

**Combined Entrance Examination
conducted by
Jawaharlal Nehru University
for admission to
M.Tech. Biotechnology Programme**
(General Biotechnology, Bioprocess Technology, Food Biotechnology
Marine Biotechnology and Pharmaceutical Biotechnology)

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PROSPECTUS

ACADEMIC SESSION 2017-18

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I. GENERAL

Biotechnology is a multi-disciplinary area on the educational scene and programmes have been developed to meet the growing demand for trained manpower for any meaningful Biotechnology activity. The Government of India has allotted high priority for the development of Biotechnology and its exploitation in agriculture and other related disciplines.

The Jawaharlal Nehru University will hold an entrance examination for the academic year 2017-18 for admission to four-semester (Two years) M.Tech Biotechnology programme being offered by the following participating Universities:

1. ANNA UNIVERSITY, CHENNAI
2. COCHIN UNIVERSITY OF SCIENCE AND TECHNOLOGY, KOCHI, KERALA (M.Tech. in Marine Biotechnology)
3. MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY (formerly known as West Bengal University of Technology), KOLKATA.
4. INSTITUTE OF CHEMICAL TECHNOLOGY (ICT), MUMBAI (M.Tech. in Bioprocess Technology)
5. INSTITUTE OF CHEMICAL TECHNOLOGY (ICT), MUMBAI (M.Tech. in Food Biotechnology)
6. INSTITUTE OF CHEMICAL TECHNOLOGY, (ICT), MUMBAI (M.Tech. in Pharmaceutical Biotechnology)

The entrance examination will be held on May 19, 2017 at centres all over the country. (Detail of examination centers is shown under Section-XII of this Prospectus)

1. Anna University, Chennai (30 Seats) *

The Centre for Biotechnology was established in 1987 in Anna University with a financial support from the Department of Biotechnology, Government of India with the objectives of providing excellent state of art educational and research facilities in frontier areas of biotechnology. The centre also carries out fundamental and translational research to develop technologies to benefit society. It also promotes research and consultancy services in biotechnology.

The Centre for Biotechnology has two campuses, one at Guindy which houses the teaching and administrative blocks and a R&D campus at Taramani which is called SPIC Bioprocess facility which houses state-of-art bioprocess laboratories and impressive facilities in cellular and molecular biology.

The major thrust areas of teaching and research offered by experienced faculty at the Centre for Biotechnology, Anna University, for the programme are:

1. Cellular and Molecular Biology
2. Chemical Biology and Biocatalysis
3. Protein Biotechnology
4. Bioprocess Engineering and Technology
5. Recombinant DNA Technology
6. Computational Biology, Genomics and Proteomics
7. Drug Discovery
8. Infectious Diseases
9. Molecular Immunotechnology
10. Stem cellular Technology and Regenerative Medicine

The candidates admitted to the program are eligible for the award of M.Tech degree in Biotechnology on successful completion of the programme. The candidates admitted to the programme are also eligible to receive scholarship at the rate prescribed by DBT.

****Fees to be paid at the time of Admission:** For Tamil Nadu State: General -Rs.27520/- and SC/ST - Rs.22520/-

For Other State: General -Rs.27520/- and SC/ST - Rs.27520/-

Note: The fee is for 2015-16, and is subjected to change every year.

Contact Address:

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2. Cochin University of Science and Technology, Kochi, Kerala (6 Seats) *

The M.Tech programme in Marine Biotechnology sponsored by Department of Biotechnology, Government of India is a unique course of its kind in the country.

Over above two decades, Government of India has been supporting infrastructure development and research in focused areas of Marine Biotechnology to develop novel processes and products aiming at enhancement of manifold industrial processes, biomedical material development and environment management. These efforts paved the way for the development of Marine Biotechnology industry in the country harnessing the potentials of the marine environment. The Department of Biotechnology, Government of India on taking stock of the situation realized that to infuse power to the sector effective human resource with vibrant entrepreneurship and high level technical expertise were the prime requirements. This paved the way for instituting the M.Tech. programme in Marine Biotechnology at National Centre for Aquatic Animal Health, Cochin University of Science and Technology in 2008 with the objective of generating the right kind of human resource to augment the developments in Marine Biotechnology industry in the country. The National Centre for Aquatic Animal Health is equipped with state-of-the-art facilities for research and education in Marine Biotechnology. This programme was constantly under revision and up-dating and the one offered right now has the motto - **'Ignite young talented minds having strong foundation in science, engineering and technology to take up major challenges of human race and find practical solution through marine biotechnological interventions'**. The challenges to be addressed are:

1. Food and nutritional security through enhancement of marine/aquatic food production through intensive aquaculture.
2. Depleting fuel stock and alternate next generation fuel (Bio-fuel).
3. Climate change and need of its reversal for survival.
4. Human and animal health related issues and requirement of next generation pharmaceuticals with minimal or no side effects.

The four semester M.Tech programme consists of two semesters of theory, practical classes, assignments, problem analysis, short term projects and case studies with in-house research during the third and fourth semesters. The thrust areas are:

1. Advanced molecular biology
2. Marine genomics and proteomics
3. Animal cell culture and hybridoma technology
4. Marine algal biotechnology
5. Marine bioprospecting
6. Marine microbiology and microbial productivity of the Oceans
7. Biotechnological interventions in aquatic animal health management
8. Fish genetics and high health brood stock development
9. Bioprocess engineering
10. Nano-biotechnology
11. Systems and computational biology
12. Marine Biotechnology industry management

The curriculum includes a short term cruise onboard FORV Sagar Sampada.

A training programme in an industry or in an Institution is placed during summer vacation after the first year. Scholarships are paid at the rate prescribed by Department of Biotechnology, Government of India.

****Fees to be paid at the time of Admission: Rs.18500/-(approx.)**

Contact Address: Prof. I S Bright Singh,
 UGC-BSR Faculty
 National Centre for Aquatic Animal Health,
 Cochin University of Science and Technology,
 Lakeside Campus, Fine Arts Avenue,
 Kochi - 682016 Kerala
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 E-mail : bsingh@cusat.ac.in, isbsingh@gmail.com
web site : www.ncaah.org

3. Maulana Abul Kalam Azad University of Technology, Kolkata (21 Seats) *

The Government of West Bengal under its Ministry of Higher Education has set up the Department of Biotechnology with a view to establish a Centre for Excellence in Biotechnology at Maulana Abul Kalam Azad University of Technology (formerly known as West

Bengal University of Technology). The Department of Biotechnology (DBT), Government of India is initially supporting this 4-semester M.Tech. programme in Biotechnology at Maulana Abul Kalam Azad University of Technology for 5 years. The M.Tech.(Biotechnology) programme took off successfully in early 2003. A good and sufficient infrastructure has been established with the financial support received from the Department of Biotechnology, Govt. of India. The main focus of this department is training of students and developing expertise in various facets of Biotechnology. The research trainings (R&D) that will be undertaken as a part of the future programme, and the knowledge students would gather from the course curricula would help them and the researchers in future to develop commercially viable biotechnological processes/products. Scholarships will be payable at the rates prescribed by the Department of Biotechnology.

