



Ph.D. PROGRAMME RULES & REGULATIONS

SANGAM UNIVERSITY, BHILWARA

NH-79, Atoon, Rajasthan 311001

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Contents:

1. PREAMBLE	1
2. DIRECTORATE OF RESEARCH (DOR)	1
3. ELIGIBILITY CRITERIA FOR ADMISSION TO PH.D. PROGRAM	4
4. DURATION OF THE PROGRAM	4
5. PROCEDURE FOR ADMISSION	5
6. SELECTION PROCEDURE	7
7. CANDIDATURE OF PH.D. SCHOLARS	8
8. ALLOCATION OF RESEARCH SUPERVISOR	9
9. ELIGIBILITY AS RESEARCH SUPERVISOR	10
10. PROGRAMME STRUCTURE	13
11. RE-REGISTRATION	25
12. CANCELLATION OF REGISTRATION	25
13. DEGREE REQUIREMENTS	26
Annexure-1 (Pre Ph.D.- Course Work Syllabus)	27
Annexure-2 (Six Monthly Progress Report)	36
Annexure-3 (Format of Synopsis Front Page)	40
Annexure-4 (Guidelines for Thesis Preparation)	41
Annexure - 4.1 (Format of Front Page of Thesis)	52
Annexure - 4.2 (Declaration by the Candidate)	53
Annexure - 4.3 & 4.4 (Certificates)	54
Annexure - 4.5 (Format of Table of Content)	57
Annexure-5 (Pre-Submission Form)	59

1. PREAMBLE

The Doctor of Philosophy (Ph.D.) degree is one of the highest academic degrees awarded by a University and requires extensive study and intellectual effort. It is awarded to a candidate who, as per these regulations, has submitted a thesis or dissertation, based on original and independent research in any particular subject/discipline, or more than one discipline (interdisciplinary), and which makes a contribution to the advancement of knowledge in science, technology, humanities & social sciences.

2. DIRECTORATE OF RESEARCH (DoR)

DoR is the regulatory body for Ph.D. programs and research activities of the University.

2.1. Functions:

2.1.1. To coordinate with the Admissions Cell and Exam Cell for conduct of the entrance examination for admission to the Ph.D. program (twice in a year).

2.1.2. To publish Ph.D. program regulations, details of the subject offered, vacancies in respective departments and details of the eligible Ph.D. supervisors on the University website.

2.1.3. To coordinate the research activity of all departments, including selection and admission of research scholars.

2.1.4. To organise the Research Advisory Committee (RAC Mains) meeting.

2.1.5. To organise and coordinate the entire registration process.

2.2. Research Advisory Committee (RAC): There shall be RAC for each Ph.D. Scholar at the University level.

2.2.1. Constitution

President/ Pro President or his nominee	Chairman
Concerned Dean of School	Member
External Subject Expert	Member
Supervisor	Member
School Research Coordinator	Member
Dean (Research)	Member Secretary

- As the viva is open in nature, therefore all the schools and departments will be invited in the vivas.

2.2.2. Functions:

2.2.2.1. To conduct a meeting every three months.

2.2.2.2. To frame and revise policies for the Ph.D. programme.

2.2.2.3. To ensure that all rules and regulations of the Ph.D. programme are strictly followed as per the UGC (Minimum Standards and Procedure for Award of Ph.D. Degrees) Regulations, 2022.

2.2.2.4. To make periodic review of ordinances, regulations and instructions issued by UGC pertaining to the Ph.D. programme and give recommendations to the Academic Council for any modifications thereof.

2.2.2.5. To scrutinise the biodata of prospective external research co-supervisors and to approve the issue of registration letters.

2.3. Research Advisory Committee Mains (RAC Mains): There shall be RAC Mains for the enhancement of the quality of the research at the university level.

2.3.1. Constitution

Dean Research	Chairman
Concerned Dean/ Dy. Dean of School	Member
All Professors*	Members
Department Heads**	Member
Supervisor	Member
School Research Coordinator	Member Secretary

*Recognized as research supervisors and to be nominated by the President.

**Concerned department heads where they imply.

*** The chairman may invite more members, including a maximum of two external experts.

2.3.2. Tenure: The RAC Mains will be constituted by the URC with approval of the President for a maximum tenure of 2 years. Majority of the members shall be present in the meetings.

2.3.3. Functions:

2.3.3.1. To coordinate the research activities of the School.

2.3.3.2. To select candidates for admission to Ph.D. programmes and allot supervisors in the relevant subject/discipline.

2.3.3.3. To monitor the conduct of all Ph.D. courses running in the department.

2.3.3.4. To monitor and evaluate the quality of research in the department.

- 2.3.3.5. To take appropriate action on the recommendations of the Academic Council, RAC Mains.
- 2.3.3.6. To recommend the panel of members (as proposed by the supervisor)
- 2.3.3.7. To consider any matter related to the research programme of the department.
- 2.3.3.8. To conduct at least two meetings in each semester and send the proceedings to DoR.
- 2.3.3.9 To recommend RAC for each Scholar admitted in the school.
- 2.3.3.10. External experts shall be called by RAC Mains for the Synopsis presentation by the candidate/s.

2.4. Research Advisory Committee Pre (RAC Pre): There shall be RAC Pre for the enhancement of the quality of the research at the school level.

2.4.1. Constitution

Concerned Dean/ Dy. Dean of School	Chairman
All Professors*	Members
Department Heads**	Member
Supervisor	Member
School Research Coordinator	Member Secretary

*Recognized as research supervisors and to be nominated by the President.

**Concerned department heads where they imply.

2.4.2. Tenure: The RAC Pre will be constituted by the RAC Mains with approval of the President for a maximum tenure of 2 years. Majority of the members shall be present in the meetings.

2.4.3. Functions:

- 2.4.4.1. To coordinate the research activities of the School.
- 2.4.4.2. To select candidates for admission to Ph.D. programmes and allot supervisors in the relevant subject/discipline.
- 2.4.4.3. To monitor the conduct of all Ph.D. courses running in the department.
- 2.4.4.4. To monitor and evaluate the quality of research in the department.
- 2.4.4.5. To take appropriate action on the recommendations of the Academic Council, RAC Mains.
- 2.4.4.6. To consider any matter related to the research programme of the department.
- 2.4.4.7. To conduct at least two meetings in each semester and send the proceedings to DoR.
- 2.4.4.8 To recommend RAC for each Scholar admitted in the school.

2.4.4.9. To review the research proposal and finalize the topic of research;

2.4.4.10. To guide the research scholar to develop the study design and methodology of research and identify the course(s) that he/she may have to do.

2.4.4.11. To periodically review and assist in the progress of the research work of the research scholar.

3. ELIGIBILITY CRITERIA FOR ADMISSION TO Ph.D. PROGRAM

Subject to the conditions stipulated in these Regulations, the following persons are eligible to seek admission to the Ph.D. programme:

3.1. Candidates who have completed:

3.1.1. 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.

3.1.2. 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.

3.1.3. Provided that a 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.

3.2. In case of candidates holding a qualifying degree from foreign Universities/institutions, registration for Ph.D. at SU will be confirmed after determination of equivalence by the Directorate of Research (DoR).

3.3. A candidate would be allowed to register for Ph.D. in a department relevant to his/her field of study, but the degree would be awarded from the Faculty in which he/she has completed his/her PG degree.

4. DURATION OF THE PROGRAM

4.1. The duration of Ph.D. programme including coursework for the two categories of scholars is as under:

S.No.	Candidature	Minimum Years	Maximum Years
1.	Full Time Scholars	3	6
2.	Part Time Scholars	4	8

4.2. A maximum of an additional two (2) years can be given through a process of re-registration as per the Statute/Ordinance of the Sangam University, 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.

4.3. Women scholars and persons with disability (more than 40% disability) may be given a relaxation of two (2) years for Ph.D. in the maximum duration. In addition, women scholars may be provided Maternity Leave/Child Care Leave once in the entire duration of Ph.D. programme, for up to 240 days, however, that the total period of 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.

4.4. If a scholar fails to present his 6 monthly progress report and/or final research proposal within the set time period, his/her minimum duration shall be extended accordingly but not exceeding the maximum duration of 6 years.

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

4.6. 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.

4.7. Notwithstanding anything contained in these Regulations or any other law, for the time being in force, no Higher Educational Institution or research institution of the Central government or a State Government shall conduct Ph.D. programmes through distance and/or online mode.

5. PROCEDURE FOR ADMISSION

5.1. Eligible candidates desirous of admission to the Ph.D. programme at SU shall apply through the online / offline application and bear mentioned qualification.

5.2. The candidate must ensure that the application is complete in all respects and all the necessary documents are uploaded before final submission of the application. Incomplete applications will not be accepted.

5.3. Normally, the candidates will be eligible for admission to the Ph.D. Program in the subject/discipline in which he/she has obtained the PG degree. It shall, however, be open for a candidate to apply for admission in another discipline related to the subject in which he/she has obtained a PG degree or has relevant work experience in the field of research. However, the University also promotes interdisciplinary research areas.

5.4. The candidate seeking admission as a part-time scholar must submit NOC from his/her current employer at the time of admission/registration in SU.

5.5. Transfer Case from another University to Sangam University, Bhilwara.

5.5.1. Under normal circumstances, a candidate registered for Ph.D. in another University & seeking registration for Ph.D. at SU, will be treated as a fresh Ph.D. candidate. He/she has to apply afresh and follow the registration process accordingly.

