Central University of Himachal Pradesh

Department of Computer Science and Informatics

School of Mathematics, Computers and Information Science

AGENDA

7th BOARD OF STUDIES MEETING

TO BE HELD ON **28th September, 2021**

Venue: Through Online Mode on Google Meet

हिमाचल प्रदेश केन्द्रीय विश्वविद्यालय

Central University of Himachal Pradesh

(Established under Central Universities Act 2009)

शाहपुर परिशर, शाहपुर, ज़िला काँगड़ा, हिमाचल प्रदेश -176206

Shahpur Block, Shahpur, Distt. Kangra (HP) - 176206

Website: www.cuhimachal.ac.in

7th Meeting of Board of Studies (BOS), 28th September 2021

AGENDA-INDEX

Agenda Item No.	PARTICULARS	Information
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CSI-BOS-7/21-2	To place before the BoS for its approval, a revised structure of the MCA (2 Year) program in light of the National Education Policy-2020. All the revisions made from time to time in the scheme and syllabus of different courses of the MCA (2 Year) program as per the NEP-2020 guidelines will be reported to the upcoming BOS meetings.	Annexure-II,III
CSI-BOS-7/21-3	To place before the BoS for its approval, the adoption of Blended mode of learning in MCA (2 Year) program in the light of National Education Policy-2020.	-
CSI-BOS-7/21-4	To place before the BoS for its approval, the adoption of Multiple Entry-Exit systems in MCA (2 Year) programme in the light of National Education Policy-2020.	-
CSI-BOS-7/21-5	To place before the BoS for its approval, the list of new courses to be included in the course work of Ph.D. Computer Science & Informatics in the light of National Education Policy-2020.	Annexure- IV
CSI-BOS-7/21-6	To place before the BoS for correction in the typo errors in the MCA (3 years, 2020-23 Batch) programme scheme. The following corrections are required: MCA-E04 Data Mining, MCA-OC7 Image Processing, MCA-SD4 Introduction to Latex, MCA-SD2 Web Designing, and MCA-SD7 Network Administration.	-
CSI-BOS-7/21-7	Any item with the permission of the Chair.	-

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आज़ादी का अमृत महोत्सव

File No.: CSI/1-5/BoS/CUHP/21/133 Dated: 28/09/2021

MINUTES OF THE 7th BOARD OF STUDIES MEETING

HELD ON 28th September, 2021

The **meeting** of the **7th Board of Studies** of the **Department of Computer Science & Informatics**, School of Mathematics, Computers and Information Science, Central University of Himachal Pradesh, Shahpur Parisar, Shahpur was held through **online mode** on Google Meet on **28th September, 2021** at **9:00 AM**. During the meeting, all members were available on Google Meet. Prof. Rakesh Kumar, Head and Dean, School of Mathematics, Computers and Information Sciences chaired the meeting.

Following members attended the meeting:

1. **Prof. Rakesh Kumar – Head and Convener**
   Head, Department of Computer Science and Informatics and Dean, School of Mathematics, Computers and Information Science, Central University of Himachal Pradesh, Shahpur Parisar, Shahpur.
2. **Dr. T.P. Sharma– Subject Expert**
   Associate Professor, Department of Computer Engineering, National Institute of Technology, Hamirpur.
3. **Prof. Shakshi Kausal – Subject Expert**
   Professor, UIET, Panjab University, Sector- 25, Chandigarh
4. **Prof. O.S.K.S. Sastri – Vice Chancellor's Nominee**
   Professor, Department of Physics and Astronomical Science, Central University of Himachal Pradesh, Shahpur Parisar, Shahpur.
5. **Dr. Rajender Kumar – Vice Chancellor's Nominee**
   Associate Professor, Department of Chemical and Chemical Sciences, Central University of Himachal Pradesh, Shahpur Parisar, Shahpur.
6. **Dr. Keshav Singh Rawat – Dean's Nominee**
   Incharge, Assistant Professor, Department of Computer Science and Informatics, Central University of Himachal Pradesh, Shahpur Parisar, Shahpur.
7. **Sh. Ajay Kumar, Member**
   Assistant Professor, Department of Computer Science and Informatics, Central University of Himachal Pradesh, Shahpur Parisar, Shahpur.
8. **Sh. Manoj Dhiman– Special Invitee**
   Assistant Professor, Department of Computer Science and Informatics, Central University of Himachal Pradesh, Shahpur Parisar, Shahpur.

The **Chairman** welcomed all the **Hon'ble members** & **Special Invitees** and **briefed** about the **past activities** and also about the various **agenda items** to be **discussed** in the **meeting** which were **sent** in **advance** to all the members through **e-mail** including **External subject experts**.

All the members were **informed** about the issuance of the **University guidelines** regarding the **implementation of NEP 2020** which are **subject to** the **approval** from **Academic Council** and **Executive Council** of CUHP. The **Agenda Items** were **placed** before the **committee** and after **detailed discussions** and **deliberations** on each, the **following decisions** were taken:-

AGENDA ITEM NO. - CSI-BOS-7/21-1

Confirmation and Approval of the Minutes of the 6th Board of Studies meeting held on 23rd July, 2021.

Decision:

The Minutes of the 6th meeting of the BoS were Confirmed and Approved attached as Annexure-I.

AGENDA ITEM NO. - CSI-BOS-7/21-2

To place before the BoS for its approval, a revised structure of the MCA (2 Year) program in light of the National Education Policy-2020. All the revisions made from time to time in the scheme and syllabus of different courses of the MCA (2 Year) program as per the NEP-2020 guidelines will be reported to the upcoming BOS meetings.

Decision:

All the members of BoS unanimously approved the revised course basket of the MCA (2 Year) program in light of the National Education Policy-2020 as Annexure-II, III. Subject Experts were of the opinion that the revisions made from time to time in the scheme & syllabus of different courses of the MCA program as well as other modifications as per the NEP-2020 guidelines of the Central University of Himachal Pradesh may be reported to the upcoming BOS meetings.

AGENDA ITEM NO. -CSI-BOS-7/21-3

To place before the BoS for its approval, the adoption of Blended mode of learning in MCA (2 Year) program in the light of National Education Policy-2020.

Decision:

All the members of BoS unanimously approved the adoption of blended/hybrid mode of learning in MCA (2 year) programme of study in the light of National Education Policy-2020 of the Central University of Himachal Pradesh.

AGENDA ITEM NO. - CSI-BOS-7/21-4

To place before the BoS for its approval, the adoption of Multiple Entry-Exit systems in MCA (2 Year) programme in the light of National Education Policy-2020.

Decision:

All the members of BoS unanimously approved the adoption of Multiple Entry-Exit system in MCA (2 Year) programme in the light of National Education Policy-2020 of the Central University of Himachal Pradesh.

All the members were **informed** about the issuance of the **University guidelines** regarding **the implementation of NEP 2020** which are **subject to** the **approval** from **Academic Council** and **Executive Council** of CUHP. The **Agenda Items** were **placed** before the **committee** and after **detailed discussions** and **deliberations** on each, the **following decisions** were taken:-

AGENDA ITEM NO. - CSI-BOS-7/21-1

Confirmation and Approval of the Minutes of the 6th Board of Studies meeting held on 23rd July, 2021.

Decision:

The Minutes of the 6th meeting of the BoS were Confirmed and Approved attached as Annexure-I.

AGENDA ITEM NO. - CSI-BOS-7/21-2

To place before the BoS for its approval, a revised structure of the MCA (2 Year) program in light of the National Education Policy-2020. All the revisions made from time to time in the scheme and syllabus of different courses of the MCA (2 Year) program as per the NEP-2020 guidelines will be reported to the upcoming BOS meetings.

Decision:

All the members of BoS unanimously approved the revised course basket of the MCA (2 Year) program in light of the National Education Policy-2020 as Annexure-II, III. Subject Experts were of the opinion that the revisions made from time to time in the scheme & syllabus of different courses of the MCA program as well as other modifications as per the NEP-2020 guidelines of the Central University of Himachal Pradesh may be reported to the upcoming BOS meetings.

AGENDA ITEM NO. -CSI-BOS-7/21-3

To place before the BoS for its approval, the adoption of Blended mode of learning in MCA (2 Year) program in the light of National Education Policy-2020.

Decision:

All the members of BoS unanimously approved the adoption of blended/hybrid mode of learning in MCA (2 year) programme of study in the light of National Education Policy-2020 of the Central University of Himachal Pradesh.

AGENDA ITEM NO. - CSI-BOS-7/21-4

To place before the BoS for its approval, the adoption of Multiple Entry-Exit systems in MCA (2 Year) programme in the light of National Education Policy-2020.

Decision:

All the members of BoS unanimously approved the adoption of Multiple Entry-Exit system in MCA (2 Year) programme in the light of National Education Policy-2020 of the Central University of Himachal Pradesh.

AGENDA ITEM NO. - CSI-BOS-7/21-5

To place before the BoS for its approval, the list of new courses to be included in the course work of Ph.D. Computer Science & Informatics in the light of National Education Policy-2020.

Decision:

All the members of BoS unanimously approved the list of new courses for the course work in Ph.D. Computer Science & Informatics in the light of National Education Policy-2020 attached at Annexure-IV. Subject experts also suggested that the subjects of PhD course work may be divided into two semesters.

AGENDA ITEM NO. - CSI-BOS-7/21-6

To place before the BoS for correction in the typo errors in the MCA (3 years, 2020-23 Batch) programme scheme. The following corrections are required: MCA-E04 Data Mining, MCA-OC7 Image Processing, MCA-SD4 Introduction to Latex, MCA-SD2 Web Designing, and MCA-SD7 Network Administration.

Decision:

All members agreed and approved the correction in the typo errors in the MCA (3 years, 2020-23 Batch) programme scheme.

AGENDA ITEM NO. - CSI-BOS-7/21-7

Any item with the permission of the Chair:

All the members were of the opinion that approved CUHP guidelinesas per National Education Policy 2020 may be incorporated in the course schemes of different programmes of study of the Department of Computer Science & Informatics, and advised to report the same in the upcoming BoS meetings.

The meeting ended with a vote of thanks to the chair.

Sh. Ajay Kumar
(Member)

Sh. Manoj Dhiman
(Special Invitee)

Dr. Keshav Singh Rawat
(Dean's Nominee)

(approved through E-mail)
Dr. Rajender Kumar
(VC's Nominee)

Prof. O.S.K.S. Sastri
(VC's Nominee)

(approved through E-mail)
Dr. T.P. Sharma
(Subject Expert)

(approved through E-mail)
Prof. Sakshi Kausal
(Subject Expert)

Prof. Rakesh Kumar
(Chairman & Convener)

हिमाचल प्रदेश केन्द्रीय विश्वविद्यालय

Central University of Himachal Pradesh

(Established under Central Universities Act 2009)

अस्थाई शैक्षणिक खण्ड, शाहपुर, जिला कांगड़ा, हिमाचल प्रदेश -176206

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File No.: CSI/1-3/BoS/C UHP/21/82(a) Dated: 13.07.2021

MINUTES OF THE 6th BOARD OF STUDIES MEETING

HELD ON 23rd JULY, 2021

The **meeting** of the 6th **Board of Studies** of the **Department of Computer Science and Informatics**, School of Mathematics, Computers and Information Science, Central University of Himachal Pradesh, Temporary Academic Block, Shahpur was held through **online mode** on Google Meet (meet.google.com/pqp-ngzb-pwx)on 23rd **July, 2021** at **11:00 AM**. During the meeting, all members were available on **Google Meet**. Prof. Rakesh Kumar, **Head**, Department of Computer Science and Informatics and Dean, School of Mathematics, Computers and Information Science **chaired** the meeting.