****Fees to be paid at the time of Admission: Rs.26700/- (approx.) (excluding accommodation)**

Contact Address: Prof. Subrata Kumar Dey, Professor
& Director Department of
Biotechnology,
Maulana Abul Kalam Azad University of Technology,
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*** No. of seats is subject to change by Department of Biotechnology, Government of India. ** Subject to revision.**

4. INSTITUTE OF CHEMICAL TECHNOLOGY (ICT), MUMBAI (39 seats)

M.Tech. Bioprocess Technology (Special Emphasis on upstream and downstream processing)

Fees to be paid at the time of Admission:

S. No.	Details	Fee for 1 st Year (in Rs.)	Fee for 2 nd Year (in Rs.)
1	Library Deposit	2,000	-
2	Tuition Fee	70,595	70,595
Total		72,595	70,595

Contact Address: **Dr. Sandeep B. Kale,**
Head & Coordinator
DBT-ICT-Centre for Energy Biosciences (DBT-ICT-
CEB), Institute of Chemical Technology, N. P. Marg,
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Phone No. : 91-22-33612313
Fax No. : 91-22-33611020
Mobile : 91-9594351422
E-mail : sb.kale@ictmumbai.edu.in; sanykale@gmail.com

5. INSTITUTE OF CHEMICAL TECHNOLOGY (ICT), MUMBAI (13 seats)

M.Tech. Food Biotechnology

Fees to be paid at the time of Admission:

S. No.	Details	Fee for 1 st Year (in Rs.)	Fee for 2 nd Year (in Rs.)
1	Library Deposit	2,000	-
2	Tuition Fee	70,595	70,595
Total		72,595	70,595

Contact Address: **Dr. Laxmi Ananthanarayan,**
Head & Coordinator
Department of Food Engineering and Technology, Institute
of Chemical Technology, N. P. Marg, Matunga (E),
Mumbai – 400019
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Fax No. : 91-22-33611020
Mobile No. : 09664540070
E-mail : laxmi.ananth.iver@gmail.com

6. INSTITUTE OF CHEMICAL TECHNOLOGY (ICT), MUMBAI (13 seats)

M.Tech. Pharmaceutical Biotechnology**Fees to be paid at the time of Admission:**

S. No.	Details	Fee for 1 st Year (in Rs.)	Fee for 2 nd Year (in Rs.)
1	Library Deposit	2,000	-
2	Tuition Fee	70,595	70,595
Total		72,595	70,595

Contact Address: Prof. Padma V. Devarajan,
 Head & Coordinator
 Department of Pharmaceutical Sciences and
 Technology, Institute of Chemical Technology,
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 E-mail : pvdevarajan@gmail.com

Institute of Chemical Technology (ICT), Mumbai, established on October 1, 1933 as the UDCT –University Department of Chemical Technology of the University of Bombay (now Mumbai), with the noble intention of advancing India's knowledge reserves in chemical science and technology, is now a premier (deemed) university devoted to education, training, research and industrial collaboration in Chemical Engineering, Biotechnology and Bio-processing, Chemical Technology, Applied Chemistry, and Pharmacy. The Institute's alumni have distinguished themselves in all walks of life, be it in industry, academia, government or public service in India as well as abroad. Indeed the Institute has produced 19 Padma awardees. Institute is ranked as Number 2 among all universities in India by the National Institutional Ranking Framework (NIRF) by the MHRD, Govt of India on 4th April 2016. Based on its stellar performance and national and international accolades, the ICT was declared as Elite Institute and Centre of Excellence by Government of Maharashtra on 20th April 2012 in the State Assembly, on par with national institutes of importance such as IITs, IISc and IISERs. The magic for the success is a concoction of dedicated faculty, meritorious students, admirable support staff, distinguished alumni, strong connectivity with industry, and assistance to all needy students, a grand alumni association and above all relevance of our courses in wealth creation. It is not surprising thus that the Institute of Chemical Technology is ranked as the best Chemical Engineering and Chemical Technology teaching and research institute in India and now stands at number 4 in the world in an annual ranking of Chemical Engineering programs conducted by the Georgia Institute of Technology, USA in January, 2012.

The Institute's strong multi-disciplinary research programs have helped create a unique learning environment that places great emphasis on synergizing knowledge from several sources to develop creative and effective solutions to many of the problems faced in industry and society and providing an eclectic combination of rigorous and up-to-date curriculum, excellent laboratory and demonstration facilities, world-renowned faculty and a conducive learning environment brimming with the next generation of great minds.

ICT conducts three multidisciplinary programs supported by Department of Biotechnology (DBT), New Delhi. These programs are M.Tech. Bioprocess Technology, M.Tech Food Biotechnology and M.Tech. Pharmaceutical Biotechnology. All three programs are two year (four semester) full time programs with first two semesters involving theory and practicals, and third and fourth semester involving full time research work on specific topic under the guidance of faculty from ICT. At ICT students get exposed to various analytical techniques, processing equipment and other facilities. Students are sent on factory visits and are also encouraged to attend various national and international conferences to participate and present technical papers/ posters based on their research work. While a large number of students get placed in the Industry every year through central and departmental placement cell, some are motivated to go for higher studies i.e. Doctoral program and also to become entrepreneur through entrepreneurship development cell. The M. Tech programmes supported at ICT are very well received by industries. The brief details about three M. Tech Programmes at ICT are as follows:

M. Tech. Bioprocess Technology is an interdisciplinary programme started in year 1993 with support from DBT and has current intake of 30 seats. This programme is conducted in five departments of ICT and is coordinated by DBT-ICT-Centre for Energy Biosciences. The programme holds theory and research work involving topic of strong industrial relevance and large societal impact with balance between fundamental aspects and recent advancements in the field with upstream and downstream processing, bioanalytics, secondary agriculture, molecular biotechnology, food and pharmaceutical biotechnology, bioprocess development and engineering, industrial biotechnology, bioprocess integration and intensification, technology translation, scale-up and building of business model for small, medium and large scale industries.

