

Ph.D. (MICROBIOLOGY)

Syllabus 2024-2025



**DEPARTMENT OF MICROBIOLOGY
FACULTY OF ARTS, SCIENCE, COMMERCE
AND MANAGEMENT**

KARPAGAM ACADEMY OF HIGHER EDUCATION

(Deemed to be University, Established Under Section 3 of UGC Act, 1956)

(Accredited with A+ Grade by NAAC in the second cycle)

Eachanari (Post), Coimbatore – 641 021.

Phone No. 0422-2980011-15

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Regulations
for
Ph.D., Full Time (FT) / Part Time (PT)

As per the UGC (Minimum Standards and Procedures for Award of Ph.D., Degree)
Regulations, 2022

The Regulation will be effective from 7th November, 2022
(The research scholars admitted from January, 2023 onwards will be governed by this regulation)



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Regulations for Ph.D., Full Time (FT) / Part Time (PT)

1.0 Preamble

The Degree of Doctor of Philosophy (Ph.D.,) is awarded to a candidate who has submitted a thesis on the basis of original and independent research work done in any particular discipline or involving more than one discipline (inter-disciplinary), that make a contribution to the advancement of knowledge, which is approved by Board of Examiners as per the requirement.

2.0 Eligibility Criteria for admission to the Ph.D., Programme:

- 2.1 A 1-year/2-semester master's degree programme after a 4-year/8-semester bachelor's degree programme or a 2-year/4-semester master's degree programme after a 3-year bachelor's degree programme or qualifications declared equivalent to the master's degree by the corresponding statutory regulatory body, with at least 55% marks in aggregate or its equivalent grade in a point scale wherever grading system is followed

or equivalent qualification from a foreign educational institution accredited by an assessment and accreditation agency which is approved, recognized or authorized by an authority, established or incorporated under a law in its home country or any other statutory authority in that country to assess, accredit or assure quality and standards of the educational institution.

- 2.2 Candidate seeking admission after a 4-year/8-semester bachelor's degree programme should have a minimum of 75% marks in aggregate or its equivalent grade on a point scale wherever the grading system is followed. A relaxation of 5% marks or its equivalent grade may be allowed for those belonging to SC/ST/OBC (non-creamy layer)/Differently-Abled, Economically Weaker Section (EWS) and other categories of candidates as per the decision of the Commission from time to time.

Candidates who have completed the M.Phil. programme with at least 55% marks in aggregate or its equivalent grade in a point scale wherever grading system is followed or equivalent qualification from a foreign educational institution accredited by an assessment and accreditation agency which is approved, recognized or authorized by an authority, established or incorporated under a law in its home country or any other statutory authority in that country to assess, accredit or assure quality and standards of educational institutions, shall be eligible for admission to the Ph.D. programme. A relaxation of 5% marks or its equivalent grade may be allowed for those belonging to SC/ST/OBC (non-creamy layer)/Differently-Abled, Economically Weaker Section (EWS) and other categories of candidates as per the decision of the Commission from time to time

- 2.3 The Part Time research scholars have to report to the guide once in a month till they submit their Synopsis/Thesis.

3.0 Admission

Admission for Ph.D. programme shall be made on half yearly basis viz. January and July. The admission shall be based on the criteria notified by the Institution, keeping in view the guidelines/norms issued by the UGC and other statutory bodies concerned and taking into account the reservation policy of the Central / State Government and the number of vacancies available with each recognized guide of the Department concerned.

4.0 Selection Procedure

4.1 The candidates will be selected for admission to Ph.D., programme based on the performance in the **Entrance Test** and **Interview** conducted to assess the aptitude of the candidate for research, subject to satisfying the eligibility conditions.

The candidates who have qualify for fellowship/scholarship in UGC-NET//UGC-CSIRNET/GATE/CEED and similar National level tests based on an interview. And/or The candidates who have qualified from “Karpagam Academy of Higher Education entrance test” conducted at the level of our Institution. The Entrance Test syllabus shall consist of 50% of research methodology, and 50% shall be subject-specific.

Students who have secured 50% marks in the entrance test are eligible to be called for the interview. A relaxation of 5 % marks will be allowed in the entrance examination for the candidates belonging to SC/ST/OBC/differently-abled category, Economically Weaker Section (EWS), and other categories of candidates as per the decision of the Commission from time to time.

KAHE may decide the number of eligible students to be called for an interview based on the number of Ph.D. seats available.

- 4.2 The candidates selected for admission to the Ph.D., programme shall be required to submit attested copy of the certificates with 3 passport size recent Photo. The original certificates brought during interview will be returned immediately after verification.
- 4.3 Provided that for selection of candidates, a weightage of 70% to the entrance test and 30% to the performance in the interview shall be given.
- 4.4 The Karpagam Academy of Higher Education shall maintain the list of all the Ph.D., registered students on its website year-wise. The list shall include the name of the registered candidate, topic of his/her research, name of his/her supervisor / co-supervisor and date of enrolment /registration.
- 4.5 Admission of International students in Ph.D., programme is also based on Entrance test and Interview keeping in view the guidelines/norms in this regard issued by statutory/regulatory bodies concerned from time to time.

5.0 Eligible Degrees for Ph.D., Registration:

Master's degree / M.Phil., Degree in the relevant disciplines or 4-Year Bachelor's Degree in the relevant disciplines, approved by Central and State approval authority.

6.0 Duration of the Programme

Ph.D. Programme shall be for a minimum duration of three (3) years, including coursework, and a maximum duration of six (6) years from the date of admission to the Ph.D. programme.

A maximum of an additional two (2) years can be given through a process of re-registration as per the Statute/Ordinance of the Higher Educational Institution concerned; provided, however, that the total period for completion of a Ph.D. programme should not exceed eight (8) years from the date of admission in the Ph.D. programme.

Provided further that, female Ph.D. scholars and Persons with Disabilities (having more than 40% disability) may be allowed an additional relaxation of two (2) years; however, the total period for completion of a Ph.D. programme in such cases should not exceed ten (10) years from the date of admission in the Ph.D. programme.

Female Ph.D. Scholars may be provided Maternity Leave/Child Care Leave for up to 240 days in the entire duration of the Ph.D. programme.

Ph.D. programmes through part-time mode will be permitted, provided all the conditions stipulated in these Regulations are fulfilled.

The Higher Educational Institution concerned shall obtain a “No Objection Certificate” through the candidate for a part-time Ph.D. programme from the appropriate authority in the organization where the candidate is employed, clearly stating that:

- i. The candidate is permitted to pursue studies on a part-time basis.
- ii. His/her official duties permit him/her to devote sufficient time for research.
- iii. If required, he/she will be relieved from the duty to complete the course work.

7.0 Conversion from Full Time Ph.D. to Part Time Ph.D. and Vice-versa

- i. Conversion from Full time to Part time or vice versa is permitted on recommendation of the Research Supervisor
- ii. A conversion fee of ₹2000 has to be paid towards the conversion.

8.0 Modification of Topic

Modification of topic of research by the candidate is permitted. A fee of ₹ 2000 has to be paid for a change of topic of research. The time limit fixed for modification of topic of research in Ph.D., programme is up to final DCM prior to submission of synopsis.

9.0 Language

The Ph.D., Part I course work and Part II synopsis / thesis must be written in English for subjects other than languages.

10.0 Eligibility criteria to be a Research Supervisor:

Permanent faculty members working as Professor/Associate Professor with a Ph.D., and at least five research publications in peer-reviewed or refereed journals and permanent faculty members working as Assistant Professors with a Ph.D., and at least three research publications in peer-reviewed or refereed journals may be recognized as a Research Supervisor in the university where the faculty member is employed. Such recognized

research supervisors cannot supervise research scholars in other institutions, where they can only act as co-supervisors. Ph.D. awarded by a university under the supervision of a faculty member who is not an employee of the university would be in violation of these Regulations.

For Ph.D. scholars working in Central government/ State government research institutions whose degrees are given by Higher Educational Institutions, the scientists in such research institutions who are equivalent to Professor/Associate Professor/Assistant Professor can be recognized as supervisors if they fulfill the above requirements.

Provided that in areas/disciplines where there is no, or only a limited number of peer-reviewed or refereed journals, the Higher Educational Institution may relax the above condition for recognition of a person as Research Supervisor with reasons recorded in writing.

Adjunct Faculty members shall not act as Research Supervisors and can only act as co-supervisors.

However, Co-Supervisor can be allowed in inter-disciplinary areas from other departments of the same institute or from other institutions with the approval of the Doctoral Committee.

In case of interdisciplinary/multidisciplinary research work, if required, a Co-Supervisor from outside the University may be appointed.

A Research Supervisor who is a Professor, at any given point of time, can guide a maximum of 8 Ph.D., scholars only. An Associate Professor upto a maximum of 6 Ph.D., scholars and an Assistant Professor upto a maximum of 4 Ph.D., scholars.

In case of relocation of a female Ph.D. scholar due to marriage or otherwise, the research data shall be allowed to be transferred to the Higher Educational Institution to which the scholar intends to relocate, provided all the other conditions in these Regulations are followed, and the research work does not pertain to a project sanctioned to the parent Institution/Supervisor by any funding agency. Such scholar shall, however, give due credit to the parent institution and the supervisor for the part of research already undertaken.

Faculty members with less than three years of service before superannuation shall not be allowed to take new research scholars under their supervision. However, such faculty members can continue to supervise Ph.D. Research scholars who are already registered until superannuation and as a co-supervisor after superannuation, but not after attaining the age of 70 years.

11.0 Admission of International students in Ph.D., programme.

Each supervisor can guide up to two international research scholars on a supernumerary basis over and above the permitted number of Ph.D. scholars as specified.

12.0 Change of Research Supervisor

Transfer of Ph.D., scholars from one Research supervisor to another Research supervisor shall be permitted under the following conditions:

- i. If the Research Supervisor resigns and leaves the institution.
- ii. If the Research Supervisor expresses unwillingness to guide the candidate
- iii. If the Research Scholar expresses his/her unwillingness to work under a specific Research Supervisor.

- iv. By mutual consent.
- v. A fee of ₹2000 has to be paid towards the change of Research Supervisor, if the change is requested by the Research scholar.

13.0 Doctoral Committee (Research Advisory Committee as per UGC)

There shall be a Doctoral Committee (Research Advisory Committee as per UGC) for every Ph.D., scholar to monitor the progress of his/her research work. The Research Supervisors in consultation with Head of the Department shall furnish a panel of minimum five experts with doctoral qualification in their respective research field, from the other Academic Institutions / National Laboratories and established research laboratories. From this list one will be nominated as a external expert for each Ph.D research scholar. The Research Supervisor of the research scholar shall be the convener of the Doctoral Committee. The Co- Supervisor, if applicable, shall also be a member. In the absence of Research Supervisor, the Co-Supervisor can be the convenor of the Doctoral Committee. **The Doctoral Committee Meeting shall be conducted in presence of Ph.D Research Supervisor and the nominated external expert.** If a Doctoral Committee member is away from his/her place of work for a longer period, the Research Supervisor shall request for an alternate member from the Panel of experts submitted.

13.1 Functions of Doctoral Committee (Research Advisory Committee as per UGC):

The Research Supervisor of the Ph.D. scholar concerned shall be the Convener of this committee, and this committee shall have the following responsibilities:

- i. To review the research proposal and finalize the topic of research.
- ii. To guide the Ph.D. scholar in developing the study design and methodology of research and identify the course(s) that he/she may have to do.
- iii. To periodically review and assist in the progress of the research work of the Ph.D. scholar.