Following members attended the meeting:

1. **Prof. Rakesh Kumar – Head and Convener**
   Head, Department of Computer Science and Informatics and Dean, School of Mathematics, Computers and Information Science, Central University of Himachal Pradesh, Temporary Academic Block, Shahpur.
2. **Dr. ArvindKalia – Subject Expert**
   Department of Computer Sciences,Himachal Pradesh University, Shimla.
3. **Dr. T.P. Sharma– Subject Expert**
   Associate Professor, Department of Computer Engineering, National Institute of Technology, Hamirpur.
4. **Prof. O.S.K.S. Sastri – Vice Chancellor's Nominee**
   Professor, Department of Physics and Astronomical Science, Central University of Himachal Pradesh, Temporary Academic Block, Shahpur.
5. **Dr. Rajender Kumar – Vice Chancellor's Nominee**
   Associate Professor, Department of Chemical and Chemical Sciences, Central University of Himachal Pradesh, Temporary Academic Block, Shahpur.
6. **Dr. Keshav Singh Rawat – Dean's Nominee**
   Assistant Professor, Department of Computer Science and Informatics, Central University of Himachal Pradesh, Temporary Academic Block, Shahpur.
7. **Mr. ManojDhiman – Special Invitee**
   Assistant Professor, Department of Computer Science and Informatics, Central University of Himachal Pradesh, Temporary Academic Block, Shahpur.

The **Chairman** welcomed all the **Hon'ble members &Special Inviteesand briefed** about the **past activities** and also about the various **agenda items** to be **discussed** in the **meeting** which were **sent** in **advance** to all members through **e-mail** including **Subject Experts**. Various **Agenda Items** were **placed** before the **committee** and after **detailed discussion** and **deliberations** on each, the **following decisions** were taken:-

AGENDA ITEM NO. - CSI-BOS-6/21-1

Confirmation and Approval of the Minutes of the 5th Board of Studies meeting held on 23rd September, 2020attached as Annexure - I.

Decision:

The Minutes of the 5th meeting of the Board of Studies were Confirmed and Approved.

AGENDA ITEM NO. - CSI-BOS-6/21-2

To deliberate and approve the start of a MCA (Masters of Computer Applications)Programme of Two Years durationw.e.f. Academic Session 2021-22.

Decision:

Both Subject expertsDr.ArvindKalia, Dr. T. P. Sharma and Prof. O.S.K.S. Shastrisuggested the following points regarding duration of MCA programme-

1. MCA programme of 2 year duration with eligibility criteria **"Bachelor of Computer Applications (BCA)/ B.Sc.(Computer Science)/ B.Sc. (IT)/ BA(ComputerScience)/ BA (IT) OR any Graduate with PGDCA OR any Graduate with 20-24 credits in the subjects of computer OR any graduate with minimum of 6 courses of computer studied in graduation (in case of degree not in credit system)from a recognized University or an equivalent examination".**
2. Any Candidate with eligibilitycriteria**"Bachelor Degree with Mathematics either at 10+2 Level or at Graduation Level with at least 50% marks"** must be required to pass additional one year diploma course offered by the department. After completion of one year diploma course, candidate is eligible for admission in MCA programme of 2 year duration.

After deliberate discussion, all the members agreed to start MCA (Masters of Computer Applications) Programme of Two Years duration with eligibility criteria as per mentioned in point one. The MCA programme with eligibility criteria mentioned in point 2 may be started in the future.

AGENDA ITEM NO. - CSI-BOS-6/21-3

To deliberate and approve the minutes of the meeting of Course Development Committee (CDC) as well as the Course Scheme (course duration, eligibility conditions, criteria of selection, credit requirement and conditions for the award of Degree etc.) for the MCA Programme of Two Years duration.

Decision:

Subject experts strongly suggested following necessary changes in course scheme structure for MCA (Masters of Computer Applications) Programme of Two Years-

- **Student intake, examination pattern, and evaluation have been included in the proposed course scheme.**
- **Eligibility conditions are included as per suggestions in AGENDA ITEM NO. - CSI-BOS-6/21-2.**
- **All credits of fourth semester are assigned to project work.**
- **Some courses of core compulsory, core open, elective specialization, and elective open have been shifted to suggested course categories.**

All members agreed and approved the CDC minutes and the Course Schemewith above mentioned suggestions as per Annexure –II, IIIIa).

AGENDA ITEM NO. - CSI-BOS-6/21-4

To deliberate and approve the course contents developed by CDC (Course Development Committee) for the MCA Programme of Two Years duration

Decision:

Subject experts suggested that the course contents developed by CDC (Course Development Committee) for the MCA Programme of Two Years duration may be fitted according to the course structure as suggested in AGENDA ITEM NO. - CSI-BOS-6/21-3.All members agreed and approved the course contents with these changes as per Annexure-IV(a).

AGENDA ITEM NO. - CSI-BOS-6/21-5

To deliberate and approve the course contents for the MCA Programme of Three Years duration

Decision:

All members agreed and approved the course contents for the MCA Programme of Three Years duration as attached in Annexure –V.

AGENDA ITEM NO. - CSI-BOS-6/21-6

Proposal of the Faculty Member of the Department of Computer Science and Informatics to become M.Phil./Ph.D. Supervisor/Guide

Decision:

All the members of BoS unanimously approved the Dr.Keshav Singh Rawat, Assistant Professor, Department of Computer Science and Informatics, School of Mathematics, Computers and Information Sciences to Supervise thePh.D scholars of the Department (as per CUHP Ordinance No. 42, Clause 6):

AGENDA ITEM NO. - CSI-BOS-6/21-7

To approve the change of Research Supervisor for the Ph.D. Students in the Department of Computer Science and Informatics

Decision:

All members agreed and approvedDr.Keshav Singh Rawat, Assistant Professor, Department of Computer Science and Informatics as the Research Supervisor of Mr.Dheeraj Kumar (Roll No. CUHP20RDCS01), Mr.Girish Sharma (Roll No. CUHP20RDCS02), and Mr. Manoj Dhiman (Roll No. CUHP20RDCS03) in place of previous supervisor Dr.Sandeep Kumar Sood as he left the University.

AGENDA ITEM NO.-CSI-BOS-6/21-8

To approve the Co-Supervisor for the Ph.D. Students in the Department of Computer Science and Informatics

Decision:

All members agreed to allow Dr. Sandeep Kumar Sood, Associate Professor, NIT Kurukshetra to act as research Co-Supervisor of Mr. Dheeraj Kumar (Roll No. CUHP20RDCS01) and Mr. Girish Sharma (Roll No.CUHP20RDCS02) as per the recommendations from the present Supervisor and approval from the RAC.

AGENDA ITEM NO.-CSI-BOS-6/21-9

Approval of List of Experts as Examiners for the Practical and Viva Voce Examinations of M.Sc. IT and MCA.

Decision:

All members agreed and approved the list of examiners as proposed at Annexure VI. It was also suggested that the list will be updated regularly by the faculty members of the Department of Computer Science and Informatics with the consent of the respective Head of the Department and the same be reported in the next meeting of BoS. It was also suggested that preferably the subject course experts be invited for specific courses. The BoS also recommended that, if needed, HoD may invite a Subject Expert (External Examiner) not included in the list, on the recommendations of the concerned faculty member(s) and after approval of competent authority of the university.

AGENDA ITEM NO. - CSI-BOS-6/21-10

Any item with the permission of the Chair.

The subject experts also suggested that a different department-level committee may be constituted instead of BoS for discussion of research degree matters.
In this context, as per the CUHP ordinance, the Research Advisory Committee (RAC) of the Department is already constituted, and all research degree matters are approved by the Research Advisory Committee (RAC) followed by BoS and School Board.

The meeting ended with a vote of thanks to the chair.

Mr. Manoj Dhiman
(Special Invitee)

Dr. Keshav Singh Rawat.
(Dean's Nominee)

Dr. Rajender Kumar
(VC's Nominee)

Prof. O.S.K.S. Sastri
(VC's Nominee)

Dr. T.P. Sharma
(Subject Expert)

Dr. Arvind Kalia
(Subject Expert)

22/09/2021

Prof. Rakesh Kumar
Chairman & Convener

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Shahpur Parishar, District Kangra, Himachal Pradesh-176206
Department of Computer Science &Informatics

MCA Programme (2-years) as per the NEP-2020 guidelines of CUHP

A student must have to earn 80 credits as per the Course Scheme for the award of MCA degree.

Course category	Credit
Disciplinary/ Interdisciplinary: Major Course	30
Disciplinary/ Interdisciplinary: Minor Course	16
Vocational/ Skill	14
IKS	4
Review of Literature, Research Proposal	8
Dissertation	8
Total	**80**

*University has issued the guidelines for the implementation of NEP 2020 which are subject to the approval from Academic Council and Executive Council, CUHP.

First Semester- Master of Computer Applications

S. No.	Course Code	Course Name	Credits
1.	MCA-501	Data Structures	4
2.	MCA-502	Data Structures Lab	2
3.	MCA-503	Operating System	4
4.	**	Minor-I	4
5.	**	*Vocational/ Skill	4
6.	**	+IKS	2

Second Semester- Master of Computer Applications

S. No.	Course Code	Course Name	Credits
1.	MCA-504	Theory of Computation	4
2.	MCA-505	Database Management System	4
3.	MCA-506	Database Management System Lab	2
4.	MCA-507	Design & Analysis of algorithms	2
5.	**	Minor-II	4
6.	**	Vocational/ Skill	2
7.	**	#IKS	2

Third Semester- Master of Computer Applications

S. No.	Course Code	Course Name	Credits
1.	**	Elective Specialization	4
2.	MCA-601	Minor-III (*Research Methodology)	4
3.	**	*Vocational/ Skill	4
4.	MCA-604	*Literature Review	4
5.	MCA-605	Research Proposal	4

Fourth Semester- Master of Computer Applications

S. No.	Course Code	Course Name	Credits
	**	Elective Specialization	4
1.	MCA-602	Minor-IV(*Academic writing)	2
2.	MCA-603	Minor-V(Paper publication)	2
3.	**	*Vocational/ Skill	4
4.	MCA-606	Dissertation	8

Note: Students can opt Minor/ vocational courses/ bridge courses from certificate courses offered by the department.

