

**RAJIV GANDHI INSTITUTE OF VETERINARY
EDUCATION AND RESEARCH (RIVER)
KURUMBAPET, PUDUCHERRY – 605 009**



Affiliated to



**PONDICHERY UNIVERSITY
PUDUCHERRY**

**MSc DEGREE IN
BIOTECHNOLOGY**

REGULATIONS & CURRICULUM

2020

RAJIV GANDHI INSTITUTE OF VETERINARY EDUCATION
AND RESEARCH (RIVER)
(Affiliated to Pondicherry University)

M.Sc. Degree Programme

Regulations & Syllabus

(2020-21 onwards)

1. Short title, application and commencement:
 - 1.1. These regulations may be called as MSc Degree Regulations 2020
 - 1.2. They shall govern the Post-graduate studies leading to the award of Degree of Master of Science by the Pondicherry University.
 - 1.3. They shall come into force with effect from the academic year 2020-21
2. Definitions:

In these regulations, unless the context otherwise requires

 - 2.1. Academic year: A period consisting of two consecutive semesters including inter-semester break as announced by the Institute.
 - 2.2. Semester: An academic term consisting of not less than 110 instructional days excluding the days of external examinations.
 - 2.3. Credit hour, Semester Credit or Credit: One hour of lecture or three hours of laboratory or field practicals or hospital each week in a semester.
 - 2.4. Course: A unit of instruction or segment of subject matter (as specified in the course catalogue) to be covered in a semester, having a specific number and credits.
 - 2.5. Course Catalogue: A list of approved courses for the M.Sc. degree programme wherein each course is identified with a specific number and credits giving outlines of syllabus.
 - 2.6. Grade Point (GP) of a course: The value obtained by dividing the percentage of marks earned in a course by 10 and the grade point expressed on a 10-point scale up to one decimal place.
 - 2.7. Credit Point of a course: The product of grade point and credit hours in a course.
 - 2.8. Grade Point Average (GPA): The quotient of the total credit points obtained by a student in various courses at the end of each semester divided by total credit hours completed by

the student in that semester. The Non Credit and Research Credits are not to be included for the calculation of GPA. The GPA shall be corrected to second decimal place.

- 2.9. Overall Grade Point Average (OGPA): The quotient of cumulative credit points obtained by a student in all courses completed by a student from the beginning of the first semester of the P.G. degree course divided by completed credit hours up to the end of a specified semester and it determines the overall performance of a student in all the courses taken during the period covering more than one semester. The Non Credit and Research Credits are not to be included for the calculation of OGPA. The OGPA has to be corrected to second decimal place.

3. **Academic Departments involved in this programme:**

- I. Animal Genetics and Breeding
- II. Animal Nutrition
- III. Veterinary Biochemistry
- IV. Veterinary Gynaecology & Obstetrics
- V. Veterinary Microbiology
- VI. Veterinary Pathology
- VII. Veterinary Physiology
- VIII. Veterinary Public Health and Epidemiology

4. **Major Field of study for MSc degree:** Biotechnology specialized in Animal Biotechnology

5. **Admission Procedure:**

- 5.1. **Eligibility for admission:** The candidate seeking admission to Postgraduate programme leading to MSc Degree shall possess

5.1.1. BSc degree in Biotechnology/Biochemistry/ Microbiology/ Zoology/Animal Science from an Institution recognized by the UGC or BVSc/BVSc & AH degree from an institution recognized by the VCI with a minimum OGPA of 6.0 in 10 point scale (5.0 for SC/ST candidates and OBCs). In the other grading systems, OGPA/ marks will be appropriately proportioned to the 10 point grading scale.

5.1.2. Appearance for entrance examination conducted by the RIVER, Puducherry.

- 5.2. **Application for Admission:** Application for admission shall be made in the prescribed form to be obtained from the

office/website of the Institution after the notification is issued to this effect. The admissions shall be regulated and made in accordance with the regulations in force.

- 5.3. **Number of Seats:** The total number of seats is 20, of which 10 seats are allotted for the resident candidates of Puducherry and remaining 10 seats are for the candidates of other States and Union Territories of India. If sufficient applicants are not available in respective categories, the seats will be filled by the candidates from category where excess eligible applicants are available.
 - 5.4. **Criteria for Residents of Pondicherry:** Criteria prescribed by the Government of Pondicherry from time to time for residents of Pondicherry will be followed.
 - 5.5. **Reservation:** Reservation of seats in different fields of study will be according to the reservation policy announced by the Government of Pondicherry from time to time for admission to Educational Institutions. If the reserved seats fall vacant those seats will be filled by the candidate from the general merit list. The details of reservation for different categories will be indicated in the Information Bulletin for the year of admission.
 - 5.6. **Selection:** The selection of candidates based on merit list drawn based on the aggregate of marks obtained in the qualifying examination (80%)(marks will be derived from OGPA obtained using applicable formula) and entrance examination (20%).
 - 5.7. **Entrance Examination:** An entrance examination will be conducted by RIVER, Puducherry on a date and time to be notified. The syllabus and the details of entrance examination will be furnished in the information bulletin for admission.
 - 5.8. **Admission:** The candidates provisionally selected for admission have to pay the prescribed fee and deposit all the original certificates and transcripts at the time of admission. Failure to pay the required fee and deposit the above mentioned documents in original will result in the cancellation of his/her admission.
6. **Courses and Credits:**
 - 6.1. **Duration of the Course:** The M.Sc. programme shall have duration of minimum four semesters of 110 instructional days each (two academic years).