Each semester, a Ph.D. scholar shall appear before the Doctoral Committee in the Karpagam Academy of Higher Education campus to make a presentation and submit a brief report on the progress of his/her work for evaluation and further guidance. The Doctoral Committee shall submit its recommendations along with a copy of Ph.D. scholar's progress report to The Registrar, Karpagam Academy of Higher Education. A copy of such recommendations shall also be provided to the Ph.D. scholar.

The first Doctoral Committee meeting of a scholar which shall be conducted within one month from the date of registration shall decide the topic of research, work plan and the course work to be undertaken by the scholar. The Doctoral Committee shall also submit a Panel of three Experts from recognized institutes (other than Parent Institution) along with their CV for question paper setting and evaluation relating to Part –I Examinations.

The scholar shall be permitted for pre-submission presentation after recommended by the Final Doctoral Committee Meeting. The synopsis to be submitted only after the successful completion of pre-submission presentation. The time gap between the date of pre-submission and the date of submission of synopsis shall be atleast one month.

14.0 Submission of Progress Report:

Progress report is to be submitted every half-year period during the entire duration of Ph.D., programme

15.0 Course of Study:

The course of study of Ph.D., programme consists of Part I Course work and Part II Research work.

15.1 Part I: Course Work

Course work comprises the following three theory papers.

Paper I : Research Methodology and Pedagogy

Paper II : Research and Publication Ethics

Paper III : Special Paper (Research Area)

15.2 The course work shall be treated as a prerequisite for Ph.D., preparation. The credit assigned to the Ph.D. course work shall be 12 credits.

Paper I on Research Methodology and Pedagogy a minimum of four credits shall be assigned which could cover areas such as quantitative methods, computer applications, research ethics and review of published research in the relevant field, training, field work, etc.

Paper II Research and Publication Ethics and Paper III Special Paper carry 4 credits each. The total number of special papers in each discipline shall be 10. The candidate has to select one among the 10, in consultation with the Research Supervisor.

The Credit requirement for the Ph.D. coursework is a minimum of 12 credits, including a "Research and Publication Ethics" course as notified by UGC vide D.O. No. F.1- 1/2018(Journal/CARE) in 2019 and a research methodology course. The Research Advisory Committee can also recommend UGC recognized online courses as part of the credit requirements for the Ph.D. programme.

Ph.D. scholars, irrespective of discipline, shall be trained in teaching / education / pedagogy / writing related to their chosen Ph.D. subject during their doctoral period. Ph.D. scholars will also be assigned 4-6 hours per week of teaching/research assistantship for conducting tutorial or laboratory work and evaluations.

The Full-Time scholar is required to write all the three courses within six months and for Part time the research scholar has to write within one year, from the date of registration, but has to pass all the courses within a maximum of one and half years (three attempts). If the scholar fails to complete course work within one and half years (three attempts) his/her registration will stand automatically cancelled.

15.3 A Ph.D., scholar has to obtain a minimum of 55% of marks or its equivalent grade in the UGC 10 point scale in the course work in order to be eligible to continue the programme and submit the dissertation/thesis.

The pattern of question paper for course work for Ph.D., programme is given below.

Pattern of Question Paper (Common for FASCM /FoE/FoP)(For Course Work in Ph.D, Programme)

Part – A (5 X 7 = 35 marks - Answer any FIVE out of Seven)

Part – B (5 X 10 = 50 marks - Answer any FIVE out of Ten)

Part – C (1 X 15 = 15 marks - Compulsory Question)

15.4. Part II: Research Work

Upon satisfactory completion of course work and obtaining the marks/grade prescribed, the Ph.D., scholar shall be required to undertake research work. The Ph.D., candidates shall select an original research topic within the chosen area of research specialization. At the end of the minimum period of duration the candidates are eligible to submit the thesis.

16.0 Publication of Articles

Before sending the articles for publication, the article/manuscript is to be submitted to Scrutiny Committee for language and technical scrutiny with a fee of ₹450 per article. After publication, the candidate has to submit the copy of his/her article to the members of the Doctoral Committee.

16.1 Publication of a minimum of two articles is mandatory for submission of a thesis.

16.2 Condition for submission of thesis:

It is Mandatory for the Ph.D., Scholars to publish two research articles for submission of his/her of Ph.D., thesis as mentioned below:

- (i) Engineering, Science and Pharmacy: One article should be in SCI / SCIE / Web of Science and another one in Scopus
- (ii) Commerce, Management, Arts: One in Scopus and another one in Peer reviewed / UGC care listed Journals
- (iii) To attend at-least two timeline presentations and two annual research congress

17.0 Pre-Submission Presentation

The Pre-submission will be permitted only when the research scholar has either published his/her article or it has been accepted for publication provided the date of publication of the article is given in the acceptance letter for publication in an approved Journal. All the published papers by the scholar shall have name of the Research Supervisor and Karpagam Academy of Higher Education. Papers without the name of the Research Supervisor and Karpagam Academy of Higher Education will not be accounted. The Research Scholar should be one among the first two authors in the paper.

Prior to submission of the synopsis, the scholar shall make Pre-submission presentation and it is open to all faculty members and research students, and their feedback and comments if any may suitably be incorporated in the draft synopsis and thesis in consultation with Doctoral Committee. A notification may be issued to all the Departments regarding the same. The report in the prescribed format shall be forwarded

by the Research Supervisor to the Research section on the same day along with the certificate of bonafide research work done.

18.0. Plagiarism (Turnitin Software):

18.1 The research scholar has to submit his/her synopsis and thesis for checking plagiarism on payment of prescribed fee. If the percentage of plagiarism is more than 10% the thesis will not be accepted for submission. Same is the case for manuscripts and synopsis.

18.2 Further while submitting for evaluation, the thesis shall have an undertaking from the research scholar and a certificate from the Research Supervisor attesting the originality of the work, vouching that the plagiarism is less than 10% and that the work has not been submitted for the award of any other degree/diploma of the same Institution where the work was carried out, or any other Institution.

18.3 In any case if scholars have committed an act of plagiarism with more than 10%, his/her Thesis / degree shall be withdrawn and his / her registration shall be cancelled and also, he / she shall be debarred to register for any other programme in the Karpagam Academy of Higher Education. Appropriate legal action shall also be initiated.

18.4 Research Supervisor ship of the Supervisor will also be withdrawn.

19.0. Submission of synopsis

The research scholar who has successfully completed the course work alone is eligible to submit the synopsis. He/she shall be permitted to submit the synopsis during the last quarter of the eligible minimum period on the recommendation of the Final Doctoral Committee Meeting and after Pre-submission Presentation. The research scholar shall submit five copies of synopsis with a soft copy along with prescribed application through the Research Supervisor to the Controller of Examinations. Synopsis shall be accepted only when the Panel of Examiners is submitted to Controller of Examinations. In case the panel is exhausted, the Vice Chancellor can either call for a fresh panel of examiners from the Research Supervisor or nominate examiner(s).

19.1 Submission of thesis

Five copies of thesis with flexible cover along with soft copy (PDF format) shall be prepared in accordance with the format and specifications prescribed. Thesis shall be submitted together with the prescribed application form along with the prescribed fee, within three months from the date of submission of the synopsis.

All the Ph.D., scholars are encouraged to submit their thesis within the stipulated time period. However, for those candidates who have submitted synopsis but unable to submit the thesis within the stipulated period, an extension of three months will be allowed on payment of ₹ 2000/- as extension fee. If the candidate fails to submit within the extension period of three months, he / she has to pay full year fee for all the years till he / she submits the thesis.

20.0 Evaluation of the Thesis

- 20.1 The Ph.D. thesis submitted by a Ph.D. scholar shall be evaluated by his/her Research Supervisor and atleast two external examiners who are experts in the field. Such examiner(s) should be academics with a good record of scholarly publications in the field. Wherever possible, one of the external examiners should be chosen from outside India. The viva-voce board shall consist of the Research Supervisor and at least one of the two external examiners and may be conducted offline.
- 20.2 The viva-voce of the Ph.D. scholar to defend the thesis shall be conducted if both the external examiners recommend acceptance of the thesis after incorporating any corrections suggested by them. If one of the external examiners recommends rejection, the Institution concerned shall send the thesis to an alternate external examiner from the approved panel of examiners, and the viva-voce examination shall be held only if the alternate examiner recommends acceptance of the thesis. If the alternate examiner does not recommend acceptance of the thesis, the thesis shall be rejected, and the Ph.D. scholar shall be declared ineligible for the award of a Ph.D.
- 20.3 Each member of the Board shall adjudicate the thesis and shall submit a detailed report as given in the prescribed form on the merits and demerits of the thesis and finally explicitly indicate whether the thesis is Recommended or Recommended for Resubmission or Not Recommended within a period of 6 months.
- 20.4 If the evaluation report from the examiner is not received within 6 Months, another examiner will be appointed from the panel of examiners.
- 20.5 As soon as the reports of evaluation are received from the examiners by Controller of Examinations, they shall be sent to the Research Supervisor (Convener) for consolidation of the reports.
- 20.6 If the examiners insist on corrections to be made in the thesis, the same shall be made before appearing for the Public viva-voce examination, along with a certificate as given below from the Research Supervisor that the corrections have been satisfactorily carried out.

A Ph.D. scholar shall submit the thesis for evaluation, along with (a) an undertaking from the Ph.D. scholar that there is no plagiarism and (b) a certificate from the Research Supervisor attesting to the originality of the thesis and that the thesis has not been submitted for the award of any other degree/diploma to any other Higher Educational Institution.

<p>CERTIFICATE</p> <p>This is to certify that all corrections, modifications suggested by the examiners of the thesis entitled, “.....”submitted by Mr./Ms have been incorporated and resubmitted. The thesis may be accepted.</p> <p style="text-align: right;">Signature of the Research Supervisor</p>

- 20.7 In case of a thesis, which has not been specifically ‘recommended’ or ‘not recommended’ but revision and resubmission is suggested, the thesis shall be

revised and the thesis duly certified by the Research Supervisor be sent to the same examiner who has suggested the revision for obtaining the recommendation.

- 20.8 The time-limit to resubmit the revised thesis, as per the suggestions for revision and resubmission of thesis by the examiner(s) shall not exceed twelve full months. A candidate shall not ordinarily be permitted to submit the thesis for the degree or to take the public viva-voce examination on more than two occasions.
- 20.9 The viva-voce shall be conducted by the Research Supervisor and atleast by one of the two external examiners, on the critiques given in the evaluation report. It is open to DC Members, all faculty members, research scholars and other interested experts/researchers.
- 20.10 The first notification for Ph.D., viva-voce shall be issued only after the Research Supervisor of the candidate, receives the approval from the authorities to issue the first notice.
- 20.11 15 clear days' notice may be required to be given for issue of the second notification from the date of the first notification. Similarly, 15 clear days are required to be given for conducting the public viva-voce from the date of issue of the second notification.
- 20.12 The Research Supervisor shall fix the date and time of the viva-voce in consultation with the External Examiner and Head of the Department concerned. After conducting the public viva-voce, the Research Supervisor shall convey to the Controller of Examination, the result of such examination endorsed by the External Examiner along with list of participants, recommending for the award of Ph.D.,
- 20.13 A candidate who is not successful in the Public viva-voce may be permitted to undergo the Public viva-voce second time, within a period of three months but not before one month after the first viva-voce.
- 20.14 The entire process of evaluating a Ph. D. thesis, including the declaration of the viva-voce result, within a period of six (6)months from the date of submission of the thesis.

21.0 Award of the Degree

A candidate who has successfully completed the public viva-voce shall be declared to have qualified for the award of Ph.D., degree of Karpagam Academy of Higher Education. Viva voce evaluation of the thesis shall be conducted offline. Prior to actual award of the degree, provisional certificate shall be issued after approval by the Board of Management.

