DEPARTMENT OF BIOTECHNOLOGY, JIIT, NOIDA

Plant and Microbial Biotechnology

Research Group

Vision

Create a wealth of scientifically verified information
On natural resources
Including plants and microbes

Mission

To provide biotechnology driven solutions

For abetting developmental concerns

In Environment, Agriculture & Industrial sectors

Thrust Areas / Major Research Areas / Major Research Groups

Area / Group Name: Plant and Microbial Biotechnology

Group coordinator: Dr S Krishna Sundari

Research Focus:

New advances in biotechnology are providing great insights in to the workings of nature, presenting interesting opportunities to apply principles of biology to different fields of science. Sustainable solutions are emerging to address the concerns on improving crop productivity, depleting natural resources, environmental pollution, safety of food and agricultural products etc.. Concurrently, there is an increasing demand for natural bio-products of therapeutic and industrial importance (in the areas of healthcare, environmental remediation, agriculture biotechnology). This has provided an impetus for research on plants and microorganisms that produce novel bio-products with variable properties and understanding their mechanisms of action at molecular level. Hence research activities of the Plant and Microbial Biotechnology group at Department of Biotechnology are comprehensively focused up on major sectors *viz*., bioresources, biorefining, bioremediation of organic and inorganic pollutants, enzymes for environment, food, industrial applications, biofertilisers, biocontrol agents for agriculture improvement and natural products for healthcare applications. The group has garnered extra mural funding to the tune of ~ 91 lakhs through research grants from Department of Biotechnology (DBT), Department of Science & Technology (DST) & Department of Ayurveda, Yoga & Naturopathy, Unani, Siddha and Homoeopathy (AYUSH), Govt. of India.

A brief over view of research in the group:

Ability of native plant growth promoting microorganisms (PGPMs) are being evaluated to offer holistic plant growth benefits (providing nutritional benefits along with resistance to soil pathogens, and help reclaim agriculture soils containing residual pesticides). A consortium of PGPM is developed that can be used as bioinoculant (biofertilisers, biopesticides) to improve agriculture productivity. Ability of select PGPM to remediate organic pollutants in agriculture soils is also being explored.

Biorefining, involving biocatalysts in the form of whole cell microbes or enzymes derived from native sources is being experimented with, to remove nitrogen and sulfur/aromatic content present in fossil fuels. Research comprises isolation of microorganisms capable of expressing genes involved in the degradation of contaminants present in fossil fuels.

Microbes (bacteria/actinomycetes) are being screened from niche habitats (desert/hydrocarbon-polluted soil) for isolating antibiotics, biosurfactants, enzymes and are also being characterized to study taxonomic diversity. Industrial enzymes being studied to obtain improved properties for technical applications are: phytase (phosphate utilisation properties for fish/poultry feed), tannase (treatment of industrial effluents), protease, keratinase (feather degradation property for solid waste management), tannase (for tea processing, effluent treatment, juice processing) and amylase (starch desizing in textile industry).

Research groups in the department are actively working on certain other important bio-products viz. food flavours (vanillin), biopolymers (resistant starch from elephant foot and chitosan from fungi, bacterial cellulose), antibiotics and other by-products (gallic acid). Probiotic formulations are being developed using novel microorganisms and those exhibiting resistance to gastric digestion.

New structurally diverse natural products of industrial importance (healthcare - drugs, and environmental remediation- enzymes, biosurfactants) are being studied to address the need for newer molecules with better target profiles. Natural products from plants are being evaluated for respiratory diseases and as immune boosters for asthma and diabetic conditions as well as for neurological conditions and for anti-oxidative activity.

Isolation and identification of microorganism for the bioremediation of sites contaminated with poly-aromatic compounds is being studied. Microbial (ex. *Pseudomonas putida*) ability for tertiary treatment of paper mill effluent has been studied by applying sequential treatment composed of two-step chemical precipitation in order to meet discharge limits for various environmental contaminants. Project related to bacterial surface display of outer membrane protein in *E. coli* to harvest metal ions from the environment is in progress.

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Facilities / Infrastructure

S.No.	**Name of equipments& numbers**	**Make/company**
1	BOD Incubator	Hicon
2	Cold room	Blue star
3	Spectronic(20d+)	Thermospectronic
4	Monocular microscope	Olympus
5	Autoclave	Hicon, Atlantis
6	Laminar flow (horizontal)	S.m. International
7	Micropippetes	Eppendorf
8	Centrifuge (refrigerated) -3k30	Sigma
9	Gel documentation system	Bio-rad
10	Gel drying system	Bio rad
11	Elisa reader model -benchmark	Bio-rad
12	Water bath	Gfl, Germany
13	Incubator shaker	Kuhner
14	Thermal cycle (PCR)	Bio rad
15	Electronic analy. Balance	Denver
16	Conductivity meter model - 145a+	Thermo Orion
17	pH meter model - 420a+	Thermo Orion
18	Comprehensive plant tissue culture lab	Vista biocell
19	pH meter digital	Elico
20	Fermentor (7 ltrs)	Bioage
21	Deep freezer -80 model - u410+	New brunswick
22	Lyophilizer model - alpha 1-2ld	Christ
23	HPLC model- water -2996	Waters
24	BOD incubator	Narang sci. System
25	Binocular microscope ch20i	Olympus
26	Digital incubator orbital shaker	Macflow
27	Digital circular chillar bath	Macflow
28	Digital water bath with incubator shaker	Macflow
29	High precision balance - cy510c	Citizen
30	Balance model - CTG 602	Macflow
31	Binocular microscope with photo interface -bx51	Olympus
32	Magnus zoom trinocular microscope model- msz-	Olympus
33	Olympus zoom binocular microscope model- sz51-	Olympus
34	Magnus zoom binocular microscope model-msz	Olympus
35	Thermal cycler (PCR) model- peltier	Bio-rad
36	Incubator shaker model -lab thermlt-x	Kuhner
37	Laminar flow	Atlantis
38	Biosafety hood	Atlantis india
39	Refrigerator- (Sanyo)	Sanyo
40	Universal frequency counter,power supply	Bharti electronics
41	Premium upright freezer, model no -u410	New Brunswick
42	Chemical storage cabinet (model-csc-pp-40-24-87) 45	Atlantis India
43	Laminar flow vertical -model v-42	Atlantis India
44	Remi cooling microfuge -cm-12 -, microcentrifuge -1020	Remi
45	UV-Vis spectrophotometer model UV-1800	Shimadtzu
46	Gas chromatography	Thermo scientific

Annexure-BT1

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Research Grants

Research efforts of the group reflects in sponsored research grants of **Rs.124.67 Lakhs** from premier funding agencies of Govt. of India namely: Department of Biotechnology (DBT), Department of Science & Technology (DST), Department of Ayurveda, Yoga & Naturopathy, Unani, Siddha and Homoeopathy (AYUSH) and Industry sponsored project.

