ACADEMIC AFFAIRS OFFICE
INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

No. Acd./764 /IAPC-75(emergent) Dated: October 17, 2019

CORRIGENDUM

The IAPC in its 75th meeting (emergent) held on 23.09.2019 vide Item No. 75.2 had approved the following Pre-Ph.D. courses vide letter No. Acd./632/IAPC-75(emergent) dated Oct. 03, 2019.

1. **BTN-701: Experimental Animal Biotechnology**
2. **BTN-703: Advanced Genetic Engineering**
3. **BTN-705: Functional Genomics**
4. **BTN-706: Biomolecular Spectroscopy**

As corrigendum to the course BTN-701, the name of the course BTN-701 shall now be read as "Methods in Animal Biotechnology" instead of "Experimental Animal Biotechnology".

Assistant Registrar (Curriculum)

Copy to (through e mail):-

1. All faculty
2. All Head of Departments/Centres
3. Dean, Academic Affairs
4. Associate Dean of Academic Affairs(Curriculum)
5. Channel I/ Academic webpage of iitr.ac.in/ acad portal

ACADEMIC AFFAIRS OFFICE
INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

No. Acd./ 632 /IAPC-75(emergent) Dated: October 03, 2019

Head, Department of Biotechnology
(through e-mail)

The IAPC in its 75th meeting (emergent) held on 23.09.2019 vide **Item No. 75.2** considered and accepted the proposal of Department of Biotechnology to introduce following new Pre-Ph.D. courses **(Appendix-A)**:

1. **BTN-701: Experimental Animal Biotechnology**
2. **BTN-703: Advanced Genetic Engineering**
3. **BTN-705: Functional Genomics**
4. **BTN-706: Biomolecular Spectroscopy**

Assistant Registrar (Curriculum)

Copy to (through e mail):-

1. All faculty
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INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT. /CENTRE : **Department of Biotechnology**

1. Subject Code : **BTN- 701** Course Title: **Methods in Animal Biotechnology**

2. Contact Hours : **L:3** **T:1** **P:0**

3. Examination Duration (Hours): **Theory** : **3** **Practical** :**0**

4. Relative weightage: **CWS**: **20-35** **PRS: 0** **MTE: 20-30** **ETE: 40-50** **PRE:0**

5. Credits: **04** 6. Semester: **Both** 7. Subject Area: **PEC**

7. Pre-requisite: Basic knowledge in biotechnology

9. Objective: To impart knowledge to pre-PhD students on various aspects of ethical and appropriate use of laboratory and experimental animals in basic and translational research.

10. **Details of Course:**

S.No.	Contents	Contact Hours
1.	**Introduction**: laboratory animals and their handling, experimental animal facility equipment, purpose of using animals in biomedical research.	**5**
2.	**Welfare of Experimental Animals:** Ethics in handling of laboratory animals and various ethics committees, 3 "R", requirements of animal house facility, housing and caging systems.	**7**
3.	**Animal husbandry practices for different experimental animals:** Different laboratory animals (Rats, Mice, Rabbits, Guinea Pigs, Hamster, Non human Primates), Breeding, Weaning, Housing, Feeding, health monitoring of researchers and experimental animals, sentinels.	**8**
4.	**Experimental Methods**: Anesthesia and euthanasia, techniques for drug administration, Blood collection methods, tissue harvesting and processing, physiological salt solutions used for tissue harvesting.	**8**
5.	**Experimental Animal Models:** Infectious diseases, autoimmune models, cancer and toxicological studies, transgenic and Immunocompromised animal models.	**7**
6.	**Clinical biochemistry and pathology in experimental animals:** Histopathology, hematology, plasma proteins and blood p analysis.	**7**
	Total	**42**

11. Suggested Books:

S.No.	Name of Authors /Books / Publishers	Year of Publication/
1.	Willard, M. and Tvedten, H., "Small Animal Clinical Diagnosis by Laboratory Methods". Elsevier publication, 5th Edition.	**2011**
2.	Wolfensohn, S. and lioyd, M., "Handbook of Laboratory Animal Management and Welfare" by Wiley-Blackwell; 4th Edition.	**2013**
3.	Anderson, L., Otto, G., Pritchett-Corning, C.R., Whary, M.T., Fox, J.G., "Laboratory Animal Medicine (American College of Laboratory Animal Medicine)" Academic Press. 3rd Edition	**2015**
4.	Barthhold, S.W., Griffey, S.M., Percy, D.H., "Pathology of Laboratory Rodents and Rabbits", Wiley-Blackwell; 4th Revised edition	**2016**
5.	Latimer, K.S. "Duncan and Prasse′s Veterinary Laboratory Medicine: Clinical Pathology", Wiley-Blackwell; 5th Revised edition	**2011**

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE
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NAME OF DEPT./CENTRE: **Department of Biotechnology**

1. Subject Code: **BTN- 703** Course Title: **Advanced Genetic Engineering**

2. Contact Hours: **L: 3** **T: 1** **P: 0**

3. Examination Duration (Hrs.): **Theory: 3** **Practical: 0**

4. Relative Weightage**:** **CWS: 20-35** **PRS: 0** **MTE: 20-30** **ETE: 40-50** **PRE: 0**

5. Credits**: 4** 6. Semester**: Both** 7. Subject Area**: PEC**

8. Pre-requisite**: Basic knowledge of Biotechnology**

9. Objective: To impart advanced knowledge to Pre-PhD students about the developments in molecular biology and Genetic engineering from research point of view.

