

# **GITAM UNIVERISTY**

(Estd. U/S 3 of UGC Act 1956)



**Microbiology M.Phil., and Pre Ph.D. Syllabus**  
(w.e.f.Academic year 2012-13)

**DEPARTMENT OF MICROBIOLOGY  
GANDHI INSTITUTE OF SCIENCE  
GITAM UNIVERSITY**

Gandhi Nagar Campus, Rushikonda  
Visakhapatnam-530 045, A.P., India  
Website: [www.gitam.edu](http://www.gitam.edu)

# **GITAM UNIVERSITY**

(Declared as Deemed-to-be-University u/s 3 of the UGC Act., 1956))

Gandhi Nagar Campus, Rushikonda, Visakhapatnam – 530 045, A.P., INDIA

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## **RESEARCH REGULATIONS**

**(w.e.f. Academic year 2012-13)**

**GITAM University shall offer the following Research Programmes**

1. M. Phil (Full-time/ Part-time)
2. Ph. D (Full-time/ Part-time)
3. D.Litt. / D.Sc.

The regulations relating to eligibility, duration, recognition of guides, requirements to be fulfilled for the award of research degree and such other related matters are as per the minimum standards and procedure for the award of M.Phil / Ph.D degree regulations of UGC, 2009 vide its notification No: F.1-1/2002(PS) Exemp dated 1<sup>st</sup> June 2009. These regulations are furnished in the following Sections:

SECTION – I M. Phil. Regulations

SECTION – II Ph.D. Regulations

SECTION – III D. Litt. / D.Sc. Regulations

**SECTION-I**  
**M. Phil. REGULATIONS**

The Master of Philosophy (M. Phil.) is the first research degree and the study will provide the necessary advanced training in research methodology and latest developments in the subject followed by submission of dissertation on the topic chosen.

**1. Eligibility:**

**Candidates pursuing the degree of M.Phil., either Full-time or Part-time, shall possess the minimum qualification for admission as specified below.**

**A. Full Time:**

- a) Postgraduate degree holders of GITAM University or of any other University recognized by the GITAM University as equivalent thereto with atleast second class securing at least 55% of marks or equivalent grade (50% in the case of SC / ST candidates) in the concerned subject or in an allied subject can register for fulltime M. Phil. Degree.
- b) Admissions shall be based on a Entrance Test followed by interview.
- c) The candidates qualified in CSIR-UGC (NET), ICMR, GATE and Project Fellows working in the projects recognized in national funding agencies with one year experience are eligible to join M.Phil. (FT) without appearing for the above test.

**B. Part Time :**

- a. Postgraduate degree holders of GITAM University or of any other University recognized by the GITAM University as equivalent thereto, with II class securing at least 55% of marks or equivalent grade (50% in the case of SC / ST candidates) in the concerned subject or in an allied subject can register for part time M. Phil. Degree without appearing for entrance test.

Candidates satisfying the above eligibility conditions can be registered as Part-Time candidates in the following order of priority and by following service seniority in the respective cadre.

- a) Teachers working in PG Departments of recognized Universities and their affiliated Colleges with a minimum of one year of service.
- b) Teachers working in Degree colleges and other professional colleges affiliated to recognized Universities with at least two years of service.
- c) Executives / Administrators / Engineers / Scientists with at least three years of service in Govt. / Quasi Govt. / Judiciary / Public Sector organizations / Public and Private Limited Companies and other organizations approved by Board of Research Studies.
- d) Teachers working in approved Junior Colleges with at least three years of service.
- e) Administrative and Technical staff of GITAM University with at least four years of service

- f) Employees not covered in the above clauses with at least four years of service as approved by Board of Research Studies.

