

### 3. Credits

	Courses	Title		Contact hours	Library hours	Total hours	Credit	CIA marks	SE marks	Total marks
Semester-I	C1	Professional Skills for Teaching-Learning	T	3	2	5	3	25	50	100
			P	2	2	4	1			
	C2	Research Methodology		5	4	9	4	25	75	100
	C3	Core Paper		5	5	10	4	25	75	100
	C4	Guide Paper		5	5	10	4	25	75	100
<b>Total</b>				<b>20</b>	<b>18</b>	<b>38</b>	<b>16</b>	<b>100</b>	<b>300</b>	<b>400</b>

Semester-II	C5	Internal	Cr	Mk	External	Cr	Mk
		Seminar & Review of Related Literature	1	15	Dissertation Evaluation	6	75
		Mid-term Review Presentation	1	15	Viva-voce	2	25
		Dissertation Work	4	50			
		Publication of Research Articles	1	10			
		Viva-voce	1	10			
<b>Total</b>		<b>8</b>	<b>100</b>		<b>8</b>	<b>100</b>	

#### 4. Question Pattern

Course	Mid & End Semester Tests		
<b>SCIENCE</b>			
<b>C1</b>	Section A: Short Answers Section B: Either/Or - Essay Type	7/9 3	7×2 = 14 3×7 = 21
<b>C2</b>	Section A: Short Answers Section B: Either/Or - Essay Type	10 5	10×3 = 30 5×9 = 45
<b>C3</b>	Section A: Short Answers Section B: Either/Or - Essay Type	10 5	10×3 = 30 5×9 = 45
<b>C4</b>	Open Choice: Comprehensive Type	5/8	5×15 = 75
<b>ARTS</b>			
<b>C1</b>	Section A: Short Answers Section B: Either/Or - Essay Type	7/9 3	7×2 = 14 3×7 = 21
<b>C2</b>	Open Choice: Comprehensive Type	5/8	5×15 = 75
<b>C3</b>	Open Choice: Comprehensive Type	5/8	5×15 = 75
<b>C4</b>	Open Choice: Comprehensive Type	5/8	5×15 = 75

Course	Semester Examination		
<b>SCIENCE</b>			
<b>C1</b>	Section A: Short Answers Section B: Either/Or - Essay Type	7/9 3	7×2 = 14 3×12 = 36
<b>C2</b>	Section A: Short Answers Section B: Either/Or - Essay Type	10 5	10×3 = 30 5×9 = 45
<b>C3</b>	Section A: Short Answers Section B: Either/Or - Essay Type	10 5	10×3 = 30 5×9 = 45
<b>C4</b>	Open Choice: Comprehensive Type	5/8	5×15 = 75
<b>ARTS</b>			
<b>C1</b>	Section A: Short Answers Section B: Either/Or - Essay Type	7/9 3	7×2 = 14 3×12 = 36
<b>C2</b>	Open Choice: Comprehensive Type	5/8	5×15 = 75
<b>C3</b>	Open Choice: Comprehensive Type	5/8	5×15 = 75
<b>C4</b>	Open Choice: Comprehensive Type	5/8	5×15 = 75

#### 5. Dissertation

For carrying out the dissertation, it is mandatory to strictly adhering to the rules of the college as given below:

##### 5.1 Requirement

Every student is expected to give two seminars one concerning Review of Related Literature within the four weeks from the beginning of the second semester and the other on Data Analysis/Result/Mid Term Review just before the submission of the final draft of the dissertation

##### 5.2 Submission

Candidates shall submit the Dissertations to the Controller of Examinations **not earlier than five months but within six months** from the date of the start of the Semester –II. The above said time limit shall start from the 1<sup>st</sup> of the month which follows the month in which Semester - I examinations are conducted. If a candidate is not able to submit his/her Dissertation within the period stated above, he/she shall be given an extension time of **four** months in the first instance and another **four** months in the second instance with penalty fees. If a candidate does not submit his/her Dissertation even after the two extensions, his/her registration shall be treated as cancelled and he/she has to re-register

for the course subject to the discretion of the Principal. However the candidate need not write once again the theory papers if he/she has already passed these papers.