10. Details of Course:

S. No.	Contents	Contact Hours
1.	**Overview:** Organization of prokaryotic and eukaryotic genomes, transcription and translation, gene regulatory elements like repressors, activators, enhancers and non-coding regulatory RNA.	**6**
2.	**Tools in genetic engineering:** Enzymes (Restriction endonucleases, methylases, phosphatases, ligases, helicases; Plasmids and vectors: Cloning and expression vectors in prokaryotes and eukaryotes, high capacity vectors, artificial chromosomes, recombinant protein expression techniques in microbes, animal and plant cells.	**10**
3.	**Transformation methods:** Competence, Transformation techniques for animal cells, plant cells and prokaryotes.	**4**
4.	**Advanced techniques in molecular biology:** PCR and its applications: RT-PCR, qPCR, Taqman, Inverse PCR, Overlap extension PCR, Ligation mediated PCR, Site directed mutagenesis; Electrophoresis, Next generation sequencing and whole genome/transcriptome analysis.	**10**
5.	**Interaction studies:** Techniques to study DNA-Protein (EMSA, Footprinting, ChIP, reporter assys) and Protein-Protein interactions (SPR, Yeast 2 Hybrid, phage display, pull-down assays, FRET)	**7**
6.	**Recent advances in genetic engineering:** Riboswithces, CRISPR-Cas, Knock-in and Knock outs, Stem cells technology, GMOs- plants, animals and prokaryotes, their applications.	**5**
	Total	**42**

11. Suggested Books:

S. No.	Name of Books/Authors/Publisher/	Year of Publication/ Reprint
1.	Jocelyn E. Krebs, Elliott S. Goldstein, Stephen T. Kilpatrick. ***GENES XII*** Jones and Bartlett Publishers.	**2017**
2.	Sandy B. Primrose, Richard Twyman. ***Principles of Gene Manipulation and Genomics,*** 7th Edition. Wiley-Blackwell	**2014**
3.	Nathan S. Mosier, Michael R. Ladisch. ***Modern Biotechnology: Connecting Innovations in Microbiology and Biochemistry to Engineering Fundamentals.*** Wiley-Blackwell	**2009**
4.	Jeremy W. Dale, Malcolm von Schantz, Nicholas Plant. From Genes to Genomes: ***Concepts and Applications of DNA Technology*** 3rd Edition. Wiley-Blackwell	**2012**
5	Lundgren M., Charpentier E., Fineran P.C**. CRISPR: Methods and Protocols (Methods in molecular biology)**. Springer protocols, Springer	**2015**

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NAME OF DEPTT. /CENTRE : **Department of Biotechnology**

1. Subject code : **BTN-705** Course Title: **Functional Genomics**
2. Contact Hours : **L: 3** **T: 1** **P: 0**
3. Examination Duration (Hours): **Theory: 3** **Practical: 0**
4. Relative Weightage: **CWS : 20-35** **PRS : 0** **MTE: 20-30** **ETE : 40-50** **PRE: 0**
5. Credits: **4** 6. Semester: **Both** 7. Subject Area: **PEC**
8. Pre-requisite: Basic knowledge of Biology

9. Objective: To impart knowledge on various research methods & approaches in functional genomics and to provide understanding to address research based biological problems through functional genomics

10. **Details of Course:**

S.No.	Contents	Contact Hours
1.	**Introduction**: General introduction and history of genomic approaches, epigenetics and metagenomics, various components of functional genomics, technologies used, gene-to-gene vs. high throughput global approaches, confocal imaging, and applications of functional genomics in bacteria, animals and plants	**6**
2.	**Forward & Reverse Genetics in Functional Genomics:** Identifying suitable mutants of interest, mutagenesis, analysis of mutants, studying temporal and spatial expression pattern and protein localization of identified genes, in situ hybridization, enhancer trapping, candidate vs genome-wide approaches	**8**
3.	**Genetic & Physical Interaction studies:** Studying genetic interactions and cross talk in signaling pathways, combinatorial mutant analysis, Identifying & characterizing regulatory complexes (DNA-protein, RNA-protein and protein-protein)	**7**
4.	**Methods in gene expression analysis:** cDNA library-methods and applications, DNA microarray- technologies and applications, Oligonucleotide and cDNA microarrays, Gene expression analysis, Array comparative genomic hybridization, Identification of regulatory target genes: direct vs. indirect targets through chromatin immunoprecipitation, microarray, SNP and HRM analysis	**8**
5.	**Genome sequencing:** Physical and Genetic linkage maps, development and automation of sequencing technologies, genome sequencing- development and applications	**6**
6.	**RNA modifications:** Splicing, RNA processing, gene product turnover, RNA interference, RNA-Sequencing, identifying gene of interest for functional studies, genome editing technologies	**7**
	Total	**42**