Issuing a Provisional certificate:

Prior to the actual award of the Ph.D. degree, the degree- awarding Higher Educational Institution shall issue a provisional certificate to the effect that the Ph.D. is being awarded in accordance with the provisions of these Regulations.

Award of Ph.D. degrees:

Award of degrees to candidates registered for the Ph.D. programme on or after November,07, 2022 shall be governed by University Grants Commission (Minimum Standards and Procedures for Award of Ph.D. Degree) Regulations, 2022.

Depository with INFLIBNET:

Following the successful completion of the evaluation process and before the announcement of the award of the Ph.D. degree(s), the Karpagam Academy of Higher Education shall submit an electronic copy of the Ph.D. thesis to INFLIBNET, for hosting the same so as to make it accessible to all the Higher Educational Institutions and research institutions.

22.0. Cancellation of Registration

The registration of a research scholar shall stand cancelled if -

- The research scholar has not paid the prescribed fee within the stipulated time;
- The Full-Time candidate has not completed his course work within one and half years (three attempts) and Part-Time candidates within two years (three attempts)
- The progress report is not submitted consecutively or the progress reports are not satisfactory as decided by the Doctoral Committee;
- The maximum period stipulated for the programme exceeded; and
- The research scholar withdraws from the course voluntarily.

In all the above cases, the fees paid by the research scholar shall be forfeited. However, such candidates may be permitted for fresh registration.

23.0 Publication of the thesis

The candidate may publish his/her thesis on the recommendation of the Research Supervisor in the format as given below and after getting permission from the Karpagam Academy of Higher Education. At least ten copies of the published work should be given to the Karpagam Academy of Higher Education at free of cost Permission for publication of the thesis should be obtained within FIVE years of the award of the degree. All the publications arising out of the research work shall have the name of Karpagam Academy of Higher Education. Due credit shall be given to the Institution and Research Supervisor if any patent is filed out of the work undertaken during the period of research.

[CERTIFICATE]

This is to certify that the thesis entitled, “.....” submitted by Mr. / Ms. does not contain any objectionable material and is a record of original and independent research work done by him/her. Hence the thesis is fit for publication, if the candidate so desires.

Signature of the Research Supervisor

24.0 Conferment of the Degree

Candidates who qualify for the Ph.D., degree shall be awarded the degree in the discipline in which he/she has registered.

25. Preparation and Submission of Synopsis and Thesis

25.1 Preparation of Synopsis

Synopsis should outline the research problem, the methodology adopted and the summary of the findings. The synopsis should not exceed 10 pages from the first page to the last page including the List of Publications. The sequence in which the Synopsis should be arranged is as follows:

- i. Cover Page and Title page (as shown in the Annexure I) (Page No.17& Page No.18)
- ii. Text divided into suitable Headings (numbered consecutively)
- iii. References
- iv. List of Publications (those published / accepted for publication in Journals and papers presented in Conferences / Symposia)
- v. Standard A4 size (297mm x 210mm) paper shall be used for preparing the copies.

Top edge: 30 mm

Bottom edge: 30 mm

Left side: 35 mm

Right side : 25 mm

The Synopsis should be prepared on good quality white bond paper preferably not lower than 80 gsm. One and a half spacing should be used for typing the general text. The general text shall be typed in Font Style Times New Roman and Font Size 12. All page numbers (Arabic numbers) should be typed without punctuation on the upper right hand corner. Synopsis should be bound using flexible cover of thick white art paper. The cover should be printed in black letters and the text for printing should be identical to what has been prescribed for the title page. References, if any cited in the text of the Synopsis, should be listed at the end of the Synopsis under the heading "REFERENCES" as per the following format:

References

I. References cited from published research papers should be in the following format:

a. Single author

Wattenberg, L.W.,2008.Chemoprevention of cancer. *Cancer Research.*, 45:1-8.

b. Two authors

Defendi, V. and B. Pearson, 2012. Quantitative estimation of succinic dehydrogenase activity in a single microscopic tissue section. *Journal, Histochemistry, Cytochemistry*, 3: 61-64.

c. More than two authors

Kristan K., M. Kotnik, M. Oblak and U.J. Urleb, 2009. New high throughput fluorimetric assay for discovering inhibitors of UDP-N-acetylmuramyl-l-alanine: d-glutamate (MurD)lLigase.*Biomol. Screen*, 14: 412-418.

II. References cited from a published book

Vuković-Gačić, B. and D.Simić, 2010. Identification of natural antimutagens with modulating effects on DNA repair, In: *Antimutagenesis and anti-carcinogenesis mechanisms III* (Eds. G.Bronzzeti, H. Hayatsu, S. De Flora, M.D. Waters and D.M. Shankel), Plenum Press, New York,269-277.

III. References cited from approved Thesis / Dissertation

Ratnakar, P., 2012. Biochemical studies of *Allium sativum* Linn. (Garlic). Ph.D.,Thesis, DelhiUniversity. P. 87.

25.2 Preparation of Thesis

A. General

In general, the Thesis shall be presented, in an organized and scholarly fashion, the original research work of the research scholar.

B. Size of Thesis

The size of the Thesis should not exceed 250 pages of typed matter reckoned from the first page of Chapter 1 to the last page of the Conclusion Chapter exclusive of tables, photographs, figures, references & appendices.

C. Sequence of the Contents of the Thesis

The sequence in which the Thesis material should be arranged is as follows:

- i. Cover Page and Title page (as shown in Annexure II Page 19& Page 20)
- ii. Bonafide Certificate (as shown in Annexure III Page 21)
- iii. Declaration and Certificate from the Research Supervisor and co-Research Supervisor (if any)(as shown in Annexure IV Page 22& V Page 23)
- iv. Acknowledgement
- v. Table of Contents
- vi. List of Symbols and Abbreviations.
- vii. Abstract
- viii. Chapters
- ix. References
- x. Appendices
- xi. List of Publications- only title of the paper with ISSN and other details.

D. Page Dimensions and Margin

The dimensions of the final bound Thesis report (5 copies) should be 290 mm x 205mm. Page margins: Tables and Figures should conform to the margin specifications. Large sized figures may be as it is or otherwise reduced to the appropriate size before insertion.

E. Bonafide Certificate

The Bonafide Certificate shall be typed in **double line spacing** using Font Style Times New Roman and Font Size 12 as per the format shown in Annexure III. The certificate shall carry the Supervisor's signature and shall be followed by the Supervisor's name, academic designation, department and full address of the institution where the Research Supervisor has guided the research scholar.

F. Acknowledgement

It should be brief and should not exceed two pages when typed in double spacing. The scholar's signature shall be made at the bottom right end above his / her name typed in capitals.

G. Table of Contents

The Table of contents should list all captions from items v to xi following it. The title page, Bonafide Certificate and Declaration Certificate will not find a place among the items listed in the Table of Contents but the page numbers must be typed in lower case Roman letters in all the pages (excepting No. i on the Title page). One and a half spacing should be adopted for typing the matter under Table of Contents.

H. List of Symbols and Abbreviations

One and a half spacing should be adopted for typing the matter under this head. Standard symbols, abbreviations, etc. should be used. The list should be arranged alphabetically with respect to the contents on the right side.

I. Abstract

Abstract should be an essay type of narration not exceeding four pages outlining the research problem, methodology used for solving it and a summary of the findings. This shall be typed in double line spacing using Font Style Times New Roman and Font Size 12.

J. Chapters

The chapters may be broadly divided into Introduction, Review of Literature, Material and Methods, Results, Discussion, Summary and References.

- a. Each chapter should be given an appropriate title.
- b. Tables and Figures in a chapter should be placed in the immediate vicinity of the reference where they are cited.
- c. Footnotes should be used sparingly. They should be typed single space and placed directly underneath in the very same page which refers to the material they annotate.

K. List of References

The listing of references cited in the text should be typed in single line spacing starting from 4lines spaces below the heading "REFERENCES". The reference material should be listed in the alphabetical order of the first author of each reference. The name of the author / authors should be immediately followed by the other details and year. The cited references in the Text should be listed "REFERENCES" as per the specified format:

L. Appendices

Appendices are provided to give supplementary information's relevant to the research work done by the candidate.

M. List of Publications

Reprints / Photostat copies of research papers already published / accepted for publication in Journals are to be attached in chronological orders and these pages need not be numbered. The heading "List of Publications" alone must find a place in the Table of Contents without page numbers for this item only.

N. Tables and Figures

"Table" means tabulated numerical data in the body of the Thesis as well as in the appendices. All other non-verbal material used in the body of the Thesis and appendices such as charts, graphs, maps, photographs and diagrams may be designated as Figures.

- a. A Table or Figure including caption should be accommodated within the prescribed margin limits and appear on the page following the page where their first reference is made.
- b. Tables and Figures on half page or less in length may appear on the same page along with the text. However, they should be separated from the text both above and below by triple spacing.

- c. All Tables and Figures should be prepared on the same paper or material used for the preparation of the rest of the Thesis.
- d. Two or more small Tables or Figures may be grouped, if necessary, in a single page.
- e. Wherever possible, the photograph(s) shall be reproduced on a full sheet of photographic paper or colour xerox.
- f. More than one photograph can be included in a page.
- g. Samples of Fabric, Leather, etc., if absolutely necessary may be attached evenly in a page and fixed/pasted suitably and should be treated as Figures.

O. Typing Instructions

General

This section includes additional information for final typing of the Thesis. The impressions on the typed / photo-stated / printed copies should be black in colour.

A sub-heading at the bottom of a page must have at least two full lines below it or else it should be carried over to the next page.

The last word of any page should not be split using a hyphen. One and a half spacing should be used for typing the general text. The general text shall be typed in Font Style Times New Roman and Font Size 12. Single spacing should be used for typing:

- (i) Long Tables
- (ii) Long quotations
- (iii) Foot notes
- (iv) Multiline captions
- (v) References

All quotations exceeding one line should be typed in an indented space – the indentation being 15 mm from either side of the margin.

P. Page Numbering

All page numbers (small case Roman numerals or Arabic numbers) should be typed without punctuation on the **upper right hand corner** 20 mm from the top with the last digit of the number in line with the right hand margin. The preliminary pages of the Thesis (such as Title page, Bonafide Certificate, Declaration and Certificate, Table of Contents, Acknowledgement, List of Symbols and Abbreviations and Abstracts) should be numbered in lower case Roman numerals. The Title page will be numbered as (i) but this should not be typed on the page. The page immediately following the Title page shall be numbered as (ii) and it should appear **at the top right hand corner** as already specified. Pages of main text, starting with Chapter 1 should be consecutively numbered using Arabic numerals.

Q. Numbering of Chapters, Divisions and Sub-Divisions

The numbering of chapters, divisions and sub-divisions should be done using Arabic numerals only and further decimal notation should be used for numbering the divisions and sub-divisions within a chapter. For example, sub-division 4 under division 3 belonging to chapter 2 should be numbered as 2.3.4. The caption for the sub-division should immediately follow the number assigned to it.

Every chapter beginning with the first chapter should be serially numbered using Arabic numerals. Appendices, included if any, should also be numbered in an identical manner starting with Appendix 1.

R. Numbering of Tables and Figures

Tables and Figures appearing anywhere in the Thesis should bear appropriate numbers. The rule for assigning such numbers is illustrated by an example. Thus, if a Figure in Chapter 3, happens to be the fourth then assign 3.4 to that Figure. Identical rules apply for Tables except that the word Figure is replaced by the word Table. If Figures (or Tables) appear in appendices, then Figure 3 in Appendix 2 will be designated as Figure A 2.3. If a table is to be continued into the next page this may be done, but no line should be drawn underneath an unfinished Table. The top line of the Table continued into the next page should, for example read Table 2.1 (continued) placed centrally and underlined.