5.5.2. No credit will be given for work done in the previous registration. However, in special cases, such as the supervisor joining SU, the RAC Mains may permit a candidate registered with the supervisor in his/her earlier University, to transfer accumulated credits and register at SU.

5.5.3. Registration for Ph.D. for such candidates will be through a protocol presentation covering all details of the case and work already done, to the RAC Mains. The RAC Mains, if satisfied with merits of the case, may recommend his/her registration at SU.

5.5.4. In case the RAC Mains is satisfied, it may allow transfer of credits for the course work completed during the earlier registration. RAC Mains may also allow the work done during the earlier registration.

5.5.5. Such candidates will be required to submit a letter regarding cancellation of registration for Ph.D. from the previous University.

5.5.6. In case of relocation of an Ph.D. woman scholar due to marriage or otherwise, the research data shall be allowed to be transferred to the University to which the scholar intends to relocate, provided all the other conditions in these Regulations are followed in letter and spirit and the research work does not pertain to the project secured by the parent institution/supervisor from any funding agency. The scholar will however give due credit to the parent guide and the institution for the part of research already done.

6. ADMISSION PROCEDURE

6.1. There shall be two sessions for selection/provisional registration of research scholars in an academic year as follows:

6.1.1. January – June

6.1.2. July - December

6.2. The notification for the Ph.D. admissions shall be made available on SU website; advertisement will be circulated in the regional dailies.

6.3. The number of seats for admission, subject/discipline-wise distribution of available seats, criteria for admission, procedure for admission, and all other relevant information related to the Ph.D. program shall be made available on the SU website.

6.4. The procedure for selection of candidates for admission shall be based on both entrance test and personal interview.

6.4.1. Entrance Examination:

6.4.1.1. The entrance examination will consist of 100 multiple choice questions of equal marks containing 50 questions each from research methodology and subject specialisation.

6.4.1.2. There will be no negative marking for incorrect answers.

6.4.1.3. SU admit students who qualify for fellowship/scholarship in UGC-NET/UGC- CSIR NET/GATE/CEED and similar National level tests are exempted from the written examination.

6.4.1.4. Candidates will be selected as per the number of vacancies in the department.

6.4.1.5. The Score / Application of the Entrance test shall be valid for two consecutive cycles of admission subject to availability of seats in the department / School.

6.4.1.6. 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 UGC regulations updated from time to time.

6.4.1.7. Provided that for the selection of candidates based on the entrance test conducted by the SU, in which, a weightage of 70 % for the entrance test and 30 % for the performance in the interview/viva- voce shall be given.

6.4.2. Personal Interview: All the candidates have to appear before the interview board duly constituted by the RAC Pre. Constitution of the Interview Board is as follows

1. All RAC Pre members
2. Prospective supervisors

6.4.2.1 Functions:

The interview board will ensure the transparency in the interview process, and proper evaluation of the applicant's subject knowledge, research and presentation skills i.e., whether: the candidate possesses the competence for the proposed research and look into the aspect that research work can be suitably undertaken at the University. The proposed area of research can contribute to new/additional knowledge.

6.4.3. The merit list duly approved by the RAC Mains nominee prepared by the interview board will be submitted to the DoR.

6.4.4. The CoE will compile and upload the final result on the University webpage after approval of the Hon'ble President.

7. CANDIDATURE OF Ph.D. SCHOLARS

7.1. FULL-TIME Research Scholars: Full-time research scholars are those who register for Ph.D. at Sangam University, Bhilwara on full-time basis and are not employed anywhere.

7.2. PART-TIME Research Scholars: Part-time research scholars are those who are presently employed in any college/school/ institute/industry and are registered for Ph.D. at Sangam University.

7.3. Change in Candidature

7.3.1. The University may permit the conversion of candidature of the student from part-time to full-time or vice-versa for valid reasons, with the approval of the RAC and DoR.

7.3.2. A full-time registered scholar cannot change his/her candidature to part-time for at least 3 years from the date of registration (i.e., minimum duration of Ph.D. program). For these scholars, the minimum and maximum period of research will be decided on a pro-rata basis, based on the period already completed in full-time / part-time mode.

8. ALLOCATION OF RESEARCH SUPERVISOR

8.1. The allocation of research supervisor for a selected research scholar shall be decided by the DRC concerned depending on the number of scholars per research supervisor as decided by the DoR, the available specialisation among the supervisors and research interest of the scholars as indicated by them at the time of interview.

8.2. Mutual consent of prospective supervisor & scholar be duly considered during finalisation of Ph.D. Supervisor. Preference for admission will be given to Full-time Ph.D. candidates.

8.3. For external part-time candidates, there may be a co-supervisor at the place of work (University/College/ Institution), if required.

8.4. The RAC Pre will ensure that the selected research topic by the respective supervisors is novel and not a repetition of the work done earlier by the supervisor.

8.5. Candidates will have to qualify the entrance test and interview in his/her research discipline.

8.6. Upon qualifying, he/she can generally be registered in the faculty of his/her PG specialisation. The candidate may have one supervisor/co-supervisor from the Department.

8.7. Based on the research requirements and recommendation of RAC Pre, a co-supervisor from another Department can be appointed.

9. ELIGIBILITY AS RESEARCH SUPERVISOR

9.1. All professors (with Ph.D. degree) working on regular basis in the Departments/Schools/Faculty of SU, with at least 5 research publications in refereed journals and all regular Associate/Assistant Professors of SU (with a Ph.D. degree) with at least 3 research publications in peer reviewed journals, can be recognized as research supervisors.

NOTE: The upper age limit for continuation of Supervisor is 70 years.

9.2. Scientists/Researchers working on a regular basis in various regional and national institutions / research laboratories/organisations/industries (which are recognized as research centres by Sangam) and fulfilling UGC Regulations, 2022 are also eligible for supervising research as external co-supervisors at Sangam University.

9.3. A research supervisor/co-supervisor who is a Professor, at any given point of time, cannot guide more than 8 Ph.D. scholars. Associate Professor and Assistant Professor as research supervisor can guide up to a maximum of 6 and 4 Ph.D. scholars, respectively (counting one) for each scholar guided alone and ½ for guiding a scholar as co-supervisor). These will include part-time scholars and Ph.D. candidates registered with other Universities / Institutions, if any.

9.4. Further, a research supervisor cannot take more than 2 new research scholars in an academic session (July-June). However, to increase the number of research scholars working under eminent scientists/ academicians, the decision is left to the discretion of the President, based on the merit of the individual case. *No person will be allowed to guide his / her close relatives.

9.5. Responsibilities of research supervisor

9.5.1. To guide the scholar to select a problem / question for research.

9.5.2. To suggest the courses for Ph.D. course work.

9.5.3. To monitor the progress of the scholar.

9.5.4. To approve and forward all applications of the scholar.

9.5.5. To provide or arrange necessary facilities for carrying out research work.

9.5.6. To arrange for a change of supervisor(s), in the event of his/her leaving the University or going away from the University for a period of more than one year.

9.5.7. To suggest a panel of examiners to the DoR.

9.5.8. To ensure that the scholar has deposited all the fees regularly.

9.6. Guidelines for outside academicians/researchers to register as Ph.D. co-supervisor at Sangam University

9.6.1. Application for appointment as an external co-supervisor will be sent through the supervisor of the research scholar at Sangam based on his/her requirement.

9.6.2. The eligibility of the proposed external co-supervisor will be ascertained by the DRC and approved by the DoR.

9.6.3. The approved person will then be registered as external co-supervisor till the completion of the Ph.D. of the research scholar at Sangam.

9.7. Change of Supervisor: In exceptional cases, applications from a research scholar for change of research supervisor (s) shall be permitted, on recommendation of the RAC Pre after obtaining the consent of the present and proposed supervisor(s). Change of supervisor for the candidates not covered under above will be decided by RAC Mains as per vacancies and research topic of the student.

9.8. Supervisor leaving Sangam /resigning/passing away:

9.8.1. If the research supervisor is on official leave for more than one year, or passes away, a new supervisor will be appointed by the DoR from the Department, subject to approval by RAC.

9.8.2. Due to the movement of faculty from Sangam, who were supervising Ph.D. candidates, his/ her scholar will be transferred to another suitable supervisor. In case of unavailability of a supervisor, the candidate will work under the guidance of the dean of the concerned school for not more than six months. Before the said duration is concerned, the school should arrange a suitable supervisor for the scholar.

10. PROGRAMME STRUCTURE

10.1. The Ph.D. Programme consists of the following stages:

10.2. Program Fee structure

COURSES	TUITION FEE PER SEMESTER
Ph.D. - All disciplines	Rs. 65000

***Plagiarism, thesis evaluation and viva voce charges (To be submitted before Pre-Submission) will be Rs. 20000/=**

Development fee not applicable.

10.2.1. The research scholar needs to pay the tuition fees regularly every semester till submission of the thesis.

10.3. Ph.D. Course Work & Progression

1. All the Ph.D. scholars will be required to undergo one-semester course work.
2. All the Ph.D. Scholars will be required to attend their Department regularly during the Semester.
3. A semester will be of 90 working days.
4. Course work will consist of following:

- A. Research methodology
- B. Computer and Internet related methodologies.
- C. Research & Publication Ethics.
- D. Elective Subjects

End semester examination for paper-I will consist of theory / practical paper of 100 marks each. Candidates are required to pass in theory / practical papers by scoring 55% of the maximum marks.

