Ph.D., COMPUTER SCIENCE
CHOICE BASED CREDIT SYSTEM (CBCS)

Curriculum and Syllabus

Regular (2024 – 2025)

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KARPAGAM
ACADEMY OF HIGHER EDUCATION
(Deemed to be University)
(Established Under Section 3 of UGC Act, 1956)

DEPARTMENT OF COMPUTER SCIENCE
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)
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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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KARPAGAM
ACADEMY OF HIGHER EDUCATION
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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-semesterbachelor'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, accreditor 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 and30% 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 out \side 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.

CERTIFICATE

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.

Signature of the Research Supervisor

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 fluorimetricassay 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 modulatingeffects on DNA repair, In: Antimutagenes is 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 atleast 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.

TEMPLATE

ANNEXURE I

Specimen of Cover Page and Title Page
<Font Style Times New Roman>

ANTIOXIDANT ACTIVITY OF INDIAN MEDICINAL PLANTS FROM WESTERN GHATS
Font Size 18><1.5 line spacing>

SYNOPSIS
<Font Size 14>

Submitted by
<Font Size 14><Italic>

RAGHAVENDRA S A
<Font Size 16>

in partial fulfilment of the requirements for the award of the degree of
<Font Size 14><Italic><1.5 line spacing>

DOCTOR OF PHILOSOPHY
<Font Size 16>
IN
BIOTECHNOLOGY
<Font Size 14>

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
<Font Size 16><1.5 line spacing>

December, 2022
<Font Size 14>

ANTIOXIDANT ACTIVITY OF INDIAN MEDICINAL PLANTS FROM WESTERN GHATS

SYNOPSIS

Submitted by

RAGHAVENDRA S A

in partial fulfilment of the requirements for the

award of the degree of

DOCTOR OF PHILOSOPHY
IN
BIOTECHNOLOGY

Enable | Enlighten | Enrich

KARPAGAM
ACADEMY OF HIGHER EDUCATION
(Deemed to be University)
(Established Under Section 3 of UGC Act, 1956)

DEPARTMENT OF BIOTECHNOLOGY

Karpagam Academy of Higher Education
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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
<Font Style Times New Roman>

ANTIOXIDANT ACTIVITY OF INDIAN MEDICINAL PLANTS FROM WESTERN GHATS
<Font Size 18><1.5 line spacing>

THESIS
<Font Size 14>

Submitted by
<Font Size 14><Italic>

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December, 2022
<Font Size 14>

ANTIOXIDANT ACTIVITY OF INDIAN MEDICINAL PLANTS

FROM WESTERN GHATS

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DOCTOR OF PHILOSOPHY

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

December, 2022

ANNEXURE III

Specimen of Bonafide Certificate
<Font Style Times New Roman>

KARPAGAM ACADEMY OF HIGHER EDUCATION
COIMBATORE-21
<Font Size 16>

BONAFIDE CERTIFICATE
<Font Size 14>

<Font Size 12>

Certified that this Thesis entitled
"_____ " is the bonafide
work of Mr./Ms. _____ who carried out the
research under my supervision. Certified further, that to the best of my knowledge the work
reported herein does not form part of any other thesis or dissertation on the basis of which a
degree or award was conferred on an earlier occasion in this or any other scholar.

<<Signature of the Co Supervisor>>   <<Signature of theSupervisor>>
            <<Name>>   <<Name>>
     CO SUPERVISOR   SUPERVISOR
<<Designation & Address >>   <<Designation & Address >>
(If applicable)

ANNEXURE IV

Specimen of Declaration

<Font Style Times New Roman>

DECLARATION

<Font Size 16>

<Font Size 12>

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

<Font Style Times New Roman>

CERTIFICATE

<Font Size 16>

<Font Size 12>

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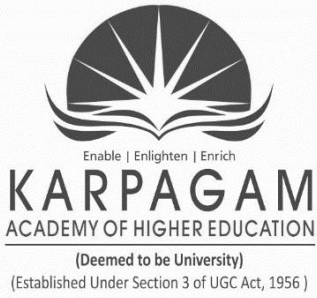
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(Accredited with A+ Grade by NAAC in the Second Cycle)

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

This is a Format only (Neatly typed, aligned and duly signed form to be submitted)

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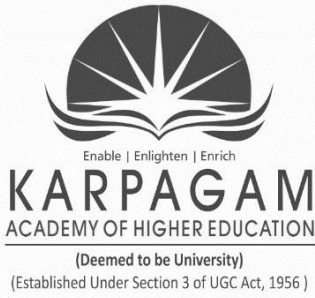
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FORMAT II

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   **Signature of the Research Supervisor**

*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.
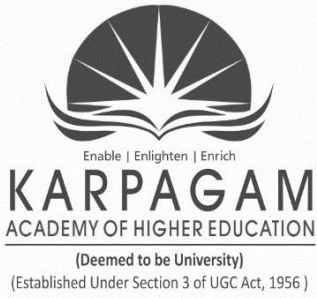
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FORMAT III

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.
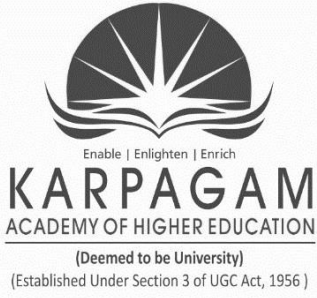
Venue   :
Date   :
Time   :

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

KARPAGAM ACADEMY OF HIGHER EDUCATION

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

This is a Format only (Neatly typed, aligned and duly signed form to be submitted)

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* : Good/Satisfactory/Needs improvement
     (additional sheets may be used)   (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.)
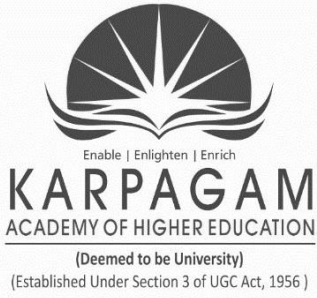
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Phone: 0422 - 2980011- 14 | Email : info@ kahedu.edu.in

This is a Format only (Neatly typed, aligned and duly signed form to be submitted)
FORMAT – IV Annexure

<u>Pre-submission Presentation: A brief report on the Question & Answer Session</u>
Answers should be brief and relevant to the question. If needed, additional sheets may be used

<u>Topic of the Research work:</u>

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 :   **Signature of the Research Supervisor**
Date   :   **(Name & Address)**

Counter Signed:
HOD
(Name & Seal)

KARPAGAM ACADEMY OF HIGHER EDUCATION

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

This is a Format only (Neatly typed, aligned and duly signed form to be submitted)

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 :
    (Attach photocopies of reprints)
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**

