

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

PLANT AND MICROBIAL BIOTECHNOLOGY
Department of Biotechnology, IIIT, NOIDA

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, Biofertilizer, biocontrol agents for agriculture improvement, *in vitro* culturing of medicinal plants for production of therapeutic compounds, quality testing for herbal products, remediation of pharmaceutical compounds and their interaction with plant metabolites and natural products for healthcare applications. The group has garnered extra mural funding to the tune of Rs. **302.65** 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.

PLANT AND MICROBIAL BIOTECHNOLOGY

A brief overview 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 (biofertilizers, 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 sulphur/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.

Evaluation of probiotic properties of bacterial isolates of various fermented foods with an aim to obtain novel isolates with potential probiotic properties. Further work to focus on analyzing these isolates for their anti-oxidative, anti-cholesteremic, anti-bacterial properties and to evaluate the health benefits of these bacterial isolates. Research on possibility to use probiotics (pure / as functional fermented foods) regularly, to improve the quality of life.

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. Culture-dependent as well as metagenomic approaches are utilized to achieve the same. 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. Developing *in vitro* culture systems for Indian medicinal plants *Bacopamonnieri* and *Stevia rebaudiana* and studying the effects of various biotic and abiotic parameters on yield of therapeutically important phytochemicals.

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, anti cancer and diabetic conditions as well as for neurological conditions and for anti-oxidative activity as well as development of new food products.

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. The group is also exploring the role of quorum sensing in regulating fermentation of non-dairy food products by probiotics. Quorum sensing or bacterial communication is a strategic approach that may be used to regulate microbial growth and fermentation.

PLANT AND MICROBIAL BIOTECHNOLOGY
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	Micropipettes	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 thermIt-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
47	Microwave Digestor	Nu Tech

PLANT AND MICROBIAL BIOTECHNOLOGY

Research Grants

Research efforts of the group reflects in sponsored research grants of **Rs.302.65 Lakhs** from premier funding agencies of Govt. of India namely: Department of Biotechnology (DBT), Department of Science & Technology (DST) and Department of Ayurveda, Yoga & Naturopathy, Unani, Siddha and Homoeopathy (AYUSH).

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: 57.39, (JIIT: **24.22 Lakhs**, TERI: 33.17 Lakhs). (Completed)
2. Scientific documentation (digitization) of the selected Indian Medicinal Plants used for antidiabetic and other activities” **AYUSH-NMPB-MHRD, Govt of India, PI: Dr Rachana**, (2008-2011) Grant Value: **Rs. 7 Lakhs**. (Completed)
3. 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: **6.92 Lakhs**. (Completed)
4. Ability of select PGPM strains to remediate organophosphate pesticides commonly used in agriculture (**DBT**) **PI: Prof. S Krishna Sundari** (2013-2014) Grant value: **Rs. 6.59 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. 27.5 Lakhs**. (Completed)
6. Potentially novel carbohydrases (cellulase and related enzymes) for waste management from cultivable bacteria and functional metagenomic library of North East India biodiversity hotspot (DBT- under Twinning Program for North-East). **PI (JIIT): Dr. Indira P. Sarethy**, PI (CSIR-NEIST) Dr. Hari Prasanna Deka Boruah (2017-2020). Grant value: **22.21 Lakhs** (JIIT), Co-PI: Prof. Sanjay Gupta, Dr. Ratul Saikia, Dr. Anil Kr. Singh Total grant value Rs. 55 lakhs (Ongoing)
7. Evaluation of the heavy metals content in market samples of plant raw drugs used in Ayurveda (AYUSH, GoI), **PI: Dr. Pammi Gauba** (2018-2021). Grant value: **Rs. 41.10 Lakhs**. (Ongoing).

8. Application of customized PGPM based formulations for reclamation of soil permeated with Organophosphate pesticide residues (DBT), **PI: Prof. Krishna S. Sundari**, Co-I: Dr. Sudha Srivastav (2017-2020). Grant value: **Rs. 62.10 Lakhs.** (Ongoing)

Women Scientist Project (DST-WoS-A)

Studies on production of therapeutically important saponins using *in-vitro* culture of *Bacopa monnieri*. (DST) **PI: Pragya Bhardwaj** (2014-2018); **Faculty mentors: Dr. Ashwani Mathur, Dr. Chakresh K Jain.** Grant value: **19.61 Lakhs.** (Completed)

Post Doctoral Research Associateship

Screening of native microbes with tannase producing ability, production of tannase and gallic acid using alternate substrate. (DBT), **PI: Prof. S Krishna Sundari, Post-Doctoral Fellow: Dr. K E Nandini** (Jan 2012- Dec 2015). Grant value: **19.44 Lakhs.** (Completed)

SPONSORED FELLOWSHIP

1. Bioprospection of Microorganisms from Selected Niche Habitat(s) (Soil/ Rocks) for Antimicrobial Products. Indian Council of Medical Research. Fellowship holder: Nidhi Srivastava (ICMR fellowship No. [3/1/3JRF-2013/HRD-136 (30690), PhD Scholar, IIIT Noida), Duration: 2014-2019, **Mentor: Dr. Indira P. Sarethy.**
2. Bioprospection of Actinomycetes from Indian desert and antimicrobial activity of selected isolates: Department of Science and Technology- INSPIRE Program, Fellowship holder: A. Ibeyaima (IF120267, PhD Scholar, IIIT Noida), Duration: 2012-2017, **Mentor: Dr. Indira P. Sarethy.**

Total research grant value: Rs. 302.65Lakhs

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.
- Prof S. P Singh, Department of Biochemistry, BHU, Varanasi, UP.
- Dr.HariPrasannaDekaBoruah, Principal Scientist, CSIR-North East Institute of Science and Technology, Jorhat, Assam
- Prof. Surya Pratap Singh, HOD, Biochemistry Department, BHU, Varanasi, Uttar Pradesh
- Prof.Siddartha Panda, Chemical Engineering Department, IIT Kanpur, Uttar Pradesh
- Prof.Prashant Mishra, Professor and Former Head, Department of Biochemical Engineering & Biotechnology, Indian Institute of Technology Delhi

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.
- 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.
- *In vitro* propagation of medicinal plants and evaluation of their therapeutic potential
- Monographs of medicinal plants of India.
- Submitted two 400 pages Monographs for medicinal plants (*Andrographispaniculata* and *Salaciareticulata*) of India AYUSH-NMPB, Govt 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
- Novel actinomycete isolates have been obtained from niche habitats – desert, limestone rock and forest soil – showing production of bioactive compounds (antimicrobial, biosurfactant and antioxidant activity).

