



**Guru Gobind Singh Indraprastha University**  
**Sector – 16C Dwarka, New Delhi – 110078**

**(Coordination Branch)**


Ph:011-25302135-136, Email: coordination112@gmail.com,  
Website: www.ipu.ac.in

**F.No.: GGSIPU/Co-ord./49<sup>th</sup> AC/2019/2/1**

**Dated: 21<sup>st</sup> December 2020**

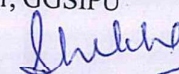
**Circular**

Please find enclosed herewith the final Minutes of the 49<sup>th</sup> meeting of the Academic Council of the Guru Gobind Singh Indraprastha University held on **09/11/2020 at 11:00 AM** on Cisco Webex platform.

  
(Ravi Dadhich)  
Registrar

**To**

1. Dean- USBAS/ USBT/ USCT/ USEM/ USICT/ USHSS/ USMC/ USLLS/ USM&PMHS/ USMS/ USAP/ USE, GGSIP University.
  2. Director- Academic Affairs/ Coordination/ Students' Welfare/ CDMS/ Development/ International Affairs/ CEPS/ Research and Consultancy/ Legal Aid / IUIIC, GGSIP University
  3. Librarian, GGSIP University
  4. Prof. P.K. Jhulka, (Retired), Max Institute of Cancer Care, 26-A Ring Road, Nirmal Puri, Nirmal Colony, Block -2, Lajpat Nagar-IV, New Delhi-110024
  5. Prof. M.C. Sharma, 109, Nav Shakti Sadan, Sector 13, Rohini, New Delhi-110085
  6. Prof. Karmeshu, (Retired), 150, Deepali, Road No. 42, Pitampura, Delhi-110034
  7. Sh. Arvind Misra, 5/101, Mathura Road, Agra-282002
  8. Shri. Sandeep Gupta, 100 UB Jawahar Nagar, Delhi-110007
  9. Prof. Rajiv Bhat, School of Biotechnology, Jawaharlal Nehru University, New Delhi
  10. Prof. (Dr.) Pradeep Kulshrestha, Dean, School of Law, Sharda University, Plot No. 32 & 34, Knowledge Part-III, Greater Noida-201306 (UP)
  11. Ar. Rupal S. Randhawa, 204-A, Pocket B, Mayur Vihar, Phase-2, New Delhi-110091
  12. Dr. Jagdish Lal Gupta, CP-18, Maurya Enclave, Pitam Pura, Delhi-110034.
  13. Prof. Sanjiv Mittal, University School of Management Studies, GGSIP University
  14. Prof. U.K. Mandal, University School of Chemical Technology, GGSIP University
  15. Prof. Udyan Ghosh, University School of Information Communication & Technology, GGSIP University
  16. Dr. Nimisha Sharma, Associate Professor University School of Biotechnology, GGSIP University
  17. Dr. Gulshan Dhamija, Asst. Professor, University School of Basic and Applied Science, GGSIP University.
  18. Prof. M.N. Hoda, Director, Bharti Vidhyapeeth's Institute of Computer Application & Management, A-4, Paschim Vihar, Rohtak Road, New Delhi-63.
  19. Prof. (Dr.) Sonia Jindal, Principal, Gitarattan Institute of Advanced Studies and Training, Rohini, Delhi-85.
  20. Dr. Ravi K. Dhar, Director, Jagannath International Management School, OCF, Pocket-9, Sector-B, Vasant Kunj, New Delhi-110070.
  21. Dr. Surendra Kumar, Principal, Delhi Institute of Rural Development, Holamb Khurd, Delhi.
  22. Dr. Maharaj Krishen Bhat, Director, Maharaja Agrasen Institute of Management Studies, Maharaja Agrasen Camp, Plot No. 1, Sec-22, Rohini, Delhi.
- Copy for information of the Competent Authority:
1. AR to the Vice Chancellor Secretariat for kind information of Hon'ble Vice Chancellor, GGSIPU
  2. AR to the Registrar office for information of Registrar, GGSIPU

  
(Shikha Agarwal)  
Dy. Registrar (Coordination)



**GURU GOBIND SINGH INDRAPRASTHA UNIVERSITY  
SECTOR – 16 C, DWARKA, NEW DELHI - 110078**



**GURU GOBIND SINGH  
INDRAPRASTHA  
UNIVERSITY**

**FORTY NINETH (49<sup>th</sup>) MEETING OF THE ACADEMIC COUNCIL**

**DATE: 9<sup>th</sup> NOVEMBER, 2020 (MONDAY)**

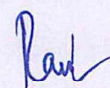
**TIME: 11:00 A.M.**

**MINUTES**



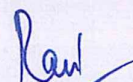
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S. No.	Agenda Item(s) No.	Particulars	Page No.
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**Additional Agenda Item Consideration and approval for Eligibility /  
No. AC49.18: Admission Criteria for starting of B.Sc. (Medical  
Imaging Technology) (BMIT) Programme**

The Academic Council considered and approved the Eligibility / Admission Criteria for starting of B.Sc. (Medical Imaging Technology) (BMIT) programme from Academic Session 2020-21 and onwards.