Research projects:

1. Formulation of Microbial consortia with parallel biofertilizer and biocontrol properties. (DBT): **PI: Krishna Sundari,** Co-PI: Dr Reena Singh (TERI). (2010-2014) Total grant value: Rs. 57.39 Lakhs, (**JIIT: Rs. 24.22 Lakhs**, TERI: 33.17 Lakhs). (Completed)

2. Development of a biocatalyst for dearomatization of diesel. **(DBT)**, **PI: Nidhi Gupta**, Co-PI: Sanjay Gupta, Co-PI: D.K. Adhikari (Indian Institute of Petroleum, Dehradun) (2013-2014). Grant value: **Rs. 6.92 Lakhs.** (Completed)

3. Ability of select PGPM strains to remediate organophosphate pesticides commonly used in agriculture. **(DBT) PI: Krishna Sundari** (2013-2015) Grant value: **Rs. 6.59 Lakhs.** (Ongoing)

4. Scientific documentation (digitization) of the selected Indian Medicinal Plants used for antidiabetic and other activities. **AYUSH-NMPB-MHRD**, **PI: Dr Rachana,** (2009-2011) Grant Value: **Rs. 7 Lakhs.** (completed)

5. Development of a biocatalyst for the removal of nitrogen and sulfur from diesel: (**DST**), **PI: Nidhi Gupta** (2013-2016). Grant value: **Rs. 24.9 Lakhs.** (Ongoing)

Industry Sponsored Project:

1. Biotechnological solution for attaining longer shelf life and portability of microbial inoculum**.** Funded by Trident GreenTech Pvt. Ltd., Andhra Pradesh. **PI: Dr. S Krishna Sundari** (August 2015 – June 2016); Grant value: **Rs. 19 Lakhs** approx. (Ongoing)

Women Scientist Project (DST-WoS-A)

1. Studies on production of therapeutically important saponins using *in-vitro* culture of *Bacopa monnieri.* (**DST**) PI: Pragya Bhardwaj (2014-2017); **Faculty mentors: Dr. Ashwani Mathur, Dr. Chakresh K Jain**. Grant value: **Rs. 16.60 Lakhs**. (Ongoing)

Post Doctoral Research Associateship

1. Screening of native microbes with tannase producing ability, production of tannase and gallic acid using alternate substrate: (**DBT**), **PI: Krishna Sundari** (Jan 2012- Dec 2015). Grant value: **19.44 Lakhs.** (Ongoing)

Total research grant value: Rs. 124.67 Lakhs

Inter Institutional Collaborations

Strategic partnerships and collaborations have been established with scientists from various institutions and research centres of repute that enable exchange of research reagents and protocols and sharing specialized expertise and facilities.

- Prof. Sanjay Rangnate Dhakate, Principle Scientist, Department of Materials Physics and Engineering, NPL, CSIR, New Delhi.
- Dr D.K Adhikari, Chief Scientist, Biofuels Division & HOA Biotechnology Conversion Area, Indian Institute of Petroleum, Mohkampur, Dehradun.
- Dr. Reena Singh, Area Convenor, CMR, TERI, Habitat place, Lodi road, New Delhi.
- Prof. Rup Lal, Department of Zoology, Delhi University, Delhi.
- Prof. Subhash Chand, Professor Emeritus, Department of Biochemical Engineering & Biotechnology, IIT Delhi.
- Prof. J.N Chakraborty, Department of Textile Technology, National Institute of Technology, Jalandhar.

Research Achievements

Some of the Research Achievements of the department in the thrust area Plant & microbial Biotechnology are:

- Isolated and characterised 13 plant growth promoting isolates to be developed as bioinoculants for crop improvement.
- A consortium of PGP microbes with dual biofertiliser and biocontrol abilities developed.
- Isolated and characterized four different microorganisms for the degradation of carbazole.
- Cloning expression & purification of enzyme dioxygenase for carbazole degradation.
- Development of sequential tertiary treatment method using metal salt and microorganism for paper mill effluent.
- Production of bacterial cellulose, characterization and application in bioprocessing
- Production of fungal chitosan and preparation of blend membranes for industrial application.
- Isolation, taxonomic identification and characterization of actinomycetes from desert; characterization of antimicrobial compounds from them.
- Identification and characterization of bacteria from sodic-alkaline soil for amylase production and starch desizing
- *In vitro* propagation of medicinal plants and evaluation of their therapeutic potential
- Monographs of medicinal plants of India.
- Enzyme Keratinase produced from soil isolate with proven applicability in imparting anti-shrink functionality to wool and works synergistically with other scale removing enzymes

Resource Development:

The department contributes in the research training of undergraduate and graduate students through both vertical and horizontal integration of research projects in Ph.D, M.Tech and B.Tech programs. Degree has been awarded to PhD (4), M.Tech (55) and B.Tech (226) students who have pursued research in this thrust area. Presently the faculty in the area are actively involved in scientific engagements where research projects at post doctoral, doctoral training are presently ongoing: Post doc (1), PhD (12), M.Tech (20) and B.Tech (24).

Well-trained undergraduates and postgraduates students have gone for their MS or PhD degrees to Universities of National and International repute such as: University of Pennisylvania (Ashmita Saigal); Pennsylvania State University (Manmeet S Dayal); Yale (Anumeha Shah), University of southern California (Ambika ramrakhiani), North Carolina (Tanya Sabharwal), University of Cincinnati (Vikram Kapoor), New York University (Rohan Seth), Kent university (Aanchal Khadelwal), University College London (Radhika Chadda); NYU Polytechnic School of Engineering (Sneh Sharma), Center Ambedkar Centre for Biomedical Research (Manal Shakeel), IITs (Shivani Bisht, Richa Nigam, Sharadwata Pan), NITs (Sakshi), TERI-SAS (Rahul Singh, Anushka Jain), BITS (Neha Panjiar), ICT, Mumbai (rohan Chabbra). Some of the students secured employment / research position with reputed biotech/biopharma industries such as: U.S. Environmental Protection Agency (Vikram Kapoor), Memorial Sloan Kettering Cancer (Sneh Sharma), Novartis Health care pvt. Ltd.(Abhishek Neeraj), Zydus Cadila (Siddharth Bichpuria), Pall Life sciences (Prashant Kishore), Reddy labs (Siddharth Bichpuria), TERI (Madhusmita, Rahul), Panacea Biotec (Geetanjali Menia, Shambhavi Seth, Priyanka Gupta, Tanya Sabharwal), Premas Biotech (Priyo Kumar) Biocon (Rajat Goyal). Some students have taken up the path of entrepreneurship and established their own start ups: Gralit India Biotech Pvt. Ltd (Gaurav Kumar, Atul Kumar).