+*02 Credits Course Developed by University Level Committee and uniform for all the programmes*

02 Credits Course Developed by the Department concerned,

* 50% Theory and 50% Practical

** Course code belongs to Minor/ Vocational/ Skill /IKS/ Elective Specialization courses list.

Major Courses (30 credits)

S. No.	Course Code	Course Name	Credit
1.	MCA-501	Data Structures	4
2.	MCA-502	Data Structures Lab	2
3.	MCA-503	Operating System	4
4.	MCA-504	Theory of Computation	4
5.	MCA-505	Database Management System	4
6.	MCA-506	Database Management System Lab	2
7.	MCA-507	Design & Analysis of algorithms	2

Elective Specialization (08)

S. No.	Course Code	Course Name	Credit
1.	MCA-508	Digital Image Processing	4
2.	MCA-509	Computer Graphics	4
3.	MCA-510	Data Mining	4
4.	MCA-511	Machine Learning	4
5.	MCA-512	Cloud Computing Concepts	4
6.	MCA-513	Internet of Things	4
7.	MCA-514	Mobile Computing	4
8.	MCA-515	Cryptography and Network Security	4
9.	MCA-516	Web Programming	4

Minor Courses (16 credits)

S. No.	Course Code	Course Name	Credit
1.	MCA-517	Soft Computing	4
2.	MCA-518	Bioinformatics	4
3.	MCA-519	Computer Networks	4
4.	MCA-520	Computer Organization & Architecture	4
5.	MCA-521	Software Engineering	4
6.	MCA-522	Software testing	4
7.	MCA-523	Software Project Management	4
8.	MCA-524	Compiler Design	4
9.	MCA-525	Distributed System	4
10.	MCA-526	Discrete structure	4
11.	MCA-601	Research Methodology	4
12.	MCA-602	Academic Writing	2
13.	MCA-603	Research Paper Publications	2

Review of Literature, Research Proposal (8 credits)

S. No.	Course Code	Course Name	Credit
1.	MCA-604	Review of Literature	4
2.	MCA-605	Research Proposal	4

Dissertation and Viva-Voce (8 credits)

S. No.	Course Code	Course Name	Credit
1.	MCA-606	Dissertation and Viva-Voce	4

Vocational/ Skill Courses (14 credits)

S. No.	Course Code	Course Name	Credit
1.	MCA-527	Python Programming	2
2.	MCA-528	Web Applications	4
3.	MCA-529	Business Data Processing	4
4.	MCA-530	Office Communication Tools	4
5.	MCA-531	Basics of Web Designing	2
6.	MCA-532	Network Administration	4
7.	MCA-533	Cyber Security	4
8.	MCA-534	Object Oriented Programming	4
9.	MCA-535	Introduction of Data Analytics Tools	4
10.	MCA-536	Java Programming	4
11.	MCA-537	Android Application Development	4
12.	MCA-537	NoSQL Databases	2

#Indian Knowledge System (2 credits)

S. No.	Course Code	Course Name	Credit
2.	MCA-551	IT Tools for IKS	2
3.	MCA-552	Knowledge Representation in Sanskrit and Artificial Intelligence	2

Bridge Courses (0 credits)

S. No.	Course Code	Course Name	Credit
1.	CS-401	Fundamentals of Computer	2
2.	CS -402	Programming in C	2

Note: Practical work of all the lab courses will be based on corresponding theory courses.

MCA 501
Data Structures

UNIT- I

Introduction: Basic Terminology, Data structures and its classification, Algorithm, Complexity-space & time complexity, complexity notations- big Oh, Omega, Theta. Array Definition, Representation and Analysis of Arrays, Single and Multidimensional Arrays, Address calculation, Linear Search, Binary Search of Array, Traversing, Insertion & deletion in array, Sparse Matrices, Strings. Internal and External sorting, Insertion Sort, Bubble Sort, selection sort, Quick Sort, Merge Sort, Radix sort.

UNIT- II

Linked List Introduction, Representation of linked list in to memory, Memory allocation -Garbage Collection, Traversing & Searching in Linked List, Insertion into linked list- at beginning of list & at given location, Deletion in linked list- from starting of list & given location of node, Header Linked List, two way List, Input & output restricted liked list, Circular Header Linked List, Representation of Polynomials using linked List.

UNIT- III

Stack, Array Implementation of stack, Linked Representation of Stack, Application of stack: Conversion of Infix to Prefix and Postfix Expressions and Expression evaluation. Queue, Array and linked implementation of queues, Circular queues, D-queues and Priority Queues.

UNIT- IV

Trees: Basic terminology, Binary Trees, algebraic Expressions, Complete Binary Tree, Extended Binary Trees, Array and Linked Representation of Binary trees, Traversing Binary trees, Threaded Binary trees, Binary Search Tree (BST), AVL Trees, B-trees. Graphs: Introduction, Sequential Representations of Graphs, Adjacency Matrices, Traversal, Connected Component and Spanning Trees, Minimum Cost Spanning Trees. Searching & Hashing: Sequential search, binary search, Hash Table, Hash Functions, Collision Resolution Strategies.

Text Books:

1. Lipschuitz L. Seymour, “Data Structures”, Schaum Outline Series, TMH.
2. R. S. Salaria, “Data Structures & Algorithm Using C”, Khanna Book Publishing.

Reference Books:

1. Horowitz and Sahani, “Fundamentals of data Structures”, Galgotia Publication Pvt. Ltd., N Delhi.
2. R. S. Salaria, “Data Structures & Algorithm Using C++”, Khanna Book Publishing
3. A.M. Tenenbaum, “Data Structures using C & C++”, Prentice-Hall of India Pvt. Ltd., New Delhi.
4. Trembley and Sorenson, “Data Structures”, TMH Publications

MCA 503
Operating System

UNIT-I

Operating System Introduction: function, characteristics, structures–simple batch, multiprogrammed, timeshared, personal computer, parallel, distributed systems, real-time systems, system components, operating system services, system calls, virtual machines. **Process and CPU Scheduling:** Process concepts and scheduling, operation on processes, cooperating processes, threads and inter-process communication scheduling criteria, scheduling algorithm, multiple-processor scheduling, real time scheduling.

UNIT-II

Management and Virtual memory: logical versus physical address space, swapping, contiguous allocation, paging, segmentation, segmentation with paging. Demand paging, performance of denuding paging, page replacement, page replacement algorithm, allocation of frames, thrashing.

UNIT-III

File System Interface and Implementation: access methods, directory, structure, protection, file system structure, allocation methods, free space management, directory management, directory implementation, efficiency and performance. **I/O Management:** I/O software and its types, disk scheduling. **Process Management and Synchronization:** Critical section problem, synchronization, critical regions, monitors.

UNIT-IV

Deadlocks: system model, dead locks characterization, methods for handling deadlocks, deadlock prevention, deadlock avoidance, deadlock detection and recovery from deadlock. **Shell Programming:** vi editor, shell variables, I/O in shell, control structures, loops, subprograms, creating shell scripts. Basic system administration in Linux/Unix.

Text Books:

1. Silberschart, Galvin, Gagne, "Operating System Concepts", Ninth Edition, WSE Wiley.
2. Das, S., Your UNIX: The Ultimate Guide, Fourth Edition, McGraw-Hill Inc.

Reference Book:

1. D.M. Dhamdhere, "Operating Systems: A Concept Based Approach", Tata McGraw-Hill.
2. Milan Milenkovic, "Operating system-concepts and design", McGraw Hill International
3. Edition
4. A. S. Godbole, "Operating systems", Tata McGraw hill
5. Deitel H. M., "Operating System", Pearson Publications
6. William Stallings, "Operating Systems: Internals and Design Principles", Prentice-Hall of India
7. Andrew. S. Tanenbaum, "Modern operating systems", Pearson Prentice Hall.

MCA 504
Theory of Computations

UNIT-I

Introduction of Theory of Computation, Alphabet, Strings and their properties, Definition of an automation, Description of a finite Automation, Transition graph, transition function, Acceptability of a string by a Finite Automation, Deterministic and nondeterministic FSM'S, Equivalence of DFA and NDFA, Mealy & Moore machines, Minimization of finite automata.

UNIT-II

Chomsky classification of Languages, Languages and their relation, Languages and Automata, Regular sets, regular expression, Regular Grammars, Finite state machine and regular expression, Pumping lemma for regular sets, Application of pumping lemma, closure properties of regular sets.

Introduction to CFG, Context-free languages and Derivation Trees, Ambiguity in context-free Grammars, simplification of context-free Grammars, Normal forms for context-free Grammars – Chomsky normal form and Greiback normal form.

UNIT-III

Pushdown Automata: Definitions – Moves – Instantaneous descriptions – Deterministic pushdown automata – Pushdown automata and CFL, PDA corresponding to given CFG, CFG corresponding to a given PDA, Closure properties of CFL's.

UNIT-IV

Introduction, TM model Representation of Turing machines, languages acceptability of TM, Design of TM, Universal TM & Other modification, Church's hypothesis, Properties of recursive and Recursively enumerable languages.
Tractable and Untractable Problems: P, NP, NP complete and NP hard problems

Text Books:

1. John E. Hopcroft, Jeffery Ullman,"Introduction to Automata theory, Langauges& computation" , Narosa Publishers.
2. John C Martin, "Introdution to languages and theory of computation", McGraw Hill

Reference Books:

- K.L.P Mishra & N.Chandrasekaran,"Theory of Computer Science", PHI Learning
- Daniel I.A. Cohen,"Introduction to Computer Theory",Wiley India.
- Peter Linz, "An Introduction to Formal Languages and Automata", Jones & Bartlett Learning.

MCA 505
Data Base Management System

UNIT-I

Basic Concepts: Entity, Relationship and its types, Components of a database, three level architecture of a DBMS, Database models.

File Organization: Serial, Sequential, Index Sequential and Direct file organization.

UNIT-II

Entity-Relationship Model: Entity Types, Entity Sets, Attributes & keys, Relationships,Relationships Types, Roles and Structural Constraints, Design issues, E-R Diagrams,Design of an E-R Database Schema, Reduction of an E-R Schema to Tables.

Relational Data Model: Relational model concepts, Integrity constraints over Relations,Relational Algebra – Basic Operations.

SQL: DDL, DML, and DCL, views & Queries in SQL, Specifying Constraints & Indexesin SQL.

UNIT-III

Relational Database Design: Functional Dependencies, Decomposition, Normal formsbased on primary keys (1 NF, 2 NF, 3 NF, & BCNF)

Transaction Processing Concepts: Introduction to Transaction Processing, Transaction &System Concepts, Properties of Transaction, Schedules and Recoverability, SerializabilityofSchedules.

Concurrency Control Techniques: Locking Techniques, Timestamp ordering, MultiversionTechniques, Optimistic Techniques, Granularity of Data items.

UNIT-IV

Databases for Advanced Applications: Active database concepts, Temporal database concepts, Spatial databases, Deductive databases; Emerging Database Technologies: Mobile databases, Multimedia Databases, Geographic information systems (GIS); XML and Internet Databases: Structured, Semi-structured and Unstructured Data, Introduction to web databases and XML, Structure of XML data.

Text Books:

1. R. Elmasri and S. B. Navathe, “Fundamentals of Database Systems”, 7E, Addison Wesley.
2. Bayross, I., “SQL, PL/SQL: The Programming Language of Oracle”,4E , BPB Publications.

Reference Books:

1. R. Ramakrishnan and J. Gehrke, “Database Management Systems”, 3E, McGraw Hill.
2. A. Silberschatz, H. Korth and S. Sudarshan, “Database System Concepts”, 6E, McGraw Hill.

MCA 507
Design & Analysis of Algorithm

UNIT- I

Algorithms, designing algorithms, analyzing algorithms, asymptotic notations, Introduction to divide and conquer technique, analysis, design and comparison of various algorithms based on this technique, example binary search, merge sort, quick sort, strassen's matrix multiplication.

UNIT- II

Study of Greedy strategy, examples of greedy method like optimal merge patterns, Huffman coding, minimum spanning trees, knapsack problem, job sequencing with deadlines, single source shortest path algorithm.

Concept of dynamic programming, problems based on this approach such as 0/1 knapsack, multistage graph, reliability design, Floyd-Warshall algorithm.

UNIT- III

Backtracking concept and its examples like 8 queen's problem, Hamiltonian cycle, Graph coloring problem etc.Introduction to branch & bound method, examples of branch and bound method like travelling salesman problem etc.Meaning of lower bound theory and its use in solving algebraic problem.

UNIT- IV

Binary search trees, height balanced trees, 2-3 trees, B-trees, basic search and traversal techniques for trees and graphs (In order, preorder, postorder, DFS, BFS), NP-completeness.