5. Course work elective subject will cover major research disciplines relevant to the area of research of the candidate as well as a review of relevant literature.

Each department has a curriculum for elective subjects based on the research advancement. Ph.D. students are expected to carry out course work for elective subjects on a prescribed syllabus basis.

6. The candidate will be required to prepare an Assignment for elective subject examination based on the prescribed syllabus course coverage. He / She will be required to score 55% of maximum marks for satisfactory completion of the course work. On the basis of marks awarded in various courses by the examiners and performance in the Viva-voce, University will award grades for the course work. Candidates who fail in their coursework will require repeating course work as and when the same is offered by the University.

SCHEME OF EXAMINATION OF Ph.D. COURSE WORK

Paper No.	Name of the Paper	Assignment Marks / Internal**	Semester Exam Marks / Viva*	Total	Exam Duration
I	Research Methodology	40	60	100	3 Hrs.
II	ICT Lab work / presentation (practical)	40	60*	100	1 Hr.
III	Elective Subject	40	60*	100	3 Hrs.
IV	Research and Publication Ethics	40	60	100	2 Hrs.

Paper Code	Paper Name	Contact Hours	Paper Credit
RES-I	Research Methodology	3 L + 1 T	4
RES-II	ICT Lab Work & Presentation	2 P	2

RES-V	Elective Subject	3 L + 1 T	4
RES -IV	Research and Publication Ethics	2 L	2

L = Lecture

T = Tutorial

P = Practical

Elective Subjects name with codes

Paper Code	Name of the Paper	Assignment Marks / Internal	Semester Exam Marks/Viva	Total	Contact Hours	Paper Credit	Exam Duration
PHENGG101	PROJECT MANAGEMENT	40	60	100	3 L+1 T	4	3 Hrs.
PHENGG102	ADVANCED ROBOTICS & MECHATRONICS	40	60	100	3 L+1 T	4	3 Hrs.
PHENGG103	MACHINE LEARNING FOR ENGINEERING APPLICATIONS	40	60	100	3 L+1 T	4	3 Hrs.
PHENGG104	APPLIED IOT FOR ENGINEERS	40	60	100	3 L+1 T	4	3 Hrs.
PHCSE101	INTRODUCTION TO MACHINE LEARNING	40	60	100	3 L+1 T	4	3 Hrs.
PHCSE102	ARTIFICIAL INTELLIGENCE	40	60	100	3 L+1 T	4	3 Hrs.
PHCSE103	CYBER SECURITY	40	60	100	3 L+1 T	4	3 Hrs.
PHCSE104	BIG DATA ANALYTICS	40	60	100	3 L+1 T	4	3 Hrs.
PHP101	PHARMACEUTICS	40	60	100	3 L+1 T	4	3 Hrs.
PHP102	PHARMACEUTICAL CHEMISTRY	40	60	100	3 L+1 T	4	3 Hrs.
PHP103	PHARMACOLOGY	40	60	100	3 L+1 T	4	3 Hrs.
PHP104	PHARMACOGNOSY	40	60	100	3 L+1 T	4	3 Hrs.
PHL101	CONSTITUTIONAL LAW	40	60	100	3 L+1 T	4	3 Hrs.
PHMG101	CONTEMPORARY DEVELOPMENTS IN BUSINESS MANAGEMENT	40	60	100	3 L+1 T	4	3 Hrs.
PHAG101	ANIMAL SCIENCE	40	60	100	3 L+1 T	4	3 Hrs.
PHMA101	SPECIAL FUNCTIONS, INTEGRAL TRANSFORMS, AND FRACTIONAL CALCULUS	40	60	100	3 L+1 T	4	3 Hrs.

Total Credit for Paper 1: L (3)-T (1)-P (2): Total Credit 6
L = Lecture, T = Tutorial, P = Practical

The detailed syllabus of course work is given below.

Annexure- 1 (Syllabus of Pre-Ph.D. Course work)

10.4. Research Progress:

Every six months, research scholars must submit a progress report in prescribed format (**Annexure -2**) to indicate satisfactory progress to the Supervisor, until submission of the thesis. The RAC Pre will evaluate the progress through an open seminar and submit the evaluation report in prescribed format to the DoR.

NOTE: Failure to submit half yearly reports shall lead to automatic cancellation of registration.

10.5. Change of Area of Research and Title of Ph.D.:

In general, any change in the title of the thesis is not permitted. However, requests for change of research specialisation (within the approved broad area) shall be submitted to RAC Pre. Such requests shall be permitted only once. The RAC Pre

will ensure that the course work undertaken by the scholar is relevant to the subject/discipline requested for change.

10.6 Synopsis Submission

GUIDELINES FOR THE Ph.D. SYNOPSIS

Choosing your research problem

Topic of research or the research problem should be chosen with care because it will play a vital role in the Ph. D. program as well as shaping your career. Your heart, mind and of course your supervisor must be involved in the process of identifying the right research problem. The first step in this direction should be to identify the broad area which usually is the area of specialization in post-graduation. You should choose an area where you feel the urge to explore deeper, which excites you because research is a long and arduous journey and there may be moments when only your passion for the subject will sustain you. At the same time it is important to see the practicality of the topic. Scholars in the applied subjects must gauge the practical utility of the proposed topic while scholars in humanities must be aware of the recent trends. Flipping through standard journals of respective subjects will certainly help in knowing the recent trends in research as well as confirming the uniqueness of the problem that you have in mind. In this regard, the Shodhganga portal of UGC is very useful to know the recently submitted Ph.D.s in various universities across India as well as formulation of the research topics. A supervisor with his experience and knowledge will help you in knowing about the practicality, facilities available and other practical aspects. Summing up, selection of topic will depend upon specialisation, interest, contemporarily, uniqueness, and availability of facilities and manageability.

Writing your Synopsis

Significance of synopsis or the research proposal cannot be overrated. Synopsis is virtually a blueprint of research which will guide you throughout your Ph.D. program. It will also act as a reference point for the examiner in evaluating your final thesis.

It is recommended that the synopsis must follow the following format

1. Introduction

Introduction may include a brief background of the problem followed by necessity, utility and importance/ significance of the proposed research work for the Ph.D. Thesis. Introduction should be as brief as possible.

2. Literature Survey

Literature review surveys scholarly articles, books and other sources (e.g. dissertations, conference proceedings) providing a description, summary, and critical evaluation of each work relevant to your research problem. It can be arranged thematically or chronologically. Works cited in the literature survey must have proper Referencing. The review of literature should lead to synthesis and identification of research gaps.

3. Objectives

In this section the scholar is supposed to give clear cut objectives of the research work related to his/her proposed Ph.D. thesis. Objectives ought to be precisely stated, in numbered form.

4. Scope, Limitations and Delimitations

Scholar is supposed to state the scope, limitations and delimitations of the investigations/study.

Scope means what does your proposed research cover and what are its boundaries.

Limitations are the shortcomings, conditions or influences that cannot be controlled by the researcher that place restrictions on your methodology and conclusions. Any limitations that might influence the results should be mentioned.

Delimitations are choices made by the researcher which should be mentioned. They describe the boundaries that you have set for the study, for example, the things that you are not doing (and why you have chosen not to do them); the population you are not studying (and why not); and the methodological procedures you will not use (and why you will not use them).

5. Research Methodology/ Requirements of the Research Work

This section should be precise, focused and must include the following:

Statement of Research problem: Research design: The design of a study defines the study type (e.g. descriptive, correlational, semi-experimental, experimental, review, meta-analytic) and sub-type (e.g., descriptive-longitudinal case study), independent and dependent variables, research questions, hypotheses, experimental design, and if applicable, data collection methods and a statistical analysis plan.

Sampling design

Planning of analysis of data

Plan about time scheduling of research

1. References

Text of the manuscript should have proper citations wherever necessary. Synopsis must contain the latest references. References must follow APA style for Humanities/ Management, MLA style for Literature, and IEEE style for Sciences/Engineering.

Annexure-3 : Format of Synopsis front page.

10.7 Guidelines for Thesis Submission

10.7.1 Format of Thesis Preparation:

This document lists the general and specific requirements governing thesis preparation including guidelines for structuring the content.

SUBMISSION OF THESIS

Six copies of the thesis and the abstracts are to be submitted to the DoR, along with the checklist as per the **Annexure-4**. Thesis will be submitted only after all other requirements for the degree have been completed.

10.7.2 Guidelines for Pre Thesis Submission:

The University will conduct pre-submission presentations for which only those scholars will be eligible who have:

- a. Completed at least three years from the date of their respective DRC.
- b. Successfully cleared Ph.D. Course Work assignments and examination,
- c. Submitted all six-monthly progress reports (5) through their supervisors,
- d. Published at least three research papers in international/national (In a UGC listed Journal) journals of repute having good impact factor, co-authored with their respective supervisors, as research scholars of Sangam University, Bhilwara,
- e. Cleared all pending dues,
- f. Completed their proposed work as approved in Synopsis and are ready for presentation of their work.

Such candidates, whenever they become eligible for pre-submission seminar, may apply to the DoR through their respective supervisors in the prescribed application (**Annexure -5**).