6.2. **Minimum Credit requirements for Master's Degree:**

6.2.1. **Course work** : 40 credits

Major Field : 30 credits

Minor/Supporting subject(s) : 10 credits

6.2.2. **Research Work** : 20 credits

Total Credits : 60 credits

6.2.3. **Non credit compulsory courses:** Three courses are of general nature compulsory for master's programme as given in the syllabus. Satisfactory completion of the courses is required for the award of degree.

6.2.4. **Credit load:** A candidate shall be allowed to register for a maximum of 20 credits excluding non credit courses, if any in a semester.

7. **Residential requirements:** Minimum residential requirement for M.Sc. degree programme is two years from the date of admission and four semesters of 110 days each (two academic years) and the maximum limit for completion of M.Sc. programme is eight semester i.e. four academic years (inclusive of duration of discontinuation, if any). No further extension of time will be given. .

8. **Attendance:** The student is required to have an attendance of at least 80% of total classes separately for theory and practical in each course. If any student falls short of the required attendance he/she will not be permitted to appear in the University examinations and such candidates are required to re-register the course (s) in which he or she had fallen short of the required attendance whenever it is offered.

9. **Evaluation and Examinations:** Evaluation of a student in each course is based on Internal assessment and external examination in theory and practical, separately, which is weighted equally (50% for internal assessment and 50% for external examination). The weightage between theory and practical shall be as per the credit load of the courses.

9.1. **Internal Examinations:** It shall be the responsibility of the Dean / Head of the Department to ensure proper conduct of all internal evaluations in all the courses offered by that Department. The concerned course teachers will conduct the internal assessment of theory and practical as detailed below.

9.1.1. The theory internal assessment consists of one mid-term examination (after completion of 50% of total instructional days) and another end-term examination (after the completion of 90% of total instructional days) of 40 marks each and assignment for 20 marks towards the end of the semester. A total of 100 marks will be presented to the

university. Score of minimum of 35% is required to become eligible to appear for the external examination.

9.1.2. The internal practical examination shall be conducted at the end of the semester for 100 marks comprising of 70 marks for practical (methods, analysis and recording observations, analytical problems), 20 marks for practical assignments/record and 10 marks for viva-voce. Submission of records/assignments and attendance in viva-voce examination are compulsory. The total of 100 marks assessed will be presented to the university. Score of minimum of 50% is required to become eligible to appear for the external examination.

9.1.3. The answer scripts of all the internal examinations will be shown to the students after evaluation. The concerned HOD will retain the answer scripts for a minimum period of two years after the student completes the degree programme.

9.2. **External Examinations:** The external examination in each course will be conducted in theory and practical after the end of the semester by the Pondicherry University and one external examiner will be invited to conduct the practical examination and also to evaluate the theory papers for all the courses offered by one department including major and minor/supporting fields of study.

9.2.1. **Theory:** The external examination for each course in theory will consist of one paper for 100 marks comprising subjective questions for 3 hours duration. The answer scripts will be evaluated by the external examiner and as well as by the concerned course teacher. The average of marks of double evaluation will be the final score. A Minimum of 50% is required to be scored in a course.

9.2.2. **Practical:** The external examination in practical is for 100 marks (80 marks for practical – methods/analysis and recording of the observation/analytical problems and 20 marks for viva-voce exam) for 3 hours duration by the board of examiners consist of Head of the concerned department, concerned course teacher and external examiner. Minimum number of examiners in a board is two, of which external examiner is compulsory. A minimum of 50% of marks is required to be scored in a course.

9.3. **External Examiners:** All the Professors, Associate Professors and those Assistant Professors who possess Ph.D. Degree with five years of Teaching/Research experience in the concerned field of specialization and

working in veterinary colleges/institutes and other academic institutions are eligible for appointment as external examiners and also as question paper setters. The retired experts with above criteria below the age of 65 years can also be appointed as external examiners.

- 9.4. **Panel of examiners:** The HOD will submit a panel of six external examiners to the University through the Dean of the Institute for conducting the Semester Theory and Practical External Examinations.
10. **Minimum Marks for Pass:** A minimum of GP 6.0 is required for pass in a course in aggregate of theory and practical. If a candidate fails in any course in aggregate of theory and practical with GP of less than 6.00, he/she should reappear for the external examinations in theory and practical conducted in that course to be held in ensuing semesters. The internal marks scored originally in the courses failed will be retained.
11. **Advisory Committee:** The HOD shall allot a major advisor / Chairman advisory committee for each student registered for M.Sc. programme in the second semester. The major advisor in consultation with the HOD will propose an advisory committee for approval by the Dean in the second semester. The committee shall consist of at least three members from the field of study.

The following teachers are eligible to be appointed as Chairman of the Student Advisory committee:

- i. Professors and Associate Professors
- ii. Assistant Professors who possess Ph.D. Degree with five years of Teaching/Research experience in the concerned field of specialization
- iii. Assistant Professors who do not possess Ph.D Degree but have eight years of Teaching/Research experience in the concerned field of specialization.

However, Assistant Professors who do not possess Ph.D. Degree but have at least five years of experience in Teaching/Research in the concerned field of specialization are also eligible to be appointed as members of the advisory committee.

- 11.1. **Changes in Advisory committee:** If the Chairman / any member of the advisory committee is not available for any reason or proceeds on long leave / resigns / retires from the present assignment, the HOD may recommend an eligible substitute for approval by the Dean. However, in such cases, if the concerned student is likely to submit his or her

thesis within 90 working days, the same Chairman/member(s) may be permitted to continue to guide the student.