**Additional Agenda Item No. Approval of the revised Scheme and Syllabus of  
AC 49.19: BA LLB (Hons) and BBA LLB (Hons), to be  
implemented from the Academic Session 2021-  
2022.**

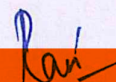
The Academic Council considered and approved the revised Scheme and Syllabus of BA LLB (Hons) and BBA LLB (Hons) to be implemented from the Academic Session 2021-2022. It was also directed that the nomenclature of the programme shall be as per the approved nomenclature by UGC's notified regulation and accordingly the nomenclature shall be finalized as per applicable regulation of the University.

**Additional Agenda Item No. Ratification of Syllabus of M.Voc. (Interior Design)  
AC 49.20: of 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> Semester.**

The Academic Council considered and approved the ratification of Syllabus of M.Voc. (Interior Design) of 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> Semester.

**Additional Agenda Item No. To consider and approve regarding incorporating  
AC 49.21: the course on Research and Publication Ethics of  
two credit in the Scheme and Syllabi for Ph.D.  
Programme for Centre of Excellence in  
Pharmaceuticals Sciences (CEPS).**

The Academic Council considered and approved the Agenda Item regarding incorporating the course on Research and Publication Ethics of two credit in the Scheme and Syllabi for Ph.D. Programme for Centre of Excellence in Pharmaceuticals Sciences (CEPS). The Academic Council decided that the course/paper be included by all the schools / centers of the University in the Course Work of Ph.D. Programme for Academic Session 2020-21.



**SCHEME and SYLLABUS**  
**OFFERED**  
**TO**  
**Ph.D.**  
**Students**  
**Admitted in**  
**University School of**  
**Biotechnology**

**Entrepreneurship** | **Employability** | **Skill Development**

**2020-21 Onwards**

**GGs INDRAPRASTHA UNIVERSITY  
SECTOR 16 C, DWARKA  
NEW DELHI- 110078**

**SCHEME AND SYLLABUS**

**OFFERED TO Ph.D. (Biotechnology)**

**STUDENTS**

<b>S.No.</b>	<b>Paper Code</b>	<b>Title</b>
1.	BT-701	Latest Trends in Drug Research
2.	*BT-702	Research Methodology
3.	BT-703	Advanced Microbial Biotechnology
4.	BT-705	Genes and Genomics
5.	BT-707	Protein Purification and Characterization
6.	BT-709	Advances in Plant Tissue Culture
7.	BT-711	Cancer Biology
8.	BT-713	Clinical Immunology
9.	BT-715	Molecular Aspects of Plant Abiotic Stress
10.	BT-717	Advanced Molecular Biology and Functional Genomics
11.	*Ph-DICT 102	Research Publication and Ethics

\* Mandatory course

As per approval of the 49<sup>th</sup> Academic Council Meeting dated 9<sup>th</sup> November, 2020, Agenda item 49.21  
Implemented from 2020-21 session

### **Ph. D. Program Specific Outcome(s)**

The objective of Ph.D. (Biotechnology) program is to:

1. Provide a solid foundation to Biotechnology engineering students in thrust areas of Molecular biology, Bioprocess control engineering, Genetic engineering, Pharmaceutical biotechnology, Medical biotechnology, Virology etc.
2. Provide students with hands-on technical skills necessary for excelling in biotechnology research and industrial activities.
3. Inculcate professional, ethical and responsible attitude with team work and entrepreneurship skills having a multidisciplinary approach.
4. Develop an ability to relate to issues in biotechnology and provide research-based solutions for welfare of mankind, environment and society as a whole.
5. Understand the impact of biotechnological solutions for society and environment and demonstrate skills for sustainable development.



## SECOND SEMESTER EXAMINATION (Ph.D.)

L	T	Credits	Hours
3	1	4	40

### BT-701 LATEST TRENDS IN DRUG RESEARCH

#### Course Outcome:

1. To develop an understanding of processes and techniques involved in drug research.
2. To familiarize with tools and methods of imaging involved in drug research.
3. To gain in-depth knowledge in *in silico* analysis of drug-discovery dependent methods.
4. To develop understanding of carbohydrate-based therapeutics in drug discovery.
5. To understand future aspects of drugs from the aspect of clinical trials.

#### Syllabus

1. Drug discovery and development process: A brief overview. Phases of the drug discovery process and stages of drug discovery process before clinical trials. (4)
2. Drug discovery and utilization of imaging in drug research. Computerized Tomography, Positron Emission Tomography, and Single Photon Emission, Computed Tomography, Ultrasound, Optical Imaging .Benefits & limitation of MRI .InvivoMRTechniques in drug research. (4)
3. Imaging as biomarker for decision making in drug development. Biomarkerlexicon, progression from validation to qualification .Imaging biomarker. Imaging in cardiovascular diseases ,in neuroscience and multi modality challenge (5)
4. Drug discovery based on functional genomics. EST database, proteomic methods in target identification, role of bioinformatics in target identification. Genomic based drug target validation. Gene disruption technique, antisense methods, ribozymes, antibodies & intra bodies,chemicalligands,for RNA targets.High-through put drug screening. (5)
5. Combinatorial chemistry. Parallel syntheses, (multipin, teabag, spot and other methods). Split-mix synthesis, mixed monomer and light-directed combinatorial synthesis. Deconvolution methods, Radio frequency encoding of capsules and string syntheses. (5)
6. Lead search, selection and optimization in silico (virtual) screening. Binding site, ligand structure, methods. Test compound selection, undesired chemical groups. Drug likeness, Rule of five (Lipinski's rule).Blood-brain barrier penetration. Application of QSAR methods. Validation of QSAR models, and selection and optimization for leads election. (6)
7. Development of carbohydrate based therapeutics, Role of carbohydrates (N-Glycans, O- Glycans, Glycolipids& Proteo-glycans).Carbohydrate therapeutics-antithrombosis perspective.Anti-inflammatories. antibiotics, carbohydrate anti-cancer vaccine. Future potential for carbohydrates in drug discovery. (6)
8. Systemic antifungal agents. Azoles, Polyenes, Allylamines Nucleic acid in hibitors. Glucan synthesis inhibitors, manno protein binders,chitinsynthaseinhibitors. Drug under clinical trials& future prospects. (5)