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Group Members

Faculty	Area of Specialization
Dr. Neeraj Wadhwa	Enzyme technology
Dr. S Krishna Sundari	Bioactive products, Environmental, Agriculture Biotechnology
Dr. Indira P Sarethy	Bioresource, Natural products
Dr. Nidhi Gupta	Environmental Biotechnology
Dr. Susinjan Bhattacharya	Microbial biotechnology
Dr. Rachana	Natural products
Dr. Ashwani Mathur	Bioprocess Engineering, Natural products
Dr. Pammi Gauba	Environmental Biotechnology
Dr. Smriti Gaur	Microbial Biotechnology
Dr. Garima Mathur	Environmental Biotechnology, Natural products

PLANT & MICROBIAL BIOTECHNOLOGY
Publications

International Journal: 94

1. S.Khan, D.K. Adhikari, S.Gupta, **N.Gupta**, "High -level Expression, purification and characterization of carbazole dioxygenase, a three components dioxygenase, of *Pseudomonas* GBS.5" Biotechnology Letters, 2015, Doi: 10.1007/s10529-015-1876-3 [Indexed in Scopus, Impact Factor:1.7]
2. S. Dangayach, P. Sharma, P. Singhai, **N. Gupta**, "Microbial removal of arsenic: Mechanisms and Applications" *Asian Journal of Multidisciplinary studies*, Vol 2, pp. 159 – 170, 2014.
3. Yadav, P. and **Sundari, S. Krishna.** "Plant growth promoting rhizobacteria: An effective tool to remediate residual organophosphate pesticides applied principally in agriculture soils". Journal of Environmental Research and Development. Vol. 9(4), 1138-1149, 2015.
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5. Prakash, A., Verma, A., Goyal, S. and **Gauba P**. "Remediation of Antibiotics from the Environment". Journal of Basic and Applied and Engineering Research. Vol. 2(8), pp 632-636, 2015.
6. Goyal, S., Prakash, A., Verma, A. and **Gauba P.** "Remediation of heavy Metals. Journal of Basic and Applied and Engineering Research. Vol. 2(9), pp. 727-729, 2015.
7. Basu, S, Pant, M. and **Rachana**. "Protective effect of *Salacia oblonga* against tobacco smoke-induced DNA damage and cellular changes in pancreatic â-cells". Pharmaceutical biology pp. 1-7, 2015.
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10. Mishra, N. and **Sundari, S. Krishna**. "Native PGPM Consortium: A Beneficial Solution to Support Plant Growth in the Presence of Phytopathogens and Residual

Organophosphate Pesticides". Journal of Bioprocessing and Biotechnology. Vol. 5(2), pp. 1-8, 2015. doi:10.4172/2155-9821.1000202

11. Sharma, P., **Mathur, G., Goswami, N., Sharma, S. K**., Dhakate, S. R., Chand, S. and **Mathur, A.** "Evaluating the potential of chitosan/poly(vinyl alcohol) membranes as alternative carrier material for proliferation of Vero cells". **e-Polymers.** (DOI 10.1515/epoly-2015-0021) 2015.
12. Yadav, T., Mishra, S., Das, S., Aggarwal, S. and **Rani, V**. "Anticedants and natural prevention of environmental toxicants induced accelerated aging of skin". Environmental Toxicology and Pharmacology. Vol. 9(1), pp.384-391, 2015.
13. **Gauba, P.** "Lactose Intolerance –A Review". Current Nutrition and Food Science Vol. 11(3), pp. 209-212, DOI: 10.2174/1573401311666150514231452.
14. Singh, A., Gupta, P., Shukla, G. and **Wadhwa, N**. *"Quality* attributes and acceptability of bread made from wheat and *Amorphophallus paeoniifolius* flour". Journal of Food Science and Technology. 2015. DOI 10.1007/s13197-015-1834-z [Indexed in Scopus, Impact factor: 2.024].
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40. Pant, M., Basu, S. and **Rachana.** "Protection against cytotoxicity due to tobacco smoke by *Adhatoda vasica* and vasicine," Journal of Pharmaceutical Technology Research and Management. Vol. 1, pp. 81-88, 2013.
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42. Pathak, G. and **Rachana**. Regulatory and Pharmacovigilance of Biosimilars medicinal products". The Pharma Review. Vol.11(65), pp. 44-47, 2013.
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6. **I.P. Sarethy**, Y. Saxena, A. Kapoor, M. Sharma, S.K. Sharma and S. Gupta "*Bacillus* sp. SI-136 16S ribosomal RNA gene, partial sequence," GenBank Accession No. JN314426, 2011.

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1. Monograph for the Indian medicinal plant *Salacia reticulata*
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Chapter Publications

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3. **Mathur A**., Sharma P., **Goswami N**., Sahai A., Dua A., Das A.R., Kaur H., Kukal S., Dayal M.S., Arora S., Mishra P., Jain V. and **Mathur G**. Comparative studies on production of bacterial cellulose from *Acetobacter* sp. and application as carrier for cell culturing. Industrial, Medical and Environmental Applications of Microorganisms: Current Status and Trends, Wageningen Academic Publishers, 2014, Vol. 37, issue 8, pp. 403-407.
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7. **S. Krishna Sundari** and N. Mishra. "Contribution of Plant Growth Promoting Microorganisms for sustainable agricultural and forestry management practice". In *Soil Microbiology and Biotechnology* Ed. M. Miransari. Houstan, Texas: Studium Press LLC, 2013, Chapter 12.
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11. **S Krishna Sundari**. (2012). Organic pollutants in agricultural soils, risks involved and options for remediation. In "*Environmental Biotechnology-Recent Perspectives: Application and New Horizons of Environmental Biotechnology*". Eds. N. Joshi, K.C. Sharma, M. Sharma. Lambert academic Publishing, Gmbh & Co., KG., 2012. pp. 194-232*,* . ISBN: 978-3-8484-2515-0
12. **Gaur, S.** and V K Gupta., "Biotechnological Perspective of Bacterial Proteases: An Overview"in *Biotechnology of Microbial Enzymes*, Nova Science Publishers, USA 2012, pp 69-79.
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15. **Gaur**, **S.**, Ahmad, N. and Maheshwari, S., "Impact of fungal phytases in biotechnology: present and future perspectives. In: Fungal Biochemistry and Biotechnology, (Eds. Gupta, V.K., Tuohy, M.G. and Gaur,R.K.) Lambert Academic Publishing, Germany. (ISBN No. 978-3-8433-5800-2), pp 20-34, 2010.
16. Vandana Gupta and **Sanjay Gupta**, Diversity of Microbial World: General Microbiology (chapter in e-book for first year undergraduate students), Council of Scientific and Industrial Research (CSIR), Government of India, 2008.