KARPAGAM ACADEMY OF HIGHER EDUCATION

(Deemed to be University)
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Pollachi Main Road, Eachanari Post, Coimbatore - 641 021, Tamil Nadu, India.
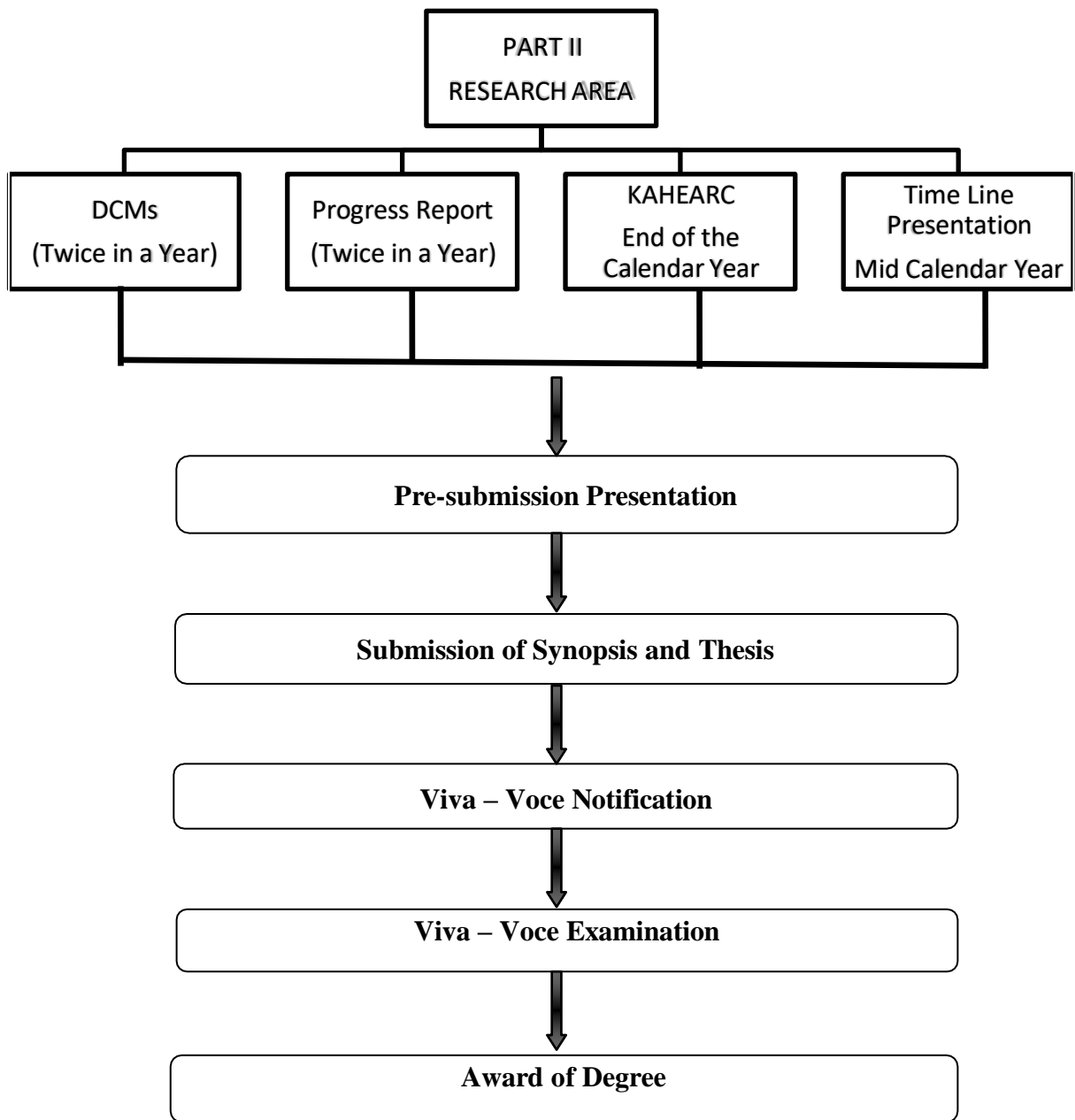Phone: 0422 - 2980011- 14 | Email : info@ kahedu.edu.in

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

```
                    ┌──────────────────────┐
                    │       PART II        │
                    │   RESEARCH AREA      │
                    └──────────┬───────────┘
        ┌──────────────┬───────┴────────┬──────────────┐
┌───────────────┐ ┌──────────────┐ ┌──────────────┐ ┌──────────────┐
│     DCMs      │ │Progress Report│ │   KAHEARC    │ │  Time Line   │
│(Twice in a Year)│ │(Twice in a Year)│ │  End of the  │ │ Presentation │
│               │ │              │ │ Calendar Year│ │Mid Calendar Year│
└───────┬───────┘ └──────┬───────┘ └──────┬───────┘ └──────┬───────┘
        └────────────────┴────────┬───────┴────────────────┘
                                  ▼
```

Pre-submission Presentation

Submission of Synopsis and Thesis

Viva – Voce Notification

Viva – Voce Examination

Award of Degree

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 2008.

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, Impactfactor (in 2022) $= \dfrac{A}{B}$

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.

DEPARTMENT OF COMPUTER SCIENCE
FACULTY OF ARTS, SCIENCE, COMMERCE AND MANAGEMENT
Ph. D Computer Science
(2024 – 2025 Batch and onwards)

Course Code	Name of the Course	Lecture Hours / Week	Credit(s)	Maximum Marks	Page No
		L		ESE (100)	
24RCS101	Research Methodology and Pedagogy	4	4	100	2
24RCS201	Research Publication Ethics	4	4	100	4
24RCS301	Cryptography and Network Security	4	4	100	6
24RCS302	Advanced Networking	4	4	100	8
24RCS303	Data Mining and Analytics	4	4	100	10
24RCS304	Digital Image Processing	4	4	100	13
24RCS305	Soft Computing	4	4	100	15
24RCS306	Web Data Analytics	4	4	100	17
24RCS307	Software Engineering	4	4	100	19
24RCS308	Cyber Security	4	4	100	21
24RCS309	Machine Learning	4	4	100	23
24RCS310	Cloud Computing	4	4	100	25
24RCS311	Internet of Things	4	4	100	27
24RCS312	Artificial Intelligence	4	4	100	29

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24RCS301	Cryptography and Network Security	4	4	100	6
24RCS302	Advanced Networking	4	4	100	8
24RCS303	Data Mining and Analytics	4	4	100	10
24RCS304	Digital Image Processing	4	4	100	13
24RCS305	Soft Computing	4	4	100	15
24RCS306	Web Data Analytics	4	4	100	17
24RCS307	Software Engineering	4	4	100	19
24RCS308	Cyber Security	4	4	100	21
24RCS309	Machine Learning	4	4	100	23
24RCS310	Cloud Computing	4	4	100	25
24RCS311	Internet of Things	4	4	100	27
24RCS312	Artificial Intelligence	4	4	100	29

24RCS101   **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 construct a coherent research proposal that includes an abstract, introduction, literature review, research questions, ethical considerations, and methodology
- To understand the methods of data collection
- To make the students understand the techniques in report writing
- To understand the use of statistical analysis
- To enable the students to understand the evaluation of research.

Course Outcomes (COs)
1. Read, interpret, and critically evaluate social research.
2. Identify, explain, and apply the basic concepts of research, such as variables, operationalization, sampling, reliability, and validity.
3. Recognize the ethical issues involved in research, and practice ethical research standards. 4. Identify and explain the difference between quantitative, qualitative, and mixed methods research and what types of research questions can be answered with each method.
4. Use theory and previous research to create research questions and hypotheses and to identify and analyze the appropriate method and variables needed for research questions.
5. Use a variety of research methods through hands-on experience.

Unit I - RESEARCH METHODOLOGY

Research Methodology: Meaning of Research – Objectives of Research – Motivation in Research – Types of Research – Research Approaches – Significance of Research – Research methods versus methodology. Research and Scientific Method – Importance of knowing how Research is done – Research process – Criteria for good Research – Problems encountered by Researchers in India. Journal Reading Techniques - Defining the Research problem – What is the Research Problem – Selecting the Problem – Necessity of Defining the problem – Technique involved in Defining the Problem – An illustration – Conclusion.

Unit II - METHODS OF DATA COLLECTION

Collection of primary data – Collection of data through questionnaires – Schedules – Differentiation between questionnaires and schedules – Other methods of data collection – Collection of secondary data – Selection of appropriate method for data collection– Guidelines for constructing questionnaire/Schedule–Guidelines for successful Interviewing – Difference between survey and experiment – Data Collection using Journals

Unit III - RESEARCH DESIGN

Need for Research Design – Features of good design – Important concepts relating to

Research Design – Different Research Design – Basic principles of Experimental Designs – Conclusion – Developing a Research Plan. Significance of Report Writing – Different steps in writing Report – Layout of the Research Report – Types of Reports – Oral presentation – Mechanics of writing a Research Report – Precautions for writing a Research Reports – Conclusions.

Unit IV - STATISTICAL ANALYSIS

Central tend in correlation, auto correlation and regression analysis, curve fitting - probability models-distribution. Testing of hypothesis- Analysis variance, testing means for small and large sequence. Simulation-render generation techniques and distribution monte carlo model. Data Analysis: Mathematical and statistical analysis using software tools.

Unit V - PEDAGOGICAL METHODS IN HIGHER EDUCATION

Objectives and roll of higher education- important characteristics of an effective LectureQuality teaching and learning- Lecture preparation Characteristics of instructional design Methods of teaching and learning: Large Group – Technique-Lecture Seminar, Symposium, Tam Teaching, Project, Small group Technique- Simulation, role playing Demonstration, Brain storing, case discussion and assignment, Methods of evaluation- Self evaluation, student evaluation. Diagnostic testing remedial teaching Question banking-Electronic media in education –'e' learning researches web based learning.

SUGGESTED READINGS

1. Deepak Chawla , Neena Sondhi. (2018). Research Methodology: Concepts and Cases. 2nd Edition. Vikas Publishing House Private Ltd, New Delhi.
2. C.R. Kothari. (2017). Research Methodology – Methods and Techniques. 2nd Edition. New Age International (P) Limited. New Delhi.
3. Wayne C. Booth, Gregory G. Colomb, Joseph M. Williams . (2017). The Craft of Research. 3rd Edition, University of Chicago Press.
4. C Eileen M. Trauth. (2017). Qualitative Research in IS: Issues & Trends. IDEA Group Publishing. USA/London (ISBN: 1-930708-06-08)
5. Vedanayagam, E.G. (1989). Teaching technology for college teachers. Sterling Publishers(P) Ltd., New Delhi.
6. Kumar K.L. (1997) Educational Technologies, New age International. New Delhi.
7. Winkler, Anthony C. & Jo Roy Mc Cuen. (1985). Writing a research Paper: A Handbook, 2nd edition, Harcourt,NY.