M. Tech. in Food Biotechnology programme is also supported by DBT and was initiated in 2008 in the Food Engineering and Technology Department with intake capacity of 10 seats. The M. Tech. in Food Biotechnology is also an interdisciplinary programme and has been initiated to impart education in Food Biotechnology to enable students to work in areas such as food fermentations, applications of enzymes in food processing, food product development, nutraceuticals, nutritional and functional foods, nutrigenomics etc. Research undertaken include areas like nutrigenomics, food genomics, molecular biology, nutraceuticals and functional foods, fermented foods,

recovery of microbial metabolites, food processing, food industry waste utilization, low glycemic index foods, novel food formulations, fruit wines, etc.

M. Tech. Pharmaceutical Biotechnology programme has been started in 2016 with intake of 10 seats and is supported by DBT. The main emphasis of this programme is on production and formulation of quality biopharmaceuticals with desired degree of safety and efficacy. This also involves biotech product development, characterization, stabilization, and regulatory affairs.

The major thrust areas of teaching and research offered by experienced faculty at various departments of Institute of Chemical Technology, for the programs are:

1. Upstream and Downstream Processing
2. Protein and Enzyme Engineering, and Biocatalysis
3. Fermentation and Cell Culture Engineering and Technology
4. Molecular biology, cloning and synthetic biology
5. Analytical techniques in bioprocessing
6. Bioreactor design and control
7. Bioprocess optimization(QbD, PAT, DOE etc.), scale up and controls
8. Patents and IPR in biotechnology
9. Biosystem and bioreaction engineering
10. Computational Biology, Genomics and Proteomics
11. Biopharmaceuticals, Biologicals and Biosimilars
12. Characterization and stabilization of biotech products
13. Bioinformatics (molecular modeling) and bio-drug development as well as discovery
14. Molecular Immunotechnology
15. Stem cellular technology and Regenerative Medicine
16. Food engineering and technology
17. Food processing and food product formulation with nutritional aspects
18. Microbial and algal technology
19. Biofuels and biochemicals
20. Secondary agriculture
21. Enzyme immobilization
22. Bioanalytical techniques and formulation of biotech products

The candidates admitted to the program are eligible for the award of M.Tech degree in Bioprocess Technology, M.Tech degree in Food Biotechnology, or M.Tech degree in Pharmaceutical Biotechnology on successful completion of the respective programme. The candidates admitted to the programme are also eligible to receive scholarship at the rate prescribed by DBT.

II. ELIGIBILITY FOR ADMISSION

Minimum 60% marks or equivalent CGPA (under grading system) from any recognized university in any one of the following: **or Anna University:** **For University:**

<u>B. Pharmacy OR</u>		<u>M. Sc. in</u>
<u>B.Tech / BE in:</u>	OR	
1. Chemical Engineering		1. Biotechnology
2. Biochemical Engineering		2. Life Sciences
3. Pharmaceutical Technology		3. Botany, Zoology, Biochemistry
4. Leather Technology		4. Microbiology, Genetics
5. Chemistry/Biotechnology		5. Biophysics
6. Biomedical Engineering		6. Microbial Genetics & Bioinformatics
7. Industrial Biotechnology		
8. Chemical Technology		
9. Food Technology		
10. Dairy Technology		
11. Food Engineering		

For Anna University: Candidates with B.Tech/B.E in Electrochemistry, Bioengineering, Pharmaceutical Technology, Food Technology, B.Tech. in Agricultural Biotechnology and M.Sc. in Chemistry & Physics are also eligible.

For Cochin University of Science and Technology: Candidates with M.Sc in Marine Biotechnology, Marine Biology/Aquatic Biology & Fisheries, Environmental Biotechnology are also eligible.

For West Bengal University of Technology: Candidates with M.Sc. in Bioengineering are also eligible.

For Institute of Chemical Technology:

- a) **M. Tech. Bioprocess Technology:** Candidates with B. Pharmacy; B. Tech. degree any branch of chemical technology of ICT or or any other equivalent degree of any University recognized by the UGC of four- year degree course after HSSC/Std. XII, with 60% marks in aggregate or equivalent CGPA [55% marks in aggregate or equivalent CGPA for the backward class candidate]. B. Tech./ B.Sc. (Tech.)/ B. E. in Food Engineering and Technology/ Food Engineering/ Food Technology/ Food Process Technology/ Food Process Engineering/ Dairy Technology/ Biotechnology/ Biochemical Engineering/ Pharmaceutical Technology/ Oil Technology, pharmaceutical technology, food technology, textile and fibers technology, polymer engineering and technology, dairy technology, industrial biotechnology, Oil & Oleochemicals technology, dyes and dyestuff technology or any equivalent degree of full four year duration of any University recognized by the UGC. B.E/B. Tech in Chemical Engineering, food engineering, biochemical engineering, biomedical engineering; B. Chemical Engineering; Three year degree programs in these disciplines are not recognized for admission; MSc in biotechnology, life sciences, biochemistry, microbiology, molecular biology, microbial genetics, genetics & bioinformatics or equivalent thereof from any recognized university are eligible.
- b) **M. Tech. Food Biotechnology:** The candidate should have passed B. Tech. degree in Food Engineering and Technology of the ICT or any other equivalent degree of any University recognized by the UGC of four- year degree course after HSSC/Std. XII, with 60% marks in aggregate or equivalent CGPA [55% marks in aggregate or equivalent CGPA for the backward class candidate]. OR B. Tech./ B.Sc. (Tech.)/ B. E. in Food Engineering and Technology/ Food Engineering/ Food Technology/ Food Science/ Food Process Technology/ Food Process Engineering/ Dairy Technology/ Biotechnology/ Biochemical Engineering/ Pharmaceutical Technology/ Oil Technology or any equivalent degree of full four year duration of any University recognized by the UGC. Three year degree programs in these disciplines are not recognized for admission; OR M. Sc. in Biotechnology/ Life Sciences/ Biochemistry/ Microbiology/ Genetics/ Microbial Genetics and Bioinformatics or equivalent thereof from any recognized university.
- c) **M. Tech. Pharmaceutical Biotechnology:** Candidates with B. Pharmacy; B. Tech. degree any branch of chemical technology of ICT or or any other equivalent degree of any University recognized by the UGC of four- year degree course after HSSC/Std. XII, with 60% marks in aggregate or equivalent CGPA [55% marks in aggregate or equivalent CGPA for the backward class candidate]. B. Tech./ B.Sc. (Tech.)/ B. E. in Biotechnology/ Biochemical Engineering/ Pharmaceutical Technology, pharmaceutical technology, industrial biotechnology, or any equivalent degree of full four year duration of any University recognized by the UGC. B.E/B. Tech in Chemical Engineering, biochemical engineering, biomedical engineering; B. Chemical Engineering; Three year degree programs in these disciplines are not recognized for admission; MSc in biotechnology, life sciences, biochemistry, microbiology, molecular biology, microbial genetics, genetics & bioinformatics or equivalent thereof from any recognized university are eligible.