Annexure BT-3

PLANT & MICROBIAL BIOTECHNOLOGY
List of Doctoral students

Ongoing

S.No	Year of Registration	Name	Title	Supervisor
1	2009	Sujata Basu	Preventive effects of *Salacia* extract in oxidatively stressed condition	Rachana
2	2009	Nivedita Mishra	Developing microbial consortia with abilities for plant growth promotion and remediation of residual pesticides	Krishna Sunadri
3	2009	Mamta Pant	To study the preventive role of *Adhatoda vasica* in oxidatively stressed condition	Rachana
4	2011	Anuradha	A study on Value added products from Aroid (*Amorphophallus paeoniifolius*)	Neeraj Wadhwa Susinjan Bhattacharya
5	2011	Parul Sharma	Biopolymeric membrane for animal cell culture	Ashwani Mathur Pros. S Chand
6	2012	Sonam Shaheen	Mass Production of PGPR for making microbial consortium and testing their ability to remediate organophoshphate pesticides	Krishna Sundari
7	2012	Ibeyaima	Bioprospection of actinomycetes from Indian Desert for antimicrobial activity and other natural products of industrial importance	Indira P Sarethy Prof. S. Sharma Prof. R. Lal
8	2014	Swarna Shikha	Phytoremediation	Pammi Gauba
9	2014	Samiya Khan	Development of a biocatalyst for refining diesel	Nidhi Gupta
10	2014	Nidhi Srivastava	Bioprospection of niche habitat(s) for anti-microbial products	Indira P Sarethy
11	2014	Pragya Bhardwaj	Studies on production of therapeutically important saponins using in-vitro culture of *Bacopa monnieri*	Ashwani Mathur Chakresh K Jain
12	2014	Pratibha Yadav	Remediation of organophosphate pesticides using PGPM	Krishna Sundari

PLANT & MICROBIAL BIOTECHNOLOGY
List of Doctoral students

Completed

S.No.	Name	Title	Supervisor	Degree Awarded
1	Smriti Gaur	Studies of Proteases from Biological Sources	Neeraj Wadhwa	2010
2	Sarita Agrahari	Production of enzymes and degradation of feathers by soil microbes	Neeraj Wadhwa	2011
3	N. Kumara Swamy	Paper mill effluent: Decolorisation and detoxification studies using chemical and microbial methods	Indira P Sarethy	2012
4	Gajendra Bahadur Singh	Microbial screening and expression of gene involved in carbazole degradation	Nidhi Gupta	2013

Annexure BT-4

PLANT & MICROBIAL BIOTECHNOLOGY

Dual degree B.Tech/M.Tech projects

Completed Projects				
S.No.	**Enrl No.**	**Name**	**Project Title**	**Faculty**
1	20002	Sharadwata Pan	Expression of Metal binding Proteins/peptides in bacterial cells (*E.coli*)	Dr. Susinjan
2	20008	Dushyant Pandey	Pegylation, a novel concept in protein modification	Dr. Indira
3	20098	Varun Roy	Effect of fungal protease on levels of proteases, gliadin, glutenin in developing	Dr. Neeraj
4	20045	Raghuraj Singh	Cloning and expression of mosquito larvicidal cry 4a protein of *Bacillus*	Dr. Krishna
5	20053	Sonal Nangalia	Antibacterial properties of allicin from garli+c3c extract: a potential for clinical	Dr. Reema
6	20070	Prashant Kishore	Bioproduct characterization and analytical method validation	Dr. Indira
7	20084	Shashank Shekhar	Media scouting for optimization of growth of adherent cell line	Dr. Indira
8	20069	Sunil Kumar	Production of cellulase enzyme from *Agaricus bisporus* by solid state	Dr. Krishna
9	20081	Shree Prakash	Expression of spermidine-binding protein PotD in *Escherichia coli*	Dr. Susinjan
10	6101060	Anjali Sharma	Development and characterization of topical microemulsion system for *Camellia*	Dr. Reema
11	6501805	Bharti Sharma	Investigating the effect of plant metabolites on yeast cells subjected to	Dr. Krishna
12	6501815	Nikhil Kathuria	Potential of *Picrorhiza kurroa* extract in preventing "Tobacco smoke" induced	Dr. Rachna
13	6501829	Swati Chabbra	Investigating the effect of fungal metabolites on yeast cells subjected to	Dr. Krishna
14	6501825	V. Divya Sai	Developing mutants with increased PHA production on alternate substrates	Dr. Krishna
15	6501826	Yashi Saxena	Amylase production and characterization from alkaliphilic isolates	Dr. Indira
16	6501827	Varun Kohli	Substrate and process optimization for maximising PHA production on alternate	Dr. Krishna
17	7501821	Prakhar Sachdeo	Generation of metal binding *E.coli* through surface display of engineered outer	Dr. Susinjan
18	7501823	Atul kumar	Dehydration and image analysis of *Vitis vinifera*	Dr. Neeraj

19	7501824	Aarushi Kashyap	In vitro propagation of the medicinal plant *Solanum nigrum* in liquid media and	Dr. Indira
20	7501825	Purva Chopra	Production and Extraction of Biosurfactant from *Streptomyces* sp. PN-18	Dr. Indira
21	7501828	Nitin Goel	An Investigation of the possible preventive role of apocynin on smoke induced cell	Dr. Rachna
22	7501829	Harsha Rohatgi	Production of Resistant Starch from Plant Sources	Dr. Neeraj
23	7501830	Vartika Mahajan	Isolation, Purification and Characterization of Protease from Vegetable Waste	Dr. Neeraj
24	7501834	Ayushi Jain	An Investigation of possible preventive role of *Tinospora cordifolia* on Smoke	Dr. Rachna
25	7501835	Aishvarya	Bioprospecting For Actinomycetes In Arid Desert	Dr. Indira
26	7501806	Uday Bahal	In-vitro propagation of the medicinal plant *Bacopa monnieri* in liquid culture and	Dr. Indira
27	7501816	Jai Surabhi Verma	Production Of Proteolytic Enzyme Keratinase By Free And Immobilized Cells	Dr. Neeraj
28	7501819	Gaurav Kumar	Wheat gluten and puroindoline as edible food coating	Dr. Neeraj
29	07501811	Deepika	Antiapoptotic activity of bioactive compounds from selected fungi	Dr. Krishna
30	7501832	Sanchit Srivastava	Decomposition of *Lycopersicon esculentum* (tomato) and *Citrus limonium*	Dr. Neeraj
31	7501807	Ishan Wadi	Studying the interactions of active ingredients from *salacia reticulata* with	Dr. Rachna
32	8101013	Yashi Bhatnagar	Degradation of carbazole by entrapped and encapsulated *Pseudomas sp.*	Dr. Nidhi
33	8512003	Deepak Kumar	Bacteriological and physicochemical quality of drinking	Dr. Smriti
34	7501830	Vartika Mahajan	Isolation, Purification and Characterization of Protease from Vegetable Waste	Dr. Neeraj
36	9101059	Mansi Sehgal	Profiling of *Bacopa monnieri* , from different geographical habitat, for	Dr. Ashwani
37	9501810	Akansha Sachdeva	Development of non-dairy probiotic	
38	9501803	Rohan Chhabra	Fungal chitosan: carrier material for animal cell culturing	
39	9101064	Mitika Gupta	Characterization of selected actinomycete isolates from dune ecosystem	Dr. Indira
40	9501801	Vandana Yadav	Characterization of selected actinomycete isolates from arid desert	
41	9501806	Gaurav Shukla	Properties of edible coatings from native and modified aroid starches	Dr. Neeraj