WEBSITES

1. www.dcs.gla.ac.uk/~johnson/teaching/research_skills/research.html
2. http://www.csc.liv.ac.uk/~ullrich/COMP516
3. http://www.idi.ntnu.no/~thomasos/paper/interpretive.pdf

24RCS201   **Paper – II Research 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 ethical codes to be followed by the researcher
- To maintain scientific integrity in the research
- To promote knowledge and truth in the research
- To understand trust, respect, and objectivity in a collaborative work

Course Outcomes (COs)
1. Be aware about the publication ethics and publication misconducts
2. Understand the philosophy of science and ethics and research integrity
3. Develop hands-on skills to identify research misconduct and predatory publications.
4. Differentiate indexing and citation databases, open access publication and research metrics
5. Use plagiarism tools

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) – ePG – 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.

24RCS301   Paper – III: Special Paper I – Cryptography and Network Security 4H-4C

Instruction Hours / Week: L: 4 T: 0 P: 0   **Marks: External: 100 Total: 100**

End Semester Exam: 3 Hours

Course Objectives
- To provide scholars with a theoretical knowledge to understand the fundamental principles of access control models and techniques and,
- To know about various encryption techniques.
- To understand the concept of Public key cryptography.
- To study about message authentication and hash functions
- To impart knowledge on Network security

Course Outcomes (COs)
1. Classify the symmetric encryption techniques
2. Illustrate various public key cryptographic techniques
3. Evaluate the authentication and hash algorithms.
4. Summarize the intrusion detection.
5. Understand basic concepts of system level security
6. Summarize the intrusion detection and its solutions to overcome the attacks.

Unit I – INTRODUCTION TO CRYPTOGRAPHY
Services. Mechanisms and Attacks – The OSI Security Architecture – A Model for Network Security – Classical Encryption Techniques –   Symmetric Cipher Model – Substitution Techniques – Transporation Techniques – Rotor Machines – Steganography.

Unit II – SIMPLIFIED DES
Block Cipher Principles – The Data Encryption Standard – The Strength of DES – Differential and Linear Cryptanalysis – Block Cipher Design Principles – Block Cipher Modes of Operation.

Unit III – PUBLIC KEY CRYPTOSYSTEM
RSA Algorithm – Key Management – Diffie–Hell man Key exchange – Introduction to Elliptic Curve Cryptography. Message Authentication and Hash functions – Authentication Requirements – Authentication Functions – Message Authentication Codes – Hash Functions – Security of Hash functions and MAC.

Unit IV – DIGITAL SIGNATURES AND AUTHENTICATION PROTOCOLS&WEB SECURITY
Digital Signature Standard – Authentication Applications – Kerberos – X.509 Authentication services and Encryption Techniques. E–mail Security – PGP – S / MIME – IP Security- Secure Socket Layer – Secure Electronic Transaction. System Security – Intruders and Viruses – Firewalls– Password Security.

Unit V – BLOCK CHAIN TECHNOLOGY

Block chain currency: Technology stack – Key Concepts in Bitcoin- How a cryptocurrency works – Block chain contracts- Financial services – crowd funding – Bitcoin prediction markets -Extensibility of block chain concepts – Fundamental Economic principles -Digital Identity verification – block chain neutrality – Digital divide of Bitcoin -Advanced concepts of Block chain – Limitations – Cryptocurrency Basics.

SUGGESTED READINGS

1. Deepti Mittal, Ajay Raj. (2018). Cryptography and Network Security. 1stEdition, Laxmi Publication Private Ltd, Delhi.
2. K.HarBaskar . (2017). Cryptography and Network Security – A Practical Approach. 1stEdition, Laxmi Publication Private Ltd, Delhi.
3. William Stallings. (2016). Cryptography and Network Security. 4th Edition, Pearson Education, Delhi.
4. Behrouz A. Forouzan. (2016). Cryptography and Network Security. Special Indian Edition, Tata McGraw Hill, Delhi.
5. Melanie Swan (2015). Block chain Blue print for a new economy.4th Edition, O'Reilly media. Inc.
6. Roberta Bragg, Mark Rhodes-Ousley and Keith Strassberg. (2016). Network Security. 1st Edition, Tata McGraw Hill, Delhi.
7. Ankit Fadia. (1998). Network Security. 1st Edition, McMillan Publications, Delhi.
8. Bruce Schneir.(1998). Applied Cryptography. 1st Edition. CRC Press, New Delhi.
9. William Stallings.(1998).Cryptography and Network Security. 3rd Edition, Pearson Education, New Delhi.

WEB SITES

1. http://domino.research.ibm.com/comm/research_projects.nsf/pages/security.index.html
2. http://whitepapers.techrepublic.com.com
3. http://www.rsa.com
4. http://www.nsa.gov/home_html.cfm

24RCS302   **Paper – III: Special Paper II - Advanced Networking**   **4H-4C**

Instruction Hours / Week: L: 4 T: 0 P: 0   **Marks: External: 100 Total: 100**
                                                      End Semester Exam: 3 Hours

Course Objectives
- To study and compare various Network architectures and fundamental protocols.
- To learn various transmission media.
- To understand the topologies of networks, layered architecture (OSI and TCP/IP) and protocol suites.
- To understand the routing techniques
- To study and compare the Adhoc network principles

Course Outcomes (COs)
1. Independently understand basic computer network technology.
2. Understand and explain Data Communications System and its components.
3. Identify the different types of network topologies and protocols.
4. Enumerate the layers of the OSI model and TCP/IP.
5. Employ fundamental computer theory to basic programming techniques.
6. Gain the skills and project-based experience needed for entry into web design and development careers.

Unit I – INTRODUCTION
Internet Protocol review, Router Basics – forwarding versus routing – ISPs – Evolution of the Internet Architecture – IP Addressing and Allocation Techniques – NAPs – Autonomous Systems.

Unit II - ROUTING PROTOCOL FOUNDATIONS
Distance vector and link state – Dijkstra's algorithm – IGPs and EGPs – RIP – OSPF – ISIS. Introduction to BGP – EBGP and IBGP

Unit III - INTERDOMAIN ROUTING AND BGP
Border Gateway Protocol details – messages and state machines – route aggregation. Policy and BGP – BGP decision process – Access lists, prefix lists, AS paths, Community – Route maps – Attributes – AS Path, local preference, MED, Community, ATOMIC_AGGREGATE, Aggregator, Origin, NEXT_HOP, AS–SET – Route filtering. Architecture and BGP – Redundancy, symmetry, load balancing – Confederations, route reflectors.

Unit IV - AD–HOC/MOBILE ROUTING
Peer to Peer Overlay Networks – Mesh Networks – Sensor Networks – MANET

Unit V- NETWORK SERVICE QUALITY AND RESOURCE RESERVATION
Queues and Delays – Queuing and Scheduling – A Reservation Protocol – Differentiated Services Network simulator tools NS2

SUGGESTED READINGS

1.   Andrew S. Tannenbaum. (2018). Computer Networks. 5th Edition. Pearson Education.
2.   Forouzan, B. A. (2017). Data Communications and Networking .4th edition. THM, New Delhi.
3.   Bassam Halabi. Internet Routing Architectures. (2016). Cisco Press, New Riders Publishing, ISBN 1-56205-652-2
4.   Christian Huitema. (2016). Routing in the Internet. 2nd Edition, Prentice Hall.
5.   W. Richard Stevens.(2005). TCP/IP Illustrated, Volume 1: The Protocols. Addison Wesley.
6.   Pete Loshin. (2004). IPv6Theory, Protocol, and Practice. 2nd Edition, The Morgan Kaufmann Series.
7.   J. Stewart. (1999). BGP4: Inter Domain Routing in the Internet. Addison Wesley.