## **2. Duration:**

- a) The duration of M. Phil (FT) shall be 12 months. The candidate is required to spend the prescribed period of 12 months in the concerned University Department or in the Institute recognized by the University as a research center for this purpose.
- b) The duration of M. Phil (PT) shall be two years. The candidate is required to spend at least eight weeks in total in each year in the concerned Department of the University or in the Institute concerned, and complete all the requirements for the award of the Degree.
- c) Where the candidate is unable to submit the thesis within the above prescribed period, the Principal/Director of the College concerned may grant extension of time up to six months for full time and one year for part time candidates for completing the work on the basis of recommendation of Departmental Research Committee (DRC) and College Research Committee (CRC). Further extension can only be granted by the Vice- Chancellor on the recommendations of DRC, CRC and Board of Research Studies (BRS). The candidate has to pay fees for the extended period.
- d) If the candidate is unable to submit the thesis within a period of 3 years in respect of M.Phil. (FT) candidates and 5 years in respect of M.Tech.(PT) candidates from the date of registration, his/her registration stands automatically cancelled. However, he may opt re-registration by paying the necessary fees.
- e) Candidates working for full-time M.Phil. programme may be permitted by Board of Research Studies to convert into part-time M.Phil. programme, provided they satisfy the eligibility conditions for part time registration for M.Phil.

## **3. Attendance**

A fulltime candidate is required to put in a minimum of 85% attendance. Condonation for shortage of attendance will be given only on medical grounds. Condonation cannot however be granted to candidates with less than 75% attendance, except with the approval of the Vice Chancellor in exceptional cases.

## **4. Requirements for the Award of M. Phil :**

The requirements for the award of M.Phil Degree shall be on the completion of the course work and submission of dissertation based on the research work carried out under the supervision of a recognized Research Guide in the University Department or in the Institute recognized by the University for the purpose, subject to qualifying in the Viva-voce examination.

### **(a) Course Work**

The course work for full time and part time M.Phil. candidates shall be as follows :

PAPER - I :	Advanced topics in the broad area of research.
PAPER - II :	Research Methods & Methodology
PAPER - III :	Seminar and Viva Voce

Each of above three courses shall consist of a written paper for 100 marks. The Departmental Research Committee of the concerned Departments shall prescribe the syllabi for papers I and II. Syllabus for paper III shall be given by the Research Guide concerned and approved by DRC. The question papers for all the above three courses are to be set by internal faculty members having eligibility to guide.

In the case of full time candidates, the M.Phil examinations are to be conducted within 8 to 10 months from the date of registration, while in the case of part time candidates, the examinations are to be conducted within 16 to 20 months from the date of registration.

**(b) Dissertation :**

After successful completion of the research work under the supervision of the Research Guide, the candidate shall submit a Dissertation embodying the results of his / her study. The thesis shall be accompanied by a declaration signed by the candidate that it is the result of independent investigation and research and that the thesis is not substantially the same as that submitted for any degree of this University or any other University. It will be evaluated for 200 marks by **two Indian external examiners independently.**

**(c) Viva – voce**

There shall be a Viva-voce examination for 100 marks on the topic of dissertation.

**5. Evaluation**

- a) The answer scripts related to Paper I, II, are to be evaluated both by internal and external examiners having eligibility to guide. The candidate must get minimum of 50% or equivalent grade in each paper for a pass.
- b) The Dissertation carries 200 marks and the viva-voce examination carries 100 marks. The candidate shall get a minimum of 50% or equivalent grade in each.
- c) The Viva-voce Committee shall consist of the Head of the Department, the Chairperson of the Board of Studies of the Department, the Research Guide and a Teacher who is a specialist in the subject of the dissertation nominated by the Vice Chancellor. A quorum of two members is required and the Convener shall be the Research Guide. All the members of Viva-voce Committee shall be eligible Research Guides.
- d) The panel of examiners for valuation of the theory papers of the Course Work and Dissertation shall be signed both by the Research Guide and Chairperson of the Board of Studies of the Department. All the examiners shall be eligible Research Guides.
- e) Candidates shall be classified as shown below based on the aggregate marks secured in the course work, dissertation and viva-voce examination :

Percentage	Class	Grade
70% and above	- I class with distinction	A <sup>+</sup>
60% and above but less than 70%	- I class	A
50% and above but less than 60%	- II class	B

- f) In case of failure in any paper of the Course Work, or in dissertation or in viva, the candidate may be permitted to retake the examination or resubmit the dissertation only once to secure a pass. If the candidate fails again, he / she must seek fresh admission.

- g)** In case any of the external examiners does not evaluate the Dissertation **within six months**, he / she shall be replaced by another external examiner.

**6. Fee Structure:**

The Fee Structure for Full time and Part time M. Phil. Programme shall be fixed by the Board of Management from time to time.