Text Books:

1. Ellis Horowitz, SartajSahni and SanguthevarRajasekaran, "Computer Algorithms", 2E, Universities Press, 2007.
2. Cormen, T.H., Leiserson, C.E., Rivest, R.L. and Stein, C., "Introduction to Algorithms", 2E, Prentice Hall of India Pvt. Ltd, 2003.

Reference Books:

1. Aho, A.V., Hopcroft J.E. and Ullman, J.D., "The Design and Analysis of Computer Algorithms", Pearson Education, 1999.
2. Sara Baase and Allen Van Gelder, "Computer Algorithms, Introduction to Design and Analysis", 3E, Pearson Education, 2009.
3. Dasgupta; "Algorithms"; TMH
4. Michael T Goodrich, RobartoTamassia, "Algorithm Design", Wiely India

MCA 508
Digital Image Processing

UNIT-I

Introduction: The role of Computer Vision, applications, successes, research issues; its relationship to natural vision, basic image properties. Digital image representation, fundamental steps in image processing, elements of digital image processing systems digitization, Display and recording devices.

UNIT-II

Digital Image fundamentals: A simple Image model. Sampling and quantization, Relationship between pixel, imaging geometry, image transformation, introduction to fourier transformation, Discrete fourier transformation, fast fourier transformation.

UNIT-III

Image Enhancement: Histogram processing, image subtraction, image averaging, smoothing filters, sharpening filters, enhancement in frequency domain, low pass filtering, high pass filtering.

UNIT-IV

Image Encoding & Segmentation: Segmentation, detection of discontinuation by point detection, line detection, edge detection. Edge linking & Boundary Detection: Local analysis, global by Hough transform & Global by graph theoretic techniques.

Image Representation and Description: Chain codes, polygonal approximation, signatures, boundary segments, boundary descriptors, regional descriptors, introduction to image understanding.Motion Tracking , Image differencing, Feature matching, Optic flow.

Text Book:

1. Gonzalez, Rafael C., and Richard E. Woods. "Digital Image Processing", 4E, Addison-Wesley.

Reference Book:

1. Jain, Anil K. "Fundamentals of digital image processing", Prentice-Hall, Inc., 1989.

MCA 509
Computer Graphics

UNIT-I

Introduction: Survey of computer Graphics and its applications; Interactive and passive graphics; display processors; Graphic Devices: Display systems-refresh CRTs, raster scan and random scan monitors, Grey shades, Interlacing, beam penetration shadow mask monitors, lookup tables, plasma panel, LED and LCD monitors, VGA and SVGA resolutions; Hard copy Devices-printers, plotters; Interactive Input Devices

UNIT-II

Drawing Geometry: Coordinate system; resolution; use of the homogeneous coordinate system; scan conversion: symmetrical DDA, simple DDA, Bresenham's line drawing algorithm, Circle drawing using DDA and polar coordinates, Bresenham's circle drawing algorithm, generation of an ellipse. Curve Drawing

UNIT-III

2-D Transformations: Translation; rotation; scaling; mirror reflection; shearing; zooming; panning; input techniques-pointing, positioning, rubber band methods and dragging; tweening, Morphing. Graphic operations: Clipping-line clipping using Sutherland-Cohen and midpoint sub- division algorithm, Liang Barsky Line clippers algorithm, polygon clipping; window and viewport; windowing transformation; Filling algorithms.

UNIT-IV:

3-D Graphics: 3D modelling of objects; 3D display techniques; coordinate system; 3D transformation matrices for translation, scaling and rotation; parallel projection; perspective projection; Hidden-surface removal - Z-buffer, back face, scan-line, depthsorting, area subdivision; Shading - modelling light intensities, Gouraud shading, Phong shading.

Text Books:

1. Hearn, D., Baker, M.P. and Carithers, W.R., “Computer Graphics with OpenGL”, 4E, Prentice Hall, 2014.

Reference Books:

1. Klinger, A., Fu, K.S. and Kunii, T.L., “Data Structures, Computer Graphics, and Pattern Recognition”, Academic Press. 2014.
2. Marschner, S. and Shirley, P., “Fundamentals of Computer Graphics”, CRC Press, 2015.
3. Enderle, G., Kansy, K. and Pfaff, G., “Computer Graphics Programming: GKS—The Graphics Standard”, Springer Science & Business Media. 2012.
4. Foley, J.D., Van, F.D., Van Dam, A., Feiner, S.K., Hughes, J.F., Angel, E. and Hughes, J., “Computer Graphics: Principles and Practice”, Addison-Wesley Professional. 2018.

MCA 510
Data Mining

UNIT I

Motivation, importance, Data type for Data Mining : relation Databases, Data Warehouses, Transactional databases, advanced database system and its applications, Data mining Functionalities: Concept/Class description, Association Analysis classification & Prediction, Cluster Analysis, Outlier Analysis, Evolution Analysis, Classification of Data Mining Systems, Major Issues in Data Mining.

UNIT II

Data Warehouse and OLAP Technology for Data Mining: Differences between Operational Database Systems and Data Warehouses, a multidimensional Data Model, Data Warehouse Architecture, Data Warehouse Architecture, Data Warehouse Implementation, Data Cube Technology. Data Preprocessing: Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization and Concept Hierarchy Generation. Data Mining Primitives, Languages, and System Architectures, Concept Description: Characterization and Comparison, Analytical Characterization.

UNIT III

Mining Association Rules in Large Databases: Association Rule Mining: Market Basket Analysis, Basic Concepts, Mining Single-Dimensional Boolean Association Rules from Transactional Databases: the Apriori algorithm, Generating Association rules from Frequent items, Improving the efficiency of Apriory, Mining Multilevel Association Rules, Multidimensional Association Rules, Constraint-Based Association Mining.

UNIT IV

Classification & Prediction and Cluster Analysis: Issues regarding classification & prediction, Different Classification Methods, Prediction, Cluster Analysis, Major Clustering Methods, Applications& Trends in Data Mining: Data Mining Applications, currently available tools.

Text Books:

1. J. Han and M. Kamber, “Data Mining: Concepts and Techniques”, Morgan Kaufmann Pub.
2. Berson “Dataware housing, Data Mining & DLAP”, TMH.

Reference Books:

1. W.H. Inmon “Building the Datawarehouse”, Wiley India.
2. Anahory, “Data Warehousing in Real World”, Pearson Education.
3. Adriaans, “Data Mining”, Pearson Education.
4. S.K. Pujari, “Data Mining Techniques”, University Press, Hyderabad.

MCA 510
Machine Learning

UNIT I

Overview and Introduction to Bayes Decision Theory: Machine intelligence and applications, pattern recognition concepts classification, regression, feature selection, supervised learning class conditional probability distributions,Examples of classifiers bayes optimal classifier and error, learning classification approaches.

UNIT II

Linear machines: General and linear discriminants, decision regions, single layer neural network, linear separability, general gradient descent, perceptron learning algorithm, mean square criterion and widrow-Hoff learning algorithm; multi-Layer perceptrons: two-layers universal approximators, backpropagation learning, on-line, off-line error surface, important parameters.

Learning decision trees: Inference model, general domains, symbolic decision trees, consistency, learning trees from training examples entropy, mutual information, ID3 algorithm criterion, C4.5 algorithm continuous test nodes, confidence, pruning, learning with incomplete data

UNIT III

Instance-based Learning: Nearest neighbor classification, k-nearest neighbor, nearest neighbor error probability, Machine learning concepts and limitations: Learning theory, formal model of the learnable, sample complexity, learning in zero-bayes and realizable case, VC-dimension, fundamental algorithm independent concepts, hypothesis class, target class, inductive bias, occam's razor, empirical risk, limitations of inference machines, approximation and estimation errors, Tradeoff.

UNIT IV

Machine learning assessment and Improvement: Statistical model selection, structural risk minimization, bootstrapping, bagging, boosting.

Support Vector Machines: Margin of a classifier, dual perceptron algorithm, learning nonlinear hypotheses with perceptron kernel functions, implicit non-linear feature space, theory, zero-Bayes, realizable infinite hypothesis class, finite covering, margin-based bounds on risk, maximal margin classifier.

Text Books:

1. E. Alpaydin, “Introduction to Machine Learning”, Prentice Hall of India, 2006.
2. C. M. Bishop, “Pattern Recognition and Machine Learning”, Springer, 2006.

Reference Books:

1. T. M. Mitchell, “Machine Learning”, McGraw-Hill, 1997.
2. R. O. Duda, P. E. Hart, and D.G. Stork, “Pattern Classification”,John Wiley and Sons, 2001.
3. Vladimir N. Vapnik, “Statistical Learning Theory”, John Wiley and Sons, 1998.
4. Shawe-Taylor J. and Cristianini N., Cambridge, “Introduction to Support Vector Machines”, University Press, 2000.

MCA 512
Cloud Computing Concepts

UNIT-I

Overview of Computing Paradigms: Recent Trends in Computing: Distributed Computing, Cluster Computing, Grid Computing, Utility Computing, Cloud Computing, Evolution of Cloud Computing: Migrating into a Cloud

Cloud Computing Basics: Cloud Computing Overview; Characteristics; Applications; Benefits; Limitations; Challenges, SOA; Cloud Computing Service Models: Infrastructure as a Service; Platform as a Service; Software as a Service, Cloud Computing Deployment Models: Private Cloud; Public Cloud; Community Cloud; Hybrid Cloud, Major Cloud Service providers

UNIT-II

Virtualization Concepts: Overview of Virtualization Technologies, Types of Virtualization, Benefits of Virtualization, Hypervisors VM Provisioning & Migration: VM Lifecycle, VM Provisioning Process, VM Migration Techniques

Scheduling in Cloud: Overview of Scheduling problem, Different types of scheduling, Scheduling for independent and dependent tasks, Static vs. Dynamic scheduling, Optimization techniques for scheduling

UNIT-III

Cloud Storage: Overview; Storage as a Service, Benefits and Challenges, Storage Area Networks(SANs), Case Study of Amazon S3

Cloud Security: Infrastructure Security: Network Level Security, Host Level Security and Application Level Security; Data Security: Data Security & Privacy Issues; Identity & Access Management; Legal Issues in Cloud Computing

UNIT-IV

Mobile Cloud Computing: Overview of Mobile Cloud Computing, Advantages, Challenges, Using Smartphones with the Cloud, Offloading techniques - their pros and cons, Mobile Cloud Security.

SLA Management: Overview of SLA, Types of SLA, SLA Life Cycle, SLA Management Process

Text Books:

1. RajkumarBuyya, James Broberg, AndrzejGoscinski, " Cloud Computing: Principles and Paradigms", Wiley, 2011
2. Barrie Sosinsky: Cloud Computing Bible, Wiley, 2011.

Reference Books:

1. Anthony T. Velte, Toby J. Velte, and Robert Elsenpeter, "Cloud Computing: A Practical Approach", McGraw Hill, 2010.
2. Judith Hurwitz, Robin Bloor, Marcia Kaufman,FernHalper, "Cloud Computing for Dummies", Wiley, 2010.
3. BorkoFurht, Armando Escalante , "Handbook of Cloud Computing", Springer, 2010.

MCA 513
Internet of Things

UNIT-I

Introduction to IoT: Sensing, Actuation, Networking basics, Communication Protocols, Sensor Networks, Machine-to-Machine Communications, IoT Definition, Characteristics. IoT Functional Blocks, Physical design of IoT, Logical design of IoT, Communication models & APIs.