WEB SITES

1.   http://www.academ.com/nanog/feb1997/BGPTutorial
2.   http://www.ietf.org/html.charters/manet-charter.html
3.   http://tools.ietf.org/html/rfc2475
4.   http://www.ietf.org/rfc/rfc2205.txt

24RCS303   Paper – III: Special Paper III – Data Mining and Analytics   4H-4C

Instruction Hours / Week: L: 4 T: 0 P: 0   **Marks: External:100 Total: 100**
                                                                                  End Semester Exam: 3 Hours

Course Objectives
- provide grounding in basic and advanced methods to big data technology and Understand the Big Data Platform
- To Understand MapReduce features, cluster analysis and tools.
- To provide exposure to Graph databases Neo4J, Connecting your data and Dashboard
- To understand the Big Data Platform and its Use cases
- To make the students to learn the Map Reduce Jobs and apply analytics on Structured, Unstructured Data.

Course Outcomes (COs)
1. Apply Hadoop ecosystem components.
2. Analyze MapReduce Types
3. Apply Data Model and Connect your data and Dashboard
4. Participate data science and big data analytics projects
5. Understand the fundamentals of Hadoop system and analyze data with Hadoop
6. Understand MapReduce function and its types and apply MapReduce function to various datasets

Unit I - INTRODUCTION: FUNDAMENTALS OF DATA MINING
Data Mining Functionalities - Classification of Data Mining systems - Major issues in Data Mining - Data Warehouse and OLAP Technology for Data Mining Data Warehouse - Multidimensional Data Model - Data Warehouse Architecture - Data Warehouse Implementation - Further Development of Data Cube Technology - From Data Warehousing to Data Mining. **Data Preprocessing:** Needs Preprocessing the Data - Data Cleaning - Data Integration and Transformation - Data Reduction - Discretization and Concept Hierarchy Generation - Online Data Storage. Preparing Data for Mining: Variable Measures.

Unit II - DATA MINING PRIMITIVES AND MINING ASSOCIATION RULES
Languages, and System Architectures: Data Mining Primitives - Data Mining Query Languages - Designing Graphical User Interfaces Based on a Data Mining Query Language Architectures of Data Mining Systems. **Concepts Description:** Characterization and Comparison: Data Generalization and Summarization - Based Characterization - Analytical Characterization: Analysis of Attribute Relevance - Mining Class Comparisons: Discriminating between Different Classes - Mining Descriptive Statistical Measures in Large Databases. Association Rule Mining - Mining Single -Dimensional Boolean Association Rules from Transactional Databases - Mining Multilevel Association Rules from Transaction Databases - Mining Multidimensional Association Rules from Relational Databases and Data Warehouses - From Association Mining to Correlation Analysis – Constraint - Based Association Mining. **Classification and Prediction:** Issues Regarding Classification and

Prediction - Classification by Decision Tree Induction - Bayesian Classification - Other Classification Methods – Prediction - Classifier Accuracy.

Unit III - CLUSTER ANALYSIS AND APPLICATIONS

Types of Data in Cluster Analysis - A Categorization of Major Clustering Methods - Partitioning Methods – Density -Based Methods - Grid-Based Methods - Model-Based Clustering Methods - Outlier Analysis. Machine Learning: Basic Concepts in machine learning - Supervised and Unsupervised Learning. Mining Spatial Databases - Mining Multimedia Databases - Mining Time-Series and Sequence Data - Mining Text Databases - Mining the World Wide Web - Visual Data Mining

Unit IV – DATA ANALYTICS AND TOOLS

Introduction to big data: Introduction – Big Data- Characteristics of Big Data – Big data management architecture- Examining Big Data Types – Big Data Technology Components - Big data analytics – Big data analytics examples - Web Data Overview – Web Data in Action.
Hadoop: Introduction – History of Hadoop - Hadoop Ecosystem- Analyzing data with Hadoop, Hadoop Distributed File System- Design - HDFS concepts - Hadoop filesystem –Data flow – Hadoop I / O - Data integrity – Serialization - Setting up a Hadoop cluster -
Cluster specification -cluster setup and installation – YARN. **MapReduce:** Introduction – Understanding MapReduce functions - Scaling out - Anatomy of a MapReduce Job Run - Failures – Shuffle and sort - MapReduce types and formats - features –counters - sorting - MapReduce Applications – Configuring and setting the environment - Unit test with MR unit-local test.

Unit V – SPARK AND NO SQL

Spark: – Installing spark – Spark applications, Jobs, Stages and Tasks –Resilient Distributed databases- Anatomy of a Spark Job Run – Spark on YARN- SCALA: Introduction- Classes and objects- Basic types and operators- built-in control structures- functions and closures- inheritance. **NoSQL Databases:** Introduction to NoSQL- MongoDB: Introduction – Data types —- Creating, Updating and deleing documents -Querying – Introduction to indexing – Capped collections. HBase: Concepts - HBase Vs RDBMS - Creating records- Accessing data – Updating and deleting data –Modifying data- exporting and importing data.

SUGGESTED READINGS

1. Han, Kamber & Pei. (2018). Data Mining: Concepts and Techniques. 3rd Edition. University Press.
2. Zaki & Meira. (2017). Data Mining and Analysis Fundamental Concepts and Algorithms. Prentice Hall of India, New Delhi.
3. Agarwal. (2015). Data Mining: The Textbook. Prentice Hall of India, New Delhi
4. Boris lublinsky, Kevin t. Smith, Alexey, Yakubovich (2015). Professional Hadoop Solutions,Wiley Bill Franks (2012). Taming the Big Data Tidal wave, John Wiley & Sons
5. 10. Tom White (2012). Hadoop: The Definitive Guide, Third Edition, O'Reilly Media

6.   Michael J. A.Berry, Gordon S.Linoff. (2007). Data mining Techniques, Second Edition.
7.   K.P.Soman, Shyam Diwakar, V.Ajay. (2006). Insight into Data Mining Theory and Practice, Prentice Hall of India.
8.   Jiawei Han & Micheline Kamber. (2001). Data Mining – Concepts and Techniques, Harcourt, India.

WEB SITES

1.   http://www.the-data-mine.com/bin/view/Misc/ApplicationsOfDataMining
2.   http://www.biomedcentral.com/info/about/datamining
3.   http://www-users.cs.umn.edu/~han/kdd/kdd-info.html
4.   http://www.dmreview.com/article_sub.cfm?articleId=1046025   5.   http://www.datamining.databasecorner.com/?
6.   http://www.web-datamining.net/tools/
7.   http://databases.about.com/od/datamining/a/datamining.htm
8.   http://www.dwreview.com/DW_Overview.html
9.   www.kdnuggets.com
10.   http://www.improvedoutcomes.com/docs/WebSiteDocs/Clustering/Clustering_Overview.
11.   http://dms.irb.hr/tutorial/tut_dtrees.php
12.   http://www.aaai.org/AITopics/pmwiki/pmwiki.php/AITopics/MachineLearning
13.   http://robotics.stanford.edu/~nilsson/mlbook.html

24RCS304   Paper – III: Special Paper IV - Digital Image Processing   4H – 4C

Instruction Hours / Week: L: 4 T: 0 P: 0   **Marks: External: 100 Total: 100**
                                                      End Semester Exam: 3 Hours

Course Objectives
- To make the students learn the fundamental theories and techniques of digital image processing
- To cover the fundamental concepts of visual perception
- To know the basic techniques of image manipulation segmentation and coding and a preliminary understanding of Computer Vision
- To know the relationships between pixels
- To understand the techniques in compression and pattern recognition.

Course Outcomes (COs)
1. Perform image manipulations and analysis in many different fields.
2. Apply knowledge of computing mathematics science and engineering to solve problems in multidisciplinary research.
3. Apply knowledge to threshold an image
4. Implement the image compression using the lossy techniques.
5. Analyze pattern recognition.
6. Apply knowledge to process Histogram

Unit I – INTRODUCTION
Digital image processing – Origins of digital image processing- Examples of fields that use digital image processing - Fundamental steps in digital image processing - Components of an image processing system - Representing digital image.

Unit II - BASIC RELATIONSHIPS BETWEEN PIXELS
Basic gray level transformations - Histogram processing - Basic spatial filtering - Smoothing special filtering - Image Degradation/Restoration process - Noise Models.

Unit III - IMAGE SEGMENTATION: THRESHOLDING
Edge Based Segmentation – Region Based Segmentation – Matching. Image Compression: Error Criterion - Lossy Compression - Lossless Compression.