42	9501822	Mahima Malik	Effect of gluten coating enriched with bioactive compound to improve the	
43	9501807	Apoorva Gaur	Production and purification of tannase from SSF, merits of co-culture for	Dr. Krishna
44	9501827	Pratima Mishra	Bioprocess parameter optimization for in vitro propagation of medicinal plants	Dr. Garima
45	9501828	Ravish Rana	Screening and isolation of vanillin producing microorganisms	
46	9501824	Anukriti Verma	Evaluation of probiotic characteristics of bacteria isolated from fermented foods.	Dr. Smriti
47	9501816	Abhishek Rathore	Removal of azo dye by bacterial isolate	
48	10101020	Niyanta Bhatia	Characterization of endophytic microorganisms for bioactivity	Dr. Indira
49	10501830	Taru Gupta	Antimicrobial activity of an endophytic streptomyces from *Phyllanthus niruri*	Dr. Indira
50	10501818	Kirti Chauhan	Screening of Indian medicinal herbs for cell death	Dr Rachana
51	10501823	Akanksha Mohindra	Biodegradation of phenols	Dr Neeraj
52	10501831	Harleen Kaur	Biodegradation of Crude oil hydrocarbons	Dr Nidhi
53	10101014	Aalapti Singh	Application of phytoremediation technology in remediation	Dr.Pammi
54	10101023	Prachi	Fungal chitosan and its membranes: preparation, characterization and	Dr. Ashwani
55	10501817	Sukriti	A study exploring effect of organophosphate pesticides on oxidative	Dr. Krishna

Annexure BT-5

PLANT & MICROBIAL BIOTECHNOLOGY

B.TECH PROJECTS

Completed Projects				
S.No.	Enrl. No.	Name	Project Title	Faculty
1	20019	Greta Kasliwal	Establishment of an optimal micropropagation technique for mass propagation at *Jatropha curcas*	Dr. Neeraj
2	20072	Neha Gupta		
3	20099	Jiwateshwar		
4	20015	Vipul Jain	Designing fuel cell using halophiles and Hydrogen metabolisers	Dr. Krishna
5	20030	Swatantra Kumar		
6	20039	Nitesh Raut		
7	20002	Sharadwata Pan	Tissue culture and micropropagation studies on the living fossil *Cycas* sps. for potential commercial application	Dr. Indira
8	20029	Abhishek Neeraj		
9	20033	Kumar Shivam Shrivastava		
10	20070	Prashant Kishore		
11	20014	Sumanth Alla	Cost-effective protocols for rapid micropropagation of rare succulents	
12	20007	Piyush Gupta	Study of the antagonistic microorganisms against milk protein and fat degradative microorganism	Dr. Susinjan
13	20042	Anurag Sharma		
14	20078	Amit Pramod Aggarwal		
15	20109	Kapil Mishra		
16	30025	Abhishek Tyagi	Isolation, identification and characterization of *Streptomyces* isolates from India for potential production of anti-cancer metabolites	Dr. Indira
17	30040	Nikhil Shanker		
18	30036	Nitin Vikram		
19	30003	Anmol Grover	Isolation of eDNA and biodiversity study of metal metabolizing microbes	Dr. Krishna
20	30010	Harish Sharma		
21	30084	Hemant Jethwani	Bioplastic Production	
22	30081	Mansi Varma		
23	40003	Neha Panjiar	Isolation, identification and characterization of *Streptomyces* isolates having potential petrol and diesel degrading properties.	Dr. Indira
24	40005	Praveshika Katiyar		
25	40018	Tishya Tripathi	Isolation of a protease inhibitor from leaves of neem (*Azadirachta indica*)	Dr. Neeraj
26	40004	Vritika M Gaur		
27	5101022	Akshay Banga	Screening of dibenzothiophene desulfurizing microbes from soil and quantification of dibenzothiophene utilization	Dr. Nidhi
28	5101026	Anuj Garg		
29	5101028	Yashika Khanna		
30	5101080	Pratyush Banga		
31	5101021	Shabnam Sourav	Novel Enzymes from alkaliphilic	Dr. Sanjay
32	5101024	Prerna Kumari		

33	5101040	Neha Arora	bacteria	Dr. Indira
34	5101100	Suyashi		
35	5101007	Shubham Tyagi	Protease extraction from senesced leaves and its potential commercial	Dr. Neeraj
36	5101018	Pranjal Gupta		
37	5101019	Parul Gupta		
38	5101032	Nishika Malhotra	Study exploring bioremediating abilities of plant growth promoting microorganisms	Dr. Krishna
39	5101036	Divyanshu Jain		
40	5101043	Kumar Siddhartho Talukdar		
41	5101044	Meha Saxena		
42	601010	Neha Ansal	Protease extraction from senesced leaves and its application in food industry	Dr. Neeraj
43	601024	Swati Aggarwal		
44	601830	Apoorva Gupta		
45	601014	Padmini	Use of Glutenin coating in the storage of apple slices	
46	6101032	Akanksha Gupta		
47	6101046	Nisha Agarwal		
48	6101031	Arushi Goel		
49	601025	Tushar Agarwal	Phytochemical Screening. Purification and Characterization of cellulase from germinating garlic	
50	601038	Esha Batra		
51	601011	Neha Juneja		
52	601048	Pavni Kaushiva		
53	601055	Sumit Lamba	Isolation and characterization of new proteases from plant seeds	Dr. Neeraj
54	601061	Vipul Jain		
55	6101026	Varun Gupta	Anti-oxidant and anti apoptotic activity *Picrorhiza kurroa* : LPS induced model"	Dr. Rachna
56	6501815	Nikhil Kathuria		
57	6501828	Vaibhav Gandhi		
58	6101015	Prateek Goel	Design of portable microbial fuel cell that meets small power requirements	Dr. Krishna
59	6101016	Prateek Roy		
60	6101037	Dhananjai Sinha		
61	6101058	Vikram Kapoor		
62	6501825	Divya Sai	Microbial bioplastic production using oil cakes as alternate substrate	
63	6501827	Varun Kohli		
64	6101034	Amumeha Shah	Developing consortium of plant growth promoting microorganisms for remediation of agricultural soils	
65	6101040	Jyoti chauhan		
66	6101041	Kanika Sharma		
67	6501805	Bharti Sharma	Biochemical analyses of anti oxidative compounds in mycelia culture of ectomycorrhizal fungi	
68	6501829	Swati Chhabra		
69	6101002	Akanksha	Screening of dibenzothiophene or carbazole utilizing microbes and	Dr. Nidhi
70	6101003	Ashmita Saigal		
71	6101020	Sakshi Aggarwal		