1. Two copies of spiral bound draft of complete thesis along with two copies of research publications.
2. Soft copy of the thesis in CD along with plagiarism report duly signed by supervisor and co supervisor,
3. No dues certificate from accounts, Library, Department Library, Research Section and Student Section.

It is worth mentioning that research scholars are supposed to defend their research work before the Pre Submission Board by way of a presentation of about 30 minutes followed by a session of questions–answers for which they should bring their PPT presentation in a pen drive. It is expected that apart from meeting out the objectives of the research work with suitable research methodology, scholars should be able to present their work to the satisfaction of the Board.

It would be better if scholars come prepared for oral presentation of work being presented. Further, they must have all the data (experimental readings/ questionnaires/ interview schedules/ photographs etc.) relevant to their research, at the time of presentation for ready reference.

10.7.3 Guidelines for Submission of Final thesis

(1) After getting an approval from the Pre Submission RAC, the candidate can finalize his/her thesis. The supervisor shall intimate to the DoR that the thesis is ready for submission. He/ She shall make sure that the thesis is presentable in all aspects and shall forward three copies of the summary of the thesis to the University. The candidate shall submit his/her thesis within six months of the intimation of the supervisor and only in extraordinary cases shall the President extend the time.

(2) The thesis, when received, shall be referred for evaluation to the supervisor and two External examiners, who will be appointed in the following manner: The supervisor (the main Supervisor in case of co-supervision) of the candidate will suggest a panel of eight names (out of eight names, four names must be from outside India/ State) of external experts (including adequate data regarding designation and address) competent to evaluate the thesis. The panel will be submitted to the President, who will appoint two external examiners out of this panel. If necessary, he/she may call for additional names for the panel from the supervisor. The viva voce examination based, among other things, on the critiques given in the evaluation report, shall be conducted by the Research Supervisor and at least one of the two external examiners and shall be open to be attended by Members of the Research Advisory Committee Mains (RAC Mains), all faculty members of the Department, other research scholars and other interested experts/ researchers.

(3) The viva-voce of the research scholar to defend the thesis shall be conducted only if the evaluation report(s) of the examiner(s) on the thesis recommends acceptance. If one of the evaluation reports of the examiner in case of a Ph.D. thesis recommends rejection, the Institution shall send the thesis to an alternate examiner out of the approved panel of examiners and the viva-voce examination shall be held only if the report of the alternate examiner is satisfactory. If the report of the alternate examiner is also unsatisfactory, the thesis shall be rejected, and the research scholar shall be declared ineligible for the award of the degree.

B. Requirement for submitting Ph.D. Thesis:

(a) A 'No Dues' certificate duly signed by the Head of the Department, Hostel Warden concerned, University Library, Accounts Section of the University, Departmental Library and In charges of Central research facilities, if any, shall be required to be submitted along with the thesis.

(b) The candidate shall pursue his research at the headquarters of the supervisor, the period of residence being considered as per UGC norms in each year from the date of commencement of research. A portion of the period of residence, may for the sake of special guidance or facilities or collection of research material or field study be spent elsewhere, as directed by the supervisor.

(c) The candidate must have at least three research papers published / accepted in the UGC Care-list journals to his credit before submission and also he/she has to present a pre-submission seminar before the Departmental Committee.

(d) The minimum period required to submit the Ph.D. thesis is three years (Full time)/ four years (Part time) from the date of admission provided that the candidate has put in minimum attendance as per UGC norms.

(e) A candidate shall submit through proper channel six printed or typed copies of his / her Ph.D. thesis and one soft copy to be uploaded at appropriate places, which shall comply with the following conditions:

In either case, it shall evince the capacity of the candidate for critical examination and independent judgement. It should also be satisfactory so far as its presentation is concerned and must be suitable for publication. The major portion of the work presented in the thesis is done after registration in this university.

(f) The Ph.D. thesis can be written either in English or Hindi (written in Devnagari script whenever it is needed). When the subject matter of the thesis relates to the official language, it may be written in that language.

(g) Candidates submitting the thesis for the university degree is required to follow the following aspects regarding paper size, text layout etc.:

Size of the paper should be A4 / quarter, 210 mm x 295 mm except for maps, drawing, graphs on which no restriction is placed.

The text should be typed leaving a margin of 4 cm on the left hand side and 3 cm on the right hand side as well as 3 cm at the top and 3 cm at the bottom.

The text should be typed in 1.5 one spacing using normal typeface / electronic typing / PC Word processing in 12 font size of Arial / Times New Roman. For scripts other than Roman (Devanagari, Urdu etc.) comparable font size should be used.

Likewise, cover layout should also be specified. Affiliation of the supervisor could be added but it should not contain administrative designation like Dean/Head of the Department / Dean of the School/Faculty, etc.

Contents and text of the thesis should also be submitted on a CD, with six hard copies (Including one copy for students and one copy for supervisor). CD is not to be issued and kept under safe custody of the Dean (Research).

Candidates should submit thesis in the following specific colors on cover page:

- School of Basic and Applied Sciences : Light Blue
- School of Commerce and Management : Cream
- School of Engineering and Technology : Light Pink
- School / Faculty of Education : Navy Blue
- School of Legal Studies : Black
- School of Arts and Humanities and School of Agriculture Science and technology : Dark Tan

10.8 Award of the Degree/ Provisional Certificate

10.8.1 After satisfactory completion of the viva-voce examination, the report of viva-voce will be submitted to the office of CoE by the DoR with approval by the Chairman, RAC.

10.8.2 Provisional Certificate, if requested, will be issued on payment of prescribed fee.

10.8.3 The Provisional Certificate will be valid till the next convocation of the University.

The date of award of Provisional Certificate will be the date of successful completion of the viva voce examination.

11. RE-REGISTRATION

11.1 Scholars who fail to complete the Ph.D. work within the prescribed time limit will be given only one chance to re-register for Ph.D., provided they continue the same topic under the same supervisor. They must apply for re-registration prior to the expiry of the prescribed maximum period.

11.2 The re-registered scholars are permitted to submit the thesis after one year but not later than two years after re-registration.

11.3 Re-registered scholars will continue to be governed by the same regulations under which they have been previously registered. However, the fees must be paid as per the regulations in force.

12. CANCELLATION OF REGISTRATION

12.1. Requests for cancellation of the Ph.D. registration may be submitted either by the research supervisor or by the scholar. However, the final decision rests with the RAC.

12.2. The cancellation may be revoked upon request within three months to a maximum of 5 years after the date of cancellation by paying the prescribed cancellation revoke fee, along with the fees due to the University. After this period, the registration shall be cancelled once for all.

12.3. The Research Supervisor may recommend the cancellation of the registration of his / her scholar if they fail to show reasonable progress and are not in contact with the supervisor. Non Submission of Six Monthly progress reports for two consecutive semesters may be considered as reasonable ground for the same.

13. DEGREE REQUIREMENTS

13.1. The essential requirements for the award of Ph.D. degree to scholars are as follows:

13.2 Minimum CGPA of 5.5 in Course Work

Examination completed within the first year of provisional registration.

13.3 Institute residential requirement of 18 weeks.

13.4 Three Research Articles to be published in Scopus/ SCI/ SCIE peer-reviewed listed Journals.

13.5 Satisfactory defence of thesis during viva-voce examination

13.6 Satisfactory completion of all the stages of the programme.

ANNEXURE-1

Pre. Ph. D. Coursework syllabus

Paper-I: Research Methodology

Teaching Scheme

Lectures: 04 Hrs/week

Examination Scheme

Duration: 3 Hrs

Theory: 100 Marks

Course objectives:

- To understand the role of research methodology in engineering
- To understand literature review process and formulation of a research problem
- To understand data collection methods and basic instrumentation
- To learn various statistical tools for data analysis
- To learn technical writing and communication skills required for research
- To create awareness about intellectual property rights and patents

Unit –I: Introduction to Research Method

Definition of research, Nature and scope of research , Importance of research in current scenario, Characteristics of research, Types of research- Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical, Overview of research methodology in various areas of engineering/Management/Legal Studies/ Basic and Applied Science, Introduction to problem Identification and solving, basic research terminology such as Exposition, concept, construct, types of variables , definition and types of hypothesis, proposition etc., Role of Information and Communication Technology(ICT) in research.

Unit –II: Research Problem Formulation and methods

Literature review, sources of literature, various referencing procedures, maintain literature data using Endnote2, Identifying the gap areas from the literature review and research database, Problem Formulation, Identifying variables to be studied, determine the scope, objectives, limitations and or assumptions of the identified research problem, Justify basis for assumption, Formulate time plan for achieving targeted problem solution, Important steps in research methods: Research design , types of Observation and communication , Laws and Theories, Development of Models. Developing a research plan: Exploration, Description, Diagnosis and Experimentation

Unit-III: Data collection

Static and dynamic characteristics of instruments (structured and unstructured questionnaire) used in experimental setup, calibration of various instruments, sampling methods, sample size determination, methods of data collection, Selection of Appropriate Method for Data Collection, Data collection using a digital computer system, case studies of data collection

Unit –IV: Planning & doing Data Analysis

Editing , coding and data entry ,Data processing, data analysis strategies, and tools, data analysis with statistical packages, Basic Concepts concerning testing of hypotheses, procedures of hypothesis testing, generalization, and interpretation Applied statistics: Regression analysis, Parameter estimation, Univariate and Bivariate Multivariate statistics, Factor analysis , T test , Z test , chi square tests, Principal component analysis Software tools for modelling, Simulation, and analysis

Unit-V: Research reports and Thesis writing

Structure and components of scientific research reports, types of research report, developing a research proposal. Thesis writing: different steps and software tools in the design and preparation of thesis, layout, structure and language of typical reports, Illustrations and tables, bibliography, referencing and footnotes, word processing tools such as Latex Oral presentation: planning, software tools, creating and making effective presentations, use of visual aids, importance of effective communication.