Unit IV - SHAPE REPRESENTATION AND DESCRIPTION
Region Identification - Contour Based Representation And Description – Region Based Shape Representation And Description

Unit V - INTRODUCTION TO INFORMATION CODING
Introduction to image compression techniques Image Recognition: Introduction – Statistical Pattern Recognition - Neural Net- Syntactic Pattern Recognition - Graph Matching - Clustering

SUGGESTED READINGS

1. Rafael C. Gonzalez, Richard E. Woods. (2016). Digital Image Processing, 3rd Edition, Pearson Education, Delhi.

2. Castleman. (2014). Digital Image Processing, 1st Edition, Pearson Education Limited, Delhi.

3. T. Veera Kumaran, S. Jayakumar.(2014).Digital Image Processing, 3rd Edition, McGraw Higher Ed, Delhi.

4. Milan Sonka and Vaclav Hlavac and Roger Boyle. (2014). Image Processing, Analysis and Machine Vision. 2nd Edition. Vikas Publishing House, New Delhi.

5. Nick Efford. (2013). Digital Image Processing – A Practical introduction using JAVA. 2nd Edition, Pearson Education Limited, Delhi.

6. Chanda. B and Dutta Majumder .D. (2013). Digital Image Processing and Analysis. 2nd Edition, Prentice Hall of India, New Delhi

WEB SITES

1. www.icaen.uiowa.edu/~dip/lecture/lecture.html
2. www.ece.ucsb.edu/~manj/ecei81bso4/reviue(gw2002).pdf
3. www.wikipedia.org/wiki/image_processing
4. http://unjobs.org/authors/rafael-c.-gonzalez/image processing

24RCS305   **Paper-III: Special Paper V – Soft Computing**   **4H – 4C**

Instruction Hours / Week: L: 4 T: 0 P: 0   **Marks: External:100 Total: 100**
                                                    End Semester Exam: 3 Hours

Course Objectives
- To build intelligent and wiser machines.
- To derive the answer and not simply arrive to the answer in the fields of soft computing
- To increase purity of thinking machine intelligence freedom to work dimensions complexity and fuzziness handling capability.
- To understand the working of resonance theory in networks and usage of fuzzy logic.
- To understand the NLP models and algorithms using both the traditional symbolic and the more recent statistical approaches.

Course Outcomes (COs)
1. Universalize into domains where direct experience is absent
2. Can perform mapping from inputs to the outputs faster than inherently serial analytical representations
3. Can build intelligent and wiser machines
4. Implement the usage of networks in resonance
5. Analyze and implement the fuzzy algorithms
6. To provide students with the knowledge on designing procedures for natural language resource annotation and the use of related tools for text analysis and hands-on experience of using such tools.

Unit I - **FUNDAMENTALS OF ARTIFICIAL NEURAL NETWORKS**
Biological prototype, Artificial neuron, Single layer artificial, neural networks, multilayer artificial neural networks, training of artificial neural networks.

Unit II - PERCEPTIONS
Perceptron Representation, perceptron learning, perceptron Training algorithm. Back propagation: Introduction to back propagations and Back propagation training algorithm, counter propagation networks.

Unit III - **KOHONEN SELF-ORGANIZING NETWORKS AND HOPFILED NETWORKS**
Kohonen Self-Organizing Networks: Introduction, the Kohonen algorithm, weight training, Grossberg layer, Training the Grossberg Layer. **Hop filed Networks**: Introduction, The Hop filed model, hop filed network algorithm, Boltzmann's machine applications of Hop filed Networks, Associative Memories, Bi- directional Associative Memories. optimization using Hopfield Network. Adaptive Resonance Theory: Architecture of Adaptive Resonance Theory, Algorithm, Applicability of Artificial neural Networks to pattern Recognition and Image Processing, Dimensionality of neural Networks for pattern Recognition- Case Studies **Unit IV - FUZZY ARITHMETIC**

Fuzzy numbers, linguistic variables, arithmetic operations on intervals, fuzzy numbers, and lattice of fuzzy numbers, Possibility theory**:** fuzzy measures, evidence theory, fuzzy sets and possibility theory, possibility Vs probability theory, Fuzzy logic: Multivalued logics, propositions, quantifiers, linguistic hedges, inferences. Uncertainty based information, Fuzzy systems: fuzzy controllers, fuzzy systems and neural networks, fuzzy neural networks, fuzzy automata, dynamic systems- Applications

Unit V - NATURAL LANGUAGE PROCESSING (NLP)
Overview And Language Modeling - Word Level and Syntactic Analysis- Semantic Analysis and Discourse Processing - Natural Language Generation and Machine Translation- Information Retrieval and Lexical Resources.

SUGGESTED READINGS

1. Flasiński, Mariusz. (2016). Introduction to Artificial Intelligence. Tata McGraw Hill,
2. Delhi. Chandra.S.S.V. (2015). Artificial Intelligence and Machine Learning. Kindle Edition.
3. Dr.R.P.Das. (2015). Neural Networks and Fuzzy Logic. 1st Edition, Tata McGraw Hill, Delhi
4. Dr.R.P.Das. (2014). Neural Networks and Fuzzy Logic. 1st Edition, Tata Mcgraw Hill, Delhi.
5. S.N. Sivanandam, S. Sumathi and S. Deepa. (2014). Introduction to Neural Networks using MAT LAB 6.0, 1st Edition, Tata McGraw Hill, Delhi
6. Simon Haykin. (2013). Neural Networks. 3rd Edition, New Delhi: Pearson Education.
7. Alexander and Helen Mart William Jackson. (2013).An introduction to Neural Computing. New Delhi: McGraw Hill.
8. Robert J Schaluoss. (2010). Artificial Neural Networks. 3rd Edition, New Delhi: McGraw Hill.
9. Kishan Mehrotra, Chiluvuri K. Mohan and Sanjay Rana. (2011). Elements of Artificial Neural Networks. 2nd Edition, Mumbai: Penaram International.
10. Tanveer Siddiqui, U.S. Tiwary. (2010)―Natural Language Processing and Information Retrieval‖, Oxford University Press.
11. Daniel Jurafsky and James H Martin, (2010) S.Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition‖, 2nd Edition, Prentice Hall.

WEB SITES

1. www.doc.ic.ac.uk/~nd/surprise_96/journal/vol4/cs11/report.html
2. http://www.statsoft.com/textbook/stneunet.html
3. http://www.fuzzy-logic.com

24RCS306   **Special Paper VI: Web Data Analytics**   **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 various applications of XML in the areas of information representation, Presentation Oriented Publishing, Message Oriented Computing, and Application Configuration. Web Services Protocols
- To use JSP and Java technologies to support the development of modern applications targeted to the evolving spectrum of distributed and decentralized enterprise platforms.
- To Expose the scholars to the advanced CGI enabled capabilities of the Java 2 development environment for Enterprise Applications.
- To gain knowledge in social media mining and know about social media communities.
- To gain knowledge about sentiment analysis and its applications

Course Outcomes (COs)
1. Understand the course structure and objectives
2. Understand what XML is all about
3. Relate to the history of Javascript including some background on Markup Languages (SGML, etc.)
4. Relate to JSP Presentation Oriented Publishing (POP) applications.
5. Understand about social media communities and community algorithms
6. Demonstrate about sentiment classification

UNIT I – INTRODUCTION
Introduction: Web Analytics 2.0 - Click stream- multiple outcome analysis-experimentation and testing- voice of customer – competitive intelligence- the tactical shift -Optimal strategy for choosing web analytics. **Click stream Analysis:** Metrics-Eight critical web metrics-web metrics demystified –strategically aligned tactics for impactful web –Web analytics reportFoundational analytical strategies- click stream analysis made actionable-challenges

UNIT II – MEASURING SUCCESS
Measuring Success: Actionable Outcome KPIs- Moving beyond conversion rates- Micro and macro conversion-Measuring success for a non –ecommerce website- Leveraging qualitative data: Surveys Web enabled emerging user research options

UNIT III – A/B TESTING AND EMERGING ANALYTICS
A/B Testing: Multivariate testing - Actionable testing ideas-Controlled experiments - Competitive intelligence analysis-CI data source, types, secrets- website traffic analysisSearch and keyword analysis- audience identification and segmentation analysis. **Emerging analytics:** Social. mobile, video: Measuring social web - the data challenge- analyzing mobile customer experiences-measuring the success of blogs- quantifying the impact of Twitter – Analyzing the performance of videos.

UNIT IV – SOCIAL MEDIA MINING

Social Media Mining-Network Models- Social media Communities – Member based Detection – Node degree, reachability and similarity–Group Based detection methods - Spectral Clustering: Balanced Community algorithm Community Evolution.