**7. Submission of the soft copy to UGC:**

After the successful completion of the evaluation process and announcement of the award of M.Phil degree, a soft copy of it shall be submitted to the UGC within 30 days.

**8. Discretionary Power:**

Notwithstanding anything contained in the above sections in all exceptional cases, the Vice Chancellor may review and give his decision which will be final and binding.

## SECTION – II

### Ph. D. REGULATIONS

The Doctor of Philosophy (Ph.D.) Programme is intended to provide advanced research training in select areas of specialization. The research carried out towards this Degree should lead to new results, new methods of analysis or new findings, publishable in any refereed journal. A candidate for Ph. D. can register under (a) Full time or (b) Part time (c) or Interdisciplinary or (d) Extramural category, depending upon fulfillment of the respective conditions.

#### **1. Eligibility:**

Candidates pursuing the degree of Ph. D. whether Full-time, Part-time, or Interdisciplinary or Extramural shall possess the minimum qualifications for admissions as specified below.

#### **A. Full Time**

- a. Postgraduate degree holders of GITAM University or of any other University recognized by the GITAM University as equivalent thereto with at least second class securing at least 55% of marks or equivalent grade (50% in the case of SC / ST candidates) in the subject concerned or in an allied subject can register for fulltime Ph. D. Degree.
- b. Admissions are based on entrance test followed by Interview.
- c. The candidates qualified in CSIR-UGC (NET), ICMR, GATE, Project Fellows working in the projects recognized by national funding agencies at least for one year will be considered for admission without appearing for entrance test.

*Note: Candidates with M.Phil / M.E / M.Tech /MCA / M.L / M.Pharm / LL.M / M.D / M.D.S / M.S. are not required to i) undergo any course work or ii) appear for pre-Ph.D. examinations. Candidates with all other PG degrees are required to undergo course work and appear for pre-PhD. Examinations*

#### **B. Part Time:**

Postgraduate degree holders of GITAM University or of any other University recognized by the GITAM University as equivalent thereto with at least second class securing at least 55% of marks or equivalent grade (50% in the case of SC / ST candidates) in the subject concerned or in an allied subject can register for Ph. D. degree on part time basis without appearing for entrance test subject to fulfillment of the following conditions.

Candidates satisfying the above eligibility conditions can register as part time candidates in the following order of priority and on the basis of service seniority in each category.

- a) Teachers working in any postgraduate Departments of any recognized University or its affiliated Colleges with minimum of one year of service.
- b) Scientists working in research institutions recognized by GITAM University with a minimum of two years of service.
- c) Teachers working in any affiliated Degree / Professional Colleges with a minimum of three years of service.

- d) Executives / Administrators / Engineers with at least three years of service in Govt / Quasi Govt / Judiciary / Public Sector organizations / Public and Private Limited Companies and other organizations approved by BRS.
- e) Teachers working in Junior Colleges with at least four years of service.
- f) Administrative and technical staff of GITAM University with at least four years of service
- g) Any other employee not covered above with at least five years of service.

*Note: Candidates with M.Phil / M.E / M.Tech /MCA / M.L / M.Pharm / LL.M / M.D / M.D.S / M.S. are not required to i) undergo any course work or ii) appear for pre-Ph.D. examinations. Candidates with all other PG degree are required to undergo course work and appear for pre-PhD. Examinations.*

### **C. Interdisciplinary:**

A candidate who registers for Ph.D. whose work involves more than one department in the University will be admitted under inter-disciplinary category and will be registered in the Department in which the major part of the research work is to be carried out under the guidance of a Research Guide and a Co-Research Guide from the other department.

The Candidate who wishes to pursue inter-disciplinary research must submit a statement of purpose along with the application. The statement may contain the objective, definition of the problem, method, justification and the disciplines involved (major and related).

The candidate shall be given registration for research and the research degree shall be awarded in that Faculty where the major part of the research work is carried out.

### **D. Extramural :**

For admission into Ph.D. Programme under Extramural category, there should be an internal guide (Principal guide) recognized by GITAM University in the recognized Research Institution where the candidate is working and a co-guide from GITAM University. Eligibility for admission into extramural category shall be:

- a) Scientists working in research institutions recognized by GITAM University who have PG or equivalent degree and at least two years of experience.
- b) Research scholars with PG or equivalent degree having fellowship attached to Institutions recognized by GITAM University.
- c) Registration for an extramural candidate may be done at any time of the year.