**Text/References books:**

- Molecular pathomechanism& drug research by Keri Gyorgy&TothIstvan.2003,Taylor & Francis.
- Pharmaceutical Chemistry by Christine M. Bladon. *John Wiley&Sons,Ltd.*(2002).
- Burger's Medicinal Chemistry and Drug Discovery (5<sup>th</sup> edition) by Manfred E.Wolff.*AWiley & Sons, Inc.*(2000).



## BT-702 RESEARCH METHODOLOGY

### Course Outcome:

1. To understand principles and related aspects of scientific research communication.
2. To develop an understanding of ethical aspects of research writing.
3. To apply statistical tools and techniques for scientific data interpretation.
4. To be able to design and interpret scientific data utilizing biostatistical methods.
5. To develop an ability to analyse complex biological problems using basic principles of biological engineering sciences to achieve the desired goals.

### Syllabus

1. **Scientific Research:** Meaning and characteristics of scientific research; Validity in research; Phases or Stages in research; Various types of research: Quantitative, Qualitative, experimental, Exploratory, Empirical, Descriptive, Ex-post facto, Casestudies. (4)
2. **Review of literature:** Purpose of the review, Sources of the review, Citing references, Ethical and IPR issues in research. (3)
3. **Data representation:** Collection of data, Tabulation, Organization and graphical representation of quantitative data- Line Graphs, Bar Graphs, Pie Charts, Histograms; Probability concept and theories. (4)
4. **Sampling:** Meaning and types of sampling- Probability and Non probability Sampling. Methods of drawing random samples ,requisites of good sampling methods, Sample size, Sampling error. (4)
5. **Hypothesis testing:** Null hypothesis, Alternate hypothesis, Steps of hypothesis testing, Level of significance, Type I and Type II error. (3)
6. **Measures of Variability:** Range; Quartile Deviation; Standard Deviation; Average Deviation; and Coefficient of Variation; Measures of Relative position: Percentiles, Percentiles Ranks, Standard Scores, Stanine Scores, T-Scores; Normal Probability Distribution, properties of normal curve, applications of normal curve, Divergence from Normality :Skewness and Kurtosis. (5)
7. **Correlation and Regression:** Karl Pearson's correlation Coefficient(r), Spearman's rank order correlation coefficient(rho), Partial and Multiple Correlation, Scatter diagrams, Regression and Prediction, Regression equations, linear regression, multiple regression analysis, Cause and effect-Pathanalysis (5)
8. **Statistical inference:** Concept of Standard Error and its uses; The Significance of Statistical Measures; Tests of Significance of Difference between two means Z-Test, T-test; Analysis of variance and analysis of covariance: Assumptions of Anova, One way Anova, Two way Anova, Post Hoc tests- Duncan's multiple range test, Tukey's test, Newmann-Keuls test; Non-parametric Tests: Chi-square test, Median test, Mann Whitney U test, Kolmogorov- Smirnov two sample test; Multivariate analysis: Factor analysis, Cluster analysis and Discriminant analysis. (5)
9. **Experimental Designs:** Meaning and purpose of research design, Criteria of research design , Basic principles of experimental design, General layout and Anova of experimental designs: Completely Randomized Design, Randomized Block Design, Latin Square Design , Split Plot, Factorial designs. (4)
10. **Preparation of Thesis:** Introduction to scientific writing, Introduction to different softwares used for thesis preparation (3)

**Recommended bibliography:-**

- Kothari, C.R. (2004). Research methodology. New Age International, 2<sup>nd</sup> Edition.
- Singh, Y.K. (2009). Fundamental of research methodology and statistics. New Age International.
- Ott, R.L. and Longnecker, M. (2010). An introduction to statistical method and data analysis. Brooks/Cole Cengage Learning, Canada.
- Laake, P., Bennestad, H.B. and Olson, B.R. (Eds) Research Methodology in the medical and biological sciences (2007) Elsevier/Academic Press.
- Betz, F. (2011) Managing Science, Methodology and Organization of Research. Springer



SECOND SEMESTER EXAMINATION (Ph.D.)