- 11.2. **No of students allotted:** There should be a cap of maximum number of students allotted to the participating departments to conduct the research
12. **Research Project formulation and Supervision:** On successful completion of 75% of the Major courses with GPA 6.5, the student can register eligible research credits in the subsequent semester. The Chairman in consultation with the members of the advisory committee shall identify the topic of research project and submit the Outline of Research Work (ORW) of the proposed Research Project in prescribed format to the Dean for approval. He/she will also present a seminar on the proposed work to the faculty of the college including the members of the Research Advisory Committee (RAC) of the institute. Based on the recommendations of the RAC the Dean will accord the approval to the ORW. Subsequent change(s) if any in the ORW need to be approved by the Dean on the recommendation of the RAC. The student will carry out the research work as per the approved ORW under the supervision and guidance of the Advisory Committee.
- 12.1. **Approval of the Outline Research work (ORW):** The ORW approval must be accomplished in the third semester and the time between submission of synopsis and thesis shall be at least one semester.
13. **Preparation and submission of thesis:** On successful completion of the research credits and research work to the satisfaction of the advisory committee, the candidate will present a seminar on the research work before the faculty members including RAC members and PG students. After incorporating the necessary suggestions in consultation with the Advisory Committee, the candidate will submit three draft copies of the thesis and the approved ORW to the Dean along with a certificate in the prescribed proforma duly signed by the advisory committee. The student is permitted to submit his or her thesis within 30 calendar days after the closure of the semester failing which he/she has to register in the concerned semester by paying a registration fee of Rs. 5000/- without any credit requirements. No further extension of time will be given.
14. **Evaluation of the thesis:** The Head of the Department in consultation with the Chairman of the Advisory committee shall submit a panel of five external examiners in the field of specialization to the Dean for forwarding to the University. The thesis will be sent to one of the examiner from the panel who shall

be required to send the detailed evaluation report with specific recommendation in a prescribed proforma to the University within the stipulated time.

- 14.1. All the Professors, Associate Professors and those Assistant Professors who possess Ph.D. Degree with five years of Teaching/Research experience in the concerned field of specialization and working in veterinary colleges/educational institutes and scientist of other related academic/Research organizations are eligible for appointment as external examiners for thesis evaluation. The retired experts with above criteria below the age of 65 years can also be appointed as external examiners.
- 14.2. **Recommendation of the Examiner:** In case the external examiner recommends for the acceptance of the thesis with remarks as “HIGHLY COMMENDED OR COMMENDED,” the report will be forwarded to the concerned Head of the Department for conduct of the Vive voce examination. The student shall submit three final bound copies of the thesis after incorporating the suggested corrections of the external examiner in consultation with the Advisory Committee to the HOD who in turn will arrange for conduct of final viva-voce examination by inviting the external examiner who evaluated the thesis. The viva-voce will be conducted by the HOD, external examiner and the members of the Advisory Committee. A certificate regarding the performance of the candidate in final viva-voce examination on the thesis in the prescribed form, duly signed by all the members of the Advisory committee and the external examiner shall be forwarded to the Dean by the concerned HOD. The result of the examination should clearly indicate the performance of the student either as “SATISFACTORY” or “UNSATISFACTORY” and the same will be communicated to the University for the Declaration of the result.
 - 14.2.1. If the performance of the candidate in the viva voce examination is “UNSATISFACTORY”, he/she may be asked to take the viva voce examination after a lapse of at least 30 days after the declaration of the result of the final viva voce examination.
 - 14.2.2. If the external examiner does not recommend for the award of the degree with the comments to revise and resubmit the thesis, the concerned HOD in consultation with the chairman and members of the Advisory Committee may arrange for incorporating the suggestions given by the

external examiner and resubmit the thesis to the University to arrange for evaluation by the same examiner.

14.2.3. If the external examiner rejects the thesis, the University may send the thesis to the second examiner from the panel of examiners for evaluation. If the second examiner recommends for the award of the degree, the report will be forwarded to the concerned HOD to arrange for conduct of viva-voce examination as per the procedure in 14.2

14.2.4. In case the second external examiner also rejects the thesis, the candidate will have to re-register the research credits and carry out the research work afresh.

14.2.5. A candidate shall not be permitted to submit his/her thesis for more than two occasions.

14.3. **Grading & Transcript:** The University will award the grades to the students on a 10-point scale. The University will issue a grade report/Transcript for each semester during the subsequent semester. The University will issue a final transcript indicating the courses, credits and OGPA after the successful completion of all the courses and thesis viva voce examination.

- I. Minimum passing grade in a course : 6.00
- II. Minimum GPA/OGPA for registration of research credits and to obtain degree: 6.50

If a candidate fails to get GPA/OGPA of 6.5, he/she should improve the GP by reappearing for the examination conducted during ensuing semester in not more than two courses studied so far (Major and Minor only) with the recommendation of the advisory committee.

15. **Eligibility for Degree:** A candidate is eligible for the award of M.Sc.. degree after successful completion of the prescribed courses and research credits including final thesis viva voce examination with minimum OGPA of 6.50. Candidate securing an OGPA of 8.50 and above and completing the courses and final thesis viva-voce examination satisfactorily in the first attempt will be awarded degree in FIRST CLASS WITH DISTINCTION. Candidate securing an OGPA of 7.50 to 8.49 and completing the courses and final thesis viva-voce examination satisfactorily in the first attempt will be awarded degree in FIRST CLASS. All the other passed candidates will be placed in SECOND CLASS.

16. **Temporary discontinuation and resumption of studies:** If a student wants to discontinue his/her studies temporarily or take a

long leave, he/she may do so after successful completion of 75% of the courses with the prior approval of the Pondicherry University. Discontinuation before successful completion of 75% of the courses shall result in cancellation of admission. The discontinuation is allowed only once in the M,Sc. degree programme. However, the maximum time limit prescribed for the completion of Master's Programme shall remain unchanged. The M.Sc. student should not be on the active rolls of employment in Government or University or any private or public undertakings during the study period.