72	6101022	Shivani Bisht	quantifying the extent of utilization	
73	7101001	Sneh Sharma	Oxidative stress linked antiapoptotic activity of secondary metabolities (polysacharrides) and enzyme (SOD) from fungi	Dr. Krishna
74	7101036	Aakriti Goel		
75	7101023	Ridhie Bajaj		
76	7501811	Deepika		
77	7101028	Anubhuti Bansal	To study the ability of plant growth promoting microorganisms to remediate carbofuran and chromium	
78	7101034	Megha Sarawgi		
79	7101058	Neha Goswamy		
80	7101064	Amit Chawla	Design and optimization of a portable microbial fuel cell that meets small power requirements	
81	7101012	Anant Aggarwal		
82	7501806	Uday Bahal	Microrhizome production from black turmeric and its characterization	Dr. Indira
83	7501824	Aarushi Kashyap		
84	7501831	Nidhi Sejwal		
85	7501835	Aishvarya	Molecular characterization of Streptomyces isolates	
86	7501801	Megha Garg		
87	7501825	Purva Chopra		
88	7501812	Vidhi		
89	7501819	Gaurav kumar	Optimization studies for keratinase production	Dr. Neeraj
90	7501823	Atul kumar		
91	7501832	Sanchit Srivastava		
92	7101047	Mayank Singh		
93	7501816	Jai Surabhi Verma	Identification of prebiotics from plants	
94	7501829	Harsha Rohatgi		
95	7501830	Vartika Mahajan		
96	7101006	Akanksha Gulia	Selection of native isolates with optimal tannase activity on alternative substrates	Dr. Rachna
97	7101035	Swaran Nandini		
98	7101005	Parul Mehrotra		
99	7501807	Ishan Wadi	Potential role of Apocynin in preventing Apoptosis: yeast model	Dr. Rachna
100	7501828	Nitin Goel		
101	7501834	Ayushi Jain		
102	7101063	Akash Mathew	Screening, Isolation and identification of microbes producing phytate degrading enzymes	Dr. Smriti
103	7101056	Nidhi Magoo		
104	7101057	Srishti Rawal		
105	7101060	Gaurav Shah	Expression of metal binding peptides in *Escherichia coli*	Dr. Susinjan
106	7501821	Prakhar sachdeo		
107	7101041	Shainkee Chauhan		
108	8101001	Manal Shakeel	Developing mass production strategies for PGPMs	Dr. Krishna
109	8101011	Shivesh Ghura		
110	8101035	Anushka Jain	Exploring the plant growth promoting and bioremediating activities of PGP bacteria	
111	8101057	Ambika Ramrakhiani		
112	8101031	Poorva Mehndiratta	Carbazole degradation carbazole degradation by immobilized cells	Dr. Nidhi
113	8101025	Arushi Jain		

114	8101044	Tanya Pahwa		
115	8101013	Yashi Bhatnagar		
116	8501801	Sakshi Goel	Studying the biocontrol properties and benzopyrene degrading abilities	Dr. Krishna Dr Sujata
117	8101034	Akshara Rawat	Optimization Studies for phytase Production	Dr.Smriti
118	8101055	Rashi Bhutani		
119	8101038	Manmeet Singh Dayal	Production of bacterial cellulose from *Acetobacter* sp	Dr. Ashwani
120	8101045	Vibhor Jain		
121	8101047	Rohan Seth	Purification and properties of alkaline amylase from alkaliphilic bacteria	Dr. Indira
122	8101053	Harsh Sharma		
123	8501803	Sangey Dorji		
124	8101058	Harsh Tandon	Optimization of phytase production by response surface methodology	Dr. Pammi
125	9101011	Chandni Verma	Cytoprotective role of *Andrographis paniculata* on Nicotine induced toxicity in yeast cells	Dr. Rachna
126	9101057	Shreya Ahuja		
127	9501813	Nidhi Dogra		
128	9101039	Gautam Kapoor	Interaction of 11 hydroxy mustakone from Tinospora with	Dr. Rachna
129	9501804	Preeti Mishra	Production of phytate degrading enzyme by soil isolate	Dr.Smriti
130	9501816	Abhishek Rathore		
131	9101035	Sakshi Monga		
132	9101042	Devyani Shukla		
133	9101019	Shreya Mahajan	Exploring the ability of native microbes to produce tannase from alternative sources	Dr. Krishna
134	9501807	Apoorva Gaur		
135	9101052	Iram Hasan	Study of phosphate solubilising	Dr. Krishna
136	9101034	Kencho Wangdi	*In vitro* propagation of *Bacopa monnieri* in liquid culture	Dr. Indira
137	9101051	Priya Gaur	Diversity of Actinomycetes in desert ecosystem	Dr. Indira
138	9512001	Swati Sharma		
139	9101009	Abhishek Sahu	Phytoremediation for heavy metals	Dr. Pammi
140	9101055	Deepika		
141	9501808	Ashutosh K Mishra		
142	9512005	Akanksha Singh		
143	9101001	Ashutosh Sharma	Screening and identification of microorganisms degrading 7-ketocholesterol	Dr. Nidhi
144	9101018	Deepika Singhal		
145	9101036	Soni Dayal		
146	9101064	Mitika Gupta		
147	9101013	Shikha Arora	Process Parameters Optimization for Cellulose production from *Acetobacter* sp.	Dr. Ashwani
148	9501827	Pratima Mishra		
149	9501803	Rohan Chhabra	Bioprocess Parameters Optimization	

150	9501810	Akansha Sachdeva	for Chitosan production from soil fungal isolates	
151	9101020	Chhavi Kumar	Process parameter optimization for laccase production in solid state fermentation	Dr. Garima
152	9101065	Anushree Jaiswal		
153	9101066	Richa Nigam		
154	9501809	Medhavi Vishnoi		
155	9512008	Nidhija Roy	Evaluation of antimicrobial potential	
156	9101038	Kshitiz Chandrika Srivastava	Therapeutic potential of *Amorphophallus paeoniifolius*	Dr. Neeraj
157	9101047	Anwesa Banerjee		
158	9501806	Gaurav Shukla	Purification and application of enzymes from *Amorphophallus paeoniifolius*	
159	9512002	Parag Gupta		
160	10101055	Ayushi Jain	Bioprocess parameters optimization for in-vitro propagation of Mentha sp	Dr. Ashwani
161	10101065	Saloni Rao		
162	10101066	Shweta Agrawal		
163	10101098	Ritika Jain		
164	10101035	Aarushi Dua	Production and characterization of microbial cellulose	Dr. Garima
165	10101096	Anushuya Raj Das		
166	10501801	Samiksha Kukal		
167	10501831	Harleen Kaur		
168	10101020	Niyanta Bhatia	Study of endophytic bacteria from selected medicinal and non-medicinal plants.	Dr. Indira
169	10101031	Deeksha Gupta		
170	10501802	Bhavika Sharma		
171	10501830	Taru Gupta		
172	10101045	Nikhita Agarwal	Investigating the role of PGPMsin assisting plant growth under abiotic conditions	Dr. krishna
173	10101075	Kriti Shukla		
174	10101081	Srishti Dangayach		
175	10501817	Sukriti		
176	10101006	Abhisarika	Screening of plant poly phenol oxidase for its decolourisation and detoxification potentia	Dr. Neeraj
177	10101016	Nabeel Zaman		
178	10101037	Aditi Bhatnagar		
179	10101039	Garima Naswa		
180	10101004	Sonal Gahlawat	Phytoremediation for PPCPs	Dr. Pammi
181	10101017	Shubha		
182	10101059	Manvi Makhijani		
183	10501818	Kirti Chauhan		
184	10101056	Jasveen Kaur	Nicotine induced cell death in yeast cells	Dr. Rachna
185	10101062	Neha Choudhary		
186	10101001	Sukrati Srivastava		
187	10101092	Kritika Sharma		
188	10101050	Shruti Garg	Escherichia coli surface display using outer membrane protein C	Dr. Susinjan
189	10501809	Shilpa Mishra		
190	10501810	Vandana Sharma		
191	10501828	Kopal Jalan		
192	10101043	Monika Rani	Optimization of culture conditions for the production of phytase from	Dr. Smriti
193	10101063	Sanchita Agarwal		
194	10101078	Sakshi Madan		