## 2. Duration :

- a. The duration for submission of thesis of Ph.D.(Full Time) is three years in the case of Master's Degree holders and two years in the case of M.Phil / M.E / M.Tech /MCA / M.L / M.Pharm / LL.M / M.D / M.D.S / M.S. Degree holders from the date of registration. The M.E / M.Tech. / MCA / ML/ M. Pharm / LL.M / M.D/ MDS/ MS degree's shall be treated as equivalent to M.Phil for the purpose of admission into Ph.D programme
- b. If a candidate is unable to submit the thesis within the above prescribed period, the Principal/Director of the College concerned may grant extension of time up to one year for full time and two years for part time candidates for completing the work on the basis of recommendations of DRC & CRC. Further extension can only be granted by the Vice-Chancellor on the recommendations of DRC, CRC and BRS.
- c. The duration for submission of thesis of Ph.D. (Part Time) is four years in the case of Master's Degree holders and three years in case of M.Phil / M.E / M.Tech / MCA /M.L / M.Pharm / LL.M / M.D / M.D.S / M.S. Degree holders from the date of registration.
- d. A part time candidate employed in an outside institution will be required to spend at least eight weeks in toto per year in the University campus during the prescribed total period of research.
- e. If a candidate has completed the requirements earlier than the prescribed period, the Vice Chancellor may permit for early submission of thesis, not exceeding six months in respect of full time candidates and one year in respect of part time candidates.
- f. Candidates working for fulltime M.Phil / Ph.D. programme may be permitted by BRS to convert into part time M.Phil / Ph.D programme provided they satisfy the eligibility conditions for part time.

## 3. Requirements for the Award of Ph. D.:

The requirements for the award of Ph.D. Degree are :

- a) Degree in M. Phil / M.E / M.Tech / MCA / M.L / M. Pharm / LL.M / M.D / M.D.S / M.S.  
**or**  
Successful completion of course work and Pre-Ph.D. examination in respect of other postgraduates.  
***(The regulations for Pre-Ph.D. examination and evaluation process shall be the same as the M.Phil. Degree course examinations except the submission of dissertation and its evaluation.)***
- b) Submission of a thesis under the supervision of the approved Research Guides.
- c) Acceptance of the thesis by adjudicators and
- d) Successful completion of Viva-voce Examination.

#### **4. Procedure for Submission of Thesis :**

- a) The candidate is required to publish atleast one research paper in the refereed journal before the submission of thesis.
- b) The candidate is required to give pre-submission seminar before Departmental Research Committee (DRC) and obtain approval for submission.
- c) A candidate may utilize for his / her thesis the contents of any work which he / she may have already published on the subject. But he / she shall not submit the whole or any substantial part of the work for which a degree has been conferred on him / her by this or any other University.
- d) The thesis must form a distinct contribution to the knowledge of the subject and afford evidence of the candidate's own.
- e) The thesis shall be written and submitted only in English
- f) The candidate has to submit four hard copies and one soft copy of the thesis embodying the results of his / her research.
- g) The thesis shall be accompanied by a declaration signed by the candidate that it is the result of independent investigation and research and that the thesis is not substantially the same as that submitted for any degree of this University or any other University.

#### **5. Evaluation of Ph.D. Thesis :**

- a) The Convener, Departmental Research Committee has to forward the list of examiners (6 Indian and 3 foreign) for adjudication of Ph.D. thesis **within two weeks** from the date of communication sent for the purpose. Both the lists are to be signed by the Research Guide and the Convener of Departmental Research Committee.
- b) The Ph.D thesis shall be valued by three examiners of whom one should be from outside the State and one should be drawn from abroad. If all the three examiners recommended the thesis fit for awarding Ph.D. Degree, there shall be a viva-voce examination.
- c) In cases where the Indian examiners do not send their reports **within two months** from the date of dispatch of thesis, the Vice Chancellor may consider substituting such examiners with alternative examiners. In such cases, even if the reports from the said examiners are received subsequently, they may be ignored.
- d) In cases where a foreign examiner does not convey his acceptance **within two months** or has not sent his report **within four months** from the date of dispatch of the thesis (by airmail), the Vice Chancellor may consider substituting the foreign examiner with another foreign examiner
- e) In case none of the foreign examiners convey his/her acceptance **within six months** from the date of submission of panel of examiners, the Vice Chancellor may substitute an Indian examiner in place of foreign examiner.
- f) The viva-voce relating to Ph.D thesis shall be conducted based on the recommendations of the panel of examiners concerned. The individual examiners are requested to write summary report, possible questions / clarifications sought in report.. In addition to the above, they are required to indicate clearly one of the following remarks