Recommendation Vs Search: Recommendation Challenges – Recommender algorithms – Content Based Methods- Collaborative Filtering – Memory Based – Model Based – Social Media Recommendation – User friendship – Recommendation Evaluation – Precision – Recall –Behavioral– User Behavior – User – Community behavior – User Entity behavior – Behavioral Analytics – Methodology

UNIT V – SENTIMENT ANALYSIS

The Problem of Sentiment Analysis- Document Sentiment Classification-Sentence Subjectivity and Sentiment Classification: Subjectivity Classification – Sentence Sentiment Classification- Aspect-based Sentiment Analysis- Extraction- Sentiment Lexicon Generation- Opinion Summarization- Analysis of Comparative Opinions- Opinion Search and Retrieval- Opinion Spam Detection- Sentiment Analysis Applications.

SUGGESTED READINGS

1. David Flanagan. (2018). Javascript: The Definitive Guide 7th Edition. O'Reilly Media.
2. Dave Mercer. (2017). ASP.NET – Beginner's Guide (2nd ed.). New Delhi: MCGraw Hill
3. Thau. (2017). The Book of JavaScript: A Practical Guide to Interactive WebPages.
4. Jeffrey C. Jackson. (2017). Web Technologies, Pearson Education, 2nd Edition.
5. Paul Wilton. (2016). Beginning JavaScript. 3rd Edition. Wiley Dreamtech India(P) ltd, New Delhi.
6. Thomas A Powell. (2015). The Complete SUGGESTED READINGSHTML, 2nd Edition, Tata McGraw Hill Publishing, New Delhi.
7. Rohit Khurana. (2015). Java Script, APH Publishing Corporation. New Delhi.
8. Ivan BayRoss. (2014). HTML, DHTML, Java Script, Perl CGI, BPB Publications, 2nd Edition.
9. Social Media Mining (2014): An Introduction – Reza Zafarani , MohhammadAbiElasi – Published by Cambridge press.
10. Sybex. (2012). XML Complete, BPB Publications, 3rd Edition.
11. Deitel Nieto. (2012). World Wide Web. 3rd Edition, Pearson Education, New Delhi.

WEB SITES

1. http://www.w3schools.com/js/default.asp
2. http://www.w3schools.com/xml/default.asp
3. www.amazon.com/web-server-technology
4. http://www.brics.dk/ixwt

24RCS307   **Special Paper VII: Software Engineering**   **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 detailed concepts related to software engineering life cycle
- To Gain knowledge about the concepts of software designing and testing
- To Acquire knowledge about an overview of object-oriented analysis and design, modeling language.
- To acquire knowledge in software testing techniques.
- To make student understand the software quality insurance

Course Outcomes (COs)
1. Analyze and identify a suitable software development life cycle model for an application
2. Develop software requirements specification and cost estimation for an application
3. Differentiate the design models and testing techniques for implementing a software
4. Apply the object orientation concepts in software development
5. Apply the concept of object-oriented methodologies in software development
6. Apply the concept of unified modeling language in software development

Unit I – THE EVOLVING ROLE OF SOFTWARE
Software - software crisis - software process model. Component based development: - The formal methods model – fourth generation techniques. Software Project Planning – Project Planning Objectives - Software Scope – Resources. System planning and initial investigation, bases for planning – Investigation.

Unit II – ANALYSIS CONCEPTS AND PRINCIPLES
Requirement analysis principles – The Information domain – modeling – partitioning – Essential and implementation views. Software prototyping methods and tools. Specification: Specification principles – representation – software requirements specification.

Unit III – DESIGN CONCEPTS AND PRINCIPLES
The Design process: design and software quality – The Evolution of Software Design. Design principles: Design concepts – effective modular design – the design model – design documentation – Software Architecture.

Unit IV – SOFTWARE TESTING TECHNIQUES
Testing Techniques/Tools selection process – Selecting Techniques/tools – Structural System Testing techniques- Functional System Testing Techniques – Unit Testing Technique – Functional Testing and Analysis – Functional Testing – Test factor/Test Technique MatrixThe Cost of Computer Testing – Life Cycle Testing concept – Verification and validation in the software. Assess Project Management Development Estimate and Status - Develop Test Plan - Requirements Phase Testing -Design Phase Testing -Program Phase Testing.

Unit V – **SOFTWARE QUALITY ASSURANCE**

Case studies: WinRunner – QTP (Quick Test Professional)

SUGGESTED READINGS

1.   Pressman, R.S. (2019). Software Engineering: A Practitioner's Approach. 7th edition. McGraw-Hill, New Delhi.
2.   Aggarwal, K.K., & Singh, Y. (2018). Software Engineering. 3rd edition. New Age International Publishers.
3.   Sommerville, I. (2017). Software Engineering8   . 8th edition. Addison Wesley. New Delhi.
4.   Bell, D. (2015). Software Engineering for Students. 4th edition. Addison- Wesley, New Delhi.
5.   Richard Fairley. (2014). Software Engineering Concepts. 8th Edition. Tata McGraw Hill Publishing Company, New Delhi
6.   Mall, R. (2014). Fundamentals of Software Engineering. 2nd edition. Prentice-Hall of India, New Delhi.
7.   Elias M. Awad.(2013). System Analysis and Design. 2nd Edition. BPB Publication, New Delhi.

WEB SITES

1.   www.opensourcetesting.org
2.   www.onestoptesting.com
3.   www.cs.queensu.ca
4.   www.ece.cmu.edu

24RCS308   **Special Paper VIII: Cyber Security**   **4H-4C**

Instruction Hours / Week: L: 4 T: 0 P: 0   **Marks: External:100 Total: 100**
                                                                End Semester Exam: 3 Hours

Course Objectives
- To provides an overview of Information Security and Assurance.
- To provide an exposure to the spectrum of security activities methods methodologies and procedures with emphasis on practical aspects of Information Security.
- To provide the understanding in Cyber crime.
- To provide awareness of security in mobile devices.
- To understand the use of tools.

Course Outcomes (COs)
1. State the basic concepts in information security
2. Explain concepts related to applied cryptography
3. Explain common vulnerabilities in computer programs including buffer overflow, Vulnerabilities, time-of-check to time-of-use flaws incomplete mediation.
4. To implement the security in mobile devices.
5. To understand the tools to reduce the cyber crime.
6. To understand techniques for crypto-analysis symmetric and asymmetric cryptography, digital signature, message authentication code, hash functions and modes of encryption operations.

Unit I – INTRODUCTION TO CYBERCRIME
Definition and Information Security-who are cybercriminals? - Classification of cybercrimes. Cybercrime: The legal perspectives- cybercrimes: An Indian Perspective - cybercrime and the Indian ITA2000: Hacking and the Indian law(s) - A Global Perspective on cybercrimes: cybercrime and the Extended Enterprise - cybercrime Era: Survival Mantra for the Netizens - Concluding Remarks and Way Forward to Further Chapters.

Unit II – CYBER OFFENSES
How Criminals Plan Them: Introduction: categories of Cybercrime -How criminals Plan the Attacks: Reconnaissance Passive Attacks Active Attacks Scanning and Scrutinizing Gathered Information Attack (Gaining and Maintaining the system Access) -social Engineering: Classification of Social Engineering – Cyber talking: Types of stalkers Cases Reported on Cyber stalking How stalking Works? real-life incident of Cyber stalking -Cybercafe and Cybercrimes - Botnets: The Fuel for cybercrime: Botnet - Attack Vector-Cloud Computing: Why cloud computing? Types of Services Cybercrime and Cloud Computing.

Unit III – CYBERCRIME
Mobile and wireless Devices-Introduction - Proliferation of Mobile and Wireless Devices - Trends in Mobility-Credit Card Frauds in Mobile and Wireless Computing Era: Types and Techniques of Credit Card Frauds - Security challenges Posed by Mobile Devices - Registry

Settings for Mobile Devices - Authentication Service security: cryptographic security LDAP Security RAS Security Media Player Control Security Networking API Security - Attacks on Mobile/Cell Phones: Mobile Phone Theft Mobile Viruses Mishing Vishing Smishing Hacking Bluetooth.

Unit IV – MOBILE DEVICES

Security Implication for Organizations – Managing Diversity and Proliferation of Hand-Held Devices Unconventional/ Stealth Storage Devices Threats through Lost and Stolen Devices Protecting Data on lost devices Educating the Laptop Users - Organizational Measures for Handling Mobile devices - Related Security Issues: Encrypting Organization Databases Including Mobile Devices in Security Strategy -Organizational Security Policies and Measures in mobile Computing Era: Importance of Security polices relating to mobile Computing Devices Operating Guidelines for Implementing Mobile Devices Security Polices Organizational Policies for the Use of Mobile Hand - Held Devices - Laptops: Physical Security Countermeasures.