195	10501823	Akanksha	soil bacteria	
196	10101090	Pranav Sood	Isolation of microorganism degrading Napthalene	Dr. Nidhi
197	10101072	Farah Siddiqui		
198	10101074	Ishan Shekhar		
192	11501822	Suramya Asthana		Dr. Neeraj
193	11501817	Mohit Vadehra		
194	11101027	Meenakshi Sarpal		
195	11101013	Astha Upadhyay	Bacterial cloning of CspD	Dr Susinjan
196	11101049	Shruti Thakur		
197	11101055	Stuti Mahajan		
198	11101017	Divya Tiwari	Effect of Biosurfactant on carbazole degradation	Dr Nidhi
199	11101025	Kuldeep Nigam		
200	11101038	Pranjul Rai		
201	11101019	Farhein Akmal	Cloning of gene involved in petroleum refining	Dr Nidhi
202	11501807	Deepshikha		
203	11501818	Mridul Trehan		
204	11501805	Avantika Rawat	Role of *Tinospora cordifoila* on yeast cell death induced by carbon soot	Dr Rachana
205	11501813	Jahnavi Sharma		
206	11101054	Srishti Singh		
207	11101014	Bharti Sharma	Diversity of endophytes in the aquatic plant *Nelumbo nucifera*	Dr Indira
208	11101058	Tanuja Ijarwal		
209	11101018	Faiza Khan		
210	11101006	Anchal Sachdeva		
211	11101033	Nishtha Grover	Therapeutic potential of Probiotic Seabuckthorne Juice	Dr Ashwani
212	11101001	Aanchal Budhraj		
213	11101031	Nikita Gupta		
214	11101053	Srishti Kotiyal	Biopesticides from plant sources	Dr Krishna
215	11101037	Poorva Singhai		
216	11101032	Nilanshu Gupta		
217	11101047	Shefali Goyal	Phytoremediation of Pollutants in soil	Dr Pammi
218	11101008	Anjali Verma		
219	11101009	Ankita Prakash		
220	11501816	Meghna	Bacterial expression of metal binding peptides	Dr Susinjan
221	11501812	Ira Thapa		
222	11101060	Vrinda		
223	11101041	Raveesha	Production of exopolysaccharide from lactic acid bacteria	Dr. Smriti
224	11101005	Ananya Singh		
225	11101021	Gauri Mittal		
226	11101050	Siddhant Sharma		

PLANT & MICROBIAL BIOTECHNOLOGY

Relevant Courses conducted

Microbiology (10B11BT313)

History and scope of microbiology; Broad classification and taxonomy of microorganisms; Growth and physiology; Methods of microbial enumeration; Microbial control; Microbial metabolism, photosynthesis, fermentation, anaerobic respiration; Pathogenic microorganisms (bacteria, fungi, protozoa, and viruses, etc), host-pathogen interactions; Microbial genetics; Extremophiles; Microbes in industry.

Cell Culture Technology (10B11BT412)

Cell culture materials and tools, growth conditions and other requirements for establishment and maintenance of plant and animal cells, cell lines and tissues; *in vitro* conservation, protoplast, triploid & haploid culture, micropropagation; Animal cell cultivation: primary culture, growth kinetics, biology and characterization of cultured cells, Large scale production of biologicals in plant and animal cells.

Genetic Engineering (10B11BT513)

Concepts in Genetic Engineering, Enzymes in Genetic Engineering, Cloning Vehicles, BAC / YAC vectors, Construction & screening of genomic libraries, gene cloning strategies, DNA sequencing & mutagenesis, Cloning & expression of transgenes in Prokaryotic & Eukaryotic systems, PCR technologies, gene transfer in plant and animals, molecular markers, Applications and impact of rDNA technology, Ethical issues and biosafety regulation.

Food and Agricultural Biotechnology (10B11BT612)

Food chemistry, microbiology of fermented food products, food spoilage and food borne diseases, Food processing and preservation, Current status of Indian processed food industry, Use of enzymes in food industry, nutraceuticals and functional foods, Single Cell Proteins, Probiotics, Biotechnological approaches in production of therapeutics & industrial products in animals and plants, Production of value added products (biofuel, bioplastics, etc) from agricultural waste, traditional crop improvement vs biotechnological interventions.

Fermentation Technology and Downstream Processing (10B11BT614)

Introduction to fermentation processes, Isolation, preservation and improvement of industrially important microorganisms, Media optimization, Bioprocess Considerations for animal & plant cell cultures, Downstream Processing : Filtration, centrifugation, Separation

of insoluble products – Cell disruption : Physical methods, Chemical methods, Separation of soluble products- liquid-liquid extraction: solvent recovery, two phase aqueous extraction, Chromatography, Process design of Industrial Bio-products : Anaerobic bioprocesses – Ethanol and lactic acid production, Aerobic bioprocesses – Citric acid and penicillin production

Enzymes in Food Processing (10B1NBT735)

Principles of enzyme assay and kinetic studies, enzyme units, Carbohydrate Hydrolyzing Enzymes– amylases, cellulase, Hemicellulases, Isomerase, Pectin degradation Fat hydrolyzing enzymes Lipases, Phospholipases Application in Beverage, Juice and Wine making Industry, Enzymes in Dairy Industry, cheese making and ripening aroma and flavor production, cold sterilization, Enzymes in product modification. Debittering, Hydrolysis of Soy protein, fish protein, Milk protein, collagen, Blood protein Tailoring enzyme structure and function Alteration of technical properties, Increasing yields, Raw matter utilization, Improving preservation, flavors.

Molecular Ecology (11B1NBT831)

Molecular genetics in ecology, Understanding molecular markers, modes of inheritance, co-dominant and dominant markers, Genetic analysis of single population, Genetic analysis of multiple population, Molecular markers in phylogeography, molecular clocks, distribution of genetic lineages, Molecular approaches to behavioral ecology, Applications of molecular ecology in wildlife forensics, agriculture and fishing.