S. Numbering of Equations

Equations appearing in each Chapter or Appendix should be numbered serially, the numbering should commence afresh for each Chapter or Appendix. Thus, for example, an equation appearing in Chapter 3, if it happens to be the eighth equation in that Chapter should be numbered as (3.8) thus (3.8) While referring to this equation in the body of the Thesis it should be referred to as Equation (3.8).

T. Binding Specifications

Thesis should be bound with **black calico cloth** and using flexible cover of thick white art paper. The cover should be printed in black letters and the text for printing should be identical to what has been prescribed for the title page.

Soft copy of the Thesis (PDF format) written in CD (2 Nos.) should be submitted for Karpagam Academy of Higher Education archives.

Revision of Regulation:

The Karpagam Academy of Higher Education may from time to time, amend the Regulations based on UGC Regulations if found necessary.

ANNEXURE I

Specimen of Cover Page and Title Page

ANTIOXIDANT ACTIVITY OF INDIAN MEDICINAL PLANTS FROM WESTERN GHATS

Font Size 18><1.5 line spacing>

SYNOPSIS

Submitted by

<Italic>

RAGHAVENDRA S A

in partial fulfilment of the requirements for the award of the degree of

<Italic><1.5 line spacing>

DOCTOR OF PHILOSOPHY

IN

BIOTECHNOLOGY



DEPARTMENT OF BIOTECHNOLOGY

Karpagam Academy of Higher Education

(Deemed to be University) (Established Under Section 3 of UGC Act, 1956)

(Accredited with A+ Grade by NAAC in the Second Cycle)

Pollachi Main Road, Eachanari Post, Coimbatore – 641 021, Tamil Nadu, India

<1.5 line spacing>

December, 2022

**ANTIOXIDANT ACTIVITY OF INDIAN MEDICINAL PLANTS FROM
WESTERN GHATS**

SYNOPSIS

Submitted by

RAGHAVENDRA S A

in partial fulfilment of the requirements for the

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Pollachi Main Road, Eachanari Post, Coimbatore – 641 021, Tamil Nadu, India

December, 2022

ANNEXURE II

Specimen of Cover Page and Title Page

**ANTIOXIDANT ACTIVITY OF INDIAN MEDICINAL PLANTS FROM WESTERN
GHATS**

<1.5 line spacing>

THESIS

Submitted by

<Italic>

RAGHAVENDRA S A

in partial fulfilment of the requirements for the award of the degree of

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December, 2022

ANNEXURE IV

Specimen of Declaration

DECLARATION

I _____ hereby declare that the thesis entitled
“ _____ ”
submitted to the Karpagam Academy of Higher Education, in partial fulfillment of the
requirements for the award of the Degree of Doctor of Philosophy in
_____ is a record of bonafide and
independent research work done by me during the period from ____/____/____ to ____-
____/____/____ under the supervision and guidance of
Dr. _____, Department of
_____ at Karpagam Academy of Higher Education, and it has not
formed the basis for the award of any Degree / Diploma / Associate ship / Fellowship or other
similar title to any candidate in Karpagam Academy of Higher Education so far.

Signature of the Research Scholar

ANNEXURE V

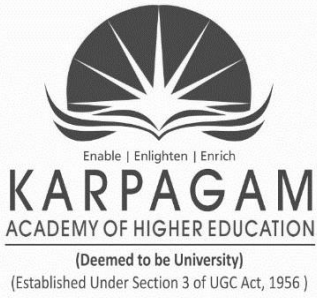
Specimen of Certificate

CERTIFICATE

This is to certify that the thesis entitled “_____” submitted to the Karpagam Academy of Higher Education, in partial fulfillment of the requirements for the award of the Degree of Doctor of Philosophy in _____ is a record of bonafide research work done by Mr. / Ms. _____ during the period from ____/____/____ to ____/____/____ of his / her study in the Department of _____ at Karpagam Academy of Higher Education, under my supervision and guidance and the thesis has not formed the basis for the award of any Degree / Diploma / Associate ship / Fellowship or other similar title to any candidate of Karpagam Academy of Higher Education so far.

**Countersigned
Head of the Department**

Signature of the Research Supervisor



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Phone: 0422 - 2980011- 14 | Email : info@kahedu.edu.in

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FORMAT I

Progress Report of Research Scholar

(To be submitted once in six months)

1. Programme : Ph.D., FT/PT
2. Subject :
3. Name & Regn.No. of the Research scholar:
4. Title of Ph.D., Research work :
5. Report No./Month/Year :

No.	Month	Year

6. Brief report about the work carried

out by the Research scholar :

- a. Article/s published _____ No's (Attach copies)
- b. Seminars/Conferences attended _____ (Attach certificate copies)
- c. Course work: Completed / Not Completed (Attach copy of Mark sheet)
- d. Course fee: Paid till _____(copies of receipts)

7. Research Guide's Comment :

Signature of the Research Scholar
(with Name & address)
Mobile No.:
E-mail id:

Signature of the Research Supervisor
(with Name & address)
Mobile No.:
E-mail id:



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FORMAT II

Request for Pre-submission presentation

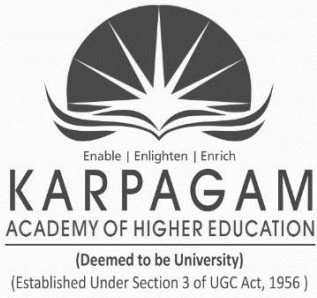
Check list

1. Name of the research scholar with Registration Number :
2. Name of the Research Supervisor :
Designation :
Department :
3. (a) Whether the minimum period completed? : Yes/No (Refer Registration Communication)
(b) If extension obtained, attach particulars :
4. Whether course fee paid for all the years : Yes/No (Attach No Dues Certificate)
5. Title of Ph.D. Research work :
6. Details of the Part I Course work :
(Enclose necessary documents)
7. Number of DC Meetings attended (Annually 2) :
8. Total No. of 6 months performance reports submitted : 6/8/10/12
9. (a) No. of Time-line presentations attended :
(b) No. of Annual Research Congress attended :
10. (a) Minimum No. of Research articles to be published : 2 as per KAHE regulation
(b) No of articles published by the scholar :
(Attach photocopies of reprints)
11. Whether submission of thesis is recommended
at the Final Doctoral Committee Meeting and
date of DCM :
12. Communication skill* : Good/Satisfactory/Need improvement
(To be judged based on the DC Meeting, (Tick whichever is applicable)
Time line Presentation and
Annual Research Congress)

**Signature of the Research Scholar
Supervisor**

Signature of the Research

*The Guide/HOD shall give specific remarks about the communication skill of the scholar. At the time of Pre-submission Presentation, if it is found that the Communication skill of the scholar is less than average, the period of submission may be extended for one more year and the scholar shall be advised to improve his/her Communication skill and may be presented again.



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FORMAT III

KAHE / RS / Rx /Ph.D./Dept./ Pre-Sub / xxxx / 2022/

Date: _____

Pre-Submission presentation of the Ph.D. research - Notification

I am by direction to inform you that a Pre-submission Presentation of the Ph.D., thesis is arranged for the candidate _____ working under the supervision of _____, Designation, Department of _____, Karpagam Academy of Higher Education, Coimbatore – 641 021.

Ph.D. Thesis Title: “ _____ ”.

All members of faculty, experts and all interested persons are requested to attend the aforesaid Pre-submission Presentation.

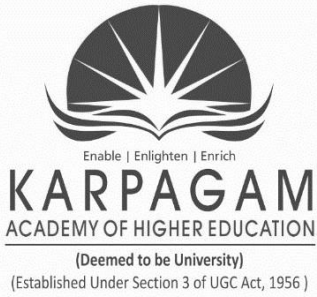
Venue :
Date :
Time :

Registrar

To

All Head of the Department of _____, requested to make necessary arrangement to conduct the programme.

Kindly circulate to Dean / Director / Research Supervisor / Research Scholars



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FORMAT - IV

DEPARTMENT OF _____
Pre-submission Presentation Report

- | | |
|---|---|
| | Date: |
| 1. Name of the Research Scholar | : |
| 2. Register Number of the Research Scholar | : |
| 3. Ph.D., programme in | : |
| 4. Department | : |
| 5. Name of the Research Supervisor | : |
| Designation | : |
| Department | : |
| 6. Presentation date & Venue | : |
| 7. No. of articles published by the scholar | : |
| 8. Number of members present in
the presentation (enclose the
attendance sheet) | : |
| 9. A report on the Question & Answer Session
(in the enclosed format) | : |
| 10. Comments of the Supervisor | : |
| (a) On the composition of the Thesis chapters | : Adequate/Needs to be revised. |
| (b) On the Communication skill*
(additional sheets may be used) | : Good/Satisfactory/Needs improvement
(Tick whichever is applicable) |
| 11. After the Pre-submission
Presentation whether the scholar
may be permitted to submit the Thesis | : Permitted/Extended for one year
(Strike out whichever is not applicable) |

Signature:

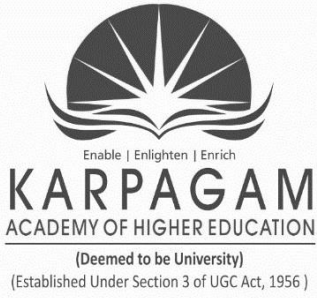
Research Scholar

Research Supervisor

HOD

Dean

*(At the time of Pre-submission Presentation, if it is found that the Communication skill of the scholar is less than average and needs improvement, the period of submission may be extended for one more year and the scholar shall be advised to improve his/her Communication skill and may be presented again.)



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FORMAT – IV Annexure

Pre-submission Presentation: A brief report on the Question & Answer Session

Answers should be brief and relevant to the question. If needed, additional sheets may be used

Topic of the Research work:

Q1.

Answer:

Q2.

Answer:

Q3.

Answer:

Q4.

Answer:

Q5:

Answer:

Signature of

Research Scholar

Research Supervisor



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FORMAT V

Pre-submission presentation

Certificate

Name & Reg. No. of the research scholar :

Subject :

Date of Presentation :

Certified that the above research scholar under my guidance has presented his/her research work during Pre-submission Presentation and his/her presentation is _____ . All the suggestions made by the participants are taken into consideration and important suggestions will be included in the thesis entitled:

“ _____ ”.