UNIT-II

M2M to IoT-The Vision-Introduction, From M2M to IoT, M2M towards IoT-the global context, A use case example, Differing Characteristics. Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT.

M2M vsIoT An Architectural Overview–Building architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. Reference Architecture and Reference Model of IoT

UNIT-III

IoT Reference Architecture- Getting Familiar with IoT Architecture, Various architectural views of IoT such as Functional, Information, Operational and Deployment. Constraints affecting design in IoT world- Introduction, Technical design Constraints.

Domain specific applications of IoT: Home automation, Industry applications, Surveillance applications, Other IoT application.

UNIT-IV

Developing IoT solutions: Introduction to Python, Introduction to different IoT tools, Introduction to Arduino and Raspberry Pi, Data Aggregation for the IoT in Smart Cities, Privacy and Security Issues in IoT.

Text Books:

1. Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-onApproach)", 1E, VPT
2. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press

Reference Books:

1. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications
2. CunoPfister, Getting Started with the Internet of Things, O"Reilly

MCA 514
Mobile Computing

Unit-I:
Wireless Networks: Introduction, Applications, History of Wireless Communication. Electromagnetic Spectrum, Radio Propagation Mechanisms, Characteristics of the Wireless Channel, Modulation Techniques, Multiple Access Techniques, Voice Coding, Error Control.
Wireless LANS and PANS: Introduction, Fundamentals of WLANs, IEEE 802.11 Standards, HIPERLAN Standard, Bluetooth, HomeRF.

Unit-II:
Wireless WANS AND MANS: Introduction, Cellular Concept, Cellular Architecture, The First-Generation Cellular Systems, The Second-Generation Cellular Systems, The Third-Generation Cellular Systems, Wireless in Local Loop, Wireless ATM.

Unit-III:
Wireless Internet: Introduction, Mobile network Layer, Mobile IP, Route optimization, Handoffs, IPv6 Advancements, IP for Wireless domains, Security in Mobile IP, Mobile Transport layer, TCP in Wireless Domain, Optimizing Web over Wireless.

Unit-IV:
Ad Hoc Wireless Networks: Introduction. Issues in Ad Hoc Wireless Networks. Ad Hoc Wireless Internet. MAC Protocols for Ad Hoc Wireless Networks, Routing Protocols for Ad Hoc Wireless Networks, Security in Ad hoc wireless networks, Recent advances in Wireless Networks.

Text Book:

1. C-Siva Ram Murthy & B S Majo, "Adhoc Wireless Networks, Architectures Protocols" , Pearson.
2. Jochen Schiller "Mobile Communications", PEARSON.
3.

Reference Book:

1. William C.Y Lee, "Mobile Communication Design Fundamental", John Wiley.
2. William Stalling, "Wireless Communication and Network", Pearson Education.

MCA 515
Cryptography and Network Security

UNIT-I

Classical Encryption Techniques: Symmetric Cipher Model, substitution Techniques, tranposition techniques, rotor machines, steganography.

Block Ciphers and the Data Encyption standards: Simplified DES, block cipher principles, the data encryption standard, the strength of DES, differential and linear cryptanalysis, blockcipher design principles, block cipher modes of operation.

Advanced Encryption Standard: Evaluation Criteria for AES, the AES cipher.

Contemporary symmetric ciphers: Triple DES, blowfish.

Confidentiality using symmetric encryption: Placement of Encryption function, traffic confidentiality, key distribution, and random number generation.

UNIT-II

Public key Encryption and Hash functions: Prime numbers, Fermat's and Euler's Theorems, testing for primality, the chinese remainder theorem, discrete logarithms.

Public key cryptography and RSA: Principles of Public key cryptosystems, the RSA algorithm.

Key Management other public key cryptosystems: Key management, diffie-Hallman key exchange, elliptic curve arithmetic, and elliptic curve cryptography.

UNIT-III

Message authentication and Hash function: Authentication

Requirements, Authentication functions, message authentication codes, hash functions, security of hash function and MACs.

Hash Algorithms: MD5 message digest algorithm, secure Hash algorithm, ripemd-160, HMAC.

Digital Signature and Authentication protocols: Digital signatures, Authentication protocols, and digital signature standard.

Authentication Applications: Kerberos, X.509 Authentication service.

UNIT-IV

Electronic Mail Security: Pretty Good privacy, S/MIME.

IP Security: IP Security overview, IP security architecture,authentication header, encapsulating security payload, combining security associations, key management.

Web Security: Web security considerations, Secure sockets layer and transport layer security, secure electronic transaction.

System security: Intruders, intrusion detection, and password management. Malicious software: Viruses and related threats, virus countermeasures. Firewalls: Firewall Design Principles, Trusted systems.

Text Books:

1. William Stallings "Cryptography and Network Security", 3 ed, Pearson Education.
2. W.Stallings" Network security Essential " Applications & Standards", 6E, Pearson.

Reference Books:

1. Kanfren "Network Secirity : Private Communications in a public world 2/e
2. Eric Maiwald" NetworkSecirity : A Preginner's Guide", Tata Mcgraw Hill.
3. Roberta Bragg, Mark Rhodes, Ousley& Keith Strassberg, "Network Secirity : The Complete Reference " Tata McGraw Hill.
4. Eric Maiwald "Fundamentals of Network Security" Wiley India.

MCA516
Web Programming

UNIT-I

Introduction to PHP: how PHP script work, PHP syntax, write your first PHP program, embed PHP in html/html in PHP, PHP data type, variable in PHP, operator in PHP.

Control Structure: if statement, if.....else statement, if...if else statement, nested if statement, switch statement

Looping Structure: for loop, while loop, do...while loop, for each loop function.

UNIT-II

Function: introduction, syntax, user defined function, system defined function, parameterized function, date & time function, hash function, mail function

Array: syntax, associative array, numeric array, multi-dimensional array.

String matching with regular expression: creating and accessing string, searching & replacing string, formatting string, string related library function, what is regular expression, pattern matching in PHP, replacing text, splitting a string with a Regular Expression?

UNIT-III

Objects: Creating classes and object in PHP, working with methods, overloading, inheritance, constructor and destructor.

Handling HTML form with PHP, Preserving state with query strings, cookies & sessions.

Working with file and directories: Understanding file & directory, Opening and closing a file, Reading, writing, coping, renaming and deleting a file, working with directories, Building a text editor

UNIT-IV

Generating images with PHP: Basics of computer graphics, creating images, manipulating images, using text in images.

Database access using PHP and MySQL: Connecting to MySQL from PHP, Retrieving data from MySQL with PHP, Manipulating MySQL data with PHP.

Text Book:

1. Matt Doyale ,"Beginning PHP 5.3", Wiley India Edition.

Reference Books:

1. Larry Ulman ,"PHP and MySQL5", Pearson
2. Robert Sebesta,"Programming with World Wide Web", Pearson.
3. John Duckett, "Beginning with HTML, XHTML, CSS and Javascript", Wiley- Wrox
4. Building PHP Applications WithSymfony, CakePHP, AndZend, Framework by BartoszPorebski Karol PrzystalskiLeszek Nowak, Wiley India.

MCA 517
Soft Computing

UNIT-I

Introduction, Soft Computing concept explanation, brief description of separate theories.Neural Networks and Probabilistic Reasoning; Biological and artificial neuron, neural networks and their classification.Adaline, Perceptron, Madaline and BP (Back Propagation) neural networks. Adaptive feed forward multilayer networks. Algorithms: Marchand, Upstart, Cascade correlation, Tilling. RBF and RCE neural networks. Topologic organized neural network, competitive learning, Kohonen maps.

UNIT-II

CPN , LVQ, ART, SDM and Neocognitron neural networks. Neural networks as associative memories(Hopfield, BAM). Solving optimization problems using neural networks. Stochastic neural networks, Boltzmann machine.

UNIT-III

Fundamentals of fuzzy sets and fuzzy logic theory, fuzzy inference principle.Examples of use of fuzzy logic in control of real-world systems.

UNIT-IV

Fundamentals of genetic programming, examples of its using in practice. Genetic Algorithms Applications of GA's – Class.

Text Books:

1. Cordón, O., Herrera, F., Hoffman, F., Magdalena, L," Genetic Fuzzy systems", World Scientific Publishing Co. Pte.Ltd
2.Kecman, V."Learning and Soft Computing", The MIT Press, 2001, ISBN 0-262-11255-8

Reference Books:

1. Mehrotra, K., Mohan, C., K., Ranka, S. "Elements of Artificial Neural Networks", The MIT Press, 1997, ISBN 0-262-13328-8
2. Munakata, T, "Fundamentals of the New Artificial Intelligence" ,Springer-Verlag New York, Inc., 1998.

MCA 518
Bioinformatics

UNIT-I

Introduction to Bioinformatics: What is a Database, Types of Databases, Biological Databases, Pitfalls of Biological Databases, Information Retrieval from Biological Databases.

UNIT-II

Sequences: Problem statement, Edit distance and substitution matrices, HMMs and pairwise HMMs, Global and local alignments, Spliced alignment, Space-efficient sequence alignment, Multiple alignment, Database searching tools, Sequence by hybridization, Profile HMMs.

UNIT-III

Structures: Protein structure alignment, Protein Structure Prediction: Methods for predicting the secondary and tertiary structure of proteins. Techniques: neural networks, SVMs, genetic algorithms and stochastic global optimization.

UNIT-IV

Transcriptomics: Methods for analysing gene expression and microarray data. Techniques: clustering, SVMs. Agent-based Genome Analysis: Automation of genome analysis using intelligent software agents. Drug Discovery Informatics: Approaches to drug discovery using bioinformatics techniques.

Text Books:

1. Compeau, P. and Pevzner, P.A., "Bioinformatics Algorithms: An Active Learning Approach", Active Learning Publishers, 2018.
2. Jones, N.C., Pevzner, P.A. and Pevzner, P., "An Introduction to Bioinformatics Algorithms", MIT press, 2004.

Reference Books:

1. Krawetz, S.A. and Womble, D.D., "Introduction to Bioinformatics: A Theoretical and Practical Approach", Springer Science & Business Media, 2003.
2. Lesk, A., "Introduction to bioinformatics", Oxford University Press, 2019.
3. Mandoiu, I. and Zelikovsky, A., "Bioinformatics Algorithms: Techniques and Applications", John Wiley & Sons, 2008.

MCA519
Computer Networks

UNIT-I

Introduction To Computer Networks: Definition of a Computer Network, The OSI Reference Model, The TCP/IP Reference Model, Protocols and Hardware involved in the OSI model, Comparison of the OSI & the TCP/IP.
Application Layer: Domain name space, DNS in internet, electronic mail, FTP, WWW, HTTP, SNMP, multimedia, network security

UNIT-II

Physical Layer: Introduction: Network topologies; Linear Bus Topology, Ring Topology, Star Topology, Hierarchical or Tree Topology, Topology Comparison, Considerations when choosing a Topology: Switching; Circuit switching, Message switching, Packet switching.
Transmission Medium: Introduction: Transmission medium; Guided & Unguided Transmission medium, Twisted pair, Coaxial cable, Optical fiber, Comparison of fiber optics and copper wire: Wireless transmission; Electromagnetic spectrum, Radio transmission, Microwave transmission.

UNIT-III

Data Link Layer: Introduction; Goal of DLL: Design issues of DLL; Services provided to the Network layer, Framing, Error control, Flow control, ARQ strategies: Stop-and-Wait, RTT estimation, sliding window, Go-Back-N retransmission, Error Detection and correction: Parity bits, Single bit error correction or (n, m), Error Detection or Cyclic Redundant Code (CRC): Data Link layer protocols; Transmission control protocols, HDLC.