L	T	Credits	Hours
3	1	4	40

**BT-703**

**ADVANCED MICROBIAL BIOTECHNOLOGY**

**Course Outcome:**

1. Understand the application and challenges of various methods for identification of microorganism.
2. Understand the microbial metabolism pathways and their significance in biotechnology.
3. Know various gastrointestinal micro flora and their beneficial uses.
4. Understand the significance of nanotechnology in the detection of microorganisms

**Syllabus**

1. Influence of *E. Coli* toxin on the mammalian central nervous system. Symptoms, CNS histopathology from autopsy. CNS pathology from MRI, animal models, CNS symptoms of animal models. CNS histopathology, Hematology & serum of animal models. Similarity between animal & human patients. (5)
2. Microbial fingerprinting using matrix-assisted laser desorption ionization time of flight- Mass spectrometry (MALDI –TOF - MS). Applications & challenge need to identify microorganism, using (MALDI –TOF). Application in case of bacteria, fungi, viruses & current application challenges, reproducibility, effect of culture conditions. (7)
3. Pathway for discovering microbial metabolism for functional genomics & biotechnology. Hypothesis, organization of existing metabolic functions. Approaches for new discoveries. Newly Discovered microbial metabolism. Significance of new discoveries in novel functional group metabolism. (6)
4. Gastrointestinal micro flora: Probiotics. Human gastrointestinal micro flora, probiotic history. Microorganisms used as probiotics. Selection criteria for probiotic bacteria. Lactose intolerance. Atopic disorders. Treatment & prevention of diarrhea, ulcerative colitis, & pouchitis, irritable bowel syndrome & *Helicobacter pylori* in infection. (7)
5. Application of Raman micro spectroscopy on identification of microbial species. Using single cell, Raman tweezers to measure & manipulate single microbial cells. Surface enhanced Raman scattering. Single cell Raman spectroscopy & measuring microbial metabolic potential. Raman spectra data analysis. (7)
6. Nanotechnology in the detection of microorganisms. Carbohydrate bio functional polymeric nano materials. Nano materials for vaccine development. Fluorescence based detection of microorganisms. Metallic nano materials, elemental metal nanomaterials, metal-oxide nanomaterials. Magnetic nano materials for the detection of microorganisms. Metallic nanomaterials, elemental metal nano materials, metal oxide nano materials. Magnetic nano materials for the detection of microorganisms. (8)

**Text/Reference books:**

1. Advances in Applied Microbiology. Vol. 71, 2010. Vol. 61, 2007.
2. Annual Reviews in Microbiology, 2010 and others volumes.
3. Critical Reviews in Biotechnology.

**SECOND SEMESTER EXAMINATION (Ph.D.)**

L	T	Credits	Hours
3	1	4	40

**BT-705**

**GENES AND GENOMICS**

**Course Outcome:**

1. Understand the various methods of DNA sequencing and their working principle.
2. Understand the basis of genetic variation using different methods.
3. Understand mechanism of gene regulation and different methods of studying the gene expression.
4. Understand the genomic approaches being exploited for crop and livestock improvement.

**Syllabus**

1. DNA Sequencing: Principles and techniques of DNA sequencing; Automated DNA sequencing ,Next Generation Sequencing, Single molecule sequencing ,Shotgun sequencing. (6)
2. Analysis of Sequence Data: Contig assembly, ORF ,Exon–Intron boundaries; Other features of nucleic acid sequencing ; Protein motifs & domains; DNA Sequence Data banks; Sequence alignment and comparisons. (6)
3. Analysis of DNA Sequence Variation: Nature of genetic variation; Methods to study variation - Hybridization and PCR based methods ,SNPs; Genome –wide comparisons. (6)
4. Comparative Genomics: Comparative account of representative microbial, animal, plant and human genome projects, Synteny in model genomes, Genome evolution. (6)
5. Analysis of Gene Expression: Methods of analyzing gene expression; whole genome expression; differential gene expression comparing transcriptomes– subtractive hybridization, deferential display, SAGE,RNA-seq, Microarrays. (8)
6. Meta genomics, epi genetics, genesilencing, genome editing. (4)
7. Genome assisted crop and livestock improvement, Genomics and human healthcare. (4)

**Text/Reference Books:**

1. Handbook of comparative Genomics: Principles and Methodology by Cecilia Saccone, Graziano Pesole. Wiley-LISS Publication, 2003.
2. Comparative Genomics by Melody S . Clark. Kluwer Academic Publishers, 2001.
3. Essentials of Genomics & Bioinformatics by C.W. Sensen Wiley, 2003.
4. Discovering Genomics, Proteomics & Bioinformatics by A.M. Campbell, C.S.H. Press, 2003.
5. Genetics: From Genes to Genomes by Hartwell, L. et al. 2010 McGraw Hill
6. Analysis of Genes and Genomes by Greece, R.J. (2008) Wiley
7. Genomes by T.A. Brown 2009 Oxford/Wiley Liss
8. Various research and review journals like Nature Biotechnology, Current Opinion Series, Trends Series and Annual Reviews, etc.

As per approval of the 49<sup>th</sup> Academic Council Meeting dated 9<sup>th</sup> November, 2020, Agenda item 49.21  
Implemented from 2020-21 session



**SECOND SEMESTER EXAMINATION (Ph.D.)**

L	T	Credits	Hours
3	1	4	40

**BT-707 PROTEIN PURIFICATION AND CHARACTERIZATION:  
A PRACTICAL APPROACH**

**Course Outcome:**

1. Comprehensively understand the various aspects of protein purification
2. Summarize and critically analyze current methodologies involved in protein characterization.
3. Apply the acquired knowledge to understand structure-function relationship of proteins and their use in industrial applications.
4. Apply principles from the various facets of protein biotechnology to solve practical problems in applied protein research.