Place :

Date :

Signature of the Research Supervisor
(Name & Address)

Counter Signed:

HOD
(Name & Seal)



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FORMAT - VI

Submission of Ph.D., Thesis: Check List

1. Name of the research scholar with Registration Number :
2. Name of the Research Supervisor :
Designation :
Department :
3. (a) Whether the minimum period completed? : Yes/No (Refer Registration Communication)
4. (b) If extension obtained, attach particulars :
5. Whether course fee paid for all the years : Yes/No (Attach No Dues Certificate)
6. Title of Ph.D. Research work :
7. Details of the Part I Course work :
8. (Enclose necessary documents)
9. Number of DC Meetings attended (Annually 2) :
10. Total No. of 6 months performance reports submitted : 6/8/10/12
(a) No. of Time-line presentations attended :
(b) No. of Annual Research Congress attended :
11. (a) Minimum No. of Research articles to be published : 2 as per KAHE regulation
(b) No of articles published by the scholar :
12. Whether submission of thesis is recommended at the Final Doctoral Committee Meeting and date of DCM :
13. Date of Pre-Submission Presentation made :
(Attach a certificate from the supervisor duly countersigned by the HOD)
14. Probable date of submission of Synopsis :
15. Expected date of submission of Thesis :

Signature of:

Research Scholar

Research Supervisor

HOD

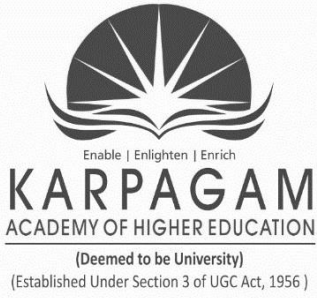
For Office of the Research use:

1	2	3	4	5	6	7	8	9	10	11	12	13	14
---	---	---	---	---	---	---	---	---	----	----	----	----	----

Recommendation for submission: **Recommended / Not recommended**

Addl. Director, Research

Director, Research



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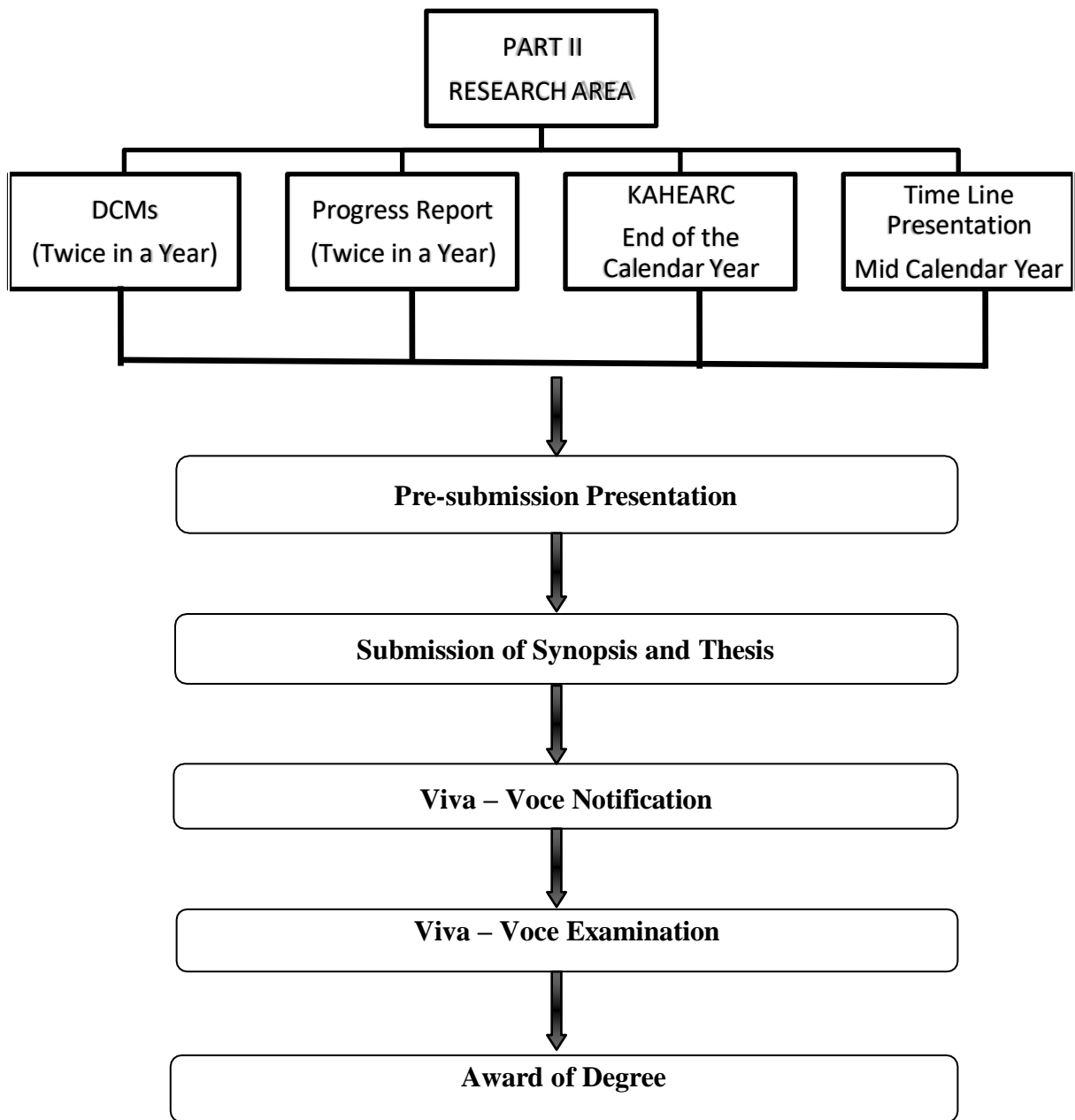
Certificate of Plagiarism

Certified that the thesis entitled “_____” for
the award of Ph.D., degree has undergone Plagiarism check through Turnitin software and the
level of plagiarism is _____.

Signature of the Research Scholar

Signature of the Research Supervisor

Professor in- charge for Plagiarism Test



Publications terminology

1. Impact Factor

The Impact Factor of an academic journal is a measure which reflects the average number of citations to recent articles published in that Journal.

- It is a measure of the relative importance of a journal in a given field.
- It was devised by **Mr. Eugene Garfield**, the founder of the **Institute for Scientific Information**.
- Impact factor is calculated yearly starting from 1975 for those journals which are indexed in the **Journal Citation Reports**.
- Normally, the impact factor for 2021 is published in 2022.
- It is a journal metric and not to be used to assess an individual researcher or research institution.

Calculation

Example: If a Journal has an impact factor of 3 in the year 2022; it means that each paper published in that journal during the years 2020 and 2021 had received an average of 3 citations in 2022.

Let A= The number of times that articles published in that journal in and 2021, were cited by articles in indexed journals during 2022.

B= The total number of “citable items” (usually, articles, reviews and proceedings) published in that journal in 2020 and 2021.

Then, Impact factor (in 2022) = $\frac{A}{B}$

2. HIndex

The h-index is an index that attempts to measure both the productivity and impact of the published work of a scientist or scholar. The index is based on the set of the scientist's most cited papers and the number of citations that they have received in other publications. The index can also be applied to the productivity and impact of a group of scientists, such as a department or university or country, as well as a scholarly journal. The index was suggested by Jorge E. Hirsch, a physicist at UCSD (University of California, San Diego), as a tool for determining theoretical physicists' relative quality and is sometimes called the Hirsch index or Hirsch number. The h-index serves as an alternative to more traditional journal impact factor metrics in the evaluation of the impact of the work of a particular researcher.

3. Scopus

Scopus, officially named **SciVerse Scopus**, is a bibliographic database containing abstracts and citations for academic journal articles. It covers nearly 20,500 titles from over 5,000 international publishers, of which 19,500 are peer-reviewed journals in the scientific, technical, medical, and social sciences (including arts and humanities). It is owned by **Elsevier** and is available online by subscription. Since Elsevier is the owner of Scopus, and is also one of the main international publishers of scientific journals, Elsevier established the independent and international Scopus Content Selection and Advisory Board to prevent a potential conflict of interest in the choice of the periodicals to be included in the database and to maintain an open and transparent content coverage policy. The board consists of scientists and subject librarians from all scientific disciplines and geographical areas, whose interest is to access any relevant information regardless of the publishers.

SciVerse

SciVerse is a platform for accessing scientific information from certain databases and the web. It is published by **Elsevier**. It provides access to 2,500 journals and 11,000 books with about 500 thousand additions each year.

"**SciVerse**" globally indexes articles, books, theses, abstracts, patents and sifts through web results, from publishers, universities and professional organizations.

4. International Standard Serial Number

An **International Standard Serial Number (ISSN)** is a unique eight-digit number used to identify a print or electronic periodical publication. Periodicals published in both print and electronic form may have two ISSNs, a **print ISSN (p-ISSN)** and an **electronic ISSN (e-ISSN or eISSN)**. The ISSN system was first drafted as an ISO international standard in 1971 and published as ISO 3297 in 1975. The ISO subcommittee is responsible for the standard.

Code format

The format of the ISSN is an eight-digit number, divided by a hyphen into two four-digit numbers. The last digit, which may be 0–9 or an X, is a check digit. The ISSN of the journal *Hearing Research*, for example, is 0378-5955, the check digit is 5.

Code assignment

ISSN codes are assigned by a network of ISSN National Centres, usually located at national libraries and coordinated by the ISSN International Centre based in Paris. The International Centre is an intergovernmental organization created in 1974 through an agreement between UNESCO and the French government. The International Centre maintains a database of all ISSNs assigned worldwide, the ISSN Register.

Availability

The ISSN Register is not freely available for interrogation on the web but is available by subscription. There are several routes to the identification and verification of ISSN codes for the general public.

- the print version of a periodical typically will include the ISSN code as part of the publication information
- most periodical websites contain ISSN code information
- derivative lists of publications will often contain ISSN codes; these can be found through on-line searches with the ISSN code itself or periodical title.

5. Peer Review

Peer review is the evaluation of work by one or more people of similar competence to the producers of the work (peers). It constitutes a form of self-regulation by qualified members of a profession within the relevant field. Peer review methods are employed to maintain standards of quality, improve performance, and provide credibility. In academia peer review is often used to determine an academic paper's suitability for publication.

Professional peer review

Professional peer review focuses on the performance of professionals, with a view of improving quality, upholding standards, or providing certification. Professional peer review activity is widespread in the field of health care, where it is best termed as **Clinical peer review**.

Scholarly peer review

Scholarly peer review (also known as **refereeing**) is the process of subjecting an author's scholarly work, research, or ideas to the scrutiny of others who are experts in the same field, before a paper describing this work is published in a journal. The work may be accepted, considered acceptable with revisions, or rejected. Peer review requires a community of experts in a given (and often narrowly defined) field, who are qualified and able to perform impartial review

6. Web of Science

Single research destination to explore the citation universe across subjects and around the world. Web of Science provides access to the most reliable, integrated, multidisciplinary research connected through linked content citation metrics from multiple sources within a single interface. Since Web of Science adheres to a strict evaluation process, one can be assured only the most influential, relevant, and credible information is included - allowing to uncover next big idea faster.

7. Science Citation Index

- The Science Citation Index (SCI) is a citation index originally produced by the Institute for Scientific Information (ISI) and created by Eugene Garfield and was officially launched in 1964. The larger version (Science Citation Index Expanded) covers more than 8,500 notable and significant journals, across 150 disciplines, from 1900 to the present. These are alternatively described as the world's leading journals of Science and Technology, because of a rigorous selection process.
- The index is made available online through different platforms, such as the Web of Science and SciSearch.

8. International Standard Book Number

The **International Standard Book Number (ISBN)** is a unique numeric commercial book identifier based upon the 9-digit **Standard Book Numbering (SBN)** code created by Gordon Foster, Emeritus Professor of Statistics at Trinity College, Dublin, for the booksellers and stationers. The 10-digit ISBN format was developed by the International Organization for Standardization (ISO) and was published in 1970 as International Standard ISO. ISO has appointed the International ISBN Agency as the registration authority for ISBN worldwide and the ISBN Standard is developed under the control of ISO Technical Committee.

ISBN issuance

International Standard Book Numbers issuance is country-specific, in that ISBNs are issued by the ISBN Registration Agency that is responsible for that country or territory. The ranges of ISBNs assigned to any particular country are based on the publishing profile of the country concerned.

Programme Outcomes (POs) for Ph. D.

PO1: Discipline knowledge: Apply the knowledge of Microbiology, life sciences and allied subjects to the understanding of microbial life processes and related phenomena.

PO2: Problem analysis: Identify research problems, review research literature, and analyse complexities of microbial interactions in vitro and in vivo

PO3: Critical Thinking Skills: Critically analyse the claims and evidences on epidemic microbe-based diseases and environmental issues, formulate alternative microbe-based therapies and remediation.