11. **Suggested Books:**

S.No.	Name of Authors /Books / Publishers	Year of Publication
1.	Brown, T. A. "Genomes 4", 4th Edition, Garland Science	**2017**
2.	Krebs J.E., Goldstein E.S., Kilpatrick S.E., "Lewin's GENES XII" 12TH Edition, Jones & Bartlett Learning	**2017**
3.	Gerstein, A.S. "Molecular Biology Problem Solver: A Laboratory Guide", Wiley-Liss, Inc.	**2001**
4.	Kaufmann, M., Klinger, C., Savelsbergh, A. "Functional Genomics: Methods and Protocols; 3rd Edition, Humana Press (Springer)	**2017**
5.	Pevsner, J. "Bioinformatics and Functional Genomics" 3rd Edition, Wiley-Blackwell	**2015**

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE
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NAME OF DEPTT. /CENTRE : Department of Biotechnology

1. Subject Code: **BTN-706** Course Title: **Biomolecular Spectroscopy**

2. Contact Hours: **L**: **3** **T: 1** **P: 0**

3. Examination Duration (Hrs.): **Theory: 3** **Practical: 0**

4. Relative Weightage: **CWS : 20-35** **PRS : 0** **MTE: 20-30** **ETE : 40-50** **PRE: 0**

5. Credits: **4** 6. Semester: **Autumn/Spring** 7. Subject Area: **PEC**

8. Pre-requisites: **Nil**

9. Objective: To inculcate the knowledge of some important advanced spectroscopic techniques used in biological research for analyzing samples and interpreting data.

10. Details of Course:

S. No.	Contents	Contact Hours
1.	Light-matter interaction, fundamental nature of light, basic structure and function of living materials, components of cells and tissues that interact with light.	4
2.	Absorption spectra – spectra of biopolymers, chromophores, applications in enzyme kinetics, linear dichroism. Infrared spectra (IR) of alpha helix and beta sheets, Optical activity and Circular Dichroism.	5
3.	Fluorescence - excitation and emission, quantum yield, fluorescence quenching, resonance energy transfer, applications, Raman spectroscopy, fluorescence microscopy.	5
4.	Mass spectrometry- Electron Spray Ionisation Mass Spectrometry (ESI MS) - theory, methods of producing biomolecular ions, mass analysis, applications, MALDI-TOF, Chromatographic techniques, electrophoresis, gel filtration techniques.	4
5.	Nuclear Magnetic Resonance (NMR) – principle, chemical shift, Instrumentation and experimental aspects, spin-spin coupling, decoupling, Nuclear Overhauser effect (NOE), polarization transfer, Spin lattice (T1) and spin-spin relaxation (T2) times, pulsed and fourier transform NMR, chemical exchange.	7
6	Two dimensional NMR- principle and techniques, homo- and hetero-nuclear coupling, correlation spectroscopy (COSY, HSQC, HMBC and NOESY).Three dimensional NMR, isotope labeling, sequential assignments, torsional angle and distance constraints, structure of peptides/ nucleic acid, solid state NMR.	5
7.	X-ray crystallography- principle, x-ray sources and instrumentation, Symmetry, space groups, crystal lattices, Laue equations, Bragg's law.	7
8.	Electron density map, data collection strategies, criteria for evaluating crystallographic structures, structure determination of macromolecules. Introduction to cryo-electron microscopy.	5
	Total	42

11. Suggested Books:

S. No.	Authors/ Name of Books/Publisher	Year of Publication/Reprint
1.	Cantor, C.R. and Schimmel, P.R., "Biophysical Chemistry, Part II Techniques for the Study of Biological Structure and Function and Part III The Behavior of Biological Molecules", W H Freeman	2008
2.	P.J.Hore, "Nuclear magnetic resonance", Oxford University Press.	1995
3.	Edward H.Egelman, "Comprehensive Biophysics- Vol 1: Bophysical techniques for structural characterization of macromolecules", Elsevier.	2012
4.	Igor A.Kaltashov and Stephen J. Eyles, "Mass spectrometry in Biophysics- Conformation and Dynamics of Biomolecules", Wiley Intersciences	2005
5.	Bernhard Rupp, "Biomolecular Crystallography: Principles, Practice, and Application to Structural Biology ", 1st Edition, Garland Science.	2010