- Wheat-Jimikand composite bread rich in Dietary fiber content and Calcium was developed that can be given to the pregnant women.

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 Post doc (01), PhD (12), Dual degree/M.Tech (83) and B.Tech (289) students who have pursued research in this thrust area. Presently the faculty in the area are actively involved in scientific engagements where 19 doctoral research projects are presently ongoing.

Well-trained undergraduates and postgraduates students have gone for their MS, MBA or PhD degrees to Universities of National and International repute such as: University of Pennsylvania (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 Chhabra), McMaster University (VipraVibhas Bhardwaj), NMIMS (Himanshu Mishra). 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 Biotech (Geetanjali Menia, Shambhavi Seth, Priyanka Gupta, Tanya Sabharwal), Premas Biotech (Priyo Kumar) Biocon (Rajat Goyal), Advika Gupta (Cadila Healthcare), Sonia Purswani (Freyrs Solutions). 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. Pammi Gauba	Environmental Biotechnology
Dr. Neeraj Wadhwa	Enzyme technology, Food Biotechnology
Dr. S Krishna Sundari	Microbial biotechnology for Environment& Agriculture applications
Dr. Indira P Sarethy	Bioresource, Natural products
Dr. Rachana	Natural products and Therapeutics
Dr. Ashwani Mathur	Bioprocess Engineering, Natural products
Dr. Susinjan Bhattacharya	Microbial biotechnology
Dr. Smriti Gaur	Microbial Biotechnology
Dr. Garima Mathur	Environmental Biotechnology, Natural products
Ms. Ekta Bhatt	Environmental Biotechnology

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Publications

International Journal:

1. A. Ibeyaima, A. K. Singh. Rup Lal, **Sanjay Gupta**, Michael Goodfellow, **I.P. Sarethy**. "*Saccharothrixtharensis* sp. Nov, an actinobacterium isolated from the Thar Desert, India", *Antonie van Leeuwenhoek*, Volume 111, pp 2141–2147, 2018. [Indexed in SCOPUS, Impact factor 1.58].
2. AyushiBhagat and **Rachana**,Bromhexine: a comprehensive review. *International journal of Biological and Medical Research Int J Biol Med Res.*2018;9(3):6455-6459
3. **Bhatt E, Gauba P**,2018,Impact of Antibiotics on Plants ,*Int. J. Pharm. Sci. Rev. Res.*, 52(1); Pages: 49-53
4. Parul Chauhan,Sanjeev Agrawal,**PammiGauba**; Status of ambient air quality in selected state capitals and metropolitan cities of india,*International Journal of Current Advanced Research*,2018,7;3(A),10504-10509
5. P. Bhardwaj, N. Goswami, P. Narula, **C.K. Jain, A. Mathur**. Zinc Oxide nanoparticles (ZnO NP) mediated regulation of bacoside biosynthesis and transcriptional correlation of *HMG-CoA reductase* gene in suspension culture of *Bacopamonneri*. *Plant Physiology and Biochemistry*, 2018; 130. 148-156
6. P. Bhardwaj, **C.K. Jain, A. Mathur**. Comparative evaluation of four triterpenoid glycoside saponins of Bacoside A in alleviating sub-cellular oxidative stress of N2a neuroblastoma cells, *Journal of Pharmacy and Pharmacology*, 2018. (DOI:10.1111/jphp.12993)
7. P. Bhardwaj, **C.K. Jain, A. Mathur**. Comparative Analysis of Saponins, Flavonoids, Phenolics and Antioxidant Activities of Field Acclimatized and *in-vitro* Propagated *Bacopamonneri* from different locations in India. *Indian Journal of Experimental Biology*, 2018(Manuscript accepted; Manuscript Number: IJEB EB 170427-1).
8. R. Barnwal and **P. Gauba**, "Impact of Antibiotics on Plant Growth" *World Journal of Pharmaceutical Research*, 7(18), 684-688 (PubMed, google scholar)
9. Saxena, A and **Gauba, P.G.**, 2018. Carbon Sequestration: A Solution to Global Problem. *World Journal of Pharmaceutical Research*, 7(16), 189-202 (PubMed, google scholar)
10. Shaurya Singh, Sanjeev Agarwal, Sanghita Roy, Chaudhary and **Pammi Gauba**. The odd even experiment in Delhi. *International Journal of Current Advanced Research* 2018, 7;1, 9319-9322
11. I. Balwani, K. Chakravarty, **S. Gaur**, Role of phytase producing microorganisms towards agricultural sustainability, *Biocatalysis and Agricultural Biotechnology*, 12, 23-29, Oct 2017. (Indexed in scopus, SCI)