17. **Amendment or Cancellation of result:** If the result of a candidate is discovered to be vitiated by error, malpractice, fraud, improper conduct or any other reason, the Vice Chancellor shall have the power to amend the result in such a manner as to accord with the true position and to make such a declaration as the Vice Chancellor may deem necessary in that behalf including debarring the candidate from the University/ College.

18. **Removal of Difficulties:**

18.1. If any difficulty arises in giving effects to provisions of these regulations, the University may issue necessary orders which appear to the authorities to be necessary or expedient for removing the difficulty.

18.2. No order under Rule 18.1 shall be questioned on the ground that no difficulty as is referred to in the said rule existed or was required to be removed

18.3. Notwithstanding anything contained in the Regulations, the University shall make changes, whenever necessary.

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Affiliated to



**PONDICHERY UNIVERSITY
PUDUCHERRY**

MSc DEGREE IN BIOTECHNOLOGY

**CURRICULUM
(Animal Biotechnology)**

**RAJIV GANDHI INSTITUTE OF VETERINARY EDUCATION AND RESEARCH
(RIVER)**

**MSc Degree in Biotechnology
(Specialized in Animal Biotechnology)**

Major Courses

Course No.	Course Title	Credits	Dept.
I Semester			
ABT611	Animal Genomics	2+1	AGB
ABT612	Cell & Molecular Biology	3+0	VBC
ABT613	Molecular Techniques for Biological Research	1+2	VBC
ABT614	Biochemical techniques	2+1	VBC
ABT615	Microbiological Techniques	1+2	VMC
II Semester			
ABT621	Molecular and Immunodiagnostics	0+2	VMC
ABT622	Bioprocess Technology	2+1	VBC
ABT623	Animal Cell Culture	1+1	VMC
ABT624	Molecular Immunology	2+0	VMC
ABT625	Reproductive Biotechnology	2+1	VGO
III Semester			
ABT631	Vaccinology	2+0	VMC
ABT632	Biosafety and Biosecurity	1+0	VPE
III & IV Semester			
ABT640	Research	0+20	---

Minor Courses

Course No.	Course Title	Credits	Dept.
I Semester			
ABT616	Animal Physiology*	2+0	VPY
ABT617	General Microbiology	2+0	VMC
II Semester			
ABT626	Introduction to Bioinformatics*	1+1	VBC
ABT627	Biology of Cancer	2+1	VPP
III Semester			
ABT633	Biostatistics and Computer Application*	1+1	AGB
ABT634	Intellectual Property Rights and its management	1+0	AGB
ABT635	Biotechnology for Animal Nutrition	2+0	VBC/ANN

* **Compulsory courses**

Non-Credit Compulsory Courses

Course No.	Course Title	Credits
PGS501	Library and Information Services	0+1
PGS502	Technical writing and Communication Skills	0+1
PGS503	Industry-Academia Interaction	0+1

Minimum requirement:

- Major Courses (30 Credits); # Minor Courses (10 credits); Research (20 Credits) and Non-Credit Courses (3 credits)
- Area of research should be broad based to Animal Sciences not in particular to Veterinary Sciences, only.

Note: The niche topics of the courses listed will be offered through webinar with the help of domain specialists

List of Departments offering the Courses:

- Department of Veterinary Biochemistry (VBC)
- Department of Veterinary Microbiology (VMC)
- Department of Animal Genetics & Breeding (AGB)
- Department of Veterinary Gynaecology and Obstetrics (VGO)
- Department of Veterinary Pathology (VPP)
- Department of Veterinary Physiology (VPY)
- Department of Veterinary Public Health and Epidemiology (VPE)
- Department of Animal Nutrition (ANN)

CURRICULUM
MAJOR COURSES

ABT 611 Animal Genomics 2+1

Theory

Historical perspective, genome organization in eukaryotes, satellite DNA including mini and microsatellites and their various families, long and short interspersed nucleotide elements, DNA markers- RAPD, STR, SSCP, RFLP, DNA fingerprinting, SNP, EST.

Importance of gene mapping in livestock, methods and techniques used for gene mapping, physical mapping, linkage analysis, cytogenetic techniques, FISH technique in gene mapping, somatic cell hybridization, radiation hybrid maps, *in-situ* hybridization, comparative gene mapping.

Genetic distance analysis, breed characterization on the basis of DNA markers, genetic markers for quantitative traits loci, marker assisted selection for incorporation of desirable traits DNA markers with economic traits.

Current status of gene maps of livestock, MHC and its relevance to disease resistance and immune response, genes influencing production traits, mitochondrial DNA of farm animals, evolutionary significance, applications of genome analysis of animals in breeding.

Practical

Chromosome preparation (normal karyotyping, different types of banding) in farm animals - Isolation and purification of animal genomic DNA from blood lymphocytes – Analysis of DNA by agarose or polyacrylamide gel electrophoresis - Checking the quality and quantity of genomic DNA - Restriction digestion and analysis- Southern hybridization - Techniques for revealing polymorphism-DNA fingerprinting, RFLP, SSCP, AFLP, - Differentiation of tissues of different species by mitochondrial genome analysis.

ABT 612 Cell and Molecular Biology 3+0

Theory

Molecular organization of cell - Cytoskeleton: Mechanism of muscle contraction, actin filaments and cell cortex, ciliary movements and cytoplasmic microtubules and intermediate filaments. Cell signaling: Endocrine, exocrine and synaptic signaling molecules, surface and intracellular receptors, G proteins and generation of secondary messengers, mode of action of cAMP and Ca⁺⁺ calmodulin, target cell adaptation. Cell growth and divisions: Cell cycle, cell division controls and transformation, growth, development and differentiation, growth

factors, genes for social control of cell division, mechanism of cell division, cell adhesion, cell junctions and the extra cellular matrix.