Important Notes:

- Before applying, please ensure that you fulfil the eligibility requirements as prescribed above. Also please note that permission to appear in the entrance examination is strictly subject to your fulfilling the minimum eligibility requirements prescribed by each University as detailed above. You may, therefore, appear in the entrance examination only if you fulfil the eligibility requirements for M. Tech Biotechnology Programme. Despite this caution, in case you do not meet the minimum eligibility criteria and still appear in the entrance examination, you will do so at your own risk and cost, and if at any stage, it is found that you do not fulfil the minimum eligibility requirements, the admission, if granted to you, shall be cancelled ipso facto.
- Number of seats is subject to change by the participating Universities.
- Candidates who are due to appear in the final semester/year of the qualifying examination shall also be considered for appearing in the entrance examination provided they have secured 60% or equivalent CGPA (under grading system) in previous semesters/year. However, in the event of their selection, the admission will be granted to them subject to their securing minimum 60% marks or equivalent CGPA in their qualifying examination.
- Candidates seeking admission to above mentioned M. Tech programmes and who are GATE/GAPT qualified or wishing to appear to such national level exams need to apply to JNU-CEEB.

III. RESERVATION/CONCESSION

- a) **Reservation:** 15%, 7½% and 3% of seats shall be reserved for Scheduled Caste (SC), Scheduled Tribe (ST) and Person with Disability (PWD) candidates (with not less than 40% disability) respectively. All the SC/ST and PWD candidates who have passed the qualifying examination are eligible to apply irrespective of their percentage of marks in the qualifying examination. OBC reservation, wherever applicable, will be implemented as per the policy of each participating University. For admissions at Institute of Chemical Technology, Mumbai, reservation policy of government of Maharashtra will be applicable (i.e. 61%, 13%, 7% and 19% seats shall be reserved for General category, Scheduled Caste (SC), Scheduled Tribe (ST) and OBC candidates respectively)
- b) **Concession for Kashmiri Migrants:** 10% marks will be added to the overall marks scored by a Kashmiri migrant candidate in the Entrance Examination. After adding 10% marks, in case he/she is covered in the cut-off point in the merit list, he/she will be offered admission strictly in accordance with his/her inter-se merit along with other candidates

subject to his/her meeting the minimum prescribed eligibility requirements and also subject to his/her producing valid registration documents issued by the notified authorities certifying the candidate's Kashmiri Migrant status.

IV. GUIDELINES FOR ENTRANCE EXAMINATION

The question paper for Entrance Examination will be of 3-hours duration consisting of Two Streams: (i) Technology Stream and (ii) Life Sciences Stream.

(i) Technology Stream :

Part A	:	Basic Engineering & Technology.....	at under graduate level
Part B	:	Physics/Chemistry/Maths.....	at under graduate level
Part C	:	Fundamental Life Sciences, chemical sciences and Informatics.....	at 10+2 level

(ii) Life Science Stream:

Part A	:	Life Sciences (Biochemistry, Molecular Biology & Immunology).....	at post graduate level
Part B	:	Physics/Chemistry.....	at undergraduate level
Part C	:	Maths, Computer & Information Sciences.....	at 10+2 level.

V. SYLLABUS

Section I

Technology/Engineering Stream

Part A

(Basic Engineering and Technology, Pharmacology)

i) Basic Engineering and Technology

Basic concepts/principles in mechanical engineering, chemical & biochemical engineering, electrical and electronics engineering:

Chemical Engineering: Computer applications in chemical engineering- chemical process industries instrumentation methods of chemical analysis, thermodynamics-laws of conservation of mass and energy, First and Second laws of thermodynamics, reversible and irreversible processes, internal energy, enthalpy, Kirchoffs equation, heat of reaction, Hess law, heat of formation, Applications of first law to close and open systems, Second law and Entropy Thermodynamic properties of pure substances: equation of state and departure function, free energy, and work function. Gibbs-Helmholtz equation, Clausius-Clapeyron equation, free energy change and equilibrium constant, Troutons rule, properties of mixtures: partial molar properties, excess properties and activity coefficients; phase equilibria: predicting VLE of systems; Azeotrope and eutectic mixtures, and ideal gas mixtures, Third law of thermodynamics, stoichiometry, fluid dynamics, mechanical operations, heat and mass transfer operations- chemical kinetics/reaction engineering- process instrumentation dynamics and control- process equipment design. Material and Energy Balances: Laws of mass conservation, heats of reactions, law of mass action, Correlation, linear regression and analysis; degree of freedom analysis.

Chemical Reaction Engineering : Basic laws of chemical kinetics, chemical rate equations, parallel, sequential and other complex system kinetics, differential and integral kinetics analysis, CSTR and Plug Flow reactors, ideal and non-ideal reactors, tank-in-series and APDF models, residence time distribution concept, homogeneous and heterogeneous catalysis

Fluid Mechanics: Fluid statics, Newtonian and non-Newtonian fluids, Bernoulli equation and its application, energy balance, flow through pipeline systems (laminar and turbulent flows, friction factor), flow meters, pumps and compressors, packed and fluidized beds, size reduction and size separation; free and hindered settling; centrifuge and cyclones; thickening and classification, filtration, mixing and agitation; conveying of solids. Relation between stress and strain rate for Newtonian fluids.

Heat and Mass Transfer: Conduction, convection and radiation, heat transfer coefficients, steady and unsteady heat conduction, boiling, condensation and evaporation; types of heat exchangers and evaporators. Fick's laws, Diffusion of fluids, mass transfer coefficients, film, penetration and surface renewal theories; momentum, heat and mass transfer analogies; stage-wise and continuous contacting and stage efficiencies; HTU & NTU concepts design and operation of equipment for distillation, absorption, leaching, liquid-liquid extraction, drying, humidification, dehumidification and adsorption.

Principles of Biochemical Engineering: Enzyme catalysis (Michaelis Menton Kinetics) and reactor design. Material & energy balances of fermentation processes. Kinetics of microbial growth and product formation (Monod model-Leudeking-Piret model). Nature of fermentation processes. Transport phenomena in biochemical reactors- Mass

transfer in immobilized enzyme systems and Oxygen transfer in submerged fermentation process, examples of primary metabolites, secondary metabolites and enzymes. Bioreactor operation and design, reactor sterilization. Batch, fed-batch and continuous culture process and cell recycle processes. Modelling of non-ideal behavior in bioreactors. Novel bioreactors, air-lift reactors, membrane bioreactors and fluidized bed reactors. (Filtration and membrane based separations, centrifugation, extraction, absorption and chromatography – to be removed).