At the time of Submission of Dissertation, the guide concerned should forward the marks to the CoE through HOD in a sealed cover

### 5.3 Publications

All the M.Phil. Scholars should publish atleast one Research article in the reputed Journals before the submission of their dissertation. Publication of research article will be considered as CIA component. According to the type of Journals marks will be distributed to each article as follows.

UGC approved Journals	-	10 marks
Other Journals with ISSN number	-	8 marks
ReTeLL or Seminar /Conference Proceedings	-	6 marks

### 5.4 Requirement

**For the valuation of dissertation it is mandatory to have passed in all the four courses.** One external examiner and the Research Adviser shall value the Dissertation. The external examiner should be selected only from outside the college and shall be within the colleges affiliated to Bharathidasan University. In case of non-availability, the panel can include examiners from the other university/colleges in Tamil Nadu. The external examiner shall be selected from a panel of 3 experts suggested by the Research Adviser. However, the Controller of Examination may ask for another panel if he deems it necessary. Both the internal and external examiner will evaluate the Dissertation and allot the marks separately. However the *viva-voce* will be done by both of them. The average marks will be considered.

### 5.5 Curbing Plagiarism

According to The draft of University Grants Commission (Promotion of Academic Integrity and Prevention of Plagiarism in Higher Education Institutions) Regulations, 2017. Before submitting the thesis every students should submit the draft and get the certificate from the college library which will be issued after the verification of plagiarism. The certificate should be enclosed along with the thesis.

Plagiarism would be quantified into following levels in ascending order of severity for the purpose of its definition:

Level-0: Similarities upto 10% Excluded

Level-1: Similarities above 10% to 40%

Level-2: Similarities above 40% to 60%

Level-3: Similarities above 60%

Penalties for Students Plagiarism Disciplinary Authority (PDA) of the HEI, based on recommendations of the Academic Misconduct Panel (AMP), shall impose penalty considering the severity of the Plagiarism.

- i. Level 0: Similarities upto 10% - Minor Similarities, no penalty.
- ii. Level 1: Similarities above 10% to 40% - Such student shall be asked to submit a revised script within a stipulated time period not exceeding 6 months.
- iii. Level 2: Similarities above 40% to 60% - Such student shall be debarred from submitting a revised script for a period of one year.
- iv. Level 3: Similarities above 60% -Such student registration for that programme shall be cancelled.

### 5.6 Viva-Voce

An open Viva-Voce examination shall be conducted by both the external examiner and the supervisor **and shall be attended by members of Department Research Committee members, all faculty members of the departments, other research scholars and other interested experts / researchers** and evaluated jointly by the Examiner and the Supervisor. The valuation of M.Phil. Dissertations and the viva-voce examination shall be carried out on the same day at the place of the Research Supervisor (viva is to be conducted only if the student passes in the valuation of the dissertation). The mark should be sent to the Controller of Examinations by the Research supervisor. A candidate shall be declared to have passed Part-II Examination if he secures not less than **55%** of the marks both in internal and external.

### 6. Classification of Final Results

- i. The classification of final results shall be based on the CGPA, as indicated in Table 2.
- ii. For the purpose of Classification of Final Results, the candidates who earn the CGPA 9.00 and above shall be declared to have qualified for the Degree as “Outstanding”. Similarly, the candidates who earn the CGPA between 8.00 and 8.99, 7.00 and 7.99, 6.00 and 6.99, and 5.00 and 5.99 shall be declared to have qualified for their Degree in the respective Programmes as “Excellent”, “Very Good”, “Good”, and “Above Average” respectively..
- iii. Absence from an examination shall not be taken as an attempt.

**Table-1: Grading of the Courses**

Marks Range	Grade Point	Corresponding Grade
90 and above	10	O
80 and above but below 90	9	A+
70 and above but below 80	8	A
60 and above but below 70	7	B+
50 and above but below 60	6	B
Below 50	NA	RA

**Table-2: Final Result**

CGPA	Corresponding Grade	Classification of Final Results
9.00 and above	O	Outstanding
8.00 to 8.99	A+	Excellent
7.00 to 7.99	A	Very Good
6.00 to 6.99	B+	Good
5.00 to 5.99	B	Above Average
Below 5.00	RA	Re-Appearence