History of molecular biology, nucleic acid as hereditary material, structure of DNA, chromatin, rRNA, tRNA and mRNA, proteins - DNA replication - Prokaryotes and Eukaryotes - Mode, Mechanism and regulation - Transcription - Prokaryotes and eukaryotes - Process - Regulation - post-transcription modification - RNA processing and alternative splicing - antibiotics which inhibit transcription.

Genetic code - concept of genetic code - deciphering of genetic code - characteristic features of genetic code - Codon and anticodon interaction (wobble hypothesis) - Translation - Prokaryotes and Eukaryotes - Activation of amino acids - Process of translation - Post-translational modification - Regulation - Drugs and inhibitors of protein synthesis.

Regulation of gene expression - Prokaryotes and Eukaryotes - Molecular mechanism of mutation. molecular biology of development and differentiation and molecular evolution,

ABT 613 Molecular Techniques for Biological Research 1+2

Theory

Recombinant DNA technology - Process - cloning and expression vectors: plasmid, Lamda (λ), Cosmid, M13, phagmid and viral vector for animal cells - Restriction enzymes - Selection and propagation of recombinants.

Polymerase Chain Reaction- method and reactants – Standardization - various types of PCR- Real time PCR - DNA & RNA Probes – Application of PCR for diagnosis of infectious diseases of animals and poultry, nucleic acid sequence based diagnostics.

Anti sense RNA - *in situ hybridization* - RNA interference and its application.

Nucleic acid transfer - Southern & Northern Blots – DNA fingerprinting - Gene sequencing - Enzymatic and chemical methods- Next generation sequencing methodologies,

Gene editing techniques such as Zinc finger nucleases, TALEN, CRISPR-Cas

Practical

Isolation and purification of animal genomic DNA from blood lymphocytes – Checking the quality and quantity of genomic DNA - Analysis of DNA by agarose or polyacrylamide gel electrophoresis - DNA Cloning - Plasmid preparation - Restriction enzyme digestion- Transformation & Selection of Recombinants - Nickel affinity chromatography - PCR and its variations – LAMP - Southern

hybridization - DNA fingerprinting – Western Blots – RNA Isolation - cDNA synthesis-Gene expression.

ABT 614 Biochemical Techniques 2 + 1

Theory

Theory and application of pH meter- Centrifugation - theory and application - Ultra centrifugation.

Theory and application of spectrophotometer - Major components of a spectrophotometer and their function - Flame photometry - Principle and application.

Principle of Partition and adsorption chromatography - Paper, column and thin layer chromatography - Gel filtration, Ion-exchange and affinity chromatography - Factors affecting chromatographic resolutions - Methods of preparation of biological samples for chromatographic analysis - Gas liquid chromatography - High performance liquid chromatography - Theory and application.

Electrophoresis - theory and application - factors affecting migration of charged particles – Electrophoresis of proteins and nucleic acids - Variations of electrophoresis – 2d gel electrophoresis - Western blotting - theory and application.

Practical

Preparation of buffers - Isolation and purification of proteins - Desalting of proteins (Dialysis and gel-filtration) – Ion-exchange/Affinity type of chromatography - Thin layer chromatography of carbohydrates and phospholipids - Agarose gel electrophoresis of nucleic acids – Polyacrylamide gel electrophoresis of proteins and its molecular weight determination - Western Blotting.

ABT 615 Microbiological Techniques 1+2

Theory

Microscopy and Micrometry - Bacterial Stains and Stainings - Sterilization and disinfection - Culture media - Cultivation of Bacteria Isolation and Identification of bacterial organisms: Morphological characterization, enrichment & isolation, various methods used in growth measurement; Characterization (biochemical, serological, pathogenicity) of bacteria.

Introduction to basic techniques in virology

Practical

Orientation to a Microbiology laboratory - Common instruments, glassware and other materials required for microbiological laboratory – Microscopy - Bacterial motility test- Simple staining - Differential staining; Gram's staining, Acid Fast Bacilli (AFB) Staining - Special

Staining: Demonstration of bacterial capsule, Staining of bacterial spore - Blood smear staining - Lactophenol cotton blue staining for fungus - Preparation of Culture media - Methods of inoculation and pure culture techniques - Anti microbial susceptibility test - Biochemical reactions - Preparation of equipment for sterilization - collection, preservation, transportation of samples and their processing - Isolation and cultivation of viruses in animals, embryonated chicken eggs - Titration of viruses by haemagglutination - Detection of viral antibodies by haemagglutination inhibition test, agar gel precipitation test, and ELISA.

ABT 621 Molecular and Immunodiagnosics 0+2

Practical

OIE guidelines in development of diagnostics.

Collection of clinical and environmental samples from animal and poultry farms for molecular detection of pathogens - Isolation of bacterial pathogens from the samples - Extraction of nucleic acids from bacteria and clinical specimens - Restriction endonuclease digestion and analysis in agarose electrophoresis - Development of animal pathogen specific nucleic acid probes - Southern blotting for detection of pathogens - Polymerase chain reaction for detection of pathogens in blood and other animal tissues - RT-PCR for detection of RNA viruses - Real time PCR for detection of pathogens in semen and other animal tissues(Demonstration).

Preparation of antigens for laboratory animals immunization - Production, collection and preservation of antisera - Quantitation of immunoglobulins in antisera by zinc sulphate turbidity and single radial immunodiffusion - Examination of lymphoid organs of animals - Tests for in vivo and in vitro phagocytosis - Separation and counting of peripheral blood lymphocytes - Separation and concentration of immunoglobulin by ammonium sulphate precipitation and dialysis - Demonstration of antigen- antibody interactions in serological tests such as Agar gel precipitation, Immunoelectrophoresis, Bacterial agglutination, Direct and passive agglutination, Latex agglutination, Complement fixation, Enzyme-linked immunosorbent assay, immunoblotting.