**Syllabus**

1. General methods for handling proteins and enzymes: Setting up a laboratory, Buffers, Measurements of enzyme activity, Quantitation of protein, Concentration of proteins and removal of salts, Maintaining protein stability. (4)
2. Preparation of crude extract and sub-cellular fractionation: Raw material, Cell disintegration and extraction of protein, Optimization and clarification of the extract, Procedures for particulate-associated enzymes. (4)
3. Concentration of proteins and removal of solutes: Chromatography, Electrophoresis, Dialysis, Ultrafiltration, Lyophilization, Precipitation, Crystallization. (4)
4. Separation of proteins by precipitation: Salting in and salting out, Organic solvent precipitation, Precipitation with organic polymers and other materials, Precipitation by selective denaturation. (4)
5. Separation of proteins by adsorption: Ion-exchange chromatography, Affinity chromatography, Dye ligand chromatography, Immunoabsorbents, Batch adsorption. (6)
6. Separation of proteins in solution: Gel filtration, Electrophoretic methods, Liquid phase partitioning, Ultrafiltration. (5)
7. Characterization of purified protein: Determination of purity, Determination of size, MW and subunit structure, Amino acid analysis, Limited N-terminal sequence analysis. Peptide mapping, Analysis of protein modifications and non-protein cofactors, Protein crystallization. (5)
8. Immunological procedures: Preparation of polyclonal and monoclonal antibodies, Protein blotting and immune detection, Immunoassays. (3)
9. Radio-labeling of proteins (2)
10. Purified proteins to gene cloning (3)

**Text/ Reference books:**

- Methods in Enzymology: Guide to Protein Purification, Edited by Richards R Burgess and Murray P Deutscher. Elsevier (2009)
- Purifying Proteins for Proteomics: A Laboratory Manual, Edited by Richard J. Simpson (Cold Spring Harbor Laboratory Press (2004)
- Protein Analysis and Purification: Benchtop Techniques by Ian M. Rosenberg (Birkhäuser Boston (2004)
- Protein Purification (THE BASICS) by Philip L. R. Bonner Taylor & Francis (2007)
- Research Papers and review articles

As per approval of the 49<sup>th</sup> Academic Council Meeting dated 9<sup>th</sup> November, 2020, Agenda item 49.21  
Implemented from 2020-21 session

SECOND SEMESTER EXAMINATION (Ph.D.)

	L	T	Credits	Hours
BT-709	3	1	4	40
ADVANCES IN PLANT TISSUE CULTURE				

**Course Outcome:**

1. To decide using suitable combination of various parameters for successful research outcomes.
2. To plan out suitable strategy for improving plants or plant related product development as well.
3. To contribute towards sustainable utilization besides various conservation efforts for available and at risk plant biodiversity, through various approaches.

**Syllabus**

1. Events in the refinement of plant tissue culture as a major biotechnological tool: tracing evolution of medium proposition, aseptic procedures, choice of sterilizing agents, nature of regeneration protocols etc. (3)
2. Introduction to variety of explants and their potential: orthodox/recalcitrant nature of explants, best explants choice, selection criterion based on purely academic interest /commercial exploitation for improvement and modification purposes. (5)
3. Understanding the requirements of In vitro culture technique: need and application of specific media (liquid/semisolid), basic composition and other supplements to be added and specific equipments/accessories (for single cell/tissue/organ culture) necessary for achieving specific targets. (5)
4. Regeneration protocol optimization: with a focus on achieving different objectives such as clonal propagation/micro propagation/cryopreservation/multiplication for saving from extinction etc. (5)
5. Protocol development for exploiting somaclonal/ tissue culture induced variations: Screening, selecting the desirable variants, characterizing their nature (heritable or otherwise) and optimizing their regeneration protocols for stable production of a biotic and biotic stress tolerant plants. (5)
6. Creating novel combinations in vitro: Using aseptic procedures to create inter/ intra specific or generic hybrids or combinations not possible in nature through somatic hybridization/ par asexual hybridization, in vitro pollination and fertilization, production of haploids/homozygous diploids, gynogenic haploids, triploids etc. (6)
7. Production of transgenic plants : Development of protocol for transforming explants from existing genotypes and their multiplication for further revaluation and characterization for academic as well as commercial purposes. (5)
8. Production of desirable compounds in vitro: Protocol development and optimization for enhanced yields of compounds such as secondary metabolites etc for flavoring, perfumery or pharmaceutical interest or molecular pharming, commercialization and automation potential. (6)

**Text/References books:**

- Bhojwani, SS. (2005). Plant Tissue Culture: Theory And Practice, 5th Revised Edition, Elsevier.
- Bhojwani, SS. (2003). Agro biotechnology and Plant Tissue Culture. Oxford University Press.
- Slater, S, Scott, NW & Fowler, MR. (2008). Plant Biotechnology: the genetic manipulation of plants, second edition, Oxford.
- Dodds, JH & Roberts, LW. (1995). Experiments in plant tissue culture. Cambridge University press, Cambridge.
- Bhojwani, SS. (2003). Agro biotechnology And Plant Tissue Culture. Oxford University Press.

As per approval of the 49<sup>th</sup> Academic Council Meeting dated 9<sup>th</sup> November, 2020, Agenda item 49.21  
Implemented from 2020-21 session

SECOND SEMESTER EXAMINATION (Ph.D.)