Unit V – TOOLS AND METHODS USED IN CYBERCRIME

Introduction - Proxy Servers and Anonymizers - Phishing: How Phishing Works? - Password Cracking: Online Attacks Offline Attacks Strong Weak and Random Passwords Random passwords - Keyloggers and Spywares: Software Keyloggers Hardware Keyloggers Anti Keylogger Spywares - Virus and Worms: Types of Virus - Trojan Horses and Backdoors: backdoor How to protect from Trojan Horses and Backdoors - Steganography: Steganalysis - DoS and DDoS Attacks: DoS Attacks Classification of DoS Attacks Types or Levels of DoS Attacks Tools Used to Launch DoS Attacks DDoS Attacks How to Protect from DoS/DDoS Attacks – SQL Injection: Steps for SQL Injection Attacks How to Prevent SQL Injection Attacks - Buffer Overflow: Types of Buffer Overflow How to Minimize Buffer Overflow - Attacks on Wireless Networks: Traditional Techniques of Attacks on Wireless Networks Theft of Internet Hours and Wi-fi-based Frauds and Misuses How to Secure the Wireless Networks.

SUGGESTED READINGS

1. Nina Godbole & SUNIT Belapure. (2013). CYBER SECURITY. Wiley India Pvt. Ltd. New Delhi
2. Charles ,P. Pfleeger ,& Shari, L. Pfleeger. (2003).
3. Dieter Gollmann . (2006). Computer Security. 2nd edition. John Wiley & Sons.
4. Godbole, N. (2009). Information Systems Security: Metrics Frameworks and Best Practices. Wiley India. New Delhi
5. Marther, T., Kumaraswamy, S.,& Latif, S. (2009). Cloud Security and Privacy: An Enterprise Perceptive on Risk and Complaince. O'Reilly.

WEB SITES

1. http://www.csc.ncsu.edu/faculty/ning
2. csrc.nist.gov/publications/nistpubs/800-12/handbook.pdf
3. www2.warwick.ac.uk/fac/sci/dcs/teaching/modules/cs134

24RCS309   Paper – III: Special Paper IX: Machine Learning   4H-4C

Instruction Hours / Week: L: 4 T: 0 P: 0   Marks: External: 100 Total: 100
                                                   End Semester Exam: 3 Hours

Course Objectives
- To introduce students to the basic concepts and techniques of Machine Learning.
- To have a thorough understanding of the Supervised and Unsupervised learning techniques
- To study the various probability-based learning techniques
- To understand graphical models of machine learning algorithms
- To study the concepts of deep learning

Course Outcomes (COs)
1. Distinguish between, supervised, unsupervised and semi-supervised learning.
2. Apply the apt machine learning strategy for any given problem.
3. Suggest supervised, unsupervised or semi-supervised learning algorithms for any given problem.
4. Design systems that use the appropriate graph models of machine learning.
5. Modify existing machine learning algorithms to improve classification efficiency.
6. Implement various deep learning models.

UNIT I – INTRODUCTION
Learning – Types of Machine Learning – Supervised Learning – The Brain and the Neuron – Design a Learning System – Perspectives and Issues in Machine Learning – Concept Learning Task – Concept Learning as Search – Finding a Maximally Specific Hypothesis – Version Spaces and the Candidate Elimination Algorithm – Linear Discriminants – Perceptron – Linear Separability – Linear Regression.

UNIT II – DEEP NETWORKS
History of Deep Learning- A Probabilistic Theory of Deep Learning- Backpropagation and regularization, batch normalization- VC Dimension and Neural Nets-Deep Vs Shallow Networks Convolutional Networks- Generative Adversarial Networks (GAN), Semisupervised Learning. **DIMENTIONALITY REDUCTION:** Linear (PCA, LDA) and manifolds, metric learning - Auto encoders and dimensionality reduction in networks - Introduction to Convnet - Architectures – AlexNet, VGG, Inception, ResNet - Training a Convnet: weights initialization, batch normalization, hyperparameter optimization.

UNIT III – LINEAR MODELS
Multi-layer Perceptron – Going Forwards – Going Backwards: Back Propagation Error – Multi-layer Perceptron in Practice – Examples of using the MLP – Overview – Deriving Back-Propagation – Radial Basis Functions and Splines – Concepts – RBF Network – Curse of Dimensionality – Interpolations and Basis Functions – Support Vector Machines. **TREE AND PROBABILISTIC MODELS:** Learning with Trees – Decision Trees – Constructing Decision Trees – Classification and Regression Trees – Ensemble Learning – Boosting – Bagging

Different ways to Combine Classifiers – Probability and Learning – Data into Probabilities – Basic Statistics – Gaussian Mixture Models – Nearest Neighbor Methods – Unsupervised Learning – K means Algorithms – Vector Quantization – Self Organizing Feature Map.

UNIT IV – DIMENSIONALITY REDUCTION AND EVOLUTIONARY MODELS

Dimensionality Reduction – Linear Discriminant Analysis – Principal Component Analysis – Factor Analysis – Independent Component Analysis – Locally Linear Embedding – Isomap – Least Squares Optimization – Evolutionary Learning – Genetic algorithms – Genetic Offspring: - Genetic Operators – Using Genetic Algorithms – Reinforcement Learning – Overview – Getting Lost Example – Markov Decision Process

UNIT V – GRAPHICAL MODELS

Markov Chain Monte Carlo Methods – Sampling – Proposal Distribution – Markov Chain Monte Carlo – Graphical Models – Bayesian Networks – Markov Random Fields – Hidden Markov Models – Tracking Methods.

SUGGESTED READINGS

1. Ashok, K.Talukder,& Roopa, R. Yavagal. (2019). Mobile Computing. 4th Edition. Tata Mc-Graw Hill Publishing Company Pvt Ltd, New Delhi.
2. Raj Kamal . (2018). Mobile Computing.3rd edition. Pearson Education. Tomasz Imielinski,
3. Henry F. Korth . (2017). Mobile Computing.2nd edition. Springer , US.
4. Mischa Schwartz. (2017). Mobile Wireless Communications.2nd edition. Cambridge University Press.
5. J.Schiller. (2016). Mobile Communication,2nd edition. Addison Wesley.
6. William Stallings. (2014). Wireless Communication and Networks.3rd edition. Pearson Education
7. Singhal. (2013). AP-Wireless, Application Protocol.2nd edition. Pearson Education. 8. Lother Merk,Martin, S.Nicklaus and Thomas Stober. (2013). Principles of Mobile 9. Computing, 2nd Edition, Springer.
8. William C.Y.Lee. (2013). Mobile Communication Design Fundamentals. 2nd edition.John Wiley.

24RCS310   **Paper – III: Special Paper X: Cloud Computing**   **4H-4C**

Instruction Hours / Week: L: 4 T: 0 P: 0   **Marks: External: 100 Total: 100**
                                                       End Semester Exam: 3 Hours

Course Objectives
- To learn about the characteristics and types of cloud.
- To know about the services such as IaaS, PaaS, SaaS, IDaaS and CaaS.
- To understand the Virtualization Technologies.
- To understand the Information Security, Privacy and Compliance Risks.
- To learn commercial Google Web services – Open Nebula.

Course Outcomes (COs)
1. Understand cloud architecture and model.
2. Implement working of service models.
3. Explore cloud infrastructure.
4. Learn Threat issues and Database Integrity Issues.
5. Learn Open Source and Commercial Clouds such as Microsoft Azure, Amazon EC2
6. Learn Service Level Agreement for Cloud

Unit I – INTRODUCTION TO CLOUD COMPUTING
Characteristics of Cloud Computing -Paradigm shift - Benefits of cloud computing - Disadvantages of cloud computing- Role of Open Standards-Cloud Computing Architecture: Cloud computing stack-Public cloud -Private cloud -Hybrid cloud -Community cloud.

Unit II – SERVICE MODELS
Infrastructure as a Service (IaaS) -Platform as a Service (PaaS) -Software as a Service (SaaS) - Identity as a Service (IDaaS) -Compliance as a Service (CaaS)- Cloud storage.
.
Unit III – VIRTUALIZATION TECHNOLOGIES
Load Balancing and Virtualization -Advanced load balancing -The Google cloud - Hypervisors -Virtual machine types -VMware vSphere - Machine Imaging -Porting Applications -The Simple Cloud API - AppZero Virtual Application Appliance

Unit IV – CLOUD INFORMATION SECURITY OBJECTIVES
Confidentiality Integrity and Availability -Cloud Security Services - Relevant Cloud Security Design Principles -Cloud Computing Risk Issues -The CIA Triad Privacy and Compliance Risks -Threats to Infrastructure Data and Access Control -Cloud Access Control Issues Database Integrity Issues -Cloud Service Provider Risks Architectural Considerations

Unit V – HOW TO MOVE APPLICATION INTO THE CLOUD
Web Application Design- Machine Image Design-privacy design –Database ManagementSpecialized cloud Architecture: Workload distribution architecture-Dynamic scalabilityCloud bursting-hypervisor clustering-service quality metrics & SLA.