- 6.1 Credit based weighted Mark System is to be adopted for individual semesters and cumulative semesters in the column 'Marks Secured' (for 100).
- 6.2 Candidates who have failed in the courses may take the supplementary exams conducted by the CoE immediately. Even then, if they could not complete the course(s), they will be given two more chances only to appear for those courses along with the next batch scholars. The maximum duration for the completion of the M.Phil. Programme is 2 Years.
7. **Attendance:** Daily attendance for 90 working days should be enforced for the students. Periodical report of a student to the guide concerned should be recorded in the register kept by the guide.
8. **The Scholar must obtain 80% of attendance per semester in order to appear for the Semester Examinations/Viva-Voce.**

**M.Phil. BIOTECHNOLOGY****Programme outcomes (POs)**

1. Scholars are to be adopted with a new paradigm of self-learning in the form of review of earlier knowledge acquired.
2. Scholars are brought to light from the previous investigation completed to the newer thrusts of knowledge and implementation in research.
3. Scholars are trained to design, implement and evaluate secured information (hard and soft) systems with assured quality and efficiency.
4. Scholars are to be oriented towards becoming globally competent.

**Programme Specific Outcomes (PSOs)**

1. Scholars will produce as Biotechnology professionals with leadership quality in technology, creativity, innovation and entrepreneurship.
2. Scholars are provided with state of the art outcome-based teaching/ learning practices
3. Scholars will be developed as a research-based education model in Biotechnology
4. Scholars will have an ability to demonstrate an advanced technical knowledge of biotechnology.
5. Scholars will have awareness of modern bioanalytical techniques and their limitations.
6. Scholars will be equipped to undertake a research project which requires an understanding of techniques and published literature, originality in the application of knowledge, and some degree of self-direction.
7. Scholars will be provided with advanced theoretical and practical training in Biotechnology with a particular specialization to produce high quality professionals.
8. Scholars will be trained to communicate by writing formal reports and by giving oral presentations.

**Course Pattern - 2018 Set**

Sem	Code	Title of the Paper
I	18MBT 101	Course – C1: Professional Skills For Teaching – Learning
	18MBT 102	Course – C2: Research Methodology
	18MBT 103	Course – C3: Advances in Biotechnology (Open online course)
	18MBT 104A	Course – C4: Intellectual Property Rights
	18MBT 104B	Course – C4: Food Biotechnology
	18MBT 104C	Course – C4: Microbial Biotechnology
II	18MBT 205	Course – C5: Dissertation

## 18MBT101

### PROFESSIONAL SKILLS FOR TEACHING-LEARNING

#### Course Outcomes:

1. To empower scholars with soft skills
2. To introduce the techniques and dynamics of teaching
3. To facilitate e-learning/e-teaching with the ICT tools
4. To know the material resources for classroom teaching
5. To introduce soft skill for class room teaching
6. To enhance the scholars with practical skills.

#### Unit-I: Soft Skills

- a. Introduction to soft skills, soft skills vs hard skills, types of soft skills
- b. Communicative skills – basics in communication, structure of written and oral sentences, verbal, non-verbal, body language, JOHARI Window, intrapersonal and interpersonal communications, activities in effective communication
- c. Behavioural skills – leadership skills, time management, creativity and lateral thinking
- d. Interview skills – resume writing, different types of interviews, etiquettes in interviews, mock interviews
- e. Team building and group discussion – progressive stages of team building, parameters of GD (special reference to attending, listening, responding skills), mock group GDs

#### Unit-II: Techniques and dynamics of teaching – learning

- a. Emerging trends in educational psychology – meaning, scope and methods
- b. Learning different theories of learning, approaches to learning (classical conditioning – Ivan Pavlov, operant conditioning – B.F. Skinner); kinds of learning, factors affecting learning
- c. Motivation: intrinsic and extrinsic motivation, development of memory and intelligence

#### Unit-III: e-Learning and e-Teaching

An overview of MS Office 2007, MS WORDS-2007, MS EXCELL-2007-MS Powerpoint-2007, concepts in e-resources and e-design: world wide web concepts – making use of web resources – website creation concepts – creating web page editions – creating web graphics – creating web audio files

#### Unit-IV: Practical Skill

Preparation of buffers (Acetate and Phosphate), Preparation of Standard curves. Electrophoresis: PAGE and AGE. Isolation and estimation of genomic DNA (Bacteria, plant and animal), Isolation of plasmid from bacteria, Restriction digestion and ligation of DNA. Antigen-Antibody interactions: Immuno electrophoresis-Rocket Immuno electrophoresis and Ouchterlony double immune diffusion. ELISA (Direct), Quantitative precipitin assay. SPSS (Statistical package).