Process Engineering (10B11BT512)

Microbial process development: Introduction to Upstream and Downstream processes, batch, Fed Batch and Continuous culture, Cell growth kinetics; Bioreactor systems including utilities: Types of bioreactor and their applications, cardinal rules of bioreactor design, utilities of bioreactors; Fluid flow and mixing – Rheological properties – Newtonian and Non-Netonian fluids, Flow behavior, mixing, power consumption and shear properties of rushton turbine, helical, anchor, bubble column, external loop, airlift etc; Heat transfer – different modes of heat transfer, Mass transfer in microbial processes: Mass transfer correlation for air solubility; Sterilization : Thermal death of micro-organisms, Batch and continuous sterilization of media, Design of sterilization equipment; Bioreactor analysis – Ideal and non-ideal reactor: immobilized enzyme and cell reactors, multiphase bioreactors, Operational measurements and control in fermentation: Bioreactor sensor characteristics; Case studies related applications in various biotech and biopharma industries.

Bioremediation (10M11BT212)

Environment pollution vis-a-vis bioremediation, Nature and fate of environmental pollutants, Methods and strategies of bio-remediation (ex situ & in situ), Biochemical pathways of degradation, monitoring of bioremediation, use of microorganisms in oil spill degradation, oil refining and oil recovery, Remediation of gaseous effluents, Aerobic and anaerobic methods for sewage treatment, Metal bioremediation, Phytoremediation, GMO's for bio-remediation.

Industrial Bioprocessing (12M1NBT431)

Bioprocess engineering principles for non ideal reactors including submerged and solid state fermentation, growth kinetics for solid state fermentation, Design of bioreactor and scale-up designs; Downstream processing techniques: concentration, purification, polishing. Purification of products from mammalian, plant and algal fermentation; Animal Cell fermentation: Methods of studying cell growth kinetics in bioreactor, Bioreactor design for anchorage dependent and suspension cell lines, 2D and 3D cell culture; Plant Cell fermentation: method of studying growth kinetics of plant cells in suspension and callus.; Algal fermentation: Photosynthetic and chemosynthetic algae of commercial importance, bioprocess conditions and bioreactor design for algal fermentation, type of metabolites produced using algal fermentation; Recent development in bioreactor design: engineering principles of Wave bioreactor, disposable bioreactor, bioreactor for 3D tissue culture, bioreactor for hairy root culture.

IPR and Bioethics (10B1NBT833)

Different forms of Intellectual Property Rights, their Relevance to Biotechnology Industry & Academia; Overview of International conventions & Trade agreements: WTO, TRIPS, WIPO, Implication for developing countries; Process involved in Patenting, Patent Search; IPR in Agriculture, Farmer's Rights, UPOV & Traditional Knowledge; Need of bioethics, Bioethics & GMO's: Issues of Genetically modified foods; Bioethics in Medicine gene therapy, Organ transplantation, ethics in patient care; Bioethics & Cloning: Human cloning, Stem cell research, Use of animals in research, human volunteers for Clinical trials; Ethics in Profession

Metagenomics (12M1NBT331)

Molecular Diversity and Metagenomics: Concept of e-DNA (environmental DNA), and introduction to Metagenomics, Diversity of Microbes in different environments; Conventional methods to study diversity, Understanding the ecosystem level functions of Microbial Communities; Human microbiome projects by NIH, India and EU; Significance of Bioinformatics in understanding and analysis of Genomic Data, Databases and Software available for analysis of Metagenomic Data; Metagenomics & Bioprospecting, Applications

in Medicine, Cancer metagenome; applications in Environmental Biotechnology, Acid Mine Drainage project, Sargasso Sea Metagenomic Metagenomics & Applications in Agriculture, The Soil Resistome project

Bioprocess and Industrial Biotechnology (14M11BT211)

Basic kinetic models of cell growth kinetics, media and air sterilization, Cell death kinetics, metabolic quotient, O_2 transfer and uptake, mass transfer and heat transfer, liquid rheology, Batch / fed batch and continuous cultivation, yield and productivity, Types of bioreactor, Ideal and non-Ideal reactors, Optimization of bioprocess operation (OVAT and statistical design), Operative measurement and control of fermentation, Bioreactor scale-up criteria, Cell growth kinetics of bacteria and fungi in non-ideal reactors: submerged and Solid state fermentation, types of reactor for solid state fermentation, recombinant bacterial cell stability and growth kinetics, Animal cell fermentation (Animal cell metabolism: basic understanding of substrate and byproduct stoichiometry, Growth characteristics and kinetics, micro-carrier attached growth kinetics, biomaterial properties for anchorage dependent cell lines, cell culture in perfusion and hollow fiber reactor, 2D and 3D cell culturing, bioreactor design considerations), plant cell fermentation (Importance of plant cell cultivation, Plant cell / hairy root cultivation, callus and shoot propagation, kinetics of cell growth and product formation, plant cell / hairy root reactors – types of rectors, comparison of reactor performance, immobilized plant cell reactors), Algal derived metabolites, methods of studying growth kinetics of chemotropic and phototropic algae, types of bioreactors: lab scale and large scale photo-bioreactor / pond reactors, Isolation, preservation and propagation of microbial cultures, Process technology for production of Organic acids, Amino acids, alcohols, antibiotics, Vitamins, nucleotides, steroids & flavours, Production of enzymes: protease, cellulose, amylase, lipase; Enzyme inhibitors: inhibitors of cholesterol synthesis; biopesticides; biofertilizers; biopreservatives; biopolymers; single cell proteins; monoclonal antibodies; phytochemicals of commercial / therapeutic importance : flavanoids, saponins.

Nutraceuticals (14M1NBT235)

Historical perspective, Classification, scope & future prospects. Bioactive Carbohydrates Bioactive Lipids, Bioactive Peptides, Polyphenols, Nutraceuticals of plant origin, Nutraceuticals of animal origin, Microbial and algal nutraceuticals, Nutraceuticlas and diseases, Product development and clinical trials, Nutraceutical Industry and Market information.

Microbial Technology (14M1NBT238)

Principles of Microbial Biotechnology and industrially important microbes; Food & Microbial biotechnology; Microbes in Medical biotechnology; Microbes and Environmental

Biotechnology; Microbes and clean energy production; Regulatory and ethical issues involved in all of the above.

Product development in Biotechnology (14M1NBT334)

Production of commercially important primary and secondary metabolites like organic acids, amino acids, Antibiotics, Vitamins and Steroids, Industrial Enzymes, Biopesticides, Biofertilizers, Biopreservatives, Biopolymers, Biodiesel, Recombinant proteins having therapeutic and diagnostic applications, Modified and Artificial Enzymes , Catalytic antibodies, Bioprocess strategies in Plant Cell and Animal Cell culture, Regulatory compliance, Analytical product testing , Biomanufacturing and Biobusiness issues.

Plant Diseases & Biotechnology (15B1NBT833)

An Introduction about Global Agriculture productivity and how disease impact crop yield; Use of chemical pesticides, insecticides and their ill effects; Plant physiology, Genetic basis of Plant genes, plant signalling pathways (systemic acquired resistance); Principle groups of plant pathogens and diseases caused, Molecular basis of genetic modification and crop improvement; RNAi technology in plant disease control; developing genetically modified plants with improved disease resistance; Biocontrol methods applying antimicrobial proteins, Plantibodies, PGPR and their role in disease control.