(ii) **Pharmaceutical Sciences & Bioprocess technology, and Pharmacology**

Physiology, Pharmacology & Biochemistry: Basic physiology and biochemistry pertaining to all the systems in the body. Classification, mode of action, pharmacological effects, side effects, toxicity and posology of drugs acting on the CNS, ANS, CVS, gastrointestinal system, endocrine system. Principles of chemotherapy, chemotherapeutic agents, anticancer drugs, vitamins and minerals.

Industrial Pharmacy : Pharmaceutical processing - mixing, milling, drying, powder compression, clarification, filtration, Rheology, sterilization, sterility testing, disinfection, Pharmaceutical dosage forms : Formulation, manufacture and evaluation of solid, semisolid, liquid, aerosols and parenterals. Chemistry of natural products, SAR and Chemistry of analgesics, anticancer, CVS drugs, drugs acting on the CNS, GIT, chemotherapeutic agents, vitamins, hormones. classification, identification, extraction and isolation of active principles of commonly used medicinal plants. Immunological preparations, genetic engineering, fermentation, Biopharmaceutics, Pharmacokinetics-drug absorption, distribution, metabolism and elimination- general principles. Basic concepts of analysis of drugs.

Biologicals and Biopharmaceuticals: Antibodies: polyclonal and monoclonal antibodies, catalytic antibodies, diagnostic antibodies; production of antibodies, vaccines: types, production and applications; Therapeutic proteins and peptides: Insulin, erythropoietin, interleukins, hormones, sterilization methods for biopharmaceuticals, biosimilars, blood plasma products, Cohn fractionation, recent examples of biopharmaceuticals.

Food Science and Technology: Food chemistry and analysis, microbiology and biochemistry of fermented food products, food spoilage and food borne diseases, Food additives and ingredients, Chemistry and technology of various food commodities like cereals, legumes and oil seeds, fruits and vegetables, meat, fish and poultry, plantation crops, milk and dairy products, confections, beverages etc., Food processing and preservation, Food packaging, Use of enzymes in food industry, Human nutrition, Nutraceuticals and functional foods, Food safety and Food laws.

Agricultural Biotechnology: Production of value added products (biofuel, secondary metabolites, natural products, bioplastics, etc.) from agricultural waste, traditional crop improvement vs biotechnological interventions, secondary agriculture, post-harvest technologies.

Fermentation Technology: Introduction to fermentation processes, Isolation, preservation and improvement of industrially important microorganisms, Optimization of media and culture conditions, Bioreactor design and operations, Modes of culture – batch, fed batch, perfusion, continuous, chemostat etc., Types of bioreactors, Scale up of microbial and animal cell based processes with case studies related to applications in biopharma, biochemical, food and agro-industries, Bioprocess considerations for animal & plant cell cultures. Applications of cell culture technology for production of vaccines, growth hormones; interferons, cytokines and therapeutic proteins; hybridoma technology and gene knockout; stem cells and its application in organ synthesis; gene therapy; transgenic animals and molecular pharming, strategies for improving yield and productivity.

Downstream Processing: Centrifugation, liquid-liquid extraction, solid-liquid extraction, sedimentation & flocculation, Cell disruption- physical, chemical, mechanical and enzymatic methods, Concentration methods, Purification by adsorption, chromatographic and membrane (microfiltration, ultrafiltration, nanofiltration, plate and frame filters, hollow fibers, cassette filters) techniques including charge based, size based and affinity based processes, drying; Process design of industrial bio-products such as proteins & enzymes, peptides, antibiotics, vitamins, natural products, polysaccharides & biopolymers, oils and Oleochemicals, enzyme immobilization, methods of controlling bioburden in biopharma and biological products and food products.

Cell Culture Techniques: Cell culture materials and tools, growth conditions and other requirements for establishment and maintenance of plant and animal cells, cell lines and tissues, micro propagation, virus free plants, protoplast & haploid culture, synthetic seeds, hairy root culture. Animal cell cultivation: primary culture, growth kinetics, biology and characterization of cultured cells.

Section I

Technology/Engineering

Stream Part - B

(Physics, Chemistry and Mathematics)

Mathematics:

Calculus - Differential Equation- Complex numbers- Complex integration- Power series- Three Dimensional Geometry- Algebra.

Physics:

Mechanics: Kinematics- Newton's laws - work and mechanical energy- dynamics of rotary motion- fundamentals of special theory of relativity- gravitation- motion in non-inertial frames.

Thermodynamics: Ideal gases- 1st law of thermodynamics- Kinetic theory of gases- 2nd law of thermodynamics -real gases.

Electricity and Magnetism: Electrostatics- Coulomb's law- electric field potential- capacitance- dielectrics in an electric field- energy of an electric field- direct current- magnetic field of direct current- - electromagnetic induction.

Waves and Optics: Free harmonic oscillators- elastic waves- electromagnetic waves- interference, diffraction, scattering and polarisation of light- thermal radiation.

Modern Physics: Structure of matter and basic solid state physics - elementary nuclear physics- elementary quantum mechanics- structure of atom.

Chemistry:

Inorganic chemistry: Electronic structure of atoms, periodic table and periodic properties. General characteristics, structure and reactions of non-transition elements and transition elements. Coordination compounds, structure, crystal field and ligand field theories, spectral and magnetic properties.

Organic chemistry: Synthesis, reactions and mechanisms of alkenes, alkynes, arenes, alcohols, phenols, aldehydes, ketones, carboxylic acids and their derivatives, halides, nitro compounds and amines. Structure and properties of biomolecules, carbohydrates, oils, oleochemical, amino acids and proteins.

Physical chemistry: Chemical equilibrium, first law, thermochemistry, second law and entropy, free energy, properties of dilute solutions. chemical kinetics, rates of reactions and factors affecting rates of reactions.

Analytical techniques in Biotechnology: Principle and applications of spectroscopy, principles of UV- visible and IR spectroscopy, analytical chromatography such as HPLC, GC, TLC, HPTLC, FPLC, ion chromatography, Gel permeation chromatography (GPC) etc., hyphenated techniques such as LC-MS and GC-MS, thermo-gravimetric analysis (DSC, TGA), Karl fisher titration, fluorescence spectroscopy, dynamic light scattering (DLS) techniques, Immunological techniques: Immunodiffusion, immunoelectrophoresis, RIA and ELISA techniques, southern & western blotting, gel Electrophoresis (PAGE, SDS-PAGE) and capillary electrophoresis, PCR & Q-PCR, AFM, SEM, TEM, EDX, X-ray diffraction, Zetasizer, acid-base titrations, common methods of organic and inorganic analysis, validation of analytical methods as per ICH guidelines, characterization of biotech products as per regulatory guidelines & pharmacopoeial guidelines, Pharmacopoeial assay, LAL-Test, BET Test, Principles and methods of microbial assay of pharmacopoeia, filter integrity test, sterility testing of biopharmaceuticals, methods of analysis of for proteins,.