#### Unit-V: Teaching skill

Preparation and Submission of Teaching aids- Power points, Animated and text materials for teaching the lessons- Teaching 15 hours theory.

#### References

##### Unit-I

1. JASS (2013). Winners in the Making. Introduction to Soft Skills. St. Joseph's College, Trichy
2. Murphy, Raymond. (1998). Essential English Grammar. 2<sup>nd</sup> ed. Cambridge University Press
3. Trishna (2004). Knowledge system how to do well in GDs and interviews. Reprographic and Printing Services, Secunderabad

##### Unit-II

1. Covey, Stephen. (2004). Seven Habits of Highly Effective People, Free Press
2. Driscoll, M P (1994). Psychology of Learning for Instruction, Needham, Ma: Allyn and Bacon
3. Gardner, Howard (1983; 1993). Frames of Mind: The Theory of Multiple Intelligences, New York; basic books

##### Unit-III

1. Joyce Cox, Curtisfrye etc (2007), Step by 2007 Microsoft Office System, Prentice Hall of India Pvt. Ltd, New Delhi

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes

Semester I	Code 18MBT101	Title of the Paper <b>PROFESSIONAL SKILLS FOR TEACHING - LEARNING</b>										Hours -	Credits 3	
		Programme Outcomes (POs)		Programme Specific Outcomes (PSOs)										Mean Score of COs
		PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6			
CO1	4	4	4	4	3	4	3	3	3	1	1	4	5	3.16
CO2	3	3	4	3	2	5	3	3	2	2	3	3	4	3.16
CO3	3	3	4	4	3	5	4	2	4	5	5	5	5	3.91
CO4	5	3	4	4	4	5	2	5	3	2	2	5	5	3.91
CO5	5	4	4	4	3	5	5	2	2	4	4	4	5	3.91
CO6	4	4	4	4	3	5	4	3	2	4	4	4	4	3.75
<b>Overall Mean Score for COs</b>												<b>3.63</b>		

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Result: The Score for this Course is 3.6 (High Relationship)

Note:

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0.0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very poor	Poor	Moderate	High	Very High

Values Scaling:

Mean Score of COs = $\frac{\text{Total of Values}}{\text{Total No. of POs \& PSOs}}$	Mean Overall Score for COs = $\frac{\text{Total of Mean Scores}}{\text{Total No. of COs}}$
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## 18MBT102

### RESEARCH METHODOLOGY

#### Course Outcomes:

1. To develop understanding of the basic framework of research process.
2. To develop an understanding of various research designs and techniques.
3. To identify various sources of information for literature review and data collection.
4. To develop an understanding of the ethical dimensions of conducting applied research.
5. Appreciate the components of scholarly writing and evaluate its quality.
6. Understand the statistical concepts and applying them in data collection, analysis and interpretation.

#### Unit-I

Microscopy – Fluorescence, Flow cytometry, confocal and Electron Microscope (SEM and TEM). Chromatography: Principles and types- TLC, HPTLC, GC, HPLC, Ion exchange, Size exclusion, Hydrophobic interaction, Gel filtration and Affinity chromatography.

#### Unit-II

Electrophoresis: Principles and types- Electrophoresis: PAGE and AGE (DNA & RNA). Blotting Technology - Southern, Northern and Western blot. PCR: Principle and types, Microarray: Principle and types, Gene sequencing: Automated and Pyrosequencing.

#### Unit-III

Spectrophotometry: Principle and Instrumentation - UV-Vis, Atomic absorption Spectrophotometry, FTIR, NMR, X-ray Crystallography, MALDI-TOF, Particle Size analyzer.. Tracer techniques - Nature of radio activity- GM Counter, Scintillation Counter, Auto radiography and applications of isotopes.