12. Singh, D Kaloni, **S. Gaur**, S. Kushwaha, and **G Mathur**. Current research and perspectives on microalgae-derived biodiesel, Biofuels, 2017,<http://dx.doi.org/10.1080/17597269.2017.1278932>.
13. **M. Singh**, R. Kaur, R. Rajput and **G. Mathur**. Evaluating the therapeutic efficiency and drug targeting ability of alkaloids present in *Rauwolfia serpentine*. International Journal of Green Pharmacy, Vol. 11, pp. 132-142, 2017.
14. N. Srivastava, A. Ibeyaima, **I.P. Sarethy** "Screening of microorganisms for antimicrobial property from the Lachhiwala Reserve Forest of Himalayas – a biodiversity hotspot", World Journal of Pharmaceutical Research, Volume 6, Issue 14, 424-442, 2017.
15. A. Verma and **S. Gaur**, Microbiological analysis of street vended sugarcane juice in Noida city, India, Int J Pharm Bio Sci; 8(3): (B) 496 – 499, 2017.
16. Bhardwaj P., **Jain C.K.**, Mishra P., **Mathur, A.** Comparative analysis of Bacoside-A yield in field acclimatized and in-vitro propagated *Bacopa monnieri*. International Journal of Pharmaceutical Sciences Review & Research, 44 (2); 168-175, 2017. [Indexed in SCOPUS]
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18. **S. Gaur** and A. Verma, Evaluation of Probiotic Characteristics of Bacteria Isolated from Fermented Foods, Journal of Pharmacy Research, 11(4), 281-285, 2017. (Indexed in scopus)
19. Parul Chauhan, Mahender Singh Rawat, **Pammi Gauba**, "ROLE OF PLANTS IN INDOOR AIR REMEDIATION" International Journal of Engineering, Technology, Science and Research, 2017, 4 ; 9, 749-756.
20. Swarna Shikha, **Pammi Gauba**, "Phytoremediation potential of three leguminous plants towards Chromium, Journal of Pharmacy Research, 11(4), 2017, 299-305.
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22. R. Singh, **A. Mathur**, N. Goswami, **G. Mathur**. Effect of carbon sources on physicochemical properties of bacterial cellulose produced from *Gluconacetobacter xylinus* MTCC 7795. E-Polymers, Vol. 16, pp. 331-336, 2016.
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24. **M Singh**, R. Kaur, S. P Singh and **Rachana**, "Intranasal Drug Delivery- New Concept of Therapeutic Implications for Effective Treatment of CNS Disorders", *International Journal of Pharmaceutical Science*, 8;8, Jan 2017, pp. 1000-1013.

25. **M. Singh**, S. P. Singh and **Rachana**, "Development, Characterization and Cytotoxicity Evaluation of *Ginkgo biloba* extract (EGB761) loaded Microemulsion for Intranasal Application", *Journal of Applied Pharmaceutical Science*, 7,1, Jan 2017, pp024-034.
26. R Kaur, R. Rajput, P. Nag, S.Kumar, **Rachana**, **M. Singh**, "Synthesis, characterization and evaluation of antioxidant properties of catechin hydrate nanoparticles" *Journal of Drug Delivery Science and Technology* 39 June 2017 pp 398- 407.
27. **M. Singh**, S. P. Singh and **Rachana**, "Antioxidant, Cytotoxicity, and Stability of *Ginkgo biloba* extract-based Microemulsions for enhanced Therapeutic Activity", *Asian J Pharm Clin Res*, Vol. 10, 8, April 2017, pp. 1-6.
28. Singh, A. & **Wadhwa**, N. "Biochemical characterization and thermal inactivation of polyphenol oxidase from elephant foot yam (*Amorphophallus paeoniifolius*)," *J Food Sci Technol* pp. 1-9 (May 2017). doi:10.1007/s13197-017-2647-z [Indexed in SCOPUS, SCI, Impact factor: 2.024]
29. **Rachana**, Kritika Sehgal and **Manisha Singh**, "Essentials to kill the cancer", *Canc Therapy & Oncol Int J.*, 4(5), May 02, 2017.
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31. Mishra N and **Sundari S K** (2017). A 'Six-Step-Strategy' to evaluate competence of plant growth promoting microbial consortia. *Current Science* (Accepted February 2017). [Indexing: SCOPUS, Thomson Reuters IF: .967, H Index: 84].
32. **Rachana**, **Manisha S.**, Tanya G. Topical Application of *Melaleuca alternifolia* for Skin Cancer and Other Conditions. *Canc Therapy & Oncol Int J.* 8(2), December 05, 2017 page 001-004.
33. **Rachana**, M. Pant, S. Basu, A. Jain, N. Goel I wadi, "A review on herbal therapy for respiratory ailments", *International Journal of Life Sciences and Pharma Research*, vol 6, 2, pp11 -15, 2016.
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39. Swarna Shikha and **Pammi Gauba**, "Phytoremediation of pharmaceutical products", *Innovare Journal of Life Sciences*, Vol 4, Issue 3, 2016, 14-17.

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47. S. Kotiyal and **S. Bhattacharya**. "Lung Cancer Stem Cells and their Therapeutic Targeting", Arch Stem Cell Res vol. 2(2), pp. 1009, 2015.
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50. S .Shikha, **P. Gauba** "Phytoremediation of copper and ciprofloxacin by *Brassica juncea*:A comparative study" Journal of Chemical and Pharmaceutical Research, 2015, 7(11):281-287. (scopus indexed)
51. S.Gahlawat, **P. Gauba**, "Phytoremediation of aspirin and tetracycline by *Brassica juncea* "International Journal of Phytoremediation. DOI:10.1080/15226514.2015.1131230 (Impact Factor: 1.73)
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Conference International/ National