1. A – Approved
2. M – To be Modified
3. R – Rejected

Based on the above evaluation, the following table depicts the various possibilities and suitable action to be initiated in this regard.

Case	Examiner I	Examiner II	Examiner III	Action to be initiated
1	A	A	A	Conduct Viva-voce
2	A	A	M	The candidate has to resubmit the thesis and it is to be sent to the same examiner for revaluation.
3	A	M	M	The candidate has to resubmit the thesis after three months and it is to be sent to the same examiner(s) for revaluation.
4	M	M	M	
5	A	A	R	The examiner(s) who rejected the thesis shall be replaced with new examiner(s). The candidate has to resubmit the thesis after six months. The adjudication process continues as per regular procedure.
6	A	R	M	
7	A	R	R	
8	R	M	M	Appointment of fresh panel of examiner(s) from the original panel of examiners. The candidate has to resubmit the thesis after one year. The adjudication process continues as per regular procedure.
9	R	R	M	
10	R	R	R	Cancel the registration

### **6. Conduct of Viva-Voce:**

The Viva-voce relating to Ph.D thesis is to be conducted in the presence of one of the external examiner(Indian) and at least two other examiners from the following Viva-voce committee constituted by the Vice-chancellor. Faculty members of the concerned department and allied departments and PG students / research scholars desirous of attending the viva-voce examination may be permitted to attend.

- I. Guide as Convener.
- II. Members of the Doctoral Committee.
- III. The HoD (both the Heads in case of interdisciplinary candidates).
- IV. Convener of Departmental Research Committee (both the Conveners in inter-disciplinary cases)
- V. One of the Indian examiners who adjudicated the thesis (nominated by the Vice-chancellor, wherever necessary).

The candidate shall have to successfully defend his/her work. Then only he / she shall be awarded the Ph.D Degree on the recommendation of the Viva-voce Committee. The candidate who is not successful at the Viva-voce may be permitted to take the Viva-voce again within a period of three months and whatever may be the result, the case shall be disposed off by the Vice-chancellor on merits.

### **7. Fee Structure:**

The Fee Structure for Full time / Part time/ Interdisciplinary/ Extramural categories of Ph.D. programmes shall be fixed by the Board of Management from time to time.

### **8. Recognition of Research Guides:**

The persons satisfying the following criteria shall be recognized as Principal Research Guides

- a) Holding Ph.D. degree
- b) Publication of two research papers in refereed journals approved by DRC
- c) Two years of teaching experience after obtaining Ph.D. or a total of ten years of experience

Persons working in other Universities / Colleges / institutions / Industry / Research Laboratories / Individuals may also be recognized as Research Guides by Vice-Chancellor provided they satisfy the above criteria and approved by BRS. Their applications will be considered by DRC, CRC and finally by BRS.

#### **Co-guides :**

Any Research Guide approved by GITAM University may serve as Go-guide to the candidate.

### **9. Allotment of Candidates:**

The following table gives the details of maximum number of research candidates to be guided by each faculty member at any point of time:

Cadre	Ph.D	M.Phil
Professor	6	2
Associate Professor	5	2
Assistant Professor	4	2

**Note:** Fro this purpose two part time M.Phil / Ph.D. candidates shall be considered as equivalent to one fulltime M.Phil / Ph.D. candidates.

### **10. Recognition of Institutions as Research Centres :**

- a) Any institution/Industry/Research Laboratory in Government / Private Sector where research activities in one of the main functions of the institute, having at least two persons qualified to guide may be considered as Research Centres.
- b) Recognition of Institution as a Research Centre will be provided on receiving application from the institute with the prescribed fee and based on the recommendations of the inspection committee constituted by the Vice Chancellor.