PO4: Scientific Reasoning: Adopt techniques in Microbiology, analyze critically, infer the outcomes of data obtained and to apply the results in various sectors like food, health, energy and environment.

PO5: Design/development of research solutions: Design processes/strategies that meet the specified needs with appropriate consideration for the public health and safety, along with societal and environmental considerations.

PO6: Conduct investigations of complex problems: Use research-based knowledge and appropriate research methodology including design of experiments, statistical analysis and interpretation of data, and synthesis of the information to provide valid experimental conclusions.

PO7: Industry related skills: Able to utilize microorganisms in various industries such as clinical, Bioprocess, patenting, pharmaceutical, food, biofertilizers and biopesticides etc.

PO8: Modern tools usage: Create, select, and apply appropriate techniques, resources, and ICT tools for understanding of the subject. Apply reasoning obtained through the contextual knowledge to assess impact of microorganisms on the society, health, etc., and the relevant responsibilities with respect to professional commitments.

PO9: Community Engagement: Involve in local community affairs, understand their issues and contribute them through consultancy and teaching

PO10: Moral and Ethical awareness/reasoning: Apply ethical values and oblige to ethics in the profession and responsibilities in practicing Microbiology techniques

PO11: Cooperation/Team work: Function effectively in a team with peers and demonstrate a commitment to the process of developing skills in Microbiology. Sharing knowledge through presentations and group work.

PO12: Self-directed and Life-long Learning: Engage in continuous knowledge assimilation through multiple academic, industry, and societal platforms to uncover newer factions of knowledge application in existing/ new domains and for higher personal intellectual growth.

Programme Educational Objectives (PEOs) for Ph. D.

PEO-I: To design, analyze, conduct and interpret the experimental data for process/product development in all the life science field. To encourage the continue learning to update and to become an entrepreneur in a competitive world of technology.

PEO-II: To explain the function of microorganisms at the level of the cell, genome, gene, etc., and develop theoretical and practical knowledge in handling the microorganisms and using them as model organisms. Understand the classification and diversity of microorganisms and the resulting implications in relation to other life forms.

PEO-III: To use the concept of theories, research skills and recent technological tools in solving any technological issues independently.

DEPARTMENT OF MICROBIOLOGY
FACULTY OF ARTS, SCIENCE, COMMERCE AND MANAGEMENT
Ph.D. SYLLABUS
(2024-2025 batch and onwards)

Course code	Name of the course	Instruction hours/ week	Credit(s)	Exam duration	Maximum Marks	Page No.
24RMB101	Research Methodology and Pedagogy	4	4	3	100	
24RMB201	Research and Publication Ethics	4	4	3	100	
24RMB301	Industrial and Pharmaceutical Microbiology	4	4	3	100	
24RMB302	Immunotechnology and Biotechnology					
24RMB303	Virology					
24RMB304	Medical Microbiology					
24RMB305	Environmental Microbiology and Sustainable Engineering					
24RMB306	Bioprocess and Microbial Technology					
Total		12	12	-	300	-

KARPAGAM ACADEMY OF HIGHER EDUCATION

(Deemed to be University Established Under Section 3 of UGC Act 1956)

(Accredited with A+ Grade by NAAC in the second cycle)

Eachanari (PO), Coimbatore – 641 021



Part I: Ph.D. in Microbiology

2024-2025

24RMB101 PAPER – I: RESEARCH METHODOLOGY AND PEDAGOGY 4H – 4C

Instruction Hours / week: L: 4 T: 0 P: 0

Marks: External: 100 Total: 100

End Semester Exam: 3 Hours

COURSE OBJECTIVES

- To develop understanding of the basic framework of research process.
- To develop an understanding of various research designs and techniques.
- To identify various sources of information for literature review and data collection.
- To develop an understanding of the ethical dimensions of conducting applied research.
- Appreciate the components of scholarly writing and evaluate its quality
- Track their progress and know where they stand
- Know in advance how they'll be assessed

COURSE OUTCOMES

1. Critically analyse research methodologies identified in existing literature.
2. Propose and distinguish appropriate research designs and methodologies to apply to a specific research project.
3. Develop a comprehensive research methodology for a research question.
4. Apply the understanding of feasibility and practicality of research methodology for a proposed project
5. Plan appropriate teaching strategies, materials and assessments
6. Learn from and make changes to curriculum to improve student learning

UNIT – I (Spectroscopy and Chromatography)

Spectroscopy: Principles and instrumentation and applications of UV-Visible light spectroscopy, UV-Visible absorption spectroscopy, Spectrofluorimeter, Atomic spectroscopy, IR spectroscopy, ES bound X ray spectroscopy, red and blue shift, R and B bands various transition compounds, Vibrational spectroscopy, different vibrations, NMR spectroscopy and MALDI-TOF. Chromatographic techniques: Principles of column chromatography. Instrumentation of Low-pressure liquid chromatography (LPLC), High performance liquid chromatography (HPLC) Fast protein liquid chromatography (FPLC), High performance Thin Layer Liquid Chromatography (HPTLC), Perfusion chromatography, Ion-exchange chromatography, Molecular exclusion chromatography, Affinity chromatography, Gas chromatography (GC – MS). HRMS, Analytical centrifuge, NG- Transcriptomics, FTIR and XRD.

UNIT – II Research design and sampling

Research: Scope and significance – Types of Research – Research Process – Characteristics of good research – Problems in Research – Identifying research problems. Research Designs – Features of good designs. Sampling design: Meaning – Concepts – Steps in sampling – Criteria for good sample design.

UNIT – III Data Analysis

Scaling measurements – Techniques – Types of scale. Correlation – Meaning and definition - Scatter diagram – Karl Pearson's correlation coefficient. Rank correlation. Regression: Regression in two variables – Regression coefficient problems – uses of regression. Hypothesis testing – Errors in Hypothesis testing - large sample test (Z – test) single and two tailed test, Small sample test (t – test)-Single mean -Two mean - Paired t -test, F – test, Chi – square test –Single variance-Goodness of fit, SPSS Software, Anova – one way and two way. – CRD, RBD Designs. RSM (Response Surface Methodology). Thesis report writing.

UNIT – IV Computer Applications

Concepts of data base management brief idea of data types, data structures, searching, sorting, designing a data base, genomic, proteomic databases. Computer analysis of genetic sequences: general concepts of sequence analysis identification of functional sequences, homology, brief idea of BLAST, ENTREZ and PUBMED. Using search engine like Google, Yahoo etc, using advanced search techniques. Plagiarism software, Literature search, Endnote, Mendeley and its application.

UNIT – V Pedagogical Methods in Higher Learning

Historical Perspectives – Objectives and role of Higher Education – Learning and Learning Hierarchy – Information processing – Learning Events and Outcomes – Motivation. Education Evaluation: A Conceptual Framework – Methods of Evaluation – Self Evaluation and Student Evaluation in Higher Education – Question Banking – Diagnostic Testing and Remedial Teaching.

REFERENCES:

1. Boyer, R. 2006 Modern Experimental Biochemistry. 3rd Edition. Addison Wesley Longman. New Delhi.
2. Wilson, K and J. Walker 2006. Principles and techniques of biochemistry and molecular biology, 6th Low Price Edition, Cambridge University Press, India
3. David Friefelder 2001. Physical Biochemistry. 5th Edition Oxford Publishers. New York.
4. Kothari, C. R. 2005. Research Methodology-Methods and Techniques, Wiley International Ltd, UK
5. S. Palanichamy and M. Manoharan 2001. Statistical methods for biologists, Palani Paramount Publications, Palani.
6. R. Rajaram, 2008. Basic Computer Science and Communication Engineering Second Edition. SCITECH Publication India Private Limited, Chennai, India.

Part I: Ph.D in Microbiology

2024-2025

24RMB201 PAPER – II: RESEARCH AND PUBLICATION ETHICS

4H – 4C

Instruction Hours / week: L: 4 T: 0 P: 0

Marks: External: 100 Total: 100

End Semester Exam: 3 Hours

COURSE OBJECTIVES

- To understand the philosophy of science and ethics, research integrity and publication ethics.
- To identify research misconduct and predatory publications.
- To understand indexing and citation databases, open access publications, research metrics.
- To understand the usage of plagiarism tools.
- To learn about violation of publication ethics, authorship and contributor ship
- To learn about databases and Research metrics

COURSE OUTCOME

1. Provide students with knowledge, general competence, and analytical skills in Research Methodology and Publication Ethics
2. Equip themselves with ethical issues related to Research and Publication.
3. Build a strong foundation for future research work in a systematic manner by applying notions of Research Methodology.
4. Appraise research integrity
5. Utilize various indexing and citation databases and outline research metrics
6. Apply various tools for plagiarism check

UNIT I:Philosophy and Ethics

Introduction to Philosophy : Definition, nature and scope, concept, branches – Ethics: Definition, moral philosophy, nature of moral judgments and reaction.

UNIT II:Scientific Conduct

Ethics with respect to science and research – Intellectual honesty and research integrity –scientific misconduct: Falsification – Fabrication – Fabrication and Plagiarism (FFP) – Redundant publications: duplicate and overlapping publication-salami slicing-selective reporting and misrepresentation of date.

Unit III :publication Ethics

Publication Ethics: Definition , introduction and importance- Best practices/ standards setting initiatives and guidelines : COPE, WAME, etc. – Conflicts of interest – publication misconduct:definition , concept , problems that lead to unethical behavior and vice versa, type- violation of publication ethics , authorship and contributing and appeals- predatory publishers and journals.

Unit IV: Publication misconduct

Group discussions : Subject specific ethical issues, FFP, authorship – conflicts of interest- complaints and appeals : examples and fraud from India and abroad.

Unit V: Development of e-content & IPR

Database : indexing database- citation database : web of science , scopus, etc. Research Metrics : impact factor of journal as per Journal Citation Report, SNIP, SJR, IPP, Cite Score – Metrics: h-index, g index, g index, I 10 index, altmetrics.

Unit VI: Development of e- content & IPR

Integrated Library Management System (ILMS) : e-journals – e-books – e-shodhsindu –shodhganga – database – e-content development – Learning Management system (LMS) – e-PG– Pathshala – CEC (UG) SWAYAM – MOOCs – NPTEL – NMEICT. IPR : Patent –Copyrights- trademark – Geographical Indication.

PRACTICE:

Open access publishing

Open access publications and initiatives-SHERPA/RoMEO online resource to check polisher copyright & self -archiving policies-software tool to identify predatory publications developed by SPPU-Journal finder / journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer Journal Suggester, etc.

Part III: Ph.D in Microbiology

2022-2023

24RMB301 PAPER – III: INDUSTRIAL AND PHARMACEUTICAL MICROBIOLOGY 4H – 4C

Instruction Hours / week: L: 4 T: 0 P: 0

Marks: External: 100 Total: 100

End Semester Exam: 3 Hours

COURSE OBJECTIVES

- To impart theoretical knowledge of role of microbes in industrial production of different biochemicals/bio-molecules.
- The theory syllabus covers area such as design of bioreactors, media formulations and factors affecting the industrial production of bio-chemicals along with approaches that can be used for enhanced production
- To understand the basics of pharmaceutical microbiology and important microorganism playing role pharmaceutically
- To understand different products of microbial origin playing key role in pharmaceutical applications.
- To understand role of secondary metabolites in pharmaceutical industry.
- To understand good practices and regulation involved in utilizing microbial product for pharmaceutical application

COURSE OUTCOMES

1. Learning of different fermentation techniques, bioreactor design, inoculum development for industrial fermentations, Microbial growth and product formation kinetics, media formulation and sterilization,
2. isolation, preservation and improvement of industrially important micro-organisms.
3. Understanding of different pathways followed in or by the microbes involved in production of these biochemicals. Method of manipulating these pathways to get desired yield.
4. Have well versed with the different microbial products used in pharmaceutical applications
5. Better understanding of good laboratory practices and regulations for utilizing microbial product in pharmaceutical applications
6. Understanding of application of these bio-molecules in benefit of mankind

UNIT – I

History and chronological development of industrial microbiology. Industrially important strains – Isolation and preservation. Inoculum development for various fermentation processes. Strain development – mutation, recombinant DNA technology and protoplast fusion

UNIT – II

Fermentation – Submerged fermentation: batch, fedbatch and continuous fermentation and solid state fermentation. Types of fermentors (Tower, cylindroconical and airlift) – batch fermentation – continuous fermentation. Fermentor design – body construction – mass transfer – oxygen transfer – effect of viscosity, Aeration, Agitation, pH – scale-up process.