Theory

Introduction, scope and historical development; isolation, screening and genetic improvement of industrially important microorganisms.

Fermentation: introduction, historical perspective of development of bioprocessing technology - Emerging new technologies for processing and production of recombinant products, isolation, preservation.

Media designs, sterilization, downstream processing, important fermentation process - Immobilization of enzymes and cells, and their application, growth rate analysis, estimation of biomass, batch and plug flow cultures, chemostate cultures.

Production of vaccines and diagnostics - Production of single cell protein, steroid transformation, silage production, waste water treatment.

Industrial application of Nanobiotechnology. Computer simulations, energy requirement and product formation in microbial culture, fed-batch and mixed cultures, scale-up principles.

Practical

Isolation of industrially important microorganisms - Study of bioreactors and their operations. - Experiments on microbial fermentation process - Harvesting purification and recovery of end products - Immobilization of cells and enzymes - Studies on enzyme kinetic behavior, growth analysis, biomass estimation, determination of mass transfer co-efficients.

Theory

Introduction, importance, history of cell culture development - Different tissue culture techniques including primary and secondary culture, continuous cell lines, suspension culture, organ culture etc.

Different type of cell culture media, growth supplements, serum free media, balanced salt solution, other cell culture reagents - Culture of different tissues and its application.

Behaviour of cells in culture conditions, division, their growth pattern, metabolism of estimation of cell number - Development of cell lines, characterization and maintenance of cell lines, cryopreservation, common cell culture contaminants.

Practical

Packing and sterilization of glass and plastic wares for cell culture - Preparation of reagents and media for cell culture - Primary culture technique chicken embryo fibroblast - Secondary culture of chicken embryo fibroblast - Cultivation of continuous cell lines- Propagation of Viruses in Cell Culture - Demonstration of Cytopathic Effect (CPE) by Viruses in Cell Culture - Cryopreservation & Recovery of Cell Cultures

ABT 624

Molecular Immunology

2+0

Theory

History of immunology, immunity types, cardinal features, phylogeny. Vertebrate immune system: lymphoid organs and tissues; development of B and T lymphocyte repertoires and other leukocytes, differentiation markers and other distinguishing characters of leukocytes; lymphoid cells trafficking.

Antigens: fundamental features, types, factors affecting immunogenicity, adjuvants - Antibodies: structure, functions and classification; theories of antibody production; immunoglobulin genes and genetic basis of antibody diversity.

Complement system: activation pathways and biological activities - Major histocompatibility complex: structure, functions and gene organization.

T-lymphocyte subsets - Antigen-specific T cell receptors: structure, gene organization and genetic basis of diversity.

Immune response development: phases of humoral and cell-mediated immune response development, cellular interactions, properties and classification of various cytokines, immunoregulation.

Immunity against veterinary infectious agents, immunological surveillance, immunological tolerance, its breakdown and autoimmunity, immuno-deficiencies: types and examples

Hypersensitivity: classification, mechanisms of induction and examples.

ABT 625

Reproductive Biotechnology

2+1

Theory

History, importance of assisted reproductive biotechnology in man and animal, introduction to embryo biotechnology, endocrine therapeutics.

Biotechnological approaches to reproduction, methodology of superovulation, *in vitro* fertilization, embryo culture and micromanipulation, preparation of sperm for IVF.

Different methods of gene transfer and their limitations, embryo splitting, embryo sexing by different methods, production of transgenic livestock by nuclear transfer and its application, regulatory issues.

Cloning of domestic animals. Conservation of endangered species. Characterization of embryonic stem cells. Different applications of embryonic stem cells.

Practical

Synchronization and superovulation protocols - Collection of embryos using non-surgical procedures - Transferring embryos using non-surgical procedures - Embryo freezing protocols - Oocyte collection and evaluation from slaughter house ovaries - *In vitro* fertilization protocols - Micromanipulation of early embryos.

ABT 631 Vaccinology 2+0

Theory

History of vaccinology - Vaccines: classification, comparison of major types - Components of various types of vaccines: immunogens, adjuvants, stabilizers, preservatives, vehicles.

Vaccine qualities: definitions and methods of testing.

Vaccine development: cost-effectiveness of preventive immunization programmes, stages of development, clinical trials and regulatory requirements.

Traditional vaccines: inactivated, attenuated and toxoid vaccines - Methods of construction of traditional vaccines: microbial cultures, embryonated eggs, cell culture - Seed-lots of vaccine organisms.

Methods of inactivation and attenuation of pathogens.

Modern vaccines: nucleic acids, vectored vaccines, recombinant expressed immunogens, synthetic peptides, marker vaccines, etc.

Combination/multivalent vaccines - Novel immunomodulators and delivery systems.

Modern methods of vaccine construction: methods based on synthetic chemistry and rDNA technology.

Vaccine formulation: pharmacopeia requirements - Vaccine stability and preservation: cold chain.

Immunization schedules of veterinary vaccines, logistic problems and vaccination failure - Strategies of disease control and eradication by vaccination

ABT632 Biosafety and Biosecurity 1+0

Theory

Biosecurity - Biological hazards and uncertainties associated with biological material - Biorisk management – Handling and transportation of biological materials – Biosafety cabinets - Biosecurity issues.