#### Unit-IV

Research: Definition, Types and objectives- Hypothesis, Characteristics, Literature collection, Writing review and Journal article, Structure of thesis. Impact factor: Plagiarism, Retraction, Research Alert and Scientific red cards. NCBI- Nucleic acids and Protein Sequences Annotation, Submission and Accession. Writing research proposals.

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### Unit-V

Biostatistics: Sampling techniques, data collection, classification, and presentation of data, Measures of location: Central values, Dispersions, Skewness, and Kurtosis. Probability: Binomial, Poisson and Normal distributions. Correlation: types and methods, regression analysis (simple, linear), T-test and Chi-square. ANOVA- one and two ways, Principles of experimental design-randomization and replication. Standard designs: CRD and RBD.

### References:

1. Maniatis and Sambrook. 2012. Molecular Cloning- A Lab manual (Vol.I, II & III), 4<sup>th</sup> Ed. Cold spring Harbour Laboratory Press, New York.
2. Wilson K and Walker J.2000. Practical Biochemistry: Principles and Techniques, 5<sup>th</sup> Ed. Oxford University Press, UK.
3. Glick BR and Pasternak JJ. 2010. Molecular Biotechnology: Principles and applications of recombinant DNA, 4<sup>th</sup> Ed. ASM Press, Washington, USA.
4. Rudolf J. Freund, Donna Mohr and William J. Wilson. 2010. Statistical methods. 3<sup>rd</sup> Ed. Academic Press, Elsevier, London.
5. Veerakumari L. 2006. Bioinstrumentation. MJP Publishers, Chennai

### Web Based References

- <http://www.jkscience.org/archive/volume93/Journal%20Knowledge/impact%20factor.pdf>
- <http://www.scientificredcards.org/content/misconduct>
- <http://www.infoplease.com/biography/var/eugenegarfield.html#axzzowdMcGvHJ>

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes

Semester I	Code 18MBT102	Title of the Paper RESEARCH METHODOLOGY														Hours -	Credits 4	
		Programme Outcomes (POs)						Programme Specific Outcomes (PSOs)										Mean Score of COs
		PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8			
CO1	4	5	4	4	4	4	4	3	4	4	4	4	4	4	3	3.91		
CO2	5	5	4	4	4	3	3	2	5	5	3	3	3	4	4	4.00		
CO3	4	5	5	3	3	3	3	3	4	4	4	5	3	3	3	3.83		
CO4	3	4	4	4	4	4	4	2	4	3	4	4	4	2	2	3.50		
CO5	4	5	5	5	4	4	4	2	2	4	3	4	4	5	4	3.91		
CO6	4	4	4	4	5	4	4	2	4	3	3	4	4	4	4	3.83		
<b>Overall Mean Score for COs</b>																<b>3.83</b>		

**Result: The Score for this Course is 3.8 (High Relationship)**

*Note:*

Mapping Scale	1-20% 1	21-40% 2	41-60% 3	61-80% 4	81-100% 5
Relation Quality	0.0-1.0 Very poor	1.1-2.0 Poor	2.1-3.0 Moderate	3.1-4.0 High	4.1-5.0 Very High

*Values Scaling:*

Mean Score of COs =	$\frac{\text{Total of Values}}{\text{Total No. of POs \& PSOs}}$	Mean Overall Score for COs =	$\frac{\text{Total of Mean Scores}}{\text{Total No. of COs}}$
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**ADVANCES IN BIOTECHNOLOGY**  
(Open Online Course)

**Course Outcomes:**

1. To provide education that leads to comprehensive understanding of the principles and practices of biotechnology.
2. To empower students with the ability to think and solve problems in the field of biotechnology.
3. To ensure students are able to effectively communicate with biotech and other interdisciplinary professionals.
4. To produce responsible biotechnologists that can work within the interdisciplinary framework of biotechnology and related fields.
5. To ensure students to gain an insight into the concepts and techniques of Plant, Animal & Microbial biotechnology and its wide industrial & medicinal applications.
6. To ensure students to understand and follow the regulatory framework important for the product safety and benefit for the society.

**Unit-I: Plant Biotechnology**

Production of transgenic plants tolerant to biotic stresses. Genetically improved crops (Golden rice). Bt and Terminator - Technology Protecting Systems (GURTs), Clean Gene Technology. Gene silencing: Anti-Sense RNA technology (*Flavr Savr*) and RNA interference. Production technology for Plantigens, Plantibodies, Food vaccines and Bioplastics.