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UNIT – III

Production of beverages: beer and wine, Production of industrially important alcohols and Concept of ethanol production from different sources, Vitamin: B12 and riboflavin, Antibiotics: penicillin and streptomycin, Production of enzymes: amylase and proteases. Free cell immobilization and enzyme immobilization techniques. Production of probiotic and Single cell protein – bakers yeast, spirulina, red algae. Downstream process – intracellular and extracellular product separation. Liquid extraction, precipitation, floatation and filtration: Micro filtration and Ultra filtration.

UNIT – IV

Chemotherapeutic agents; Antimicrobial agents, sulfa drugs, antibiotics- penicillin and cephalosporin; classification of antibiotics; antibiotics from prokaryotes; mode and action of antibiotics, origin of drug resistance, mechanism action of drug resistance. Clinical uses of antimicrobial drugs, Microbial spoilage and preservation of pharmaceutical products, Sterilization of pharmaceutical products, Applications of microorganism in the pharmaceutical sciences.

UNIT – V

Role of precursors and steering agents in production of antibiotics, vitamins and enzymes. Antiseptics-disinfectants - preparation, standardization. Quality control of Pharmaceutical products – Injectables, IV fluids and pyrogen testing.

References

1. Patel, A.H. 2003. Industrial microbiology, Macmillan India Ltd. New Delhi
2. Prescott and Dunn's 1983. Industrial microbiology, CBS Publishers, New Delhi
3. Stanbury, P.T. and A. Whitaker 2005. Principles of Fermentation Technology, Pergamon Press, NY
4. Atlas R.N and R. Bartha 2007. Microbial Ecology-Fundamental and Applications. 4th Edition. Redwood City CA. Benjamin/Cumming Science Publishing Co., New Delhi
5. Michael J Waites 2007. Industrial microbiology, Blackwell publishing.UK
6. Mansi, E.M.T. and C.F.A. Bryce 2000. Fermentation Microbiology and Biotechnology, Taylor and Francis, New York.
7. Shuler, M.L. and F. Kargi 2005. Bioprocess engineering basic concepts. Pearson Education, New Delhi.
8. Hugo, W.B. and A.D. Russell 2007. Pharmaceutical Microbiology, 7th Edition, Blackwell Science Ltd, Oxford

Part III: Ph.D in Microbiology

2022-2023

24RMB302 PAPER – III: IMMUNOTECHNOLOGY AND BIOTECHNOLOGY 4H – 4C

Instruction Hours / week: L: 4 T: 0 P: 0

Marks: External: 100 Total: 100

End Semester Exam: 3 Hours

COURSE OBJECTIVE

- To provide overview of immune system, antigen antibody structure and interactions.
- To develop understanding of innate and adaptive immunity along with major cells and molecules involved.
- To integrate immunology with health and enrich the knowledge for autoimmune disorders, hypersensitivity reaction.
- The objective of the course is to make student understand about the structure and function of biologically important molecules.
- Students will learn about DNA, RNA and the molecular events that govern cell functions.
- To develop understanding of gene transfer in transgenic animals, transgenic plants and gene cloning

COURSE OUTCOMES

1. Upon completion students will gain knowledge of immune system, cells involved along with complement system and autoimmunity
2. Develop understanding about immune system, antigen antibody interactions.
3. Gain theoretical knowledge of various diseased conditions generated due to interplay of immune system components.
4. Describe the structure and function of DNA and RNA in a cell.
5. Elucidate central cell biological processes and how they are regulated
6. Understand how genetic engineering forms the foundation of modern biotechnology.

UNIT – I

Cells and Organs of immune system, T / B cell – maturation, activation – receptor, Cytokines – structure and functions, Antigen – Structure and chemical make-up, Immunoglobulin – structure – Organization and expression of Immunoglobulin genes, Purification of antigens and immunoglobulins., MHC – structure and functions, HLA tissue typing.

UNIT – II

Antigens - Antibody reactions, *In vitro* methods – Agglutination – Passive and reverse passive agglutination, Precipitation – reactions in gels – Immuno diffusion – Counter immuno

electrophoresis, Complement fixation test, Immunofluorescence, ELISA, RIA, Immuno electron microscopy, Forensic serology.

UNIT – III

Introduction to genetic engineering, Restriction enzymes – types and nomenclature - classification – and uses, Cloning Vectors – types of vectors, pBR, pUC vectors, Phage vectors and Expression vectors Prokaryotic hosts: *E. coli*, Eukaryotic hosts: Yeast cell. Gene cloning - construction of cDNA and genomic libraries - selection and screening method of recombinants - Screening of recombinants for Site directed Mutagenesis by SSCP, heteroduplex analysis.

UNIT – IV

Isolation of DNA and RNA – Handling and quantification of nucleic acids, radiolabelling and non radiolabelling of nucleic acids, Gel electrophoresis - Blotting techniques, Hybridization and heteroduplex analysis, Molecular diagnostics of genetic disease using PCR / OLA, RT PCR, Inverse PCR, Nested PCR, Multiplex PCR, Expression cassette PCR, Real time PCR. Applications – gene cloning, DNA sequencing, genome mapping DNA diagnostic system in forensic sciences.

UNIT – V

Genetic engineering of plants and animals: Gene transfer techniques into plant and animal cell. Plants as tool for recombinant protein production; Development and use of transgenic animals; transgenic mice – methodology and applications. Ethical issues of gene cloning.

REFERENCES

1. Richard A. Goldsby, Thomas J. Kindt, Barbara A. Osborne 2000. Kuby Immunology. 5th Edition. W.H. Freeman and Company, New York.
2. Frank C. Hay and Olwyn M.R. Westwood 2002. Practical Immunology. 4th Edition, Blackwell Science Ltd. Oxford.
3. Roitt, I.M. Brostoff, J.J. and D.K. Male 2000. Immunology. 6th Edition. C.V. Mosby Publishers. St.Louis.
4. Winnacker, E.L. 2003. From genes to clones. Introduction to Gene Technology. 1st Edition VCH. Weinheim.
5. Brown, T.A. 2006. Gene Cloning and DNA analysis; An Introduction. 5th Edition. Blackwell Publishing, UK
6. Glick, B.K and J.J. Pasternak 2003. Molecular Biotechnology. Principles and applications of recombinant DNA. 3rd Edition. ASM Press, Washington.

Part III: Ph.D in Microbiology

2023-2024

24RMB303

PAPER – III: VIROLOGY

4H – 4C

Instruction Hours / week: L: 4 T: 0 P: 0

Marks: External: 100 Total: 100

End Semester Exam: 3 Hours

COURSE OBJECTIVE

- Knowledge on history, general characters of viruses and how viruses are classified on basis of architecture and genetic material.
- Discerning the plant and animal viruses and their replication strategies inside the host and also methods used in cultivation and detection of viruses.
- Comprehend the bacteriophages and other phages and their application.
- Knowledge on some common plant and animal diseases caused by different viruses, viruses transmission and control.
- Knowledge on viral infection diagnosis and control.
- Introduce a concept of biosafety against infection or genetic modification.

COURSE OUTCOMES

1. Recognize characters of different types of viruses.
2. Understand how viruses can be used as biotechnological tools, as cloning vectors and for gene transfer.
3. Understand the architecture of viruses and their genomes.
4. Theoretical knowledge on techniques employed for culturing and detection of plant and animal viruses.
5. Comprehend the intricate interaction between viruses and host immune cells and pathogenesis of virus-induced diseases, the detection and the treatment.
6. Identify the role of the Biosafety Professional in Biomedical Research Laboratories.

UNIT -I

History of Virology, Brief outline of virology, discovery of virus, General properties of viruses, Classification of viruses, Preservation of viruses, & Cultivation of viruses.

UNIT -II

Viruses & Human diseases: DNA viruses: Pox virus, Herpes virus, adenovirus. Papova virus, Hepadna virus, Pathogenesis & Laboratory diagnosis.

UNIT -III

Viruses & Human diseases: RNA viruses: Orthomyxo viruses, Paramyxo viruses, Influenzae and other arthropod born viruses, Retroviridae. Emerging Viral infection – SARS-CoV, Bird flu and Nipha Virus.

UNIT - IV

Virus – Host interaction, immunity to viral diseases. Antiviral agents and Viral Vaccines. Immunization Schedules. Animal virus- Adeno virus, Retro virus, Orthomyxo virus, Parvo virus and Corona Virus.

UNIT -V

Virology methods: Cultivation and purification of viruses, *In vitro* and *in ovo* system for virus growth, estimation of yields, methods for purification of viruses with special emphasis on ultracentrifugation. Epidemiology and Laboratory diagnosis of viruses: Electron microscopy, molecular and serodiagnosis of viral infections, PCR; Sequencing & genotyping.

REFERENCES

1. Medical Virology – Morag C, and Timby M.C. X Edition (1994) Churchill Livingstone, London.
2. Introduction to Modern Virology – Dimmock N.J. Primrose SB. IV Edition (1994). Blackwell Scientific Publications, Oxford.
3. Virology – Contrat H.F. Kimball PC and Levy JA. IIIrd Edition. (1994). Prentice Hall, Englewood cliff, New Jersey.
4. Principles of Bacteriology, Virology and Immunology – Topley & Wilson's (1995). Edward Arnold, London.
5. Virology -3rd Edition 1996, Fiels DN (Edn.) Lippincott – Raven.
6. Principles of Virology -2nd Edition 2004, SJ Flint Edn. ASM Press.
7. Clinical Virology -2nd Edition 2002, Douglas D Richman (Edn.) ASM Press.
8. Essentials of Diagnostic Virology – 2000, Gregory A Storch, Churchill Livingstone.
9. Principles of Molecular Virology, 1997. 2nd ed. A.Cann. Academic Press.
10. David Greenwood, Richard C.B, Slack, John Forest Peuthere (1992). "Medical Microbiology". 14th Edn. ELBS with Churchill Livingstone.

Part III: Ph.D in Microbiology	2023-2024
24RMB304	PAPER – III: MEDICAL MICROBIOLOGY
	4H – 4C

Instruction Hours / week: L: 4 T: 0 P: 0

Marks: External: 100 Total: 100

End Semester Exam: 3 Hours

COURSE OBJECTIVE

- Introduction to basic principles and then applies clinical relevance of many etiological agents responsible for global infectious diseases.
- The infectious disease cycle of the pathogens enables to solve the epidemics.
- The territory covered by infections and the immune response
- Focus on pathogenic mechanisms in order to foster a student's ability to solve problems in their future clinical career and able to establish the medical laboratory.
- This course provides learning opportunities in the basic principles of medical microbiology and infectious disease
- It covers mechanisms of infectious disease transmission, principles of aseptic practice, and the role of the human body's normal microflora

COURSE OUTCOMES

1. Knowledge of most common medically important organism and the infections they cause.
2. Different approaches, techniques and tools used to identify pathogens and control them.
3. Demonstrate an understanding at an advanced level of microbial virulence mechanisms and host response to infection
4. Application of molecular techniques to medical microbiology; biochemical and genetic mechanisms of antimicrobial agent activity, microbial susceptibility and resistance to antimicrobial agents
5. Diagnostic approaches for microbial pathogens
6. Developing efficient vaccines and new drugs.