Bioterrorism and biological agent outbreaks or events - Historical examples of biosecurity and bioterrorism events - response to

biosecurity and bioterrorism events - Health intelligence for the investigation and management of biosecurity and bioterrorism events
 Biosafety regulatory frameworks—Regulatory framework aimed at safeguarding human health and the environment - Legal documents (such as policy, legislation, guidelines, and decisions), authorities, advisory bodies, and enforcement mechanisms - The Institutional Biosafety Committees (IBSC), Review Committee on Genetic Manipulations (RCGM), Genetic Engineering and Approval Committee(GEAC) – Constituents and Role
 Risk analysis— Evidence-based risk analysis - Science-based approaches - management options for identified risks – effective communication to the public and relevant authorities.
 Containment and confinement of organisms - Selection, implementation, and verification of various containment and confinement approaches.
 Environmental safety— Identification of the most common sources of potential environmental harm from novel biological organisms - types of analyses to assess the potential risks of such organisms.

MINOR COURSES

ABT616 Animal Physiology 2+0

Theory

Introduction - Animal Physiology-Importance in animal science - Overview of different systems in animal body - Avian Physiology – Differentiating features
 Endocrinology - Location of Endocrine glands – Hormones released - Neuroendocrine integrating mechanism - Endocrine glands – Structure of hypothalamus, pituitary gland, limbic and other neural pathways – Functions Role of afferent impulses from genitals and other regions in reproductive system - Effects of drug on neuro-endocrine system - Neuro-endocrine mechanisms in birds – Differentiating features
 Stem Cells - Introduction to Stem cells – Types and identification of stem cells - Characterization and development of stem cells – Transfection of gene in embryonic blastomere - Stem cell therapeutics – Social, ethical religious and regulatory issues - Advances in stem cell technologies
 Lactation Physiology - Structure and location of mammary glands in animals - Functional anatomy – Histology and cytology of mammary gland in domestic animals - Development of mammary glands – Hormonal control of mammary gland growth - Lactation process – Initiation of lactation – Hormonal control – Biochemical and histological changes in mammary gland during lactation – Galactopoiesis -

Lactation – Neural control – Milk let down – Milk ejection and inhibition of milk ejection - Induced Lactation

Milk composition in different species of animals - Genes and their role in milk production

Environmental Physiology and Stress - Environmental comfort zone and stress zone - Ecology of farm animals – Biological rhythms – Mammalian circadian rhythms and their regulation - Components of physical environment – Biometeorology and principles of thermo-regulation in mammals and birds

Physiological response of farm animals to heat and cold – Heat tolerance capacity – Temperature-humidity index - Effect of various climatic components on health and production (growth and egg production) reproduction and climatic adaptation – Heat Shock Protein

ABT 617 General Microbiology 2+0

Theory

Introduction and history of Veterinary & Medical Microbiology - Classification and nomenclature of bacteria

Morphology and structure of bacteria, shape, size and arrangement of bacteria, morphological variations, cell wall capsule, nucleus, cytoplasmic inclusions, flagella, motility endospores, sporulation, vegetative reproduction - Growth and nutrition of bacteria

Sources and transmission of bacteria, Pathogenicity, virulence and infection - Resistance and susceptibility of host, bacteraemia, septicaemia, toxemia, endotoxins and exotoxins

Bacterial genetics, Plasmids, Antibiotic resistance

Origin and nature of viruses; biochemical and morphological structure of viruses; Nomenclature and classification of viruses - Replication of DNA and RNA viruses, Viral genetics and evolution.

Introduction and morphology of fungi - Growth, nutrition, reproduction and classification of fungi

ABT 626 Introduction to Bioinformatics 1+1

Theory

Introduction, biological databases – primary, secondary and structural, Protein and Gene Information Resources – PIR, SWISSPROT, PDB, genbank, DDBJ. Specialized genomic resources - DNA sequence analysis, cDNA libraries and EST, EST analysis, pairwise alignment techniques, database searching, multiple sequence alignment - Secondary database searching, building search protocol, computer aided drug design – basic principles, docking, QSAR - Analysis

packages – commercial databases and packages, GPL software for Bioinformatics, web-based analysis tools.

Practical

Usage of NCBI resources - Retrieval of sequence/structure from databases -Visualization of structures - Docking of ligand receptors - BLAST exercises.

ABT 627 Biology of cancer 2+1

Theory

Animal cell structure and function, cell injury, programmed cell death, cellular aging, cell signaling, cell cycle, mitosis. Cellular adaptations-differentiation, anaplasia and neoplasia

Epidemiology: Cancer incidence, Geographic and environmental factors, Genetic and non-genetic factors, molecular epidemiology, Cancer surveillance systems. Etiology of cancer: Physical, chemical and biological causes. Nomenclature. Characteristics of benign and malignant neoplasms. Mechanisms of carcinogenesis, Biology of tumor growth, Tumor angiogenesis, Tumor progression and heterogeneity. Role of stem cells in cancer. Tumor metastasis-Evolution and pathogenesis of metastasis, Invasion of extracellular matrix, Vascular dissemination and homing of tumor cells and molecular genetics of metastasis. Molecular basis of cancer/cancer genetics: Cancer mechanism, oncogenes, Tumor suppressor genes, Genomic instability, stromal microenvironment and carcinogenesis. Cancer genomics and proteomics. Tumor immunity - Tumor antigens, Antitumor mechanism, Immune surveillance and escape. Effects of cancer, Diagnostic modalities and targeted therapy.

Practical

Animal models of cancer. Techniques used in the diagnosis of cancer, Cytology, Biopsy, Histopathology, Histochemistry and Immunohistochemistry. Light microscopy and photomicrography.