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 11. **Indira P Sarethy**, Sharadwata Pan. "Designer Foods: Scope for Enrichment With Microbe-Sourced Antioxidants" Chapter 14 in Microbial Production of Food Ingredients and Additives, Vol. 5, (Ed. Alexandru Grumezescu Alina Maria Holban), pp 423-449, 2017, eBook ISBN: 9780128111994, Print ISBN: 9780128115206, Academic Press
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19. **Indira P. Sarethy**, **Sanjay Gupta** and Vandana Gupta E- Lesson- 'Bacterial Systematics' for Institute of LifeLong Learning, University of Delhi, Virtual learning Environment, September 2015.
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20. Vandana Gupta, **Indira P. Sarethy** and **Sanjay Gupta**, E- Lesson- 'General Characteristics of Different Types of Acellular Microorganisms' for Institute of LifeLong Learning, University of Delhi, Virtual learning Environment, September 2015.
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21. Vandana Gupta, **Indira P Sarethy** and **Sanjay Gupta**, E- Lesson- 'General Characteristics of Different Types of Cellular Microorganisms: Bacteria, Fungi and Algae' for Institute of LifeLong Learning, University of Delhi, Virtual learning Environment, September 2015.
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27. **Rachana**, S.Thakur, S.Basu on "Oxidative stress and diabetes in Free Radicals in Human Health & Diseases", publication: Springer, 2014
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33. **Indira P. Sarethy** and Kailash Paliwal (2013) "Evaluating phytoremediation using *in-vitro* plant cultures" in *Modern Biotechnology and its Applications*, Part-I, (ed. K. Behera) New India Publication Agency, India, 2013, Chapter 3, pp 57-87.
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PLANT & MICROBIAL BIOTECHNOLOGY

List of Doctoral students

Ongoing

S.N o	Year of Regist ration	Name	Title	Supervisor
1	2012	Sonam Shaheen	Mass Production of PGPR for making microbial consortium and testing their ability to remediate organophosphosphate pesticides	Krishna Sundari
2	2014	Swarna Shikha	Screening Heavy Metal Tolerant Plants and Determining Their Phytoremediation Potential	Pammi Gauba
3	2014	Samiya Khan	Development of a biocatalyst for refining diesel	Nidhi Gupta
4	2014	Nidhi Srivastava	Bioprospection of niche habitat(s) for anti-microbial products	Indira P Sarethy
5	2014	Pragya Bhardwaj	Studies on production of therapeutically important saponins using in-vitro culture of <i>Bacopa monnieri</i>	Ashwani Mathur Chakresh KJain
6	2014	Pratibha Yadav	Remediation of organophosphate pesticides using PGPM	Krishna Sundari
7	2016	Kashyapi chakravarty	Probiotics and their health benefits	Smriti Gaur
8	2017	Shashank Awasthi	Therapeutic uses of common Indian plant for treatment of brain tumor	Dr Rachana
10	2017	Sonia Sharma	Phytoconstituent screening, characterization and application of endophytes from <i>Amorphophallus paeoniifolius</i>	Neeraj Wadhwa
11	2017	Shalini Tyagi	Therapeutic potential of commercial Indian medicinal plants	Garima Mathur
12	2017	Bhumika Gupta	Bioprospecting for carbohydrases from cultivable bacteria and soil metagenome	Indira P Sarethy
13	2017	Shashank Awasthi	Isolation, Characterization & Bioactive Compounds from developing Plant Embryos	Neeraj Wadhwa
14	2017	Preeti Thakur	Water pollution and its remediation	Pammi Gauba
15	2017	Radhika Bansal	Metal toxicity in Herbs	Pammi Gauba
16	2018	Archana Kumari	A study on the Biochemical and molecular mechanisms of I pesticide degradation using	Krishna Sundari

microbes				
17	2018	Neetu Saharan	Tuber metabolites and their biodegradation in natural environment	NeerajWadhwa
18	2018	Astha Mishra	Microbe assisted fermentation of tannic acid from organic substrates to produce pharmaceutically important gallic acid and its derivatives	Krishna Sundari
19	2018	Vikrant Sharma	Bioprocess and molecular strategies for regulating centelloside production in in-vitro culture of <i>Centellaasiatica</i>	Ashwani Mathur

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	2011
5	Sujata Basu	Evaluation of protective role of Salaciaoblona and mangiferin in tobacco smoke and glucose-induced toxic conditions	Rachana	2016
6	Mamta Pant	Protective Role of AdhatodaVasica and Vasicine in Bidi Smoke Induced Cytotoxicity: An Implication for Respiratory Disorders	Rachana	2015
7.	Anuradha Singh	Phytoconstituent characterization and application of <i>Amorphophallus paeoniifolius</i> in development of food products"	Neeraj Wadhwa	2015
8	Nivedita Mishra	Developing microbial consortia with abilities for plant growth promotion and remediation of residual pesticides	Krishna Sunadri	2017
9.	Parul Sharma	Evaluating the properties of casted and electrospun chitosan blend membranes as alternative surface for Vero cell culture	Ashwani Mathur, Prof. S Chand	2018
10.	A. Ibeyaima	Bioprospection of actinomycetes from Indian Desert for antimicrobial activity and other natural products of industrial importance	Indira P Sarethy	2018
11.	Pragya Bhardwaj	Studies on production of therapeutically important saponins using in-vitro culture of <i>Bacopamonniari</i>	AshwaniMathur ChakreshKJain	Thesis submitted
12.	Manisha Singh	Development of <i>Ginkgo biloba</i> microemulsion system against Alzheimer's diesase for intranasal applications	Dr Rachana Prof. S. P. Singh	Thesis submitted

PLANT & MICROBIAL BIOTECHNOLOGY
Dual degree B.Tech/M.Tech projects

Completed Projects				
S.N	Enrl No.	Name	Project Title	Faculty
1	20002	Sharadwata Pan	Expression of Metal binding Proteins/peptides in bacterial cells (<i>E.coli</i>)	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 Dangi	Cloning and expression of mosquito larvicidal cry 4a protein of <i>Bacillus thuringiensis</i>	Dr. Krishna
5	20053	Sonal Nangalia	Antibacterial properties of allicin from garlic+c3c extract: a potential for clinical trials	Dr. Reema
6	20070	Prashant Kishore	Bioproduct characterization and analytical method validation	Dr. Indira
7	20084	Shashank Shekhar Singh	Media scouting for optimization of growth of adherent cell line	Dr. Indira
8	20069	Sunil Kumar	Production of cellulase enzyme from <i>Agaricus bisporus</i> by solid state fermentation	Dr. Krishna
9	20081	Shree Prakash	Expression of spermidine-binding protein PotD in <i>Escherichia coli</i>	Dr. Susinjan
10	6101060	Anjali Sharma	Development and characterization of topical microemulsion system for <i>Camellia sinensis</i>	Dr. Reema
11	6501805	Bharti Sharma	Investigating the effect of plant metabolites on yeast cells subjected to oxidative stress	Dr. Krishna
13	6501829	Swati Chhabra	Investigating the effect of fungal metabolites on yeast cells subjected to oxidative stress	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 <i>E.coli</i> through surface display of engineered outer	Dr. Susinjan
18	7501823	Atul kumar	Dehydration and image analysis of <i>Vitis vinifera</i>	Dr. Neeraj
19	7501824	Aarushi Kashyap	In vitro propagation of the medicinal plant <i>Solanum nigrum</i> in liquid media and	Dr. Indira
20	7501825	Purva Chopra	Production and Extraction of Biosurfactant from <i>Streptomyces</i> sp. PN-18	Dr. Indira