Unit-VI: IPR

IPR: intellectual property rights and patent law, techniques of writing a Patent, filing procedure, technology transfer, copyright, royalty, trade-related aspects of intellectual property rights

Reference/Text Books:

1. Donald R cooper Pamela Schindler, Business Research methods, 13th Edition, McGraw hill, New Delhi
2. Ranjit Kumar, Research Methodology: A Step-by-Step Guide for Beginners, SAGE publications Ltd., 2011.
3. Zikmund, W.G., Business Research methods, Cengage, latest edition
4. S.D. Sharma, Operational Research, Kedar Nath Ram Nath & Co., 1972
5. B.L. Wadehra, Law relating to patents, trademarks, copyright designs and geographical indications, Universal Law Publishing, 2014.
6. C. R. Kothari, Research Methodology: Methods and Trends, New Age International, 2004

Paper-II: ICT LAB WORK

Teaching scheme

Lectures: 02 Hrs/week

Duration: 1 Hrs

Examination Scheme

Theory: 100 Marks

Unit-I: Word Processing:

Word features, Creating, Saving and Opening Documents in Word, Interface, Toolbars, Ruler, Menus, Keyboard shortcut, Editing, Previewing, Printing and Formatting a document, Advanced Features of MS Word, Find and replace, using thesaurus, Using Auto-Multiple Functions, Mail Merge, Handling Graphics, tables and Charts, Covering a word Document into various Formats like –Text, Rich Text format, WordPerfect, HTML, PDF etc.

Unit-II: Worksheet:

Excel: Worksheet Basics, working with single and multiple workbooks, working with formula & cell referencing, Auto sum, copying formulae, Absolute & relative addressing, Worksheet with ranges, Formatting of worksheet, Previewing and printing Worksheet, Graphs, and charts, Database, Creating and using Macros, Multiple Worksheets-concepts, creating and using, Data analysis and display.

Unit-III: Presentation:

PowerPoint: Creating Slideshow with animations. Auto Wizard, Creating a blank presentation, auto layout, Screen layout, and views, insert a new slide, applying design template, changing slide layout, reordering and hiding slides, slideshow, and editing custom slide, resizing a textbox, Text Box Properties, Delete a text Box, Bulleted Lists, numbered lists, adding notes , video and audio, Adding text editing options, Formatting text, Replace fonts, Line spacing ,change case spelling check, colour schemes, Adding clip art, Adding an image from a file, Editing graphic, Auto Shapes, WordArt, backgrounds, Action Buttons, Slide Animation, Preview Slide transactions, Slide Show options, Slide Master, Header and Footer, Slide Numbers, Date and Time.

Educational and Research Resources on Net: Encyclopaedia, Wikipedia, On-line Tutorials, and lectures, virtual labs, Open Course-wares, Electronic Journals, E-Books, digital Libraries, and Searching research Information.

Unit-IV: Professional Written Communication:

Students prepare E-mails, Letters, memos, proposals, formal and informal reports, work plans, and progress reports.

Unit-V: Oral Communication:

Impromptu and Extemporaneous methods of delivery. Oral Presentations using visual aids such as handouts, overhead transparencies and presentation software such as PowerPoint.

Elective Subjects

PROJECT MANAGEMENT (PHENGG101)

Unit 1: Advanced Theories of Project Management

- Project management theories and paradigms: Classical, Contingency, and Complexity Theory
- Organizational behaviour in project teams: leadership, motivation, and communication
- Strategic project management and alignment with organizational goals
- Dynamic project management frameworks (Agile, Lean, Scrum, etc.)

Unit 2: Advanced Project Planning and Risk Management

- Advanced scheduling techniques: Monte Carlo simulations, Critical Chain Project Management (CCPM)
- Risk management frameworks: Enterprise Risk Management (ERM), Bayesian Networks
- Risk analysis in uncertain environments (Stochastic modelling)
- Game theory and decision-making under uncertainty in projects

Unit 3: Project Performance Metrics and Financial Analysis

- Multi-criteria decision analysis (MCDA) for project selection
- Advanced cost estimation techniques: Parametric modelling, Artificial Intelligence (AI) in cost prediction
- Financial risk modelling and optimization
- Advanced Earned Value Management (EVM) and its integration with performance management systems

Unit 4: Innovation and Sustainability in Project Management

- Managing innovation in projects: Technology and product innovation cycles
- Sustainable project management practices and metrics (Green Project Management)
- Post-project evaluation and organizational learning
- Research methodology in project management (Qualitative and Quantitative methods, mixed-methods)

ADVANCED ROBOTICS & MECHATRONICS (PHENGG102)

Unit 1: Advanced Kinematics and Dynamics of Robotic Systems

- Nonlinear dynamics of robotic manipulators
- Rigid body motion in robotics: Lie groups and Lie algebras
- Multi-body dynamics and the effects of friction, elasticity, and damping

- Modelling and simulation of robotic systems using advanced mathematical techniques (Lagrangian and Hamiltonian formulations)

Unit 2: Robot Perception and Autonomous Decision Making

- Computer vision for robotics: Deep learning approaches to object recognition
- Simultaneous Localization and Mapping (SLAM) in autonomous robots
- Sensor fusion for robotics: Kalman filters, particle filters, and multi-sensor integration
- Autonomous decision-making frameworks: multi-agent systems, reinforcement learning, and planning algorithms

Unit 3: Advanced Control Systems for Robotics

- Robust and adaptive control techniques in robotic systems
- Model predictive control (MPC) for robotic manipulators
- Fault-tolerant control and control under uncertainty
- Optimal control and real-time control in dynamic environments

Unit 4: Advanced Applications and Future Trends in Robotics & Mechatronics

- Soft robotics: Materials, actuators, and design principles
- Human-robot collaboration and biohybrid systems
- Robotics in industrial IoT and Cyber-Physical Systems (CPS)
- Ethical implications and regulation of autonomous robots in industry and society
- Emerging areas: Quantum robotics, neuromorphic computing for robotics

MACHINE LEARNING FOR ENGINEERING APPLICATIONS (PHENGG103)

Unit 1: Theoretical Foundations of Machine Learning

- Mathematical foundations: Optimization theory, convex analysis, and kernel methods
- Statistical learning theory: VC dimension, PAC learning, generalization bounds
- Deep learning theory: Gradient-based optimization, loss landscapes, and convergence properties
- Model complexity and the bias-variance trade-off in deep models

Unit 2: Advanced Supervised and Unsupervised Learning

- Advanced regression and classification: Support Vector Machines (SVM) with kernels, Ensemble methods (Boosting, Bagging)
- Advanced clustering techniques: Spectral clustering, Hierarchical clustering, Graph-based clustering
- Dimensionality reduction in high-dimensional data: Advanced PCA, ICA, t-SNE, and autoencoders

- Semi-supervised and self-supervised learning

Unit 3: Deep Learning and Neural Networks for Engineering Applications

- Convolutional Neural Networks (CNNs), Recurrent Neural Networks (RNNs), and their engineering applications
- Transfer learning and domain adaptation for real-world engineering problems
- Generative models: GANs, VAEs, and their applications in design and simulation
- Reinforcement learning: Q-learning, Deep Q-Networks (DQNs), Policy Gradient methods for control systems and robotics

Unit 4: Machine Learning in Engineering and Industrial Applications

- Predictive maintenance using machine learning: Case studies in manufacturing and energy sectors
- ML for optimization in engineering design: Topology optimization, multi-objective optimization
- Large-scale engineering problems: Distributed computing, cloud-based ML
- Research methodology in ML: Model interpretability, ethical challenges, and adversarial robustness

APPLIED IOT FOR ENGINEERS (PHENGG104)

Unit 1: Fundamentals of IoT and Sensor Networks

- Overview of IoT: Definitions, architecture, and key components
- IoT protocols and standards (MQTT, CoAP, HTTP/HTTPS)
- Sensor technologies: Types of sensors, transducers, and actuators for IoT systems
- Wireless sensor networks: Zigbee, LoRaWAN, Bluetooth, and 5G
- Energy-efficient IoT communication strategies
- Challenges in IoT: Scalability, interoperability, and security concerns

Unit 2: IoT System Design and Hardware Integration

- Hardware design for IoT: Microcontrollers (Raspberry Pi, Arduino, ESP32)
- IoT embedded systems: Design considerations, real-time operating systems (RTOS)
- Interface electronics: Analog-to-digital conversion, I2C, SPI, UART communication
- System on Chip (SoC) design for IoT
- Power management and low-power design in IoT systems
- Case study: IoT design in smart agriculture or smart cities

Unit 3: Data Analytics and Cloud Integration for IoT

- Data processing techniques in IoT: Stream processing, time-series analysis

- Cloud computing platforms for IoT: AWS IoT, Microsoft Azure, Google Cloud
- Big Data integration with IoT: Data lakes, distributed databases (NoSQL, Hadoop, Spark)
- Edge computing and Fog computing in IoT systems
- Real-time analytics and event-driven architectures
- Case study: Predictive maintenance using IoT data analytics in manufacturing