ABT 633 Biostatistics & Computer Applications 1+1

Theory

Aims, scope & idea of elementary statistics, Measures of central tendency & dispersion, skewness and kurtosis. Concepts of probability and probability laws. Standard probability distributions. Test of significances based on Z, X^2 , student's t and and F statistic. Correlation and regression. Basic principles organization and operational aspects of computers, operating systems. Introduction to

MS-office, MS-word, MS-excel. Statistical Data analysis through MS.Excell, spread sheet, DBMS, SPSS.

Practical

Measures of central Tendency – Measures of Dispersion, skewness and Kurtosis – Correlation – Simple Linear Regression – Probability – Probability Distribution – Large Sample test – X2 test – Student t test and F-test – ANOVA – Operating System, MS-Word, MS-Power Point and MS-Excel – Internet – SPSS

ABT 634 Intellectual Property Rights and Its Management 1+0

Theory

Historical perspectives and need for the introduction of Intellectual Property Right regime; TRIPs and various provisions in TRIPS Agreement; Intellectual Property and Intellectual Property Rights (IPR), benefits of securing IPRs; Indian Legislations for the protection of various types of Intellectual Properties; Fundamentals of patents, copyrights, geographical indications, designs and layout, trade secrets and traditional knowledge, trademarks, protection of animal varieties and farmers' rights and bio-diversity protection; Protectable subject matters, protection in biotechnology, protection of other biological materials, ownership and period of protection; National Biodiversity protection initiatives; Convention on Biological Diversity; International Treaty on Plant Genetic Resources for Food and Agriculture; Licensing of technologies, Material transfer agreements, Research collaboration Agreement, License Agreement.

ABT 635 Biotechnology for Animal Nutrition 2+0

Theory

Probiotics - Mechanism of action of probiotics - immune response to probiotics - Application of probiotics for farm animals and poultry - probiotics and intestinal infections - importance of gut microflora, prebiotics - feed processing and preservation - Enzyme production-application in Animal feeds - microbial bioconversion of lignin and cellulose rich feeds, factors affecting delignification - large scale bioconversion of substrates, pre-treatment of feeds, chemical vs. microbial treatment of feeds, anti-nutritional factors present in feeds, microbial detoxification of aflatoxins, mimosine and other anti-metabolites present - Genetic manipulation of organisms to enhance bioconversion ability, manipulation of rumen fermentation by selective removal of protozoa and fungi - effect of feed additives like antibiotics, methane inhibitors - genetic manipulation of rumen microflora to improve feed utilization - single cell protein as animal feed.

Non-Credit Compulsory Courses

PGS 501 LIBRARY AND INFORMATION SERVICES 0+1

Objective

To equip the library users with skills to trace information from libraries efficiently, to apprise them of information and knowledge resources, to carry out literature survey, to formulate information search strategies, and to use modern tools (Internet, OPAC, search engines etc.) of information search.

Practical

Introduction to library and its services; Role of libraries in education, research and technology transfer; Classification systems and organization of library; Sources of information- Primary Sources, Secondary Sources and Tertiary Sources; Intricacies of abstracting and indexing services (Science Citation Index, Biological Abstracts, Chemical Abstracts, CABI Abstracts, etc.); Tracing information from reference sources; Literature survey; Citation techniques/Preparation of bibliography; Use of CD-ROM Databases, Online Public Access Catalogue and other computerized library services; Use of Internet including search engines and its resources; e-resources access methods.

PGS 502 TECHNICAL WRITING AND COMMUNICATIONS SKILLS 0+1

Objective

To equip the students/scholars with skills to write dissertations, research papers, etc. To equip the students/scholars with skills to communicate and articulate in English (verbal as well as writing).

Practical

Technical Writing - Various forms of scientific writings- theses, technical papers, reviews, manuals, etc; Various parts of thesis and research communications (title page, authorship contents page, preface, introduction, review of literature, material and methods, experimental results and discussion); Writing of abstracts, summaries, précis, citations etc.; commonly used abbreviations in the theses and research communications; illustrations, photographs and drawings with suitable captions; pagination, numbering of tables and illustrations; Writing of numbers and dates in scientific write-ups; Editing and proof-reading; Writing of a review article.

Communication Skills - Grammar (Tenses, parts of speech, clauses, punctuation marks); Error analysis (Common errors); Concord; Collocation; Phonetic symbols and transcription; Accentual pattern:

Weak forms in connected speech: Participation in group discussion:
Facing an interview; presentation of scientific papers.

Suggested Readings

- *Chicago Manual of Style*. 14th Ed. 1996. Prentice Hall of India.
- *Collins' Cobuild English Dictionary*. 1995.
- Harper Collins. Gordon HM & Walter JA. 1970.
- *Technical Writing*. 3rd Ed. Holt, Rinehart & Winston. Hornby AS. 2000.
- *Comp. Oxford Advanced Learner's Dictionary of Current English*. 6th Ed. Oxford University Press. James HS. 1994.
- *Handbook for Technical Writing*. NTC Business Books. Joseph G. 2000.
- *MLA Handbook for Writers of Research Papers*. 5th Ed. Affiliated East-West Press. Mohan K. 2005.
- *Speaking English Effectively*. MacMillan India. Richard WS. 1969. *Technical Writing*. Barnes & Noble. Robert C. (Ed.). 2005.
- *Spoken English: Flourish Your Language*. Abhishek. Sethi J & Dhamija PV. 2004. *Course in Phonetics and Spoken English*. 2nd Ed. Prentice Hall of India. Wren PC & Martin H. 2006.
- *High School English Grammar and Composition*. S. Chand & Co.

PGS 503 INDUSTRY – ACADEMIA INTERACTION 0+1

Objectives

To provide the students the experience and expectations of industry by the way of undertaking case study/industrial visit/summer internship and attending guest lectures delivered by the industry specialists.