21	7501828	Nitin Goel	An Investigation of the possible preventive role of apocynin on smoke induced cell death,	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 <i>Tinospora cordifolia</i> on Smoke induced cell	Dr. Rachna
25	7501835	Aishvarya	Bioprospecting For Actinomycetes In Arid Desert	Dr. Indira
26	7501806	Uday Bahal	In-vitro propagation of the medicinal plant <i>Bacopa monnieri</i> in liquid culture and effect	Dr. Indira
27	7501816	Jai Surabhi Verma	Production Of Proteolytic Enzyme Keratinase By Free And Immobilized Cells Of <i>Bacillus</i>	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 <i>Lycopersicon esculentum</i> (tomato) and <i>Citrus limonium</i> (lemon) leaf	Dr. Neeraj
31	7501807	Ishan Wadi	Studying the interactions of active ingredients from <i>salacia reticulata</i> with Aldose reductase:	Dr. Rachna
32	8101013	Yashi Bhatnagar	Degradation of carbazole by entrapped and encapsulated <i>Pseudomas sp.</i>	Dr. Nidhi
33	8512003	Deepak Kumar Bharti	Bacteriological and physicochemical quality of drinking water	Dr. Smriti
34	7501830	Vartika Mahajan	Isolation, Purification and Characterization of Protease from Vegetable Waste	Dr. Neeraj
36	9101059	Mansi Sehgal	Profiling of <i>Bacopa monnieri</i> , from different geographical habitat, for phytochemicals of	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 quality of	
43	9501807	Apoorva Gaur	Production and purification of tannase from SSF, merits of co-culture for increased yield	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 <i>Phyllanthus niruri</i>	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 application	Dr. Ashwani
55	10501817	Sukriti	A study exploring effect of organophosphate pesticides on oxidative stress metabolism in	Dr. Krishna
56	6501815	Nikhil Kathuria	Study of interaction of Apocynin and related compounds with MPO and like peroxidase	Dr Rachana
57	6501828	Vaibhav Gandhi	To investigate the possible mechanism of inhibition by Apocynin towards NADPH	Dr Rachana Dr Chakresh
58	6501823	Sonam Saluja	Investigation of vascine as a potent inhibitor of myeloperoxidase	Dr Rachana Dr Chakresh
59	6501816	Priyanka Manoj Kumar	Possible Mechanism of Vascine as a potential antioxidant	Dr Rachana Dr Chakresh
56	14301320	Rushali Singh	Production of bacterial cellulose and its composites	Dr. Garima
57	12501812	Manmeet Kaur Sethi	Food enzymes in the united states	Dr. Garima
58	12501809	Vipin Kumar Verma	Laccase production and application in textile dye decolorization	Dr. Garima
56	14301317	Akanksha Aggarwal	Saponin Production in Micropropagated <i>Bacopa monnieri</i> : In-vitro Culture Conditions	Dr. Ashwani
57	12501820	Himanshu kumar	Role of abiotic parameters in regulating saponin yield in <i>Bacopa monnieri</i>	Dr. Ashwani
58	12501822	Anshul Bindal	Role of culture conditions in regulating total carbohydrate yield in microalgal biomass and	Dr. Ashwani

59	12501823	Rythm Vanvari	Role of biotic parameters in regulating saponin biosynthesis in <i>Bacopa monnieri</i>	Dr. Ashwani
60	13501826	Nidhi Bhandari	Development of Recombinant Cell Lines for the Expression of Therapeutic Antibody	Dr.Garima Mathur
81	13501837	ShikharBhola	Dosier Preparation for Different Countries	Dr.Garima Mathur
62	16301001	Pratyaksha Singh	Screening of <i>Trichoderma longibrachiatum</i> ITCC 7839 for Industrially Important Enzymes	Dr.Garima Mathur
63		Sneha Dixit	Screening of microorganisms from Baolis (2016-17)	Indira P. Sarethy
64		TanviDwivedi	Screening of microorganisms from stone monuments (2016-17)	Indira P. Sarethy
65		Shivangi Gupta	Market analysis of nutraceuticals for animal health industry (2016-17)	Indira P. Sarethy
66		PapiyaChakravorty	Bioactivity of endophytic microorganisms (2015-16)	Indira P. Sarethy
67		AnkitaVerma	Endophyte isolate IS-203 from <i>Phyllanthusniruri</i> : Bioactivity and metabolite	Indira P. Sarethy
68		AbhishekNegi	Mining novel cellulases using cultivable and uncultured bacteria (2017-18)	Indira P. Sarethy
69		Anurag Saharan	Characterization of actinomycetes from forest soil and metabolite fingerprinting of anti-	Indira P. Sarethy
70		Parul Singh	Experimental study towards modification of response after induction of cecal	Indira P. Sarethy
71	13501852	NehaMehra	Preparation of testing manual in compliance with approved test methods for applicable	Dr.NeerajWadhwa
72	12101024	Neelanjan Sarkar	Comparative Study of chemical and pharmacological activities of	Dr.NeerajWadhwa
73	13501850	Shaurya Singh	Assessment of Water Quality of River Ganga (Upper Stretch of Uttar Pradesh & Uttarakhand)	Dr.NeerajWadhwa
74	13501803	Kartikeya Srivastav	Study on the impacts of cypermethrin at cellular level	Dr. S Krishna Sundari
75	13501828	Rashi	Biotechnological solutions to control post-harvest damage in crop	Dr. S Krishna Sundari
76	6301012	Krishnanand	Study the impact of organo-phosphorus pesticide on plants and soil	Dr. S Krishna Sundari
77	13501810	RupaliBarnwal	Bioremediation for antibiotics	Dr.Pammi
78	13501813	SakshiBajpai	Impact of heavy metals on Indian spices	Dr.Pammi
79	13501839	Parul Chauhan	Future Secular Changes and Remediation of Groundwater Arsenic In the Ganga river Basin	Dr.Pammi
80	13501840	Jhumi Jain	Investigation and implementation of water samples analysis for microbial contamination	Dr.Pammi