Unit 4: Security, Privacy, and Future Trends in IoT

- Security challenges in IoT: Device authentication, data encryption, and secure communication
- Privacy concerns and GDPR compliance in IoT systems
- Blockchain for IoT security: Decentralized trust models
- IoT in Industry 4.0: Automation, robotics, and smart factories
- AI and machine learning in IoT for predictive analytics and optimization
- Future of IoT: 6G, Quantum IoT, and IoT in healthcare, automotive, and smart environments

INTRODUCTION TO MACHINE LEARNING (PHCSE101)

COURSE OBJECTIVE:

By the end of the course, students will be able to understand the basic Concepts and mathematical foundation of Genetic Algorithms and machine learning. Implement and observe the results of Genetic Algorithm based applications. Emphasize the Genetic based machine learning and its applications

UNIT-I	Introduction: Objective, scope and outcome of the course. Supervised learning algorithm: Introduction, types of learning, application, Supervised learning: Linear Regression Model, Naive Bayes classifier Decision Tree, K nearest neighbor, Logistic Regression, Support Vector Machine, Random Forest algorithm.
UNIT-II	Unsupervised learning algorithm: Grouping unlabelled items using k-means clustering, Hierarchical Clustering, Probabilistic clustering, Association rule mining, Apriori Algorithm, f-p growth Algorithm, Gaussian mixture model.
UNIT-III	Introduction to Statistical Learning Theory, Feature extraction - Principal component analysis, Singular value decomposition. Feature selection – feature ranking and subset selection, filter, wrapper and embedded methods.

UNIT-IV	Semi supervised learning, Reinforcement learning: Markov decision process (MDP), Bellman equations, policy evaluation using Monte Carlo, Policy iteration and Value iteration, Model-based Reinforcement Learning, Artificial neural network, Perceptron, Multilayer network, Back propagation, Introduction to Deep learning.
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ARTIFICIAL INTELLIGENCE (PHCSE102)

COURSE OBJECTIVE:
The principal object of this course is to give the knowledge of Artificial Intelligence as well as study the basic concept and working of artificial intelligence.

UNIT –I	Introduction to AI knowledge based Expert systems Introduction, Importance and Definition of AI, ES ES building tools and shells
UNIT –II	Concept of knowledge, Representation of knowledge using logics rules, frames Procedural versus Declarative knowledge, forward versus backward chaining Control Strategies: -Concept of heuristic search, search techniques depth first search, Breath first search, Generate & test hill climbing, best first search
UNIT–III	Biological Neurons and synapse characteristics Artificial Neural Networks Types of activation functions. Perception representation, limitations of perceptrons Single layer and multilayer perceptrons and Perception learning algorithms, Supervised learning, Back propagation algorithm, unsupervised learning Kohonen’s top field network & Algorithm
UNIT -IV	Fuzzy logic concepts, Fuzzy relation and membership functions Defuzzification, Fuzzy controllers Genetic algorithm: concepts, coding, reproduction, crossover, mutation, scaling and fitness

REFERENCE BOOK:

1. Elaine Rich and Kevin Knight, *Artificial Intelligence 3/e*, TMH
2. PADHY: *ARTIFICIAL INTELLIGENCE & INTELLIGENT SYSTEMS*, Oxford Publications.
3. James A Anderson, *An introduction to Neural Networks*. Dan. W Patterson, *Artificial Intelligence and Expert Systems*.

CYBER SECURITY (PHCSE103)

UNIT-I

Introduction to Information Security: Introduction to the unit, Definition of Information Security, Evolution of Information Security, Basics Principles of Information Security (CIA triad), Terminologies in information security, Latest news in information security

UNIT-II

The importance of Cryptography: Overview of Cryptography & Steganography, Understanding the AES and DSA (overview), Private key and public key Cryptography, RSA and Digital Signature

UNIT-III

Threats and vulnerabilities: Types of Hackers, Hacktivism, Common Threats to the data, Vulnerability and Penetration testing and its tools, Malicious Codes, Back Doors, Spoofing, sniffing, Spam, Social Engineering, Denial of Service and Distributed Denial of Service,

UNIT-IV

Network and email security: Planning for Network Security, TCP/IP and OSI models, Firewalls and its types, VPNs, and Wireless security, Intrusion Detection and Prevention

BIG DATA ANALYTICS (PHCSE104)

COURSE OBJECTIVE:

Understand the Big Data Platform and its Use cases. Provide an overview of Apache Hadoop Provide HDFS Concepts and Interfacing with HDFS. Understand Map Reduce Jobs. Provide hands on Hadoop Eco System Apply analytics on Structured, Unstructured Data.

UNIT –I	INTRODUCTION TO BIG DATA AND HADOOP : Types of Digital Data, Introduction to Big Data, Big Data Analytics, History of Hadoop, Apache, Analysing, Data with Unix tools, Analysing Data with Hadoop, IBM Big Data, Strategy, Introduction to Infosphere Big Insights and Big Sheets.
UNIT –II	HDFS(Hadoop Distributed File System) : The Design of HDFS, HDFS Concepts, Command Line Interface, Big Data In Enterprise : Problems with traditional large-scale systems, Big Data in enterprise, Comparison with other systems, Hadoop Frame work.
UNIT–III	Introduction To Hadoop :History of Hadoop, Data Storage and Analysis, Hadoop -Setup hadoop -Pseudo mode-Cluster mode-IPv6-Installation of java, hadoop-Configurations of hadoopPig : Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined, Functions, Data Processing operators.
UNIT -IV	The Hadoop Distributed File System-HDFS Design and Architecture-HDFS Concepts-Interacting HDFS using command line-Interacting HDFS using Java APIs-Dataflow-Blocks-Replica-Hadoop Processes-Name node-Secondary name node-Job tracker-Task tracker-Data node Map Reduce:How Map Reduce Works-Anatomy of a Hadoop Cluster-Hadoop Ecosystem Components-Developing Map Reduce Application-Phases in Map Reduce

Pharmacy Department

Pharmaceutics (PHP101)

Unit I: Advanced Analytical and Regulatory Pharmaceutics

- Modern Pharmaceutical Analytical Techniques (UV, IR, NMR, MS, Chromatography)
- Spectro fluorimetry, Flame Emission, AAS, Electrophoresis, X-Ray Crystallography, ELISA
- Regulatory Affairs: IND, NDA, ANDA, CTD, eCTD, clinical trial protocols, pharmacovigilance

Unit II: Modern Drug Delivery and Targeted Systems

- Sustained, Controlled, Rate-Modulated Delivery Systems (CR/SR)
- Personalized Medicines, 3D Printing, Bioelectronic Medicines
- Gastro-retentive, Buccal, Ocular, Transdermal, Protein/Peptide & Vaccine Delivery Systems

Unit III: Molecular Pharmaceutics and Nanotechnology

- Nanoparticles, liposomes, dendrimers, niosomes, aquasomes, phytosomes
- Pulmonary and Intranasal DDS, gene therapy and liposomal gene delivery

Unit IV: Biopharmaceutics and Pharmacokinetics

- ADME, pH-partition, GI transit, solubility, dissolution, Noyes Whitney, Higuchi, Peppas
- One- and two-compartment models, IVIVC, PBPK modelling

Unit V: Industrial GMP and Formulation Optimization

- Validation: IQ/OQ/PQ, Statistical Optimization (DoE, RSM, factorial designs)
- Compression/compaction physics, Micromeritics, Stability Studies
- cGMP, TQM, Scale-up, Tech Transfer, Cleanroom design

Pharmaceutical Chemistry (PHP102)

Unit I: Modern Analytical Chemistry and Spectroscopy

- Advanced Spectral Analysis (UV, IR, NMR, MS, XRD, LC-MS/MS, GC-MS)
- Validation of Analytical Methods, Pharmaceutical Process Chemistry

Unit II: Medicinal and Organic Chemistry

- Advanced Organic Chemistry (reaction mechanisms, stereochemistry)
- Drug design strategies: QSAR, SAR, Prodrugs, Target identification, Docking

Unit III: Natural Product Chemistry

- Chemistry of alkaloids, glycosides, marine drugs, steroids, saponins, macrolides
- Biosynthesis, isolation, and semi-synthesis

Unit IV: CADD and Regulatory Chemistry

- Computer-aided drug design, ligand-based and structure-based approaches
- Regulatory documentation, impurity profiling, green chemistry

Pharmacology (PHP103)

Unit I: Advanced Pharmacodynamics and Pharmacokinetics

- Receptor signalling, second messengers, desensitization, tolerance
- Advanced drug-receptor theories, dose-response relationships

Unit II: Molecular and Cellular Pharmacology

- Genetic and molecular targets, cell line pharmacology, cancer biology
- Neuropharmacology, neurodegenerative disease mechanisms (Alzheimer's, Parkinson's)

Unit III: Toxicology and Safety Pharmacology

- Acute/chronic toxicity, genotoxicity, teratogenicity, reproductive toxicity
- Animal ethics (CPCSEA), replacement, reduction, refinement (3Rs)

Unit IV: Screening and Drug Discovery

- In vivo & in vitro models: CNS, CVS, antidiabetic, anti-inflammatory
- Clinical research, pharmacovigilance systems, drug safety monitoring