### **11. Submission of the soft copy to UGC:**

After the successful completion of the evaluation process and announcement of the award of Ph.D degree, a soft copy of it shall be submitted to the UGC within 30 days.

### **12. Discretionary Power**

Notwithstanding anything contained in the above sections in all exceptional cases, the Vice Chancellor may review and give his decision which will be final and binding.

## SECTION-III

### D. Litt. / D.Sc. Regulations

#### **1. Eligibility:**

A candidate of five years of research/teaching experience after obtaining Ph.D. (Doctor of Philosophy) of GITAM University or any other recognized university and possess at least two refereed publications (single author) of international reputation on the topic in concerned may present himself / herself for award of the Degree of Doctor of Letters (D.Litt) or Doctor of Science (D.Sc) of this University in the concerned faculty.

#### **2. Application and Thesis :**

The candidate shall state in his / her application the subject /branch of knowledge in which he or she is seeking D.Litt / D.Sc. degree.

The candidate shall submit with his / her application four copies of his / her thesis in the form of published work in refereed professional journals. The concerned work should be single authored and should not have formed basis or a part for any earlier degree. The whole work must belong to a single theme or related themes only. The candidate may also submit with the thesis printed copies of any original contributions of the knowledge of his / her subject or any cognate subject which may have been published by him / her independently and upon which he / she relies in support of his / her candidature. Such papers be published only in the concerned field after the award of Ph.D. Degree.

#### **3. Acknowledgement :**

The candidate shall indicate generally in a preface of his / her thesis and more particularly in the notes the source from which the information is taken and the extent to which he / she has availed himself / herself of the work of others; and he / she also shall state in what respects his / her own investigations and conclusions appear to him / her to lend to the advancement of knowledge or otherwise from a valuable contribution of the literature of the subject dealt with.

#### **4. Declaration :**

The thesis shall be accompanied by a declaration signed by the candidate that it is the result of independent investigation and research and that the thesis is not substantially the same as that submitted for any degree of this University or any other University.

#### **5. Mode of Submission :**

The application and the thesis must be submitted to the Principal/Director of concerned University college with the prescribed fee. The Principal/Director shall forward it to the University with a list of panel of atleast 12 foreign examiners (preferably not of Indian origin), prepared in consultation with three subject experts nominated by Vice Chancellor.

#### **6. Fee Structure**

The Fee Structure for D. Litt / D. Sc Programmes shall be fixed by the Board of Management from time to time.

## **7.Evaluation of the Thesis :**

The thesis together with papers contributed shall be referred to a three member Board of Examiners constituted by the Vice Chancellor from the panel of examiners accepted by the Board of Management. After receipt of the report on the thesis and supporting contributions and papers, the Board of Management may decide whether the candidate is qualified or not for the award of D.Litt / D.Sc. degree.

- a) If all the three examiners recommend positively, the thesis is to be considered qualified for the award of degree.
- b) If two examiners recommend for the award and one rejects, then the thesis may be referred to another examiner. If that examiner recommends for the award, the thesis is to be considered qualified for the award of degree and in all other cases, the degree shall not be awarded and shall not be permitted for resubmission.

## **8. Submission of the soft copy to UGC:**

After the successful completion of the evaluation process and announcement of the award of D. Litt. / D.Sc degree, a soft copy of it shall be submitted to the UGC within 30 days.

## **9. Discretionary Power:**

Notwithstanding anything contained in the above sections in all exceptional cases, the Vice Chancellor may review and give his decision which will be final and binding

**Department of Microbiology**  
**GITAM Institute of Science, GITAM University**  
**SYLLABUS FOR Pre Ph.D / M. Phil Examination**

(2012 admitted batch)