81	13501804	AyushiBhagat	Use of microarray based immunosensors for the detection of prostate cancer biomarkers	Dr Rachana and Dr
82	13501836	Avishi Agarwal	Cultivation condition optimization for phytase production	Dr.Smriti Gaur
83	13501849 ,	Twinkle Wahi	Assessment of Probiotic properties of bacteria isolated from fermented foods	Dr.Smriti Gaur

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 <i>Jatropha curcas</i> L	Dr. Neeraj	
2	20072	Neha Gupta			
3	20099	Jiwateshwar Singh			
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 <i>Cycas</i> 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 <i>Streptomyces</i> 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 <i>Streptomyces</i> 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 (<i>Azadirachta indica</i>)	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 bacteria	Dr. Sanjay	
32	5101024	Prerna Kumari			

33	5101040	Neha Arora		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	Study exploring bioremediating abilities of plant growth promoting microorganisms	Dr. Krishna
38	5101032	Nishika Malhotra		
39	5101036	Divyanshu Jain		
40	5101043	Kumar Siddhartho Talukdar		
41	5101044	Meha Saxena	Protease extraction from senesced leaves and its application in food industry Use of Glutenin coating in the storage of apple slices Phytochemical Screening. Purification and Characterization of cellulase from germinating garlic	Dr. Neeraj
42	601010	Neha Ansal		
43	601024	Swati Aggarwal		
44	601830	Apoorva Gupta		
45	601014	Padmini Munukutla		
46	6101032	Akanksha Gupta		
47	6101046	Nisha Agarwal		
48	6101031	Arushi Goel		
49	601025	Tushar Agarwal	Isolation and characterization of new proteases from plant seeds	Dr. Neeraj
50	601038	Esha Batra		
51	601011	Neha Juneja		
52	601048	Pavni Kaushiva		
53	601055	Sumit Lamba	Anti-oxidant and anti apoptotic activity <i>Picrorhiza kurroa</i> : LPS induced model"	Dr. Rachna
54	601061	Vipul Jain		
55	6101026	Varun Gupta		
56	6501815	Nikhil Kathuria	Design of portable microbial fuel cell that meets small power requirements	Dr. Krishna
57	6501828	Vaibhav Gandhi		
58	6101015	Prateek Goel		
59	6101016	Prateek Roy		
60	6101037	Dhananjai Sinha	Microbial bioplastic production using oil cakes as alternate substrate	Dr. Krishna
61	6101058	Vikram Kapoor		
62	6501825	Divya Sai		
63	6501827	Varun Kohli		
64	6101034	Amumeha Shah	Developing consortium of plant growth promoting microorganisms for remediation of agricultural soils	Dr. Krishna
65	6101040	Jyoti chauhan		
66	6101041	Kanika Sharma	Biochemical analyses of anti oxidative compounds in mycelia culture of ectomycorrhizal fungi	Dr. Krishna
67	6501805	Bharti Sharma		
68	6501829	Swati Chhabra	Screening of dibenzothiophene or carbazole utilizing microbes and quantifying the extent of utilization	Dr. Nidhi
69	6101002	Akanksha		
70	6101003	Ashmita Saigal		
71	6101020	Sakshi Aggarwal		
72	6101022	Shivani Bisht	Oxidative stress linked antiapoptotic activity of secondary metabolites (polysacharrides) and enzyme (SOD) from fungi	Dr. Krishna
73	7101001	Sneh Sharma		
74	7101036	Aakriti Goel		
75	7101023	Ridhie Bajaj		
76	7501811	Deepika	To study the ability of plant growth	Dr. Krishna
77	7101028	Anubhuti Bansal		