Unit-IV

Network Layer: Introduction: Design issues of Network layer; Nature of the service provided, Internetworking: Principles of Routing; Types of routing algorithms, Properties of routing algorithms, Optimality principle: Routing algorithms; Shortest path algorithm, Flooding, Distance vector routing, Hierarchical routing, Link state routing, Congestion: Factors of congestion, Comparison of flow control and congestion control, General principles of congestion control, Closed loop solution: IP protocol (IPV4).
Transport Layer: Introduction: Services of Transport layer; Service primitives: Connection establishment: Connection Release: Transport Protocols; TCP protocol, UDP protocol

Text Books:

1. Behrouz A. Forouzan, “Data Communications and Networking”, 4E , 2017, Tata McGraw Hill.

Reference Books:

1. Natalia Olifer& Victor Olifer, “Computer Networks”, John Wiley & Sons Ltd., 2013.
2. William Stallings, “Data & Computer Communication”, Pearson Education, 2014.
3. Andrew S. Tanenbaum, “Computer Networks”, Pearson Education, 2017

MCA 520
Computer Organization and Architecture

UNIT – I

Digital Logic Circuits – Digital Computers, Logic Gates, Boolean Algebra, Map Simplification, Conbinational Circuits, Flip Flops, Sequential Circuits

Digital Components & Data Representation – Decoders, Multiplexers, Registers, Shift Registers, Binary Counters, Memory Units, Data Types, Complements, Fixed Point Representation, Floating Point Representation, Other Binary Codes, Error Correction Codes

UNIT – II

Register Transfer and Micro-operations – Register Transfer Language, Register transfer, Bus and Memory Transfer – Three State Bus Buffer, Memory Transfer; Arithmetic Micro-operations – Binary Adder, Binary Adder-Subtractor, Binary Incrementer, Arithmetic Circuit; Logic Micro-operations, Shift Micro-operations, Arithmetic Logic Shift Unit.

Basic Computer Organization – Instruction codes – Stored Program Organization, Indirect Address; Computer Registers – Common Bus System; Computer Instructions – Instruction Set Completeness; Timing and Control; Instruction Cycle – Fetch and Decode, Determine the Type of Instruction, Register-Reference Instructions; Memory Reference Instructions; Input-Output and Interrupt, Complete Computer Description, Design of Basic Computer, Design of Accumulator Logic

UNIT – III

Programming the Basic Computer – Machine Language, Assembly Language, Introduction to Assembler, Program Loops, Programming Arithmetic and Logic Operations

Microprogrammed Control – Control Memory, Address Sequencing – Conditional Branching, Mapping of Instructions, Subroutines, Microprogram Example – Computer Configuration, Microinstruction Format, Symbolic Microinstructions, Fetch Routine, Symbolic Microprogram, Binary Microprogram, Design of Control Unit – Microprogram Sequencer

Central Processing Unit – Introduction, General Register Organization, Stack Organization – Register Stack, Memory Stack, Reverse Polish Notation, Evaluation of Arithmetic Expressions, Instruction Formats – Three-, Two-, One- and Zero-Address Instructions, Addressing Modes, Data Transfer and Manipulation, Program Control – Status Bit Conditions, Conditional Branch Instructions, Subroutine Call and Return, Program Interrupt, Types of Interrupt, RISC & CISC Characteristics, Overlap Register Window

UNIT – IV

Pipeline and Vector Processing – Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline, Vector Processing, Array Processors

Computer Arithmetic – Addition and Subtraction, Multiplication Algorithms, Division Algorithms, Floating Point Arithmetic Operations, Decimal Arithmetic Unit and Operations

Input-Output Organization – Peripheral Devices, Input-Output Interface, Modes of Transfer – Programmed I/O, Interrupt-Driven I/O, Priority Interrupt, Direct Memory Access (DMA), Input-Output Processor (IOP), Serial Communication

Memory Organization – Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory, Memory Management Hardware

TEXT BOOK:

1. M. Morris Mano, "Computer System Architecture", Revised 3E , Pearson Education

REFERENCE BOOKS:

1. John P. Hayes, "Computer Architecture and Organization", Third Edition, McGraw Hill Publication.

2. William Stallings, “Computer Organization and Architecture: Designing for Performance”, Tenth Edition, Pearson Education India.

MCA 521
Software Engineering

UNIT-I

Introduction: Introduction to software Engineering, Software characteristics, Software components, Software applications, Software Engineering Principles, Software metrics and measurement, monitoring and control. Software development life-cycle**,** Water fall model, prototyping model, Incremental model, Iterative enhancement Model, Spiral model.

Unit-II

Software Requirement Specification: Requirements Elicitation Techniques, Requirements analysis, Models for Requirements analysis, requirements specification, requirements validation.

System Design: Design Principles: Problem partitioning, abstraction, Top down and bottom up – design, structured approach. Functional versus object-oriented approach of design, design specification, Cohesiveness and Coupling.Overview of SA/SD Methodology, structured analysis, data flow diagrams, extending DFD to structure chart.

Unit-III

Software project Management: Project planning and Project scheduling. Software Metrics**:** Size Metrics like LOC, Token Count, Function Count. Cost estimation using models like COCOMO. Risk management activities.

Software Reliability and Quality Assurance: Reliability issues, Reliability metrics, reliability models, Software quality, ISO 9000 certification for software industry, SEI capability maturity model.

Unit-IV

Testing: Verification and validation, code inspection, test plan, test case specification. Level of testing: Unit, Integration Testing, Top down and bottom up integration testing, Alpha and Beta testing, System testing and debugging. functional testing, structural testing, Software testing strategies.

Software Maintenance: Structured Vs unstructured maintenance, Maintenance Models, Configuration Management, Reverse Engineering, Software Re-engineering.

Text Book:

1. Software Engineering, “K. K. Aggarwal&Yogesh Singh”, 2E, New Age International, 2005
2. PankajJalote’s, “Software Engineering”, Wiley India

Reference Book:

1. Roger S. Pressman, “Software Engineering- A Practitioner’s Approach”, Tata McGraw Hill
2. Rajib Mall, “Fundamentals of Software Engineering”, PHI Learning Pvt. Ltd.

MCA 522
Software Testing

UNIT-I

Introduction: Software Failures, Testing Process, Program and Software, Verification and Validation, Fault, Error, Bug and Failure, Test, Test Case and Test Suite, Deliverables and Milestones, Alpha, Beta and Acceptance Testing, Quality and Reliability, Testing, Quality Assurance and Quality Control, Static and Dynamic Testing, Testing and Debugging, Limitations of Testing, The V Shaped Software Life Cycle Model, Graphical Representation, Relationship of Development and Testing Parts

Functional Testing: Boundary Value Analysis – Robustness Testing, Worst-Case Testing, Robust Worst-Case Testing, Applicability; Equivalence Class Testing – Creation of Equivalence Classes, Applicability; Decision Table Based Testing – Parts of the Decision Table, Limited Entry and Extended Entry Decision Tables, 'Do Not Care' Conditions and Rule Count, Impossible Conditions, Applicability; Cause-Effect Graphing Technique – Identification of Causes and Effects, Design of Cause-Effect Graph, Use of Constraints in Cause-Effect Graph, Design of Limited Entry Decision Table, Writing of Test Cases, Applicability

UNIT-II

Structural Testing: Control Flow Testing – Statement Coverage, Branch Coverage, Condition Coverage, Path Coverage; Data Flow Testing – Define/Reference Anomalies, Definitions, Identification of du and dc Paths, Testing Strategies Using du-Paths, Generation of Test Cases; Slice Based Testing – Guidelines for Slicing, Creation of Program Slices, Generation of Test Cases; Mutation Testing – Mutation and Mutants, Mutation Operators, Mutation Score

Software Verification: Verification Methods – Peer Reviews, Walkthroughs, Inspections, Applications; Software Requirements Specification (SRS) Document Verification – Nature of the SRS Document, Characteristics and Organization of the SRS Document, SRS Document Checklist; Software Design Description (SDD) Document Verification – Organization of the SDD Document, SDD Document Checklist; Source Code Reviews – Issues Related to Source Code Reviews, Checklist of Source Code Reviews; User Documentation Verification – Review Process Issues, User Documentation Checklist; Software Project Audit – Relevance Scale, Theory and Practice Scale, Project Audit and Review Checklist

UNIT-III

Creating Test Cases from Requirements and Use Cases: Use Case Diagram and Use Cases – Identification of Actors, Identification of Use Cases, Drawing of Use Case Diagram, Writing of Use Case Description; Generation of Test Cases from Use Cases – Generation of Scenario Diagrams, Creation of Use Case Scenario Matrix, Identification of Variables in a Use Case, Identification of Different Input States of a Variable, Design of Test Case Matrix, Assigning Actual Values to Variables; Guidelines for generating validity checks – Data Type, Data Range, Special Data Conditions, Mandatory Data Inputs, Domain Specific Checks; Strategies for Data Validity – Accept Only Known Valid Data, Reject Known Bad Data, Sanitize All Data; Database Testing

Selection, Minimization and Prioritization of Test Cases for Regression Testing: What is Regression Testing – Regression Testing Process, Selection of Test Cases; Regression Test Cases Selection – Select All Test Cases, Select Test Cases Randomly, Select Modification Traversing Test Cases; Reducing the Number of Test Cases – Minimization of Test Cases, Prioritization of Test Cases; Risk Analysis – What is Risk, Risk Matrix; Code Coverage Prioritization Technique – Test Cases Selection Criteria, Modification Algorithm, Deletion Algorithm

Software Testing Activities: Levels of Testing – Unit Testing, Integration Testing, System Testing, Acceptance Testing; Debugging – Why Debugging is so Difficult, Debugging Process, Debugging

Approaches, Debugging Tools; Software Testing Tools – Static Software Testing Tools, Dynamic Software Testing Tools, Process Management Tools; Software Test Plan

UNIT-IV

Object Oriented Testing: What is Object Orientation – Classes and Objects, Inheritance, Messages, Methods, Responsibility, Abstraction, Polymorphism, Encapsulation, What is Object Oriented Testing – What is a Unit, Levels of Testing; Path Testing, Activity Diagram, Calculation of Cyclomatic Complexity, Generation of Test Cases; State Based Testing – What is a State Machine, State Chart Diagram, State Transition Tables, Generation of Test Cases; Class Testing – How Should We Test a Class, Issues Related to Class Testing, Generating Test Cases

Metrics and Models in Software Testing: Software Metrics – Measure, Measurement and Metrics, Applications, Categories of Metrics – Product Metrics for Testing, Process Metrics for Testing; Object Oriented Metrics Used in Testing – Coupling Metrics, Cohesion Metrics, Inheritance Metrics, Size Metrics; What Should We Measure During Testing – Time, Quality of Source Code, Source Code Coverage, Test Case Defect Density, Review Efficiency; Software Quality Attributes Prediction Models – Reliability Models, An Example of Fault Prediction Model in Practice, Maintenance Effort Prediction Model

Automated Test Data Generation: What is Automated Test Data Generation – Test Adequacy Criteria, Static and Dynamic Test Data Generation; Approaches to Test Data Generation – Random Testing, Symbolic Execution, Dynamic Test Data Generation; Test Data Generation using Genetic Algorithm – Initial Population, Crossover and Mutation, Fitness Function, Selection, Algorithm for Generating Test Data; Test Data Generation Tools

Text Book:

1. YogeshSingh , “Software Testing” , Cambridge University Press.

Reference Books:

1. Paul C. Jorgensen, “Software Testing: A Craftsman’s Approach”, 4E, CRC Press.
2. Boris Beizer, “Software Testing Techniques”, 2E, Dreamtech Press.
3. A.P. Mathur, “Fundamentals of Software Testing”, Pearson.
4. S. Desikan& G. Ramesh, “Software Principals and Practices”, Pearson.
5. G.J. Myers, T. Badgett, C. Sandler, “The Art of Software Testing”, 3E, Wiley India.