L	T	Credits	Hours
3	1	4	40

BT-711

**CANCER BIOLOGY**

**Course Outcome:**

1. Gain an insight into the underlying molecular mechanisms contributing to initiation and progression of cancer.
2. Be well versed with the application and basics of new technologies being used for diagnosis and treatment of cancer.
3. Be able to apply the acquired knowledge in industrial/clinical applications to solve practical problems in cancer research.

**Syllabus**

1. Characteristics of Human Cancer: Definition and description of cancer, Significant events in cancer research, Hallmarks of malignant disease, Classification of human cancers. (5)
2. The Epidemiology of Human Cancer: Trends of cancer incidence and mortality- worldwide and Indian scenario, Role of risk factors in development of cancer-intrinsic and extrinsic factors. (3)
3. Causes of cancer: Introduction to mutagens and carcinogens, Tumor viruses and the discovery of oncogenes, Mechanism of tumor initiation promotion and progression. (5)
4. The Biochemistry and Cell Biology of Cancer: Growth characteristics of malignant cells-immortality, loss of anchorage dependence, decreased dependence on growth factors, loss of cell cycle control and resistance to apoptosis, Invasion and metastasis. (5)
5. Molecular Genetics of Cancer: Oncogenes, Tumor suppressor genes, DNA methylation, telomeres and telomerase, Molecular genetic alterations in cancer cells. (5)
6. Tumor immunology: Tumor evasion of immune system, the role of immune surveillance, tumor antigens, cytokine therapy, NK cell and dendritic cell therapy, cancer vaccines. (5)
7. Cancer Diagnosis and treatment: Present methods and techniques for cancer detection and therapy, molecular diagnosis, Tumor markers, blood based markers for early detection and screening of cancer. (6)
8. Applications of new technologies in diagnostics and treatment advances in cancer: Biomarker discovery using mass spectrometry based proteomics, Gene expression microarrays, non coding RNAs, use of RNAi techniques and stem cells. (6)

**Text/Reference books:**

- **The Biology of Cancer**, by Robert A. Weinberg, 2014, Garland Science, ISBN 978-0-8153-4220
- **Ruddon-Cancer Biology** by Raymond W. 4th Edition Oxford University Press
- Recent articles from **Nature Reviews Cancer**



BT-713

**CLINICAL IMMUNOLOGY****Course Outcome:**

1. Comprehensively understand the various aspects of immunology.
2. Be well versed with the basics of immune deficiency disorders and autoimmune diseases and various immunological techniques used in disease diagnosis.
3. Be trained to apply the acquired knowledge in industrial /clinical applications to solve practical problems in immunology research.

**Syllabus**

1. Understanding of Basic Immunology: Structure and function of the immune system, Infection and immunity, Immune regulation and Tolerance. (4)
2. Hypersensitivity Reactions – Types I, II, III, IV, IgE-mediated (type-I), Ab-mediated cytotoxic (type-II), Immune complex mediated(type-III), Delayed type hypersensitivity (type-IV) (4)
3. Autoimmune Diseases- Factors influencing the development of autoimmunity, The spectrum of autoimmunity, Organ non-specific diseases, Systemic lupus erythematosus, Rheumatoid arthritis, Sjogren's syndrome, Scleroderma, Organ-specific Autoimmune Diseases, Endocrine gland disorders, autoimmune thyroiditis, Pancreas – IDDM, Gastrointestinal disorders – pernicious anemia. (5)
4. Immune Deficiency Disorders- Accessory Cell Dysfunction, Primary Immune Deficiency Disorders, Humoral immune deficiency - Bruton's gammaglobulins, Selective IgA deficiency, Cellular immune deficiency, DiGeorge Syndrome, Combined humoral and cellular immune deficiency SCID, Wiskott-Aldrich syndrome, Secondary Immune Deficiency Disorders. (6)
5. Immuno proliferative Disorders-Mono clonal gammopathy, Multiple myeloma, Waldenstrom's macroglobulinemia, mono clonal disorders, Poly clonal gammopathy. (5)
6. The immune response in infectious diseases-Spirochetal infections: Syphilis and Lyme disease, Streptococcal infections, Epstein – Barr virus, Tuberculosis, Leprosy, HIV infection, Etiologic agents, Stages of the disease, Direct detection, Serologic disease, Treatment and prevention. (5)
7. Tumor and Transplant Immunology- Predisposing genes, role of oncogenes, tumor markers, cancer treatment. Types of grafts, graft acceptance and rejection, tissue typing, immune suppression. (5)
8. Immunodiagnostics: Theory and Diagnostic Procedures, Precipitation & Immuno electrophoresis, Agglutination, Labeled immunoassays, Flow Cytometry, Lymphocyte subset analysis, Nephelometry, Lymphocyte phenotyping in HIV infection and leukemia and other diagnostic procedures. (6)

**Text/References books:**

- Stevens, Christine Doresteyn. Clinical Immunology & Serology: A Laboratory Perspective. 3<sup>rd</sup> ed. F.A. Davis Co. Philadelphia, 2009
- Abdul K. Abbas, Andrew H, Lichtman and Shiv Pillai. Cellular and Molecular Immunology. 6<sup>th</sup> ed.
- Helen Chapel, Mansel Haeney, Siraj Misbah, Neil Snowden. Essentials of Clinical Immunology. 5<sup>th</sup> ed. Wiley Blackwell. 2006
- Robert R. Rich, Thomas A. Fleischer, William T. Shearer et al. Clinical Immunology Principles and Practice. 4<sup>th</sup> ed. Mosby Elsevier

## **BT-715      MOLECULAR ASPECT OF PLANT ABIOTIC STRESS**

### **Course Outcome:**

1. Understand the plant responses to various stresses at physiological and biochemical level.
2. Understand the factors involved in causing injury during abiotic stress.
3. Understand the abiotic stress tolerance mechanisms at molecular level.
4. Understand genetic engineering approaches for crop improvements.