78	7101034	Megha Sarawgi	promoting microorganisms to	
79	7101058	Neha Goswamy	remediate carbofuran and chromium	
80	7101064	Amit Chawla	Design and optimization of a portable	
81	7101012	Anant Aggarwal	microbial fuel cell that meets small power requirements	
82	7501806	Uday Bahal	Microrrhizome production from black	Dr. Indira
83	7501824	Aarushi Kashyap	turmeric and its characterization	
84	7501831	Nidhi Sejwal	Molecular characterization of Streptomyces isolates	
85	7501835	Aishvarya		
86	7501801	Megha Garg		
87	7501825	Purva Chopra		
88	7501812	Vidhi		
89	7501819	Gaurav kumar	Optimization studies for keratinase	Dr. Neeraj
90	7501823	Atul kumar	production	
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	Dr. Rachna
97	7101035	Swaran Nandini	tannase activity on alternative	
98	7101005	Parul Mehrotra	substrates	
99	7501807	Ishan Wadi	Potential role of Apocynin in preventing	Dr. Rachna
100	7501828	Nitin Goel	Apoptosis: yeast model	
101	7501834	Ayushi Jain		
102	7101063	Akash Mathew	Screening, Isolation and identification of	Dr. Smriti
103	7101056	Nidhi Magoo	microbes producing phytate degrading	
104	7101057	Srishti Rawal	enzymes (phytase).	
105	7101060	Gaurav Shah	Expression of metal binding peptides in	Dr. Susinjan
106	7501821	Prakhar sachdeo	<i>Escherichia coli</i>	
107	7101041	Shainkee Chauhan		
108	8101001	Manal Shakeel	Developing mass production strategies	Dr. Krishna
109	8101011	Shivesh Ghura	for PGPMs	
110	8101035	Anushka Jain	Exploring the plant growth promoting	
111	8101057	Ambika Ramrakhiani	and bioremediating activities of PGP bacteria	
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 of	Dr. Krishna Dr Sujata
117	8101034	Akshara Rawat	Optimization Studies for phytase	Dr.Smriti
118	8101055	Rashi Bhutani	Production	
119	8101038	Manmeet Singh Dayal	Production of bacterial cellulose from <i>Acetobacter</i> 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 <i>Andrographis paniculata</i> 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 <i>Tinospora</i> with biological	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 bacteria	Dr. Krishna
136	9101034	Kencho Wangdi	<i>In vitro</i> propagation of <i>Bacopa monnieri</i> 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 <i>Acetobacter</i> sp.	Dr. Ashwani
148	9501827	Pratima Mishra	Bioprocess Parameters Optimization for Chitosan production from soil fungal isolates	
149	9501803	Rohan Chhabra		
150	9501810	Akansha Sachdeva		
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 of	Dr. Neeraj
156	9101038	Kshitiz Chandrika Srivastava	Therapeutic potential of <i>Amorphophallus paeoniifolius</i>	
157	9101047	Anwesa Banerjee		

158	9501806	Gaurav Shukla	Purification and application of enzymes	Dr. Ashwani
159	9512002	Parag Gupta	from <i>Amorphophallus paeoniifolius</i>	
160	10101055	Ayushi Jain	Bioprocess parameters optimization for	
161	10101065	Saloni Rao	in-vitro propagation of Mentha sp	
162	10101066	Shweta Agrawal		
163	10101098	Ritika Jain		Dr. Garima
164	10101035	Aarushi Dua	Production and characterization of	
165	10101096	Anushuya Raj Das	microbial cellulose	
166	10501801	Samiksha Kukal		
167	10501831	Harleen Kaur		
168	10101020	Niyanta Bhatia	Study of endophytic bacteria from	Dr. Indira
169	10101031	Deeksha Gupta	selected medicinal and non-medicinal	
170	10501802	Bhavika Sharma	plants.	
171	10501830	Taru Gupta		
172	10101045	Nikhita Agarwal	Investigating the role of PGPMs in	Dr. krishna
173	10101075	Kriti Shukla	assisting plant growth under abiotic	
174	10101081	Srishti Dangayach	conditions	
175	10501817	Sukriti		
176	10101006	Abhisarika Patnaik	Screening of plant poly phenol oxidase	Dr. Neeraj
177	10101016	Nabeel Zaman	for its decolourisation and	
178	10101037	Aditi Bhatnagar	detoxification potentia	
179	10101039	Garima Naswa		
180	10101004	Sonal Gahlawat	Phytoremediation for PPCPs	Dr. Pammi
181	10101017	Shubha Valsangkar		
182	10101059	Manvi Makhijani		
183	10501818	Kirti Chauhan		
184	10101056	Jasveen Kaur	Cytotoxicity caused by environmental	Dr. Rachna
185	10101062	Neha Choudhary	pollutants obtained from different fuel	
186	10101001	Sukrati Srivastava	sources and protective effect of	
187	10101092	Kritika Sharma	berberine from <i>Tinospora cordifolia</i>	
			<i>Tinospora cordifolia</i>	
188	10101050	Shruti Garg	Escherichia coli surface display using	Dr. Susinjan
189	10501809	Shilpa Mishra	outer membrane protein C	
190	10501810	Vandana Sharma		
191	10501828	Kopal Jalan		
192	10101043	Monika Rani	Optimization of culture conditions for	Dr. Smriti
193	10101063	Sanchita Agarwal	the production of phytase from soil	
194	10101078	Sakshi Madan	bacteria	
195	10501823	Akanksha		
196	10101090	Pranav Sood	Isolation of microorganism degrading	Dr. Nidhi
197	10101072	Farah Siddiqui	Napthalene	
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 <i>Tinospora cordifoila</i> 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 <i>Nelumbo nucifera</i>	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	Biopesticides from plant sources	Dr Krishna Sundari
214	11101053	Srishti Kotiyal		
215	11101037	Poorva Singhai		
216	11101032	Nilanshu Gupta	Phytoremediation of Pollutants in soil	Dr Pammi
217	11101047	Shefali Goyal		
218	11101008	Anjali Verma		
219	11101009	Ankita Prakash	Bacterial expression of metal binding peptides	Dr Susinjan
220	11501816	Meghna Srivastava		
221	11501812	Ira Thapa		
222	11101060	Vrinda	Production of exopolysaccharide from lactic acid bacteria	Dr. Smriti
223	11101041	Raveesha Malhotra		
224	11101005	Ananya Singh		
225	11101021	Gauri Mittal		
226	11101050	Siddhant Sharma	Monitoring the effect of mangiferin against cytotoxicity induced by tobacco products	Dr Rachana
227	12101005	Shivam Arora		
228	12501820	Himanshu Kumar		
229	12501822	Anshul Bindal	Effect of some Indian herbs on the growth of yeast	Dr Rachana
230-233	13101031 13101036	Shipra Garg Neelanjan Mili Garg		
234-236	12101026 12101037 12501806	Paresh Sharma Bhawna Bhatt Shivangi Gupta	Characterization of fungal isolates from Thar Desert	Dr Indira
237-240	13101034 13501831 13101032	Abhishek Negi Harshit Saini Soumya Singh Parul Singh	Diversity of microorganisms in selected monuments of Delhi	Dr Indira
241-242	12101015 12501812	Manmeet Kaur Sethi	Microbial Production of Vanillin	Dr. Garima