MCA 524
Compiler Design

UNIT-I

Introduction to Compiler & Lexical Analysis: Introduction of Compiler, Major data Structure in compiler, BOOT Strapping, Compiler structure: analysis-synthesis model of compilation, various phases of a compiler, Lexical analysis: Input buffering , Specification & Recognition of Tokens, LEX.

UNIT-II

Syntax analysis: CFGs, Top down parsing, Brute force approach, recursive descent parsing, transformation on the grammars, predictive parsing, bottom up parsing, operator precedence parsing, LR parsers (SLR,LALR, LR).

UNIT-III

Syntax directed definitions: Construction of Syntax trees, Bottom up evaluation of S-attributed definition, L-attribute definition, Top down translation, Bottom Up evaluation of inherited attributes Recursive Evaluation, Analysis of Syntax directed definition.

Intermediate code generation: Declarations, Assignment statements, Boolean expressions, Case statements.

UNIT-IV

Type Checking & Run Time Environment: Type checking: type system, specification of simple type checker.

Run time Environment: storage organization, Storage allocation strategies, parameter passing, dynamic storage allocation, and Symbol table.

Introduction to Code optimization: sources of optimization of basic blocks, dead code elimination, loop optimization, Introduction to global data flow analysis, Code Improving transformations, peephole optimization.

Code Generation: Issues in the design of code generator, Basic block and flow graphs, Register allocation and assignment, DAG representation of basic blocks.

Text Books:

1. A. V. Aho, R. Sethi, and J. D. Ullman, “Compilers: Principles, Techniques and Tools”, Pearson Education
2. Raghavan, “Compiler Design”, TMH Pub.

Reference Books:

1. Louden, “Compiler Construction: Principles and Practice”, Cengage Learning
2. A. C. Holub, “Compiler Design in C”, Prentice-Hall Inc., 1993.
3. Mak, “Writing compiler & Interpreters”, Willey Pub.

MCA 526
Discrete Mathematics

UNIT-I

Mathematical Logic: Proposition (Compound Propositions, Tautology, Contradiction, Satisfiable, Equivalent, and Dual), Equivalences, Well-formed Formula, Logical implication, Inference with rules, Predicate and Quantifiers, Proofs, Mathematical Induction.

UNIT-II

Sets, Relations and Functions:Sets, Types of sets, Set operations, Inclusion and Exclusion, relation, Binary Relations, Equivalence Relations and Partitions, Partial Ordering Relations, Partially ordered set (POSET), Hasse Diagram, Lattice, Functions, Types of functions. Algebraic System, Semigroups, monoids, Groups, Abelian groups, subgroups, cyclic groups.

UNIT-III

Graphs theory: Graph and its types, Special graphs (null graph, cycle graph, complete graph, Bipartite graph, regular graph, N-cube), Sub graph, Adjacency Matrix, Isomorphism, Complement of graph, directed and connected graph, walk, closed walk, paths, cycles, Eulerian and Hamiltonian graphs, cut edge, cut vertex, cut set, edge and vertex connectivity.

UNIT-IV

Counting Principles: Basic counting techniques, the rules of Sum and Product, Permutations, Combinations, Generation of Permutations and Combinations.Recurrence Relations, Linear recurrence relations with constant coefficients and their solving techniques.

Text Books:-

1. 1. J.P Trembley, “Discrete mathematical Structures with Applications to Computer Science”, TMH, New York.

Reference Books:-

1. C.L. Liu, D.P Mohapatra, “Elements of Discrete Mathematics: A Computer oriented Approach”, 3E, TMH.
2. Kenneth H. Rosen, “Discrete Mathematics”, 7E , TMH,
3. Seymour Lopshutz, M. Lipson, “Discrete Mathematics”, TMH.
4. Richard Hammack, “Book of Proofs”, VCU Mathematics textbook series.
5. S. Kaushik, “Logic and Prolog Programing”, New Age International.

CSI 601
Research Methodology

UNIT-I

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem.Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations.

Effective literature studies approaches, analysis Plagiarism, Research ethics. Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.

UNIT-II

Statistical Methods of Analysis Descriptive Statistics: Mean, Median, Mode, Range, Standard Deviation, regression and correlation analysis. Inferential Statistics: Estimation of parameters, Hypothesis, Types of Hypothesis, Testing of Hypothesis, Test of Normality, Introduction to Parametric and Non Parametric tests. Test of significance: t-test, chi square test, ANOVA(1-way, 2-way), Repeated Measures ANOVA, ANCOVA, α-correction

UNIT-III

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT-IV

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology.Patent information and databases.Geographical Indications. New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc.

Text Books:-

1. Ranjit Kumar, “Research Methodology: A Step by Step Guide for beginners”,2nd Edition.
2. T. Ramappa, “Intellectual Property Rights Under WTO”, S. Chand, 2008.

Reference Books:-

1. Wayne Goddard and Stuart Melville, “Research Methodology: An Introduction” .
2. Stuart Melville and Wayne Goddard, “Research methodology: an introduction for science & engineering students”.
3. Halbert, “Resisting Intellectual Property”, Taylor & Francis Ltd ,2007.
4. Mayall, “Industrial Design”, McGraw Hill, 1992.
5. Niebel, “Product Design”, McGraw Hill, 1974.
6. Asimov, “Introduction to Design”, Prentice Hall, 1962.
7. Robert P. Merges, Peter S. Menell, Mark A. Lemley, “Intellectual Property in New Technological Age”, 2016.

MCA 527

Python Programming

UNIT-I

Introduction to Python Programming Language: History and Origin of Python Language, Installing Python, setting up Path and Environment Variables, Running Python, First Python Program. Python Data Types & Input/ Output: Keywords, Identifiers, Python Statement, Indentation, Documentation, Variables, Multiple Assignment, Understanding Data Type, Data Type Conversion, Python Input and Output Functions, Import command. Operators and Expressions: Operators in Python, Expressions, Precedence, Associativity of Operators, Non Associative Operators.

UNIT-II

Control Structures: Decision making statements, Python loops, Python control statements. Python Native. Data Types: Numbers, Lists, Tuples, Sets, Dictionary, Functions & Methods of Dictionary, Strings (in detail with their methods and operations).

UNIT-III

Python Functions: Functions, Advantages of Functions, Built-in Functions, User defined functions,Anonymous functions, Pass by value Vs. Pass by Reference, Recursion, Scope and Lifetime of Variables. Python Modules: Module definition, Need of modules, creating a module, Importing module, Path Searching of a Module, Module Reloading, Standard Modules, Python Packages.

UNIT-IV

Exception Handling: Exceptions, Built-in exceptions, Exception handling, User defined exceptions in

Python. File Management in Python: Operations on files (opening, modes, attributes, encoding, closing), read() & write() methods, tell() & seek() methods, renaming & deleting files in Python, directories in Python. Classes and Objects: The concept of OOPS in Python, Designing classes, Creating objects, Accessing attributes, Editing class attributes, Built-in class attributes, Garbage collection, Destroying objects.

Text Books:

1. R. S. Salaria, “Programming in Python”, Khanna Publishing.
2. A. Martelli, A. Ravenscroft, S. Holden, “Python in a Nutshell”, OREILLY.

Reference Books:

1. PoojaSharma,“Programming in Python”, BPB Publications.
2. R. NageswaraRao, “Core Python Programming”, 2E, Dreamtech.
3. Martin C. Brown, “Python, The complete Reference”, McGraw Hill.

MCA 531
Basics of Web Designing

UNIT-I

HTML-Introduction, Basic Formatting Tags, color coding, Grouping Using Div Span, lists, images.

UNIT-II

HTML- Hyperlinks, Tables, frames, forms, headers.

UNIT-III

Introduction to Cascading Style Sheets, Concept of CSS, Creating Style Sheet, CSS Properties, CSS Styling(Background, Text Format, Controlling Fonts), Working with block elements and objects, Working with Lists and Tables, CSS Id and Class (Introduction, Border properties, Padding Properties, Margin properties),

UNIT-IV

CSS Advanced(Grouping, Dimension, Display, Positioning, Floating, Align, Pseudo class, Navigation Bar, Image Sprites, Attribute sector), CSS Color, Creating page Layout and Site Designs.

Text Books:

1. Kogent Learning Solutions Inc., "HTML 5 in simple steps", Dreamtech Press.
2. Steven M. Schafer, "HTML, XHTML, and CSS Bible", 5ed Wiley India

Reference Books:

1. Ian Pouncey, Richard York, "Beginning CSS: Cascading Style Sheets for Web Design", 5ed Wiley India
2. John Duckett, "Beginning HTML, XHTML, CSS, and JavaScript", Wiley India.

MCA 532
Network Administration

UNIT-I

Introduction to Computer Networks: OSI & TCP/IP Model
Physical Media: UTP, Fiber and Wireless Media
LAN Architecture: 10/100/1000/10G Ethernet

UNIT-II

Switching & Routing: Layer 2 & Layer 3 switching; Routing; VLAN; Cisco L2 and L3 Switch Configuration
IP Addressing: IPv4 Addressing and Sub-netting; DHCP Configuration; IPv6
Wireless LAN: 802.11 a/b/g/n/ac WiFi; Access Point and Wireless Router configuration
Internet Architecture: ISP Architecture; DNS Resolution; BGP Routing; Content Mirroring

UNIT-III

Internet Applications: DNS; Web; Mail; Proxy; NTP
Perimeter Security: Firewall; UTM
Network Security: LAN and WLAN Security issues; IP Spoofing; Dictionary Attack; DoS

UNIT-IV

DDoS Attack; Rogue/Misconfigured/External APs
Network Troubleshooting: ping, traceroute, nslookup, dig, tcpdump
Network Monitoring: SNMP; MRTG

Text Books:

1. CCENT/CCNA ICND1 (Official Exam Certification Guide, Second Edition)By – Wendell Odom.
2. Hunt, Craig, “TCP/IP network administration”, Vol. 2. " O'Reilly Media, Inc.", 2002.

Reference Book:

1. Bergstra, Janand Mark Burgesseds,”Handbook of network and system administration”, Elsevier, 2011.

MCA 533
Cyber Security

UNIT-I

Cyber security Fundamentals: Introduction to Cyberspace, Cyber security, need of cyber security. Types of Malware:Worms, Viruses, Spyware, Trojans.Cyber Security Breaches: Phishing, Identity Theft, Harassment etc.

UNIT-II

Types of Cyber Attacks: Password Attacks, Denial of Service Attacks, Passive Attack, Penetration Testing.

Prevention Tips: Craft a Strong Password, Two-Step Verification, Download with care, Question Legitimacy of Websites.

UNIT-III

Cryptography and Network Security: Introduction to Cryptography, Symmetric key Cryptography, Asymmetric key Cryptography, Message Authentication, Digital Signatures, Applications of Cryptography.

UNIT-IV

Cyber Forensics: Introduction to Cyber Forensics, Handling Preliminary Investigations, Controlling an Investigation, Conducting disk-based analysis, Investigating Information-hiding, Scrutinizing E-mail, Validating E-mail header information, Tracing Internet access, Tracing memory in real-time.