Pharmacognosy (PHP104)

Unit I: Advanced Pharmacognosy and Phytochemistry

- Phytochemical screening, plant metabolites, biosynthesis, HPTLC, HPLC, LC-MS/MS
- Supercritical extraction, microwave-assisted extraction

Unit II: Molecular Pharmacognosy and Biotechnology

- Medicinal plant biotechnology, callus/cell cultures, gene transfer
- DNA barcoding, metabolic pathway engineering

Unit III: Traditional and Industrial Applications

- Indian Systems of Medicine (Ayurveda, Unani, Siddha), Herbal Cosmetics
- Industrial scale herbal production and standardization

Unit IV: Global Regulations and Pharmacovigilance

- WHO/AYUSH/EMA/FDA guidelines for herbal drugs
- Safety, efficacy and global harmonization in botanical drug development

Elective 5: Pharmaceutical Quality Assurance

Unit I: Quality Management Systems

- QMS, TQM, ISO 9001:2015, Six Sigma, ICH Q8–Q12, NABL/GLP
- Validation of Analytical Methods, Equipment & Cleaning Validation

Unit II: Regulatory Affairs and Audit Compliance

- GMP/GDP, Schedule M, USFDA/EMA/MHRA audits, SOPs, MFR/BMR
- Change control, deviation handling, CAPA, data integrity

Unit III: Pharmaceutical Manufacturing Systems

- Technology Transfer, Product Development Lifecycle
- Environmental monitoring, cleanroom validation, HVAC qualifications

Unit IV: Quality by Design and Risk Assessment

- QbD implementation, CPPs, CQAs, Design Space
- Risk analysis tools: FMEA, FTA, HACCP, root cause analysis

Law Department

CONSTITUTIONAL LAW (PHL101)

Objective: - The purpose of the course is to acquaint the Research students with the Basic Postulates of the Constitution like the Constitutional Supremacy, Rule of law, and Concept of Liberty. Finally, Research students should be able to articulate their independent views over contemporary crucial constitutional issues.

Unit I	General: Meaning and Significance of Constitution Classification of Constitution, Nature of Indian Constitution, Historical Background - Government of India Act, Constituent Assembly etc., Salient Features of Indian Constitution, Preamble- Nature and Significance, Citizenship under Indian Constitution -Person vis-s-vis Citizen Rights- Meaning, Nature and Classification, Fundamental Rights- Meaning, Nature and Significance, Relationship of Human Rights and Fundamental Rights
UNIT II	Right to Equality: Concept and Significance-Equality Before Law and Equal Protection of Law, Test of reasonable classification-Judicial Interpretation, Equality in Public Employment, Freedoms and Restrictions under Art.19, Protection against Ex-post facto law, Right to Life and Personal Liberty, Right to Education, Protection against Arrest and Preventive Detention.

UNIT III	Right Against Exploitation: Prohibition of Forced Labour& Child Labour, Right to Religion: Concept of Secularism, Religious Freedom to Individual and Religious Denominations, Restrictions on Right to Religion-State Responsibility in the Matters of Religion, Cultural and Educational Rights - Right to Minorities, Minority- Meaning and Nature
UNIT IV	Right to Constitutional Remedies - Rights and Remedy- The Relationship Art.32 , Meaning, Nature and Significance- Writs under Art.32, Public Interest Litigation-Art.226- Nature and its Relation with Art.32 Art.136- Special Leave Petitions

Suggested Readings: -

- M.P.Jain, Indian Constitutional Law, Wadhwa& Co, Nagpur
- V.N.Shukla, Constitution of India, Eastern Book Company, Lucknow
- Granville Austin, Indian Constitution-Cornerstone of a Nation, OUP, New Delhi
- H.M.Seervai, Constitutional Law of India (in 3 Volumes), N.M. Tripathi, Bombay
- J.N.Pandey, Constitutional Law of India, Central Law Agency, Allahabad

Management & Commerce Dept.

Course Code: (PHMG101)	Contemporary Developments in Business Management
Course Outcomes:	At the end of this course students should be able to:
CO1.	Understand and critically evaluate contemporary issues affecting business management.
CO2.	Analyse the impact of globalization, technology, sustainability, and innovation on managerial practices.

CO3.	Apply modern management strategies to real-world organizational problems.
CO4.	Anticipate and respond to emerging business trends.
Course Content:	
Unit-1:	<p>Introduction to Contemporary Management</p> <ul style="list-style-type: none"> ● Overview of traditional vs. modern management ● Forces shaping contemporary business environments ● Role of the manager today
Unit-2:	<p>Globalization and International Business Trends</p> <ul style="list-style-type: none"> ● Global economic shifts ● Cross-cultural management ● Managing global supply chains and remote teams
Unit-3:	<p>Technological Advancements in Management</p> <ul style="list-style-type: none"> ● Digital transformation and Industry 4.0 ● Artificial Intelligence and data-driven decision making ● Automation and its impact on workforce management
Unit-4:	<p>Sustainability and Ethical Management</p> <ul style="list-style-type: none"> ● Corporate social responsibility (CSR) ● ESG (Environmental, Social, Governance) frameworks ● Ethical leadership and stakeholder management
Unit-5:	<p>Contemporary Leadership Styles</p> <ul style="list-style-type: none"> ● Servant leadership, transformational leadership, etc. ● Emotional intelligence in leadership ● Remote and hybrid leadership challenges

Text Books:	<ul style="list-style-type: none"> ● Harold Koontz, Heinz Wehrich & Mark Cannice : Management: A Global and Entrepreneurial Perspective, Tata McGraw - Hill Education ● James A. F. Stoner, R. Edward Freeman, Daniel R. Gilbert: Management, Pearson Education ● Koontz and O'Donnell : Essentials of Management ● L.M. Prasad : Principles and Practice of Management, Sultan Chand & Sons ● Meenakshi Raman, Prakash Singh: Business Communication, Oxford ● Courtland L Boove, John Thill, Abha Chatterjee: Business Communication today, Pearson Education.
Reference Books:	<ul style="list-style-type: none"> ● Drucker, Peter F. – <i>Management: Tasks, Responsibilities, Practices</i> Publisher: HarperBusiness ● Kotler, Philip & Keller, Kevin Lane – <i>Marketing Management</i> Publisher: Pearson Barney, Jay B. & Hesterly, William S. – <i>Strategic Management and Competitive Advantage</i> Publisher: Pearson ● Goleman, Daniel – <i>Emotional Intelligence: Why It Can Matter More Than IQ</i> Publisher: Bantam ● Sinek, Simon – <i>Start With Why: How Great Leaders Inspire Everyone to Take Action</i> Publisher: Portfolio

Agriculture Department

Animal Science (PHAG101)

Unit I: Introduction to Animal Science and Domestication

- Definition and scope of animal science
- Importance of livestock in the national economy
- Domestication of animals – history and significance
- Classification of livestock and poultry
- Breeds of cattle, buffalo, sheep, goat, swine, poultry
- Indigenous and exotic breeds – characteristics and distribution

Unit II: Anatomy and Physiology of Farm Animals

- Basic structure and function of animal body systems: Digestive system (ruminant vs non-ruminant)
Respiratory system Circulatory system Reproductive system

- Endocrine system and hormones relevant to animal reproduction and growth
- Physiology of lactation and egg formation

Unit III: Animal Nutrition and Feeding

- Nutritional requirements of livestock and poultry
- Classification and functions of nutrients
- Types of feedstuffs – roughages, concentrates, supplements
- Feed formulation and balanced ration
- Feeding standards (NRC, ICAR)
- Importance of minerals and vitamins

Unit IV: Animal Breeding and Genetics

- Principles of animal breeding
- Mendelian genetics and inheritance
- Systems of breeding: inbreeding, outbreeding, crossbreeding
- Artificial insemination and reproductive technologies
- Selection methods and improvement of breeds
- Breeding policies in India

Unit V: Animal Health, Management, and Welfare

- Common infectious and non-infectious diseases
- Symptoms, prevention, and control measures
- Vaccination schedule for livestock and poultry
- General principles of animal management Dairy cattle management Poultry management Sheep and goat farming practices
- Animal welfare and ethical considerations in animal production

Mathematics Department

Special Functions, Integral Transforms, and Fractional Calculus (PHMA101)

Unit I: Special Functions

- Gamma and Beta functions: Properties, identities, integral representations · Bessel functions of the first and second kind: Recurrence relations, orthogonality, series expansions
- Legendre functions: Legendre polynomials, Rodrigues formula, orthogonality · Hermite and Laguerre polynomials: Generating functions, differential equations · Hypergeometric functions: Generalized hypergeometric series, convergence, transformation formulas
- Confluent hypergeometric functions (Kummer's functions)

Unit II: Integral Transforms

- Fourier Transform: Definitions, properties, inversion formula, applications to PDEs · Laplace Transform: Properties, inverse Laplace, convolution theorem, applications to ODEs
- Mellin Transform: Definition, properties, inversion, relation with Laplace and Fourier transforms
- Hankel Transform: Bessel function-based transform and applications · Operational calculus using transforms

Unit III: Fractional Calculus – Fundamentals

- Introduction and historical development
- Definitions of fractional derivatives and integral operators
 - o Pathway integral Operator
 - o Riemann–Liouville
 - o MSM fractional differential and integral operator
- Comparison between definitions, properties, and interpretations
- Laplace transforms of fractional derivatives