243-245	13101049 13501849 13101011	Muskan Agarwal Twinkle Wahi Sukriti Srivastav	Bacterial cellulose production	Dr. Garima
246-250	13101004 13101006 13101019 13101027 13101020	Avantika Mishra Stuti Agarwal Saru Aarushi Tandon Kriti Vasdev	Isolation and characterization of microalgae from fresh water river and lakes of Delhi NCR for alcohol production	Dr. Ashwani
251-255	14101072, 14101077, 14501014, 14501022, 14501026,	SakshiBhadouria, RichaVerma, Mahender Singh Rawat, Akshita Jain,	RIVER WATER POLLUTION AND ITS REMEDIATION	Dr.PammiGau ba
256-261	14101018 14101057 14101016 14101056 14101007	Advika Gupta Himanshu Mishra SakshiVashistha SiddhantKhandelwal Sonia Purswani	Preparation and characterization of fungal chitosan blend membranes	Dr.GarimaMa thur
262-266	14101037 14101042 14101053 14501030 14501007	SaloniSachdeva Akriti Jain Nawaz Alam Priyansh Srivastava ShreshtaDubey	Characterization of microbial isolates from Firoz Shah Kotla and their potential role in biodeterioration	Indira P. Sarethy
267-270	15101060 15101067 15101080 15101026	Akanksha Dixit Deepali Sharma Tanya Singh ShubhanshuUpadhyay	Application of pectinase in pigment extraction	Dr.Neeraj Wadhwa
271-274	13101047 13501814 13501809 13101005	Varun Arora HimanshuRawat Ankit Srivastava Swati Shukla	Comparison of Nutritional quality, Physico-Chemical Properties of underutilized germinated cereals	Dr.Neeraj Wadhwa
275	14501017	Mahima Maheshwari	To Study The Impact Of Salt Stress And Means To Alleviate Salt Stress In Plants	Dr Krishna Sundari
276	14501019	Akshra Gupta		
277	14501034	Ashmita Arora		
278	14501002	Purnam Hoshe		
279	14501031	Soumya Soni		
280-284	14101033 14101086 14101006 14101046 14101043	Tanya Gupta Saumya Singh JhalakManglik, Himani Singh AroshiPawar	Anti proliferativeacitiity of fruit peels of the Musa paradisiaca, Punicagranatum, and citrus limetta on A431 cell line: a comparative study	

285- 289	14101047	VasviSethi	Bioremoval of an azo textile dye, erichrome black T	Dr.Smriti Gaur
	14101071	GopikaGoyal		
	14101080	ShivangiDua		
	14101082	Shreya Mehrotra		
	14501020	Chetna Gaur		

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-Newtonian 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.

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, O₂ 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 reactors, 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, Nutraceuticals 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.

Elective

Bioeconomics (16B1NBT631)

Introduction to bioeconomics, Bio-economics- Concept, Development of Economics and Bioscience (Concept of resource economics for scarcity of biological resources), Bioresource elasticity, Evolution and Development of Economics and Biology (Charles Darwin and the evolutionary paradigm) bioeconomics and thermodynamics, Thermodynamic analysis and thermo economics, Exergy cost, Exergetic efficiency, Bioeconomics and sustainability, Benefits and challenges of knowledge-based bioeconomy, sustainable food security (Europe and African Perspective), Development of resource (agricultural) efficient bioeconomy, Social and economic challenges for bioeconomy, Bioeconomic Models- Dynamic resource harvesting model, Dynamic optimization model, Demand-limited bionomic equilibrium, Growth and aging- The cohort model, SWOT analysis of Bioeconomy, Generic bioeconomic mathematical models, ecological bioeconomics, bioeconomy for agriculture, fisheries bioeconomics and mathematical models.

Waste management (16B1NBT733)

Introduction to waste management, waste generation aspects, Biological and chemical waste treatment technologies-landfill, pyrolysis, gasification, energy recovery system, aerobic and anaerobic digestion, composting, biogasification and mechanical biological treatment of wastes, plasma-based technologies, Waste to energy (WTE), Product recovery and biorefinery, Management and treatment of hazardous waste, Legal aspects and policy guidelines, Environmental and Economic considerations of waste management.

Natural Products and Bioprospecting (19M12BT111)

Basics of bioprospecting and natural products, current aspects of bioprospecting in development of natural products from medicinal plants, marine ecosystem and microbial population, procedures for screening, identification, production and characterization of crude natural products, bioassays and industrial application, conventions and regulations in Bioprospecting

Advanced Microbiology and Immunology17M12BT122

Microbial ecology, Virology, Industrial microbiology, Environmental microbiology, Key players of immune system, Disorders of the Immune System, Tumor Immunology, Immunological Applications

17B1NBT731 Food Biotechnology (4 Credits)

Food Science and Food Chemistry Concepts, Basic principles, unit operations, and equipment involved in the commercially important food processing methods and unit operations, Food Kinetics, History of Microorganisms in food, microbiology of fermented food products, food spoilage and food borne diseases, Food processing and preservation, Use of enzymes in food industry, Single Cell Proteins, Probiotics, Current status of Indian processed food industry, Food safety and control.

Healthcare Marketplace (17B1NBT732)

Clinical trials, clinical database management, regulatory approval of drugs, role of patents, pricing of drugs and generics, quality assurance, process controls, Quality by Design, informatics in healthcare, designing of case studies

Market Research in Biosciences (19B12BT411)

Market and Marketing research, Market research providers, introduction to databases of market research, Identifying and formulating the problem, Exploratory and Descriptive Research, Causal Research, Methods of Data collection, Data analysis, Nature of Data: primary data, secondary data, big data; Descriptive and Inferential research, use of result tools in hypothesis testing, regression analysis, factor analysis, cluster analysis; Analysis of agricultural and food market, Food consumption and market, Wholesale and retailing, farm and food market