Section I**Technology/Engineering Stream****Part C****(Fundamentals of Life Sciences, Chemical Sciences and Informatics)**

Life Sciences: Organization of unicellular organisms, invertebrates and vertebrates. Ultrastructure of plant and animal cells. Nucleic acids, protein synthesis, Mendelian genetics. Morphology of angiosperms. Biotechnology, Physiology.

Information Technology: Introduction to www.Networking: Basics-modem-hub-switch-commands to transfer files-remote login. Elements of languages used on the Internet JAVA- Perl. Elements of databases- Relational databases.

Genetics and Genetic Engineering: Genotype and Phenotype, nucleic acid structure, Cell division, crossing over and mapping, Mutations and their role in evolution, Genetic Disorders, Enzymes in Genetic Engineering, Cloning Vehicles, gene cloning strategies, mutagenesis, Cloning & expression of transgenes in Prokaryotic & Eukaryotic systems, DNA sequencing, PCR technologies, gene transfer in plant and animals, molecular markers, Applications and impact of rDNA technology.

Molecular Biology: Central dogma of molecular biology, Gene structure in prokaryotes and eukaryotes, Coding and non-coding DNA & RNA, Gene regulation, Molecular mechanisms of recombination, Transposons and rearrangement of DNA, DNA damage and repair, Post transcriptional and post-translational modification. Concept of system and synthetic biology.

Bioenergy biosciences: Types of biofuels, Biomass characterization and processing, biodiesel, biogas and biohydrogen production, algal biofuels (microalgae and macroalgae cultivation, harvesting, processing and value addition). Application of enzymes in biofuels.

Chemistry and chemical equilibria: Ionic and covalent bonding, M.O. and V.B. approaches for diatomic molecules, VSEPR theory and shape of molecules, hybridisation, resonance, dipole moment, structure parameters such as bond

length, bond angle and bond energy, hydrogen bonding, van der Waals interactions. Ionic solids, ionic radii, lattice energy (Born-Haber Cycle). Identification of functional groups by chemical tests. Acids and bases, electronic and steric effects, optical and geometrical isomerism, tautomerism, conformers, concept of aromaticity. Reaction kinetics: Rate constant, order of reaction, molecularity, activation energy, zero, first and second order kinetics, catalysis and elementary enzyme reactions. Colligative properties of solutions, ionic equilibria in solution, solubility product, common ion effect, hydrolysis of salts, pH, buffer and their applications in chemical analysis, equilibrium constants for homogeneous reactions. Zeta potential and electronic double layer.

Section II

Science Stream Part A

Life Sciences

Biochemistry and Microbiology: Cell structure and function; protein synthesis; genetic code; DNA & RNA; carbohydrate, protein and lipid metabolism, clinical biochemistry; Inborn errors of metabolism; hormones and their function. Enzymes- classification, nomenclature, kinetics etc., Metabolism & regulation of: carbohydrates, proteins, fats & nucleic acids, Metabolic disorders, Classification and taxonomy of microorganisms; Growth and physiology; Laboratory cultivation of microbes, Methods of microbial enumeration; Microbial metabolism, photosynthesis, fermentation, aerobic & anaerobic respiration, Pathogenic microorganisms, Microbial genetics, Microbes in industry, Endotoxins, viruses (enveloped and non-enveloped).

Molecular biology & recombinant DNA technology: Properties of nucleic acids, chromosomes, DNA replication, damage and repair, gene manipulation, cloning vectors, gene libraries, screening of libraries, gene cloning, applications of recombinant DNA technology, PCR, RFLP, Western, Northern and Southern blotting. microarray technology, DNA fingerprinting and recombinant DNA technology; prokaryotic and eukaryotic expression systems; Vectors: plasmids, phages and cosmids. Gene mutation: Types of mutation; UV and chemical mutagens; Selection of mutants; Ames test for mutagenesis; Bacterial, yeast, cyanobacteria, fungi genetic system: transformation, conjugation, transduction, recombination, transposons genome shuffling, electroporation; DNA repair and chromosomal aberrations, synthetic biology for production of biochemicals and biotech products.

Immunology : Cells of the immune system, lymphoid tissues, complement, antibodies, hybridoma technology, applications of monoclonal antibodies, antigen recognition, processing and presentation, cell mediated immunity, cytokines, hypersensitivity, vaccines & vaccine technology, auto-immunity, transplantation, immune responses to various infections, Immunotechnology, B-cells and T-cells, Antibody structure, function and diversity, T-cell receptors, Antigen-antibody Reaction, Complement system and Cytokines, Hyper-Sensitivity, MHC and HLA, Hybridoma, Immunodeficiency diseases.

Section II

Science Stream

Part B

(Physics and Chemistry)

Physics:

Mechanics : Kinematics- Newton's laws- work and mechanical energy- dynamics of rotary motion- fundamentals of special theory of relativity- gravitation- motion in non-inertial frames.

Thermodynamics: Ideal gases – 1st law of thermodynamics- Kinetic theory of gases- 2nd law of thermodynamics-real gases.

Electricity and Magnetism : Electrostatics- Coulomb's law- electric field potential- capacitance- dielectrics in an electric field- energy of an electric field- direct current- magnetic field of direct current- electromagnetic induction

Waves and Optics: Free harmonic oscillators- elastic waves- Electromagnetic waves- interference, diffraction, scattering and polarisation of light- thermal radiation.

Modern Physics: Structure of matter and basic solid state physics- elementary nuclear physics- elementary quantum mechanics- structure of atom.

Chemistry:

Inorganic Chemistry: Electronic structure of atoms, periodic table and periodic properties. General characteristics, structure and reactions of non- transition elements and transition elements. Coordination compounds, structure, crystal field and ligand field theories, spectral and magnetic properties.

Organic Chemistry: Synthesis, reactions and mechanisms of alkenes, alkynes, arenes, alcohols, phenols, alde-

hydres, ketones, carboxylic acids and their derivatives, halides, nitro compounds and amines. Structure and properties of biomolecules, carbohydrates, amino acids and proteins.

Physical Chemistry: Chemical equilibrium, first law, thermochemistry, second law and entropy, free energy, properties of dilute solutions. Chemical kinetics, rates of reactions and factors affecting rates of reactions. Spectroscopy, principles of UV-visible and IR spectroscopy.