**Unit-II: Animal Biotechnology**

Animal cell cultures – Primary & Continuous cell lines. Animal Virus derived vectors: SV- 40 & Baculovirus. Expression vectors - GST and pET-based vectors; Protein purification: His-tag, GST-tag, MBP-tag and Inclusion bodies. Transgenic mice, fish and sheep. Hybridoma technology and Recombinant vaccines production. Gene therapy, Stem cell technology – Somatic cell, nuclear transfer, Xeno-transplantation.

**Unit-III: Microbial Biotechnology**

Scope and techniques. Selection and improvement of strains for biomass production, Production of recombinant proteins, enzymes and vaccines in microbes. Bioprospecting of Microbial diversity Bioweapons and Bioshields. Direct Mutagenesis and Protein engineering. Principle of microbial reaction engineering and novel metabolites. Uses of Genetically Engineered Microbes in Agriculture, Industries and Medicine.

**Unit-IV: Nanobiotechnology**

Carriers for Drug Delivery: Liposomes Cubosomes, Hexosomes, Virosomes and Virus like Nanoparticles. Microbial Nanoparticles: Magnetosomes and Bacteriorhodopsins. Nanoparticles for Biomedical Imaging-Immuno fluorescent Biomarker – Immuno gold labeling, Iron oxide nanoparticles for Magnetic Resonance Imaging (MRI). Applications of Nanobiotechnology – Biochips, Nucleic acid nanoparticles: Nanotubes and Nanorods. Fullerenes for Drug Delivery.

**Unit-V: Ethical Issues in Biotechnology**

Biosafety – Biosafety for human health and environment. Social and ethical issues of biosafety. Use of genetically modified organisms (BT cotton and BT brinjal) and their release into the environment. Special procedures for r-DNA based products. Intellectual property rights, patenting (Process and Product). Bioethics - Ethical issues of Synthetic biology and nano-biotechnology.

**References:**

1. Glick BR and Pasternak JJ. 2010. Molecular Biotechnology: Principles and applications of recombinant DNA, 4<sup>th</sup> Ed. ASM Press, Washington, USA.
2. Watson JD *et al.*, 2007. Recombinant DNA: Genes and Genomes- a short course. 3<sup>rd</sup> Ed. Cold Spring Harbor Laboratory Press, CSHL, New York, USA.
3. Brown TA. 2010. Gene cloning and DNA Analysis- An Introduction, 6<sup>th</sup> Ed. Blackwell Science Ltd. Oxford, UK.
4. Satish MK. 2008. Bioethics and Biosafety. I K International Publishing House Pvt Ltd, India.
5. Deepa Goel and Shomini Parashar. 2013. IPR, Biosafety and Bioethics. 1<sup>st</sup> Ed. Pearson Education, India

**Web source: Open online Course**

- a) <http://www.sjctni.edu/Department/BT/OOC/unit1.jsp>
- b) <http://www.sjctni.edu/Department/BT/OOC/unit2.jsp>
- c) <http://www.sjctni.edu/Department/BT/OOC/unit3.jsp>
- d) <http://www.sjctni.edu/Department/BT/OOC/unit4.jsp>
- e) <http://www.sjctni.edu/Department/BT/OOC/unit5.jsp>

**Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes**

Semester I	Code 18MBT103	Title of the Paper <b>ADVANCES IN BIOTECHNOLOGY</b> (Open Online Course)															Hours -	Credits 5	
		Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)												Mean Score of COs
		PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8					
CO1	4	4	5	3	4	4	4	2	5	4	5	4	4	4	4	4	4.00		
CO2	4	4	4	4	4	4	4	4	4	4	2	4	2	4	2	4	3.66		
CO3	3	4	5	5	4	4	4	4	4	3	3	4	4	5	4	4.00			
CO4	4	5	5	4	4	4	4	4	4	4	3	4	4	2	4	3.91			
CO5	3	4	4	4	4	4	4	3	4	4	2	4	2	4	4	3.58			
CO6	3	4	5	4	4	4	4	3	4	4	4	2	4	4	3	3.66			
<b>Overall Mean Score for COs</b>																			
<b>3.80</b>																			