Unit IV: Applications of Fractional Calculus

- Solution of fractional differential equations
- Modelling physical and engineering systems:
 - o Visco elasticity
 - o Diffusion processes
 - o Control theory
- Mittag-Leffler functions and their role in fractional-order systems
- Numerical methods for fractional equations

References

1. I.N. Sneddon – Special Functions of Mathematical Physics and Chemistry
2. A. Erdélyi – Higher Transcendental Functions (Bateman Manuscript Project)
3. R. Gorenflo and F. Mainardi – Fractional Calculus: Integral and Differential Equations of Fractional Order
4. K.B. Oldham and J. Spanier – The Fractional Calculus
5. Podlubny, I. – Fractional Differential Equations
6. Davies, B. – Integral Transforms and Their Applications

ANNEXURE-2

Six Monthly Progress Report of Ph.D. work

Date:

Progress Report No.:

Name of the Research Scholar	
Enrollment No.	
Name of the Supervisor	
Name of the Co Supervisor	
Department	
Date of Registration	
Title of the Research Topic	
School	
Report for the Period	From To
Date of Earlier Report	

Precise Report of the Research work done during the above period	
1	
2	
3	
4	
5	
6	
7	

Signature of Research Scholar

Signature of Supervisor/Research Guide

Details of Conference Presentations, Workshops etc. attended (Attach the proofs of subsequent stated document)

- _____
- _____
- _____
- _____
- _____
- _____
- _____
- _____
- _____
- _____
- _____

Date of Submission : _____

Signature of Supervisor/Research Guide

Signature of Dean

ANNEXURE-3

.....**TITLE OF THESIS**.....

.....



A
Thesis

Submitted to the
SANGAM UNIVERSITY

in the Partial Fulfillment of the Requirements for the
Award of the Degree of
DOCTOR OF PHILOSOPHY

in
-----<Name of Subject>-----
under the
School of -----

Submitted by
-----<Name of Research Scholar>-----
Enrolment No.:

Under the Supervision of
-----<Name of Research Supervisor(s)> -----
Designation
----- <Name of Department > -----

Instructions:

1. Paper Size and Margins:

- (i) **Size:** Standard A4 / Quarter (8.3 x 11.7 inch or 210 x 297 mm) size.
- (ii) **Margins:** Left: 1.5 inch (3.81 cm), Right/Top/Below: 1.0 inch (2.54cm).
- (iii) **Orientation:** Portrait (preferred) / Landscape (where it is required).

2. Title:

- (i) **For English:** - Font Type: Times New Roman, Font Size: 18, **Bold**, Line Spacing: 1.15, **UPPERCASE**, Centrally Aligned.
- (ii) **For Hindi:** - Font Type: Mangal Unicode, Font Size: 20, **Bold**, Line Spacing: 1.15, Centrally Aligned.

3. Central Part:

- (i) **For English:** - Font Type: Times New Roman, Font Size: 14, Line Spacing: 1.15, Centrally Aligned.
- (ii) **For Hindi:** - Font Type: Mangal Unicode, Font Size: 12, Line Spacing: 1.15, Centrally Aligned.
- (iii) Font Size of **SANGAM UNIVERSITY** and **DOCTOR OF PHILOSOPHY** will be 16 (in English) and 18 (in Hindi).

4. Name & Address of the University:

- (i) **For English:** - Font Type: Times New Roman, Font Size: 24, **Bold**, **UPPERCASE**, Line Spacing: 1.15, Centrally Aligned.
- (ii) **For Hindi:** - Font Type: Mangal Unicode, Font Size: 26, **Bold**, Line Spacing: 1.15, Centrally Aligned.

5. Month, Year:

- (i) **For English:** - Font Type: Times New Roman, Font Size: 18, **Bold**, Lowercase, Centrally Aligned.
- (ii) **For Hindi:** - Font Type: Mangal Unicode, Font Size: 20, **Bold**, Centrally Aligned.

6. Colour of the Cover Page:

Candidates should submit the thesis along with specific colour on cover page which is notified by the University faculty wise as per the details given below:

1. School of Basic and Applied Sciences: Light Blue
2. School of Commerce and Management: Cream
3. School of Engineering and Technology: Light Pink
4. School of Legal Studies: Black
5. School of Arts and Humanities and School of Agriculture Science and Technology: Dark Tan

ANNEXURE-4

Anti-Plagiarism Certificate

(To be given by the Research Scholar and Research Supervisor)

It is certified that the Ph.D. thesis entitled “.....”
.....”submitted
by Mr./Ms./Mrs has been examined with the
anti-plagiarism tool

We undertake that:

- a. The thesis has significant new work/knowledge as compared with already published or are under consideration to be published elsewhere. No sentence, equation, diagram, table, paragraph or section has been copied verbatim from previous work unless it is placed under quotation mark and duly referenced.
- b. The work presented is original and own work of the author i.e., there is no plagiarism. No ideas, processes, results or words of others have been presented as the author's own work
- c. There is no fabrication of data or results which have been compiled and analyzed.
- d. There is no falsification by manipulating research materials, equipment or processes, or changing or omitting data or results such that the research is not accurately represented in the research record.
- e. The thesis has been checked by using tool/software and found within the limits as per UGC plagiarism policy and instructions issued from time to time.

Report is also enclosed along with this Ph.D. thesis.

Date: Place:

ANNEXURE-5

DECLARATION

(To be given by the Research Scholar)

I,..... , hereby certify that the research work presented in my Ph.D. thesis entitled “.....” which is carried out by me under the supervision of Professor / Dr. and submitted in the partial fulfilment of the requirement for the award of the degree of Doctor of Philosophy of the Sangam University, represents my ideas in my own words and where others’ ideas or words have been included in this thesis, I have adequately cited and referenced the original sources.

The work presented in this thesis has not been submitted elsewhere for the award of any degree or diploma from any other institution or university in India or abroad. I declare that I have adhered to all the principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea / data / fact / source in my submission.

I understand that any violation of the above will cause disciplinary action by the University and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

Date:

Place:

Signature

(Name of the Research Scholar)

This is to certify that the above statement was made by Mr./Ms./Mrs.

.....

(Enrollment Number.....) is correct to the best of my/our knowledge.

Date:

Place:

Signature

Research Co-supervisor, *if any*

Signature
Research Supervisor

CERTIFICATE

(To be given by the Research Supervisor)

I/ We feel great pleasure in certifying that the Ph.D. thesis entitled
"....."
.....
....."submitted by Mr./Ms./Mrs. to the Sangam University in
the partial fulfilment of the requirements for the award of the degree of Doctor of Philosophy is based on
the research work carried out under my/our guidance.

He/ She has completed the following requirements as per UGC Regulations and research ordinance of the
University:

- (a) Satisfactory Completion of the Ph.D. Course Work.
- (b) Submission of Half Yearly Progress Reports.
- (c) Fulfilment of residential requirement of the Research Centre (*Minimum 200 Days*).
- (d) Presentation of research work before the Departmental Committee.
- (e) Publication of at least two research papers in the referred research journal of national and international
repute.
- (f) Two paper presentations in the Conferences/ Seminars.

I/We recommend the submission of the Ph.D. thesis and certify that it is fit to be evaluated by the
examiners.

Date:

Place:

Signature

Research Co-supervisor, *if any*

Signature

Research Supervisor

ANNEXURE-6

COPYRIGHT TRANSFER CERTIFICATE

Title of the Thesis:

Research Scholar Name:

Copyright Transfer

The undersigned hereby assigns to the Sangam University all rights under copyright that may exist in and for the above thesis submitted for the award of the Ph.D. degree.

Signature of Research Scholar

ANNEXURE-7

Sangam University

NH-79, Chittor Road, Rajasthan-312901

www.sangamuniversity.ac.in

APPLICATION FORM

[Ph.D. Pre-Thesis Submission Presentation]

Details of Scholar:

Name of Scholar	
Father's Name	
Enrollment Number	
Subject	
Department	
Coursework qualified	Yes [] / No []
Title of the Thesis	

Details of Supervisor:

Name of Supervisor	
Name of Co-Supervisor (if any)	
Contact details of Co-Supervisor	

Details of Publications (Please attach copy of Published Papers)

Research Paper 1:

Title of Paper	
Name of Journal (with Volume, Issue No., Year and Page No.)	
ISSN No. of Journal	
Journal Indexed in	UGC [] / WoS [] / Scopus [] / Others (give details below)
Others (Journal Indexed)	

--	--

Research Paper 2:

Title of Paper	
Name of Journal (with Volume, Issue No., Year and Page No.)	
ISSN No. of Journal	
Journal Indexed in	UGC [] / WoS [] / Scopus [] / Others (give details below)
Others (Journal Indexed)	

Research Paper 3:

Title of Paper	
Name of Journal (with Volume, Issue No., Year and Page No.)	
ISSN No. of Journal	
Journal Indexed in	UGC [] / WoS [] / Scopus [] / Others (give details below)
Others (Journal Indexed)	

I confirm that I have completed my thesis work and would like to present the same for Pre-Thesis submission presentation.

Date of Application: _____

Place: _____

Name and Signature of Scholar

Mobile/ Contact No. _____

Supervisor Recommendation:

—

—

Date: _____

Signature of Supervisor:

Forwarded by Dean: _____