Section II

Science Stream

Part C

(Mathematics, Computer and Information Sciences)

Mathematics: Vectors- Trigonometry- Differentiation & Integration- Matrices

Information Sciences: Introduction to www. Networking: Basics-modem-hub- switch-commands to transfer files- remote login. Elements of languages used on the Internet JAVA- Perl. Elements of databases- Relational database.

Computer Application: Basics of computers- hardware-components of a computer. Operating systems- windows-linux- simple commands. Elementary Boolean arithmetic- subtraction- addition- multiplication. Applications- word processing- spread sheets. Elementary basic programming commands and syntax. ;

VI. PREVIOUS YEARS' QUESTION PAPERS

For the reference of intending candidates, a set of question papers pertaining to the last three years are available on JNU website www.jnu.ac.in

VII. SELECTION PROCEDURE

Selection of the candidates will be done in accordance with their inter-se merit drawn on the basis of All India Entrance Examination vis-à-vis the preference of Universities exercised by candidates. In case a candidate has not indicated his/her option for joining a particular university, his/her name will not be considered for that university.

The Selection procedure will be as follows:

- 1) After the merit list is drawn more than double the number of candidates than the total intake only will be informed of their merit rank in the entrance examination. The candidates will also be informed about the total number of seats in each participating University. The candidates will be asked to exercise their options for joining the Universities in the proforma (which will be sent by JNU). The candidates will be asked to send to JNU a Bank Draft of Rs.5,000/(Rs.2,500/- in the case of SC, ST, PWD candidates) **as initial security deposit** giving their willingness to be considered for admission to the participating Universities in accordance with their options for joining the Universities vis-à-vis their inter-se merit in the Entrance Examination. **ALL CANDIDATES ARE ADVISED TO CHECK THE RESULT ON THE WEB SITE OF THE UNIVERSITY (www.jnu.ac.in) IN THE SECOND WEEK OF JUNE.**
- 2) Before exercise the options candidates are advised to check their eligibility as prescribed by different University and ensure that they fulfil the prescribed eligibility.
- 3.a) The candidates who do not exercise their options for joining any of the participating universities will not be considered for admission to that university/universities.
- 3.b) Candidates who do not fulfil the eligibility for any University would not be considered for admission to that University/ Universities.
- 4) After allotment of seats, the JNU will send intimation to the candidates about their allotment of the university and also to the concerned participating university to which the candidate has been selected. Please note that once allotment of University is made on the basis of inter se merit vis-à-vis options, other options of the universities given by the candidate shall stand frozen. **CANDIDATES ARE ADVISED TO CHECK THE ALLOTMENT OF UNIVERSITY ON THE WEB SITE OF THE UNIVERSITY (www.jnu.ac.in) IN THE FIRST/SECOND WEEK OF JULY.**
- 5) The participating university will then inform the candidate about the complete admission procedure and schedule of their university as well as the amount of fee etc. to be deposited by the candidate. The initial security deposit already sent by the candidate through demand draft to JNU will be sent to concerned University for refund to the students after first semester.
- 6) In case the candidate is offered admission in accordance with his/her options for joining the University vis-à-vis his/her inter-se merit, but subsequently either does not join the concerned University or withdraw after joining during the first semester then in that event, the initial deposit of Rs. 5,000/- and Rs.2,500/- for General/OBC and SC/ST/PWD categories respectively, **shall stand forfeited.**
- 7) The initial security deposit of Rs.5,000/-, (Rs.2,500/- in the case of SC/ST, PWD candidates) will be refunded in full to those of the candidates who are not offered admission to any of the participating university.
- 8) **Candidates may note that request for transfer from one university to another will not be entertained under any**

circumstances. Therefore, candidates are advised not to make any request in this regard.

- 9) Only those candidates who will be asked to exercise their option, the list/letter of these candidates will be available on JNU website (www.jnu.ac.in) although intimation to this effect is also sent to the candidates on their e-mail account. However, the candidates are advised to find out through their own sources whether their names appear in the list and thereby make arrangement for sending their final option together with initial security deposit by the stipulated date. **The University will not issue any paper intimation to the candidates. Candidates are advised to regularly check JNU website for updates.**
- 10) **PLEASE NOTE THAT ONLY ONE MERIT LIST WILL BE RELEASED AND THERE WILL BE NO SECOND LIST UNDER ANY CIRCUMSTANCES.**

VIII. ADMIT CARD FOR ENTRANCE EXAMINATION

The candidates may download their Admit Card from the University's website: www.jnu.ac.in around 10th May 2017 and take the Admit Card to the Examination Centre with a copy of latest passport size photograph.

Before taking the entrance examination, please ensure that you fulfil the eligibility requirements as prescribed by the University. Also please note that permission to appear in the entrance examination is subject to your fulfilling the minimum eligibility requirements prescribed for admission as notified in the prospectus. You may, therefore, appear in the entrance examination only if you fulfil the eligibility requirements as prescribed for M.Tech Biotechnology Programme under Section-II of this prospectus. Despite this caution, in case you do not meet the minimum eligibility criteria and appear in the entrance examination, you will do so at your own risk and cost, and if at any stage, it is found that you do not fulfil the minimum eligibility requirements, the admission, if granted to you, shall be cancelled ipso facto.

Those candidates who have applied and fulfil the prescribed eligibility conditions but somehow are not able to download the Admit Card are advised to contact either the JNU Representative (who will be available at the Examination Centre at least a day in advance) or the Presiding Officer/Principal of the Centre to sort out the problems. It may be noted that only those candidates will be allowed to appear in the entrance examination whose names appear in the roll-list available with the examination centre. The University will assume no responsibility whatsoever in case the candidate fails to report on the due date and time for appearing in the entrance examination.

IX. TIME-TABLE FOR ENTRANCE EXAMINATION

- | | |
|---|--|
| 1. Start of Application process | From 10.00 A.M. on 6th February, 2017 |
| 2. Closing of Application Process | till 5.00 p.m. 7 th March, 2017 |
| 3. Date and time of Entrance Examination | May 19, 2017 (2.00 P.M. to 5.00 P.M.) |
| 4. Results of Entrance Examination | |
| i. Merit list of candidates to exercise their option for Universities | 2nd/3rd week of June, 2017 |
| ii. Final result of allotted Universities | last week of June/1st week of July, 2017 |
| 5. For admission/result queries candidate may visit our website | www.jnu.ac.in |

Although the University will inform the candidates falling under consideration zone about their merit in CEEB on their e-mail account, it is the responsibility of the candidate to see the result on University website. The list/letter of these candidates will also be available on JNU website (www.jnu.ac.in). **The University will not issue any paper intimation to the candidates. Candidates are advised to regularly check JNU website for updates.**

X. HOSTEL FACILITIES

The outstation candidates admitted to the programme of study of the participating Universities will be considered for hostel accommodation as per rules of the concerned University subject to availability of hostel accommodation. Students may please note that grant of admission in a University would not ensure automatic allotment of hostel accommodation and that the same will be offered subject to its availability.