**Result: The Score for this Course is 3.8 (High Relationship)**

*Note:*

<b>Mapping Scale</b>	<b>1-20%</b>	<b>21-40%</b>	<b>41-60%</b>	<b>61-80%</b>	<b>81-100%</b>
<b>Relation Quality</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
	<b>0.0-1.0</b>	<b>1.1-2.0</b>	<b>2.1-3.0</b>	<b>3.1-4.0</b>	<b>4.1-5.0</b>
	<b>Very poor</b>	<b>Poor</b>	<b>Moderate</b>	<b>High</b>	<b>Very High</b>

*Values Scaling:*

<b>Mean Score of COs =</b>	$\frac{\text{Total of Values}}{\text{Total No. of POs \& PSOs}}$	<b>Mean Overall Score for COs =</b>	$\frac{\text{Total of Mean Scores}}{\text{Total No. of COs}}$
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**18MBT104A**

**INTELLECTUAL PROPERTY RIGHTS**

**Course Outcomes:**

1. To understand the basics of the four primary forms of intellectual property rights.
2. Able to compare and contrast the different forms of intellectual property protection in terms of their key differences and similarities.
3. Students will be able to assess and critique some basic theoretical justifications for each form of intellectual property protection.
4. To understand the trade and its related protection.
5. Students will be able to analyze the effects of intellectual property rights related to international level.
6. To analyze and compare International trade and copy right

**Unit-I**

Introduction to Intellectual property: Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

**Unit-II**

Trade Marks: Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting and evaluating trade mark, trade mark registration processes.

**Unit-III**

Law of copy rights: Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law.

Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer

**Unit-IV**

Trade Secrets: Trade secret law, determination of trade secrete status, liability for misappropriations of trade secrets, protection for submission, trade secrete litigation. Unfair competition: Misappropriation right of publicity, false advertising.

**Unit-V**

New development of intellectual property: new developments in trade mark law; copy right law, patent law, intellectual property audits.

International overview on intellectual property, international - trade mark law, copy right law, international patent law, international development in trade secrets law.

#### **Textbook**

1. Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets. Deborah, E. Bouchoux, 2013. Cengage, India. ISBN-10: 8131528979

#### **References**

1. Intellectual Property Right - Unleashing the knowledge economy, Prabuddha Ganguli, Tata Mc Graw Hill Publishing Company Ltd. 2001. ISBN-10: 0074638602.
2. Neeraj Pandey and Khushdeep Dharni, Intellectual Property Rights . Prentice-Hall of India Pvt. Ltd, 2014. ISBN-10: 812034989X.

### **18MBT104B**

#### **FOOD BIOTECHNOLOGY**

##### **Course Outcomes:**

1. To understand the positive role and benefits of microorganisms and enzymes in food production, processing, and preservation.
2. To understand basic biological and chemical processes of living cells, enzymes, and microbial nutrition in relation to fermentation processes.
3. To know clearly about the food microbiology and food borne diseases.
4. To critique the ethical concerns associated with modern biotechnology processes.
5. To appraise the beneficial effects of microorganisms on foods with regards to nutritional and functional properties.
6. To understand the strategies of food industrial biotechnological industries.

##### **Unit I: Introduction to Food Biotechnology and Food Chemistry**

Biotechnology in relation to the food industry, classes of industrially important food, Characteristics of food - Nutritional value and sensory characteristics, Food chemistry – Carbohydrates, amino acids, proteins, lipids, vitamins, macro- and micro-nutrients.. Nutraceuticals, probiotics, antioxidants, vitamins, organic acids, single cell proteins.

##### **Unit II: Spoilage of food**

Mechanisms and types of spoilage, Intrinsic and extrinsic factors affecting spoilage: water activity, pH, temperature, redox potential etc., major spoilage micro organisms and their growth conditions, effect on food.

##### **Unit III: Food microbiology and Food borne diseases**

Bacteria, yeasts and molds – sources, types and species of importance in food processing and preservation; fermented foods and food chemicals, single cell protein. Classification – food infections – bacterial and other types; food intoxications and poisonings – bacterial and non-bacterial; food spoilage – factors responsible for spoilage, spoilage of vegetable, fruit, meat, poultry, beverage and other food products.