SUGGESTED READINGS

1. BarrieSosinsky .(2017). Cloud Computing.3rd edition Bible, Wiley- India. New Delhi:
2. Rajkumar Buyya, James Broberg, & Andrzej, M. Goscinski. (2016). Cloud Computing.2nd edition New Delhi: Tata Mc-Graw Hill.
3. Ronald, L. Krutz, Russell Dean Vines. (2016). Cloud Security: A Comprehensive Guide to Secure Cloud Computing.2nd editon New Delhi: Wiley –India
4. Dr Kumar Saurabh. (2015). Cloud Computing 2nd edition. New Delhi: Wiley India.
5. Anthony T.Velte Toby J.Velte Robert Elsenpeter. (2015). Cloud Computing Practical Approach 3rd edition. New Delhi:Tata McGraw Hill.
6. Nikos Antonopoulos, Lee Gillam. (2014). Cloud Computing: Principles Systems and Applications .2nd edition. Springer.
7. Giovanni Toraldo. (2012). Open Nebula 3 Cloud Computing.1st editon.

WEB SITES

1. en.wikipedia.org/wiki/Cloud_computing
2. www.ibm.com/cloud-computing/in/en/
3. www.oracle.com/CloudComputing
4. www.microsoft.com/en-us/cloud/default.aspx

24RCS311   **Paper – III: Special Paper XI: Internet of Things**   **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 Introduction to IoT and Architectural Overview of IoT
- To Understand the various IoT Protocols (Datalink, Network, Transport, Session, Service)
- To Understand the communication technologies in IoT
- To Know the IoT protocols and web of things
- To Know the various applications of IoT

Course Outcomes (COs)
1. Understand building blocks of Internet of Things and characteristics.
2. Understand IoT protocols, Web of Things and Integrating IOT.
3. Understand the application areas of IOT ·
4. Realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks
5. Learn about communication technologies used in IoT and Web of Things
6. Learn about Structural models and applications of IoT

Unit I – OVERVIEW
IoT-An Architectural Overview– Building an architecture-Main design principle and needed capabilities-An IoT architecture outline- standards considerations. M2M and IoT Technology Fundamentals- Devices and gateways- Local and wide area networking- Data ManagementBusiness processes in IoT-Everything as a Service (XaaS), M2M and IoT Analytics, Knowledge Management

Unit II – IOT PROTOCOLS
Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Issues with IoT Standardization – Unified Data Standards – Protocols – IEEE 802.15.4 – BACNet Protocol – point-to-point protocols - Ethernet protocols - cellular Internet access Protocol - Machine-to-machine protocol – Modbus Wireless HART- ZWaveBluetooth Low Energy, DASH7 – KNX – Zigbee Architecture – Network layer – APS layer – Security-Threats to IOT system.

Unit III – WEB OF THINGS
Web of Things versus Internet of Things – Two Pillars of the Web – Architecture Standardization for WoT– Platform Middleware for WoT – Unified Multitier WoT Architecture – WoT Portals and Business Intelligence. Cloud of Things: Grid/SOA and Cloud Computing – Cloud Middleware – Cloud Standards – Cloud Providers and Systems – Mobile Cloud Computing – The Cloud of Things Architecture - Connectivity Technologies.

Unit IV – INTEGRATING IoT

Integrated Billing Solutions in the Internet of Things Business Models for the Internet of Things - Network Dynamics: Population Models – Information Cascades - Network Effects - Network Dynamics: Structural Models - Cascading Behavior in Networks - The Small-World Phenomenon.

Unit V – Applications

The Role of the Internet of Things for Increased Autonomy and Agility in Collaborative Production Environments - Resource Management in the Internet of Things: Clustering, Synchronization and Software Agents. Applications - Smart Grid – Electrical Vehicle Charging - Case studies: Sensor body-area-network and Control of a smart home.

SUGGESTED READINGS

1. HonboZhou . (2019). The Internet of Things in the Cloud:A Middleware Perspective— 3rd edition. CRC Press .
2. Dieter Uckelmann; Mark Harrison; Florian Michahelles- (2018). Architecting the Internet of Things– Springer.
3. David Easley and Jon Kleinberg . (2017). Networks, Crowds, and Markets: Reasoning About a Highly Connected World ,1st editon.CambridgeUniversity Press.
4. Olivier Hersent, Omar Elloumi and David Boswarthick . (2016). The Internet of Things: Applications to the Smart Grid and Building Automation .1st editon Wiley.
5. Olivier Hersent, David Boswarthick, Omar Elloumi. (2012). The Internet of Things – Key applications and Protocols. 2nd editon.Wiley.

WEB SITES

1. https://www.ibm.com/blogs/internet-of-things/what-is-the-iot
2. https://www.i-scoop.eu/internet-of-things-guide
3. https://iot-analytics.com
4. https://www.elsevier.com/books/internet-of-things/tsiatsis/

24RCS312   Paper – III: Special Paper XII: Artificial Intelligence   4H – 4C
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Instruction Hours / Week: L: 4 T: 0 P: 0   **Marks: External: 100 Total: 100**
                                                                                   End Semester Exam: 3 Course

Objectives
• To know about the problem solving and AI
• To learn search methods and expert systems
• To enable the student to be familiar with AI theorems and algorithms
• To enables the students to understand the graph notations and search methods
• To gain knowledge in Acquisition
• To learn Automatic program writing with expert systems.

Course Outcomes (COs)
1. Able to understand the problem states and AI
2. Able to understand state space methods
3. Able to understand problem reduction search methods
4. Understand the search algorithms and its measures
5. Able to knowledge engineer in expert systems
6. Able to understand predicate calculus

Unit I – PROBLEM SOLVING AND AI
Puzzles and Games – Problem States and operators-problem solving Agents – Heuristic programming – state space representations – state descriptions-searching for solutions – graph notations – non- deterministic programs — Uninformed search strategies.

Unit II – STATE SPACE SEARCH METHODS
Breadth first and depth first search – heuristic – admissibility- Local search algorithms and Optimization problems – optimality of algorithms – Searching with Non-Deterministic Actions- Searching with partial observations – performance measures – problem reduction representations – AND/OR graphs and higher-level state space

Unit III – PROBLEM REDUCTION SEARCH METHODS
Cost of solution trees – ordered search – alpha beta and minimum procedure-alpha beta pruning -Imperfect Real time Decisions-Stochastic Games – theorem proving in predicate calculus – syntax, semantics, Herbrand universe: variables, qualifiers, unification, resolvents

Unit IV – PREDICATE CALCULUS IN PROBLEM SOLVING& AGENTS
Answer extraction process – resolution – Automatic program writing – predicate calculus – proof finding methods – Logical Agents – Knowledge Based Agents – the Wumpus world – propositional Logic – agents based on propositional logic

Unit V – EXPERT SYSTEMS

Expert systems and conventional programs – expert system organization – Knowledge engineering: knowledge representation techniques – knowledge acquisition – acquiring knowledge from experts – automating knowledge acquisition –Building an expert system – difficulties in developing an expert system

SUGGESTED READINGS

1. Chandra.S.S.V. (2018). Artificial Intelligence and Machine Learning. Kindle Edition.
2. Dr.R.P.Das. (2018). Neural Networks and Fuzzy Logic. 1st Edition, Tata Mcgraw Hill, Delhi
3. Flasiński, Mariusz. (2017). Introduction to Artificial Intelligence.3rd edition. Tata Mcgraw Hill, Delhi.
4. E Charnail, CK Reiesbeck and D V Medermett. (2016). Artificial Intelligence Programming.2nd edition. Lawrence Erlbaum Associates, N J.
5. N J Nilson. (2015). Principles of Artificial Intelligence .2nd edition. Tiega Press, Polo Alto.
6. Elain Rich and Kevin Knight. (2014). Artificial Intelligence.1st edition. McGraw Hill.
7. Donald A Waterman. (2014). A Guide to Expert Systems, Tech knowledge series in knowledge engineering. 1st edition.

WEB SITES

1. https://www.tutorialspoint.com › Artificial Intelligence
2. www-formal.stanford.edu/jmc/whatisai/node3.html
3. http://aima.cs.berkeley.edu/contents.html
4. http://Artificial-Intelligence-3e-Modern-Approach/ contents.html