XI. CERTIFICATE AND OTHER DOCUMENTS REQUIRED AT THE TIME OF ADMISSION

- (a) Two self attested copies of the Matriculation, Higher Secondary Pre-University of Indian School Certificate or Senior School Certificate (10+2) or an equivalent examination certificate, showing the age/date of birth of the candidate;
- (b) A Character Certificate from the Head of the Institution last attended;

- (c) Two self attested copies of the statement of marks obtained by the candidate in Senior School, Bachelor's Degree/ Master's Degree examination etc; or their equivalent examination;
- (d) Two self attested copies of the Bachelor's Degree and/Master's Degree;
- (e) SC/ST/OBC Certificate, if belonging to SC/ST/OBC category
- (f) A Medical Certificate for PWD Candidates certifying that the disability is not less than 40%.
- (g) Migration Certificate (in original) from the Head of the Institution/University last attended:

Important: The candidates are also required to produce all originals of the above certificates/documents for verification at the time of registration/admission. In the absence of any of the original certificates/documents, registration/admission shall not be allowed.

XII. INSTRUCTIONS FOR COMPLETING THE APPLICATION FORM

- Name of the Candidate:** Please note that your name, your parent's/guardian's name, and your date of birth should exactly be the same as given in your 10th class or first Board/Pre-University examination certificate. Any deviation, whenever discovered, may lead to cancellation of your candidature.
- Your name should be as given in your 10th class certificate or your first Board/ Pre-University Examination. Female candidate may mention her present surname in case of name change after marriage.
- State of Domicile:**

State/Union Territory	Code	State/Union Territory	Code
Andaman & Nicobar	0 1	Maharashtra	2 0
Assam	0 2	Manipur	2 1
Andhra Pradesh	0 3	Meghalaya	2 2
Arunachal Pradesh	0 4	Mizoram	2 3
Bihar	0 5	Nagaland	2 4
Chandigarh	0 6	Orissa	2 5
Chattisgarh	0 7	Pondicherry	2 6
Delhi	0 8	Punjab	2 7
Daman & Diu	0 9	Rajasthan	2 8
Goa	1 0	Sikkim	2 9
Gujarat	1 1	Tamil Nadu	3 0
Haryana	1 2	Telangana	3 1
Himachal Pradesh	1 3	Tripura	3 2
Jammu & Kashmir	1 4	Uttar Pradesh	3 3
Jharkhand	1 5	Uttarakhand	3 4
Karnataka	1 6	West Bengal	3 5
Kerala	1 7	Any other place(in India)	3 6
Lakshadweep	1 8	Foreign Countries	3 7
Madhya Pradesh	1 9		

4. **Entrance Examination Centre:** A list of cities where JNU entrance examination is to be held is given below. **No change will be permitted and no correspondence in this context will be entertained.** In case it is not possible to allot the Centre of your choice, the University reserves the right to allot you alternative centre.

Name of the Centre	Centre Code	Name of the Centre	Centre Code
1. Agartala (AG)	3501	29. Katihar (KT)	1307
2. Ahmedabad (AH)	1601	30. Kolkata (KL)	3800
3. Aizawl (AZ)	2701	31. Lucknow (LK)	3600
4. Allahabad (AL)	3611	32. Mumbai (MB)	2401
5. Amritsar (AS)	3001	33. Madurai (MR)	3303
6. Bangalore (BL)	2101	34. Nagpur (NP)	2402
7. Bareilly (BR)	3616	35. Pant Nagar (PN)	3702
8. Bhubaneshwar (BN)	2901	36. Patna (PT)	1300
9. Calicut (CA)	2201	37. Pondicherry (PE)	3304
10. Chandigarh (CH)	3901	38. Pune (PU)	2403
11. Chennai (CE)	3301	39. Raipur (RP)	1401
12. Coimbatore (CT)	3302	40. Ranchi (RC)	2001
13. Dehradun (DD)	3701	41. Sagar (SA)	2302
14. Delhi (DL)	1500	42. Sambalpur (SP)	2902
15. Dimapur (DU)	2801	43. Secundrabad (HD)	3402
16. Gangtok (GT)	3201	44. Shillong (SL)	2601
17. Gaya (GA)	1306	45. Shimla (SM)	1801
18. Ghaziabad (GZ)	3617	46. Silchar (SC)	1202
19. Gwalior (GW)	2301	47. Siliguri (SG)	3806
20. Guwahati (GH)	1201	48. Srinagar (SR)	1902
21. Goa (GO)	3902	49. Thiruvananthapuram (TP)	2202
22. Gorakhpur (GP)	3618	50. Udaipur (UD)	3107
23. Hyderabad (HY)	3401	51. Varanasi (VR)	3606
24. Imphal (IM)	2501	52. Vijayawada (VJ)	1001
25. Itanagar (IT)	1101	53. Visakhapatnam (VP)	1002
26. Jaipur (JP)	3100	(Overseas Centre)	
27. Jammu (JM)	1901	54. Kathmandu* (KM)	5000
28. Jodhpur (JO)	3106	<i>* Subject to sufficient number of candidates available.</i>	

Note:

- The University reserves the right to change/cancel any Centre of Examination within India/abroad without assigning any reason.
 - Addresses of the Centres of Examination will be available on our JNU website (www.jnu.ac.in) around 10th May, 2017.
5. **Entrance Examination Fee:** The entrance examination fee is Rs. 1000/- for general category candidates including OBC candidates and Rs. 500/- for the candidates belonging to SC/ST and Person with Disability categories. The entrance examination fee for Foreign Nationals is US\$ 40.00 or Rs. 2640/-.

Important Notes:

- If any information furnished by the candidate in the application form is found to be false, his/her admission, if granted on the basis of such information will be cancelled, ipso facto.

2. You fulfil the eligibility requirements as detailed in the Prospectus. You should, appear in the entrance examination only if you fulfil the eligibility requirements for M.Tech. Biotechnology programme. Despite this caution, in case you do not meet the minimum eligibility criteria and still appear in the entrance examination, you will do so at your own risk and cost, and if at any stage, it is found that you do not fulfil the minimum eligibility requirements, the admission, if granted to you, shall be cancelled ipso facto.
3. Any dispute with regard to any matter relating to admission shall be subject to the jurisdiction of Delhi Courts only.