### **Syllabus**

1. Plant Stress: Abiotic and biotic stresses, Effect of a biotic stress on plant productivity and growth, Response at morphological and physiological level. (3)
2. Salinity stress: Genetic diversity for salt tolerance, Mechanisms of salt stress, Sensors, Ion Homeostasis, Na<sup>+</sup>/H<sup>+</sup> antiporter, Na<sup>+</sup>- ATPase, Na<sup>+</sup> influx and efflux, Na<sup>+</sup> compartmentalization, K<sup>+</sup>/Na<sup>+</sup> balance, Salinity responsive genes and proteins, **Recent advances in engineering of salt-tolerant crops.** (3)
3. Drought stress: Plant response to dehydration stress, Leaf water potential, Mechanisms of dehydration tolerance, **Calmodulin, Antioxidant, Late-embryogenesis-abundant (LEA) proteins, drought-responsive genes and proteins, Secondary messenger, Recent advances in engineering drought tolerance plants.** (5)
4. High temperature stress: Plant response to heat stress, Mechanisms of high temperature tolerance, Responses of C3 and C4 plants, Heat shock protein, Heat shock transcription factors, High temperature responsive genes and proteins **Recent advances in engineering heat tolerance plants.** (4)
5. Low temperature stress: Cold stress signaling, DREB1/CBFs transcription factor, Transcriptional regulation- ICE1-CBF transcriptional cascade, Negative regulators of the CBF regulon, CBF-independent regulons, Cold responsive genes and proteins, **Recent advances in engineering cold tolerance plants.** (4)
6. Stress signaling pathway: Ca<sup>2+</sup> signaling, MAPK signaling, **Phospholipid signaling**, ABA-dependent and ABA-Independent pathway, Salt Overly Sensitive (SOS) Pathway, **Heat shock signal transduction pathway.** (7)
7. Heavy metal stress: Metalloenzymes, Metal Transporters, Role of Phytochelatins, Molecular mechanisms heavy metal uptake and tolerance. (3)
8. Secondary Messenger and Hormones: Ca<sup>2+</sup> as secondary messenger, inositol phosphates, Reactive oxygen species, Abscisic acid (ABA), Jasmonic Acid (JA), Ethylene and Polyamines and their role in plant abiotic stress tolerance. (7)
9. Osmolytes and Osmoprotectants: Carbohydrates- Sucrose, Mannitol, Trehalose, Arabinitol, Mannitol, Pinitol/ononitol, Sorbitol, Nitrogen compound - Proline, Glycine betaine, Choline, Putrescine, Organic acid - Oxalate and Malate. (4)

### **Text/Reference books:**

- Abiotic Stress Adaptation in Plants: Physiological, Molecular And Genomic Foundation. Pareek, A.; Sopory, S.K.; Bohnert, H.J.; Govindjee (Eds.) 1<sup>st</sup> Edition., 2010, XXVII, 526 p., Hardcover ISBN: 978-90-481-3111-2
- Physiology and Molecular Biology of Stress Tolerance in Plants. Madhava Rao, K.V.; Raghavendra, A.S.; Janardhan Reddy, K. (Eds.) 2006 ISBN: 1-4020-4224-8
- Biochemistry & Molecular Biology of Plants. B.B. Buchanan, W. Gruissem and R.L. Jones (Eds), 2000 American Society of Plant Physiologists, Rockville, Maryland. ISBN: 0-943088-39-9
- Levitt, J. Responses of Plants to Environmental Stress, 2<sup>nd</sup> Edition, Volume 1: Chilling, Freezing, and High Temperature Stresses. 1980. Publisher: Academic Press.
- Major review articles on abiotic stresses from scientific journals including articles from Annual Review of Plant Biology, Plant Physiology, Crop Science, Environmental and Experimental Botany, Plant and Soil, and Plant, Cell, and the Environment.

## SECOND SEMESTER EXAMINATION (Ph.D.)

L	T	Credits	Hours
3	1	4	40

### **BT717: Advanced Molecular Biology and Functional Genomics**

#### **Course Outcome:**

1. Fundamental principles of genetics and biological processes.
2. Acquire understanding of basics of genetic engineering skills and its applicability in industry and for welfare of society as a whole.
3. Nuances of gene expression regulation.
4. Develop an understanding of tools and techniques to study phylogeny at molecular level.
5. Students should be able to develop an ability to use research-based knowledge and methods to design and conduct experiments, analyze and interpret data.