##### **Unit IV: Introduction to Food Processing**

Preliminary processing methods – need and types, Raw material preparation: Cleaning, sorting, grading, peeling etc Principles and methods of food preservation - Low temperature techniques: Refrigeration, Freezing and freeze

drying, High temperature techniques: Blanching, HTST pasteurization, canning, UHT treatment, dehydration, drying, extrusion cooking, Irradiation techniques: UV light, microwave processing, gamma rays, hydrostatic pressure cooking, use of additives, modified atmosphere packaging and storage

#### **Unit V: Enzymes used in food industry**

Microbial production of enzymes (proteases, amylases, invertases, pectinase, xylanase), immobilization, applications, production of organic acids using microbial production of novel sweeteners. Fermentation biotechnology of traditional foods of the Indian subcontinent.

#### **Text Books**

1. Shetty, K., Paliyath, G., Pometto, A. and Levin, R. E., "Food Biotechnology", Taylor and Francis
2. Frazier, "Food Microbiology"
3. Fellows, P., Ellis, H., "Food Processing Technology Principles and Practice", Wiley, New York

#### **Reference books**

1. Johnson-Green, Perry, "Introduction to Food Biotechnology" CRC Press. 2002. ISBN 9780849311529.
2. Roger, A., Gordan, B. and John, T., "Food Biotechnology", 1989
3. George, J. B., "Basic Food Microbiology", CBS Publishers Distributors, 1987.

## **18MBT104C**

### **MICROBIAL BIOTECHNOLOGY**

#### **Course Outcomes:**

1. It covers basic principles of fermentation and technologies of fermented food products.
2. The course covers the microbial growth kinetics, fermentation types, selection of microorganisms used in industry and production of different types of fermented food products.
3. The processes include traditional fermentation procedures and also those involving organisms modified by recombinant DNA technology.
4. To study the avenues of exploiting microbes.
5. To study the structure and types of fermentor.
6. To understand Bioprocess control mechanisms.

#### **Unit-I**

General concepts of Microbial biotechnology. Microorganisms as factories for the production of novel compounds. Genetic engineering of microbes to improve production of antibiotics, amino acids, Lipids, enzymes, steroids and secondary metabolites. Biopolymers and bioplastics.

#### **Unit-II**

Definition, concepts-history, biotechnological potentials of microalgae-food – feed – colourant - fuel and Pharmaceutically valuable compounds. Cultivation methods of microbial biofertilizers - Cyanobacteria, Rhizobium, Azospirillum, Phosphobacteria and AM fungi.

#### **Unit-III**

Biological pest control, scheme for selection of microbial antagonist for biological control of insects, bacterial, fungal and viral diseases. Mode of action of biological control involved in different biocontrol agents. Genetics of antimicrobial metabolites production in biocontrol bacteria. Risks associated with GMOs, Potential impacts on the environment and human health.

#### **Unit-IV**

Bioconversion of cellulosic and non-cellulosic wastes: Mechanism of novel Carboxylase genes involved in bioconversion. Agro by-products. Bioremediation of wood, fuels, lubricants, rubber and plastics.

**Unit-V**

Waste utilization: Waste water treatment –Aerobic and Anaerobic processes, Treatment schemes for waste water of dairy, distillery, tannery, sugar, antibiotic industries. Sewage disposal, compost making, methane generation. Hydrocarbons, Substituted hydrocarbons, oil pollution, surfactants, Pesticides.

**Text Books**

1. Bernad R. Glick and JJ Pasternak.2003. Molecular Biotechnology: Principles and Applications of Recombinant DNA. WCB.
2. Desilva EJ, Domm Ergues YR, Nyns EJ, Ratledge C.1987. Microbial technology in the Developing world, Oxford Scientific Publications.

**Reference Books**

1. Prescott and Dunn. 1992. Industrial Microbiology. 4e (Pb) 2004. CBS Publishers, Westport.
2. Watson, JD, Hopkins NH, Roberts JW, Steitz JA, Weiner AM.1987. Molecular Biology of the Gene. The Benjamin Cummings.

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**18MBT205****DISSERTATION****Course Outcomes:**

1. To prepare a project proposal (to undertake a project)
2. To organize and conduct research (advanced project) in a more appropriate manner
3. To write a research report and thesis

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