**SRFMB-121/SRPMB-121**

**Advanced Topics in Microbiology**

1. **General Microbiology** : Structure and function of cell (both Prokaryotes & Eukaryotes) bacterial nutrition and growth kinetics. Measurement of cell number and cell mass. Factors affecting growth bacterial sporulation and germination of spores. Structure, classification, genetics, reproduction & physiology of Bacteria (*E. coli*, *Bacillus*, *Staphylococcus*), Viruses (T4, TMV), Mycoplasma, Yeast and fungi, (*Aspergillus*, *Penicillium*, *Fusarium*)
2. **Immunology** : Structure & function of different classes of immunoglobulins, IgG, IgA, IgM, IgD and IgE. primary & secondary immune response, Humoral & cell mediated immunity, hybridoma techniques and monoclonal antibodies. Applications of immunological techniques.
3. **Medical Microbiology** : Normal microbial flora – resident flora. Mechanism of bacterial adhesion, colonization and invasion of mucous membranes. Pathogenic bacteria, *Staphylococcus*, *Clostridium*, *Vibrio cholerae*. Pathogenic fungi Ex. *Aspergillus*. Pathogenic protozoa *Entamoeba histolytica*. Medical virology – Hepatitis viruses and HIV. Drug resistance. New and emerging strains of bacteria and viruses
4. **Industrial Microbiology** : Fermentation – screening methods, Industrial media formulation, General design and applications of a biofermenter. Antifoams. Industrial production – Ethyl alcohol, antibiotics. Down stream processing. Microbes in decomposition & recycling process, sewage treatment.
5. **Genetics** : Genome organization, chromatin, coding, non coding sequences & satellite DNAs, mechanism of transcription in Prokaryotes & Eukaryotes, RNA processing, structure of m- RNA, protein synthesis. Law of DNA constancy; C – value paradox, molecular basis of spontaneous & induced mutations & role in evolution.
6. **Molecular Biology** : DNA sequencing, Maxam Gilbert and Sangers Method, Restriction mapping – DNA finger printing. Cloning vectors – Plasmids, bacteriophages, cosmids and phagemid., cDNA & genomic libraries, DNA & RNA probes.
7. **Enzymes** : Enzymes – Regulation of enzyme activity, active sites, coenzymes, activators and inhibitors, isoenzymes, allosteric enzymes.
8. **Environmental Microbiology** : Concept of habitat & ecological niches, limiting factor, energy flow, ecological pyramids Biotic community, N, P, C & S cycles. Climate change and its effects. Bioremediation.
9. **Soil and Agricultural Microbiology** : Symbiotic & asymbiotic N<sub>2</sub> fixation, PGPR, bacterial and microalgal biofertilizers – rhizobium, Azatobacter.
10. **Food Microbiology** : Asepsis, Methods of food preservation, pasteurization. Food poisoning. Mycotoxins, bacterial toxins, fermented foods Ex. Yogurt and cheese, Probiotics. Nano technology in food safety.

## SRFMB-131/SRPMB-131 Research Methodology

1. **Sterilization techniques-** Physical and chemical methods of sterilization.
2. **Isolation & purification techniques :** Serial dilution, various plating techniques, staining procedures – simple & differential bacterial staining, fungal staining, cultivation of bacteria & fungi. Maintenance of cultures in lab and storage, Lyophilization.
3. **Microscopy :** Principle and applications of light, phase contrast, confocal, fluorescent, scanning and transmission electron microscopy. Sample fixation & staining.
4. **Centrifugation:** Principle of centrifugation, Instrumentation, types of centrifuges – desk top, high speed, ultra centrifuge. Preparative and differential centrifugation, Density Gradient Centrifugation – Analytical Centrifugation.
5. **Chromatography :** Gel filtration, Ion exchange & affinity chromatography, TLC, GC, HPLC, LCMS
6. **Electrophoresis** – electrophoresis of DNA, PAGE, SDS PAGE, Isoelectrofocussing, 2 – D gel electrophoresis.
7. **Blotting & Spectroscopy :** Southern, Northern, Western blotting technique, PCR, Concepts of spectroscopy, visible and UV spectroscopy Beer Lambert Law, colorimetry, spectrophotometry. Proteomics.
8. **Radioisotopic Techniques :** Principle & applications of tracer techniques in biology, radioactive isotopes, half life, effect of radiation on biological systems, liquid scintillation spectrometry.
9. **Immunological techniques :** – Immuno diffusion, radioimmunoassay, Immuno electrophoresis, ELISA.
10. **Biostatistics** – Mean, Median, Mode, Average, Coefficient of variation, standard error, simple correlation & regression, confidence limits. Analysis of variance,  $\chi^2$  test, Paired t – test , SPSS package, non parametric test

## SRFMB-141/SRPMB-141

An oral presentation, for a maximum of 100 marks, in the chosen area of research of the candidate will be evaluated by subject experts.