#### **Syllabus**

1. **Molecules of Life**--Occurrence, structure, classification and functions of nucleic acids. Historical and General Aspects Basic discoveries on genetic material; geno type to phenotype. (6)
2. **Genome Replication and Maintenance**-- Basic principles of perpetuation and maintenance of genomic integrity; DNA polymerases and accessory proteins; Control of replication of chromosomes and extra-chromosomal elements, Transposable elements. (6)
3. **Regulation of Transcription and Translation** -- Discovery of RNA; Operon concept; Promoters and other control elements; RNA polymerases and accessory factors; Transcriptional controls; Controls at transcription termination; Control of gene expression in bacteriophages. Structure of ribosome and comparative studies in eukaryotes; tRNA; Genetic code; Translational and post-translational control; Codon bias. (6)
4. **Control of Gene Expression** -- Introns and exons - size, distribution and evolution; RNA splicing; Catalytic RNA; Alternative splicing; RNA stability; Small RNAs and RNA interference Transcriptional and post-transcriptional control of gene expression (6)
5. **Principles, Tools and Techniques of Recombinant DNA Technology** -- Gene cloning, Restriction enzymes and nucleic acid modifying enzymes; Vectors - plasmids, phages, cosmids, shuttle vectors, artificial chromosomes, plant viruses and other advanced vectors; cDNA and genomic libraries - construction, screening methods and applications; PCR and its applications; DNA sequencing methods; Techniques for studying gene expression and inter-biomolecular interactions. (6)
6. **Phylogenetic Analysis** -- Basic concept of phylogenetic analysis, rooted/uprooted trees, approaches for phylogenetic tree construction (UPGMA, Neighbour joining, Maximum parsimony, Maximum likelihood). (6)
7. **Introduction to Epigenetic Gene Regulatory Mechanisms**.... Post translational modifications on histone proteins, Histone code, Factors affecting chromatin remodeling and gene activation/silencing, DNA methylation, Components of DNA methylation machinery, Inheritance of epigenetic traits. (4)

#### **References**

1. **Epigenetics**, Second Edition (2015) Edited by C. David Allis, The Rockefeller University; Marie-Laure Caparros, London; Thomas Jenuwein, Max-Planck Institute of Immunobiology and Epigenetics; Danny Reinberg, Howard Hughes Medical Institute, New York University School of Medicine-Smilow Research Center; Associate Editor Monika Lachlan, Max-Planck Institute of Immunobiology and Epigenetics
2. **Lewin, B.** 2008. *Genes IX*. Jones and Bartlett Publishers, Inc., USA.
3. **Lodish, H., Berk, A., Zipursky, S.L., Matsudaira, P., Baltimore, D. and Darnell, J.** (Eds.) 2000. *Molecular Cell Biology*. W.H. Freeman & Co., USA.
4. **Baxevanis, A.D. and Ouellette, B.F.F.** 2005. *Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins*. Third Edition. John Wiley and Son Inc., USA.



5. **Watson, J.W., Baker, T.A., Bell, S.P., Gann, A., Levine, M. and Losick, R.** 2004. *Molecular Biology of Gene*. Pearson Education, USA.
6. **Brown, T.A.** 2007. *Genomes 3. Third Edition*. Garland Science Publishing, USA.
7. **Genome Science: A Practical and Conceptual Introduction to Molecular Genetic Analysis in Eukaryotes (2014).** Cold Spring Harbor Laboratory Press

Paper ID:  
Paper Code: PhDICT-102

L	T/P	C
1	2	2

**Subject: Research and Publication Ethics**

Maximum Marks: 75

Course Outcomes:

- CO1: To develop a Ethics for Scientific research
- CO2: To develop the skills for ethical publication
- CO3: To learn copyright and self-archiving policies for open access publishing
- CO4: To learn Impact factor of Journal and indexing of Database

**THEORY**

**Unit-1:**

Philosophy and Ethics: Introduction to philosophy: definition, nature and scope, concept, branches. Ethics: definition, moral philosophy, nature of moral judgments and reactions

Scientific Conduct: Ethics with respect to science and research, Intellectual honesty and research integrity, scientific misconducts: Falsification, Fabrication, and Plagiarism (FFP), Redundant publications: duplicate and overlapping publications, salami slicing, Selective reporting, and misrepresentation of data

**Unit-2:**

Publication Ethics: Publications ethics: definition, introduction and importance, Best practices/ standards setting initiatives and guidelines: COPE, WAME, etc., Conflicts of interest, Publication misconduct: definition, concept, problems that lead to unethical behaviour and vice versa, types, Violation of publication ethics, authorship and contributor ship, Identification of publication misconduct, complaints and appeals. Predatory publishers and journals

**Tutorial/Practical**

**Unit-3:**

Open Access Publishing :Open Access Publications and initiatives, SHERPA/ RoMEO online resource to check publisher copyright & Self-archiving policies, Software tool to identify predatory publications developed by SPPU, Journal finder/ journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer Journal Suggested, etc.

Publication Misconduct: Subject Specific ethical issues, FFP, authorship, Conflicts of interest, Complaints and appeals: examples and fraud from India and abroad (Through Group Discussions).Use of plagiarism software like Turnitin, Urkund and other open source software tools (Through Software Tools)

**Unit-4:**

Databases : Databases Indexing databases, Citation databases: Web of Science, Scopus, Etc.

Research Metrics: Impact Factor of journal as per Journal Citation Report, SNIP, SJR, IPP, Cite Score. Metrics: h-index, g-index, i10 index, altimetric.

References:

1. Professional Ethics by R. Subramanian, Oxford Press
2. Textbook of Research Ethics by Loue Sana, Springer 2002
3. <https://www.springer.com/gp/authors-editors/authorandreviewertutorials/submitting-to-a-journal-and-peer-review/publication-ethics/10285588>