UNIT – I

Laboratory precaution and guidelines – collection – transportation – handling and examination of pathological specimens (Blood, Urine, Stool and sputum) – methods of isolation, identification and interpretation of pathogenic organisms – Antibiotic susceptibility testing. Infections – types – methods – Infectious disease cycle. Quality control in microbiology lab and automation in medical microbiology.

UNIT – II

Gram positive organisms: Morphology, cultural characteristics, antigenic property, pathogenicity, laboratory diagnosis and Treatment. *Staphylococcus* sp., *Streptococcus* sp., *Bacillus* sp., *Corynebacterium* sp., *Clostridium* sp. and *Mycobacterium* sp.

UNIT – III

Gram negative organisms: Morphology, cultural characteristics, antigenic property, pathogenicity, laboratory diagnosis and Treatment. *E.coli*, *Klebsiella* sp., *Proteus* sp., *Pseudomonas* sp., *Vibrio* sp., *Salmonella* sp., *Shigella* sp., *Treponema* sp., *Neisseria* sp. and *Haemophilus* sp. MDR, XDR and PDR.

UNIT – IV

Superficial mycosis - *Pityriasis versicolor*, *Tinea nigra*, *pie**dra*. Cutaneous mycosis Dermatophytes. Systemic mycosis - Coccidiomycosis - Blastomycosis – Histoplasmosis. Opportunistic mycosis, Candidosis, Aspergillosis, Zygomycosis. Subcutaneous mycosis – Sporotrichosis, Chromoblastomycosis and Mycetoma.

UNIT – V

Protozoan infections - *Entamoeba histolytica*, *Plasmodium vivax*, *Plasmodium falciparum*, *Giardia intestinalis*, *Trichomonas vaginalis*, *Taenia solium*. Trematodes - *Fasciola hepatica*, *Schistosoma haematobium*, Nematodes - *Trichuris trichiura*, *Ascaris lumbricoides*, and *Wuchereria Bancrofti*.

REFERENCES

1. Ananthanarayanan, R. and C.K.J. Panicker, 2005. Text Book of Microbiology 7th Edition. Orient Longman, New Delhi.
2. Brook, G.F., J. S. Butel, A. Stephen and Morse, 2003. Medical Microbiology, 22nd Edition. Mc Graw Hill.
3. Chakraborty, P., 2003. A Text book of Microbiology. 2nd Edition. New Central Book Agency (P) Ltd., Calcutta.
4. Chander, J., 2002. A Text book of Medical Mycology. Interprint Mehta Publishers, New Delhi.
5. Chatterjee, K.D., 1980. Parasitology in relation to medicine. 12th Edition, Chatterjee Medical Publishers, Calcutta.
6. Chunin, J., 2000. Parasitology. New York Publishers, London.
7. Dismukes, W.E., P.G. Pappas and D. Sobel, 2003. Clinical Mycology. Oxford University Press, UK.
8. Jawetz, E., J.L. Melnic and E.A. Adelberg, 2001. Review of Medical Microbiology. 22nd Edition. Lange Medical Publishers. New York.
9. Mehrotra, R.S. and K.R. Aneja, 2007. Introduction to Mycology. New Age International Ltd. New Delhi.
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Part III: Ph.D in Microbiology

2024-2025

**24RMB305 PAPER – III: ENVIRONMENTAL MICROBIOLOGY AND
SUSTAINABLE ENGINEERING**

4H – 4C

Instruction Hours / week: L: 4 T: 0 P: 0

Marks: External: 100 Total: 100

End Semester Exam: 3 Hours

COURSE OBJECTIVE:

- To create the responsiveness about environmental issues among students.
- To improve the practice of concern towards the environment.
- To encourage community to involve themselves in environment upgrading.
- To create awareness among the students to know about various renewable and non-renewable resources of the region enables environmentally literate citizens (by knowing the environmental acts, rights, rules, legislation, etc.)
- To make appropriate judgments and decisions for the protection and skills associated with improvement of the earth.

COURSE OUTCOME:

1. Understand core concepts and methods from environmental sciences and their application to solve environmental issues.
2. Understand core concepts about various pollution, its impact in environment and effective solutions to be practiced.
3. Comprehend the importance Environmental management standards in India.
4. Understand the international oddity of environmental problems and mode of facing them.
5. Apply systems concepts and practices to execute green and sustainable engineering.

Unit I Introduction to Sustainability

Sustainability needs and concept, Challenges, Environmental acts and protocols, Global, Regional and local environmental issues, Natural resources and their pollution, Carbon credits, zero waste concept, Life cycle analysis, Environmental impact and assessment studies, sustainable habitat and green buildings, green, materials, energy, conventional and renewable resources, Technology and sustainable development, Industrial Ecology.

Unit II Diverse Pollutions

Air pollution, effects of air pollution; Water pollution-sources, Sustainable waste water treatment, Solid waste- sources impacts of solid waste, zero waste concept, 3R concept- Global environmental issues- Resource degradation, climate change, Global Warming, Ozone layer depletion, Regional and local environmental issues, Carbon credits and carbon trading, Carbon foot print.

Unit III Environmental standards

Environmental management standards, ISO 14000 series, Life cycle Analysis (LCA)- Scope and Goal, Bio-mimicking, Environmental impact Assessment (EIA)-Procedures of EIA in India.

Unit IV Green Construction

Basic concepts of sustainable habitat, green buildings, green material for building construction, material selection for sustainable design, green building certification, Methods for increasing energy efficiency of buildings, Sustainable cities, Sustainable transport. Microbial induced carbonate precipitation (MICP), Bio cementation.

Unit V Microbiome in Sustainability

Green Engineering, Microbiome of Green Design (building materials), Sustainable urbanisation, industrialization and poverty reduction, social and technological changes, industrial process: material selection, pollution prevention, Industrial ecology, industrial symbiosis.

REFERENCES:

1. Allen, D.T, and Shonnard D.R., Sustainability Engineering; concepts Design and case studies. Prentice Hall. 2002
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Part III: Ph.D in Microbiology

2024-2025

24RMB306 PAPER– III: BIOPROCESS AND MICROBIAL TECHNOLOGY 4H – 4C

Instruction Hours / week: L: 4 T: 0 P: 0

Marks: External: 100 Total: 100

End Semester Exam: 3 Hours

COURSE OBJECTIVE:

- To study the historical development of bio process technology
- To design and construction of fermentor
- To learn about the controlled parameters in fermentation process
- To evaluate the kinetics and thermodynamics of enzymatic process
- To study the stoichiometry and energetics of cell growth and product formation
- To evaluate the kinetics and mechanism of microbial growth

COURSE OUTCOME:

1. To prepare a research plan for his/her fermentation research project.
2. To develop skills to train others in the area of bioprocess engineering.
3. To develop entrepreneur skills for applications in biotechnology based industries.
4. To apply different biotechnological methods used in the recombinant protein production
5. in fermentation processes and in protein purification.
6. Understanding of different pathways followed in or by the microbes involved in production of these bio- chemicals.

UNIT I Introduction to fermentation technology

Interaction between biochemical engineering; Microbiology and Biochemistry; Introduction to fermentation processes; Microbial culture; Screening and selection for fermentation processes; Preservation and improvement of industrially important microorganisms; Inoculum production for bacterial and fungal processes.

UNIT II Raw material and media formulation for fermentation process:

Fermentation media; Natural media; synthetic media. Sources of Carbon; Nitrogen and vitamins; antifoams and optimization. Significance of upstream processing.

UNIT III Types of Fermentation and Process parameters

Solid Substrate fermentation and submerged fermentation: ; Process parameters measurement of temperature; pressure and pH; dissolved Oxygen; foam etc. Strain improvement by mutation and screening of improved cultures; random and strategic screening methods; strategies of strain improvement for primary; secondary metabolites with relevant examples; Preservation of cultures after strain improvement programme.

UNIT IV Design and construction of a Fermentors

Body construction; construction material; Aeration and agitation systems; Stirrer glands and bearings; Baffles; Valves and steam traps; Pressure-control valves; computer applications in fermentation technology; specialized bioreactors; membrane bioreactors; tower bioreactors; fluidized bed bioreactors; Immobilized system and packed bed reactors and Photobioreactors.

UNIT V Downstream Processing

Biomass separation by centrifugation; filtration; flocculation and other methods; Cell disintegration: Physical; chemical and enzymatic methods; Separation of solid and liquid phases; isolation and purification techniques for proteins and other products based on different physico-chemical properties, Product recovery and Quality control.

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2. H. J. Pepler, D. Perlman. Microbial Technology: Fermentation Technology. (2014). Academic Press.
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Part III: Ph.D in Microbiology

2024-2025

24RMB307

PAPER– III: MICROBIAL TECHNOLOGY

4H – 4C

Instruction Hours / week: L: 4 T: 0 P: 0

Marks: External: 100 Total: 100

End Semester Exam: 3 Hours

COURSE OBJECTIVE:

- To study the role of microorganisms in food and dairy industry.
- To develop the industrial process for the development of enzyme production
- To learn about the microbiology of wastewater and solid waste treatment.
- To evaluate the production of biofertilizer.
- To study the green energy.
- To evaluate the microbial fuel production.

COURSE OUTCOME:

1. To prepare a research plan for his/her bioprocess based research project.
2. To develop skills to train others in the area of microbial enzymes.
3. To develop entrepreneur skills for applications in pharmaceutical industries.
4. To apply different microbiological methods used in the waste water treatment process
5. Understanding the microbes involved in Renewable bioenergy using microorganisms.

Unit-I

Industrial Fermentation – role of microorganisms in food and dairy industry. Fermented beverages-beer, wine and other alcoholic beverages. Microbial preparation of Tempeh, sauerkraut, Miso, yogurt. Probiotics. Biomass production – Baker's Yeasts, Single cell protein. Mushroom cultivation.

Unit-II

Industrial Process: Antimicrobials, Organic acids and enzymes- microbial production of penicillin, Tetracycline and peptide antibiotics; Acetic acid; Lactic acid; Gluconic acid. Microbial production and commercial applications of Amylases, Proteases, Lipases. Biotransformation of steroids.

Unit-III

Microbiology of wastewater and solid waste treatment: - biological, aerobic, anaerobic, primary, secondary and tertiary treatments. Trickling filter - Activated sludge and Anaerobic digestion process. Treatment of industrial effluents by microorganisms. Composting methods. Microbiology of degradation of xenobiotics – BHC, DDT and pesticides. Bioremediation of insecticides, pesticides and heavy metals.

Unit-IV

Plant Growth Promoting Rhizobacteria (PGPR). Biofertilizers- Rhizobium, Azospirillum, Azotobacter, Gluconacetobacter, Azorhizobium, phosphobacteria - mycorrhizae - Blue Green Algae and Azolla. Biopesticides - Bacillus thuringiensis, NPV, Beauveria bassiana. Mass production of biofertilizers and biopesticides – integrated insect pest management.

Unit-V

Green Energy: Renewable bioenergy using microorganisms – Methanogenesis, Methane production by anaerobic digestion of waste organic materials. Bioethanol and Bio butanol production by using microorganisms. Biohydrogen Generation, Microbial Fuel. Biodiesel from algae.

REFERENCES

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5. Pharmaceutical Microbiology – Edt. By W.B.Hugo & A. D. Russell Sixth edition. Blackwell scientific Publications.
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