Text Book:

1. Zach Webber, “Cyber Security”.

MCA534

Object Oriented Programming Using C++

UNIT-I:
Data Types, Identifiers, Variables Constants and Literals, Basic input/output statements, Operators, Expressions, Type conversion, Control structures, Arrays, Strings, Structures and Pointers.
Functions: Basic, Recursive functions, Overloaded functions, inline functions, function with default arguments.

UNIT-II:
Introduction to classes and objects, Access specifiers, Constructor, Destructor, Function overloading, Operator overloading, friend functions.

UNIT-III:
Inheritance-Concept of derived and base class, accessing base class members, Single inheritance, multiple inheritance, hierarchical inheritance, multilevel inheritance, hybrid inheritance, constructor in derived classes.
Virtual Functions-Functions accessed with pointers, virtual member functions accessing with pointers, late binding, pure virtual functions, abstract classes, virtual base classes.

UNIT-IV:
Exception handling.
Working with files- classes for file stream operations, opening and closing a file, detecting end-of-file, file modes, file pointers and their manipulations, sequential input and output operations, updating a file, error handling.
Command line arguments.

Text Book:
1. Balagurusamy, E. "Object Oriented Programming with C++", 8E , Tata McGraw Hill.

Reference Book:
1. Herbert Schildt, " C++ The Complete Reference " , 4E , TMH Publication.
2. RobertLafore, "Object Oriented Programming in Turbo C++", 4E ,Galgotia Publications Pvt. Ltd.

MCA 536
Java Programming

UNIT-1

Object oriented programming, features of java, general structure of java program, sample program, lexical issues, data types, variables, type conversion and casting, arrays & strings, operators and expressions, controls statements.

String handling: String class, String class constructors, String class methods,StringBuffer class,StringBuffer class constructors, StringBuffer class methods.

UNIT-II Class

fundamentals & objects, Methods, constructors, this keyword, garbage collection, overloading methods & constructors, using object as arguments, returning objects, recursion, nested and inner classes, inheritance, using super, method overriding, dynamic method dispatch, using abstract classes, using final with inheritance.

Interfaces: Defining interfaces, extending interfaces, implementing interfaces, accessing interface variables.

UNIT-III

Packages: Introduction, java API packages, Using system packages, naming conventions, creating packages, accessing a package, using a package, adding a class to a package.

Multithreading: Introduction, crating threads, creating multiple threads, thread priorities, synchronization, in thread communication, suspending, resuming and stopping threads.

Exception handling: Introduction, exception types, uncaught exceptions, using try, catch, throw and throws, java's built in exceptions, creating own exception subclasses.

Applets programming: introduction, applet architecture, an applet Skelton, the HTML APPLET tag, passing parameters to applet.

UNIT-IV

Collections: Array List, Linked List, collections Methods, Stack, Sets, Maps.

Java Swings: Java Foundation Classes, Hierarchy of Java Swing classes, Swing components (Container: Window, Frame ,Dialog, Panel and Applet; JComponent: JLabel, JList, JTable, JComboBox, JSlider, JMenu, Abstract Button, JButton).

Text book:

1. Herbert Schildt, "The Complete Reference", 11E ,Tata McGraw Hill.

Reference Books:

1. Cay S. Horstmann, Gary Cornell," Core Java", Pearson.
2. R. NageswaraRao, "Core Java an integrated approach", Dreamtech Press
3. James R. Levenick , "Simply JAVA :An Introduction to JAVA programming ",Firewall Media Publication New,Delhi.
4. E Balaguruswamy," Programming with Java", Tata McGraw Hill.

MCA 537
Android App Development

UNIT-I

Android: Introduction, History of Android, Android Features, OSS, OHA, Android Versions and compatibility, Android devices, Prerequisites to learn Android, Android Architecture: Android Stack, Linux Kernel, Android Runtime, Dalvik VM, Application Framework, Android emulator, Android applications.

UNIT-II

Android development: Java, Android Studio, Eclipse, Virtualization, APIs and Android tools, Debugging with DDMS, Android File system, Working with emulator and smart devices, A BasicAndroid Application, Deployment.

UNIT-III

Android Services: Simple services, Binding and Querying the service, Executing services. Broadcast Receivers: Creating and managing receivers, Receiver intents, ordered broadcasts. Content Providers: Creating and using content providers, Content resolver. Working with databases: SQLite, coding for SQLite using Android, Sample database applications, Data analysis.

UNIT-IV

Android User Interface: Android Layouts, Attributes, Layout styles, Linear, Relative, Table, Grid, Frame. Menus: Option menu, context menu, pop-up menu. Lists and Notifications: creation and display. Input Controls: Buttons, Text, Fields, Checkboxes, alert, dialogs, Spinners, progress bar.

Text Books:

1. Barry Burd, "Android Application Development – All-in-one for Dummies", 2nd Edition,Wiley India, 2016.
2. Lauren Darcey, Shane Conder, "Sams Teach Yourself Android Application Development in 24 hours", 2nd edition, Pearson Education, 2013.

Reference Book:

1. Paul Deitel, Harvey Deitel, Alexander Wald, " Android 6 for Programmers – An App-driven Approach", 3rd edition, Pearson education, 2016.

MCA 538
NoSQL Databases

UNIT-I

Define what a NoSQL database is, Why we need NoSQL and how is it different from traditional databases. Learn about the various tools available such as MongoDB, Cassandra, HBase etc. Explore the principles of NoSQL using elementary examples in MongoDB.

UNIT-II

Develop an understanding of the available data models: value stores, document databases, column-family stores, graph databases. Understand the basic storage architecture in a distributed environment – column oriented databases, nested maps of key/value pairs, Hbase distributed storage architecture.

UNIT-III

The set of essential operations – CRUD refers to Create, Read, Update and Delete operations in the context of a NoSQL database environment. Practical experience of CRUD operations for document databases using MongoDB.

UNIT-IV

Developing Web Application with NOSQL and NOSQL Administration: Php and MongoDB, Python and MongoDB, Creating Blog Application with PHP,NOSQL Database Administration.

Text Books:

1. ShashankTiwari, “Professional NoSQL”, John Wiley and Sons.
2. Pramod J. Sadalage, Martin Fowler, “NoSQL Distilled: A Brief Guide tothe Emerging World of Polyglot Persistence”, Addison-Wesley.

MCA 401
Fundamental of ICT

UNIT-I

Introduction: Computer, Data Processing, Computer System Characteristics, Evolution of Computers, Capabilities and Limitations, Generations of computers, Block diagram of computer, Basic components of a computer system- Input unit, Output unit, Storage unit, ALU, Control unit, Central Processing unit; Number Systems- Non-positional number system, Positional number system, Decimal Number system, Binary number system, Octal number system, Hexadecimal number system.

UNIT-II

Memory: Main memory organization, Main memory capacity, RAM, ROM, PROM, EPROM, Cache Memory, Secondary storage devices: Sequential access devices- Magnetic tape; Direct access devices- Magnetic disks, Floppy disks, Optical disks, Types of Optical disks: CD-ROM, CD-R, CD-RW, DVD.

Input devices: Keyboard, Pointing Devices-Mouse, Touch screens, Joystick, Electronic pen, Trackball, Scanning devices: Optical Scanners, OCR, OMR, Bar code reader, MICR, Electronic card reader, Image capturing devices, Digital cameras.

Output devices: Monitors- CRT, LCD, Printers-Dot matrix, Inkjet, Laser; Plotters, Screen image projector.

UNIT-III

Introduction: Software, Relationship between Hardware and Software, Types of Software-System Software, Application Software; System Software-Operating System, Utility Program; Programming Languages-Machine, Assembly, High Level; Assembler, Compiler, Interpreter.

UNIT-IV

Data Communication & Computer Networks, Basic elements of a communication system, Data Transmission modes-Simplex, Half duplex, Full duplex; Data Transmission speed-Narrowband, Voice band, Broadband; Data Transmission media-Twisted Pair Wire, Coaxial cable, Optical fibers; Modems, Types of Network-LAN, WAN, MAN; Internet, World Wide Web, Web Browsers.

Text Book:

1. Pradeep K. Sinha, PritiSinha, “Computer Fundamentals”, 6E ,BPB Publications.

Reference Books:

1. Rajaraman, V., “Fundamental of Computers”, Fifth Edition, Prentice Hall India, New Delhi.
2. E. Balagurusamy, “Introduction to Computers (Special Indian Edition)”, Tata McGraw Hill.

MCA 402
C Programming

UNIT-I

Overview of C- General Structure of C Program, C compilers, Editing, Compiling & , Running of a C program Data types, Constants and Variables, Operators and expressions, Storage Classes, Different types of expressions and their Evaluation, Conditional Expression, Assignment statement, Enumerated data type, Redefining/ Creating data types, Library functions, Type casting.
Input/Output- Unformatted and formatted I/O Functions.

UNIT-II

Control Statements- Decision making using if, if-else, elseif and switch statements, Looping using for, while and do-while statements, Transferring Program controlling break and continue statements, Programming examples to illustrate the use of these control statements.
Functions- Defining a function, Local variables, return statement, invoking a Function, specifying and passing arguments to a function, Functions returning non Integer, External, static, and register variable, block structure, initialization and recursion.

UNIT-III

Array & strings- Introduction to arrays, Declaring arrays, Initializing, arrays, Processing arrays, Pointers to arrays, Passing arrays as arguments to functions, Introduction to strings, Pointers to strings, Passing strings and Arrays of strings as arguments to a function, Programming examples to illustrate the use of arrays and strings.
Pointers- Definition, Need of pointers, declaring Pointers, Accessing Values via Pointers, Pointer arithmetic, Types of pointers, Programming examples to illustrate the use of pointers.

Unit-IV

Structures- Declaring a structure type, Declaring Variables of structure type, Initializing Structures, Accessing Elements of structures, arrays of structures, nested structures, Pointers to structures Programming examples to illustrate the use of Structures. File Handling.

Text Books:

1. E. Balagurusamy, “Programming in ANSI C”, 8E ,Tata McGraw Hill.

Reference Books:

1. R S Salaria, Application in C, Khanna book publishing.
2. YashwantKanetakar, “Let us C” BPB.
3. Kerninghan B.W. & Ritchie D.M. “The C Programming Language” Prentice-Hall.
4. Mullish Cooper, “The Spirit of C” Jaico Publishing House.
5. Byron Gottfried, “Programming with C”, Schaum’s Outlines, Tata McGraw Hill.
6. Herbert Schildt, C: The complete reference, Tata mcCgraw hill.

Annexure-IV

Proposed List of Courses for the Course work in PhD Computer Science & Informatics in the Light of NEP 2020*

S. No.	Course Code	Course Name	Credit
1.	CSI 651	Research Methodology	4
2.	CSI 652	Big Data Analytics	4
3.	CSI653	Internet of Things	4
4.	CSI 654	Data Mining & Machine Learning	4
5.	CSI 655	Cloud computing Concepts	4
6.	CSI RPE	Research And Publication Ethics	2

*University has issued the guidelines for the implementation of NEP 2020 which are subject to the approval from Academic Council and Executive Council, CUHP.

CSI 651
Research Methodology

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations.
Effective literature studies approaches, analysis Plagiarism, and Research ethics. Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.

Statistical Methods of Analysis Descriptive Statistics: Mean, Median, Mode, Range, Standard Deviation, regression and correlation analysis. Inferential Statistics: Estimation of parameters, Hypothesis, Types of Hypothesis, Testing of Hypothesis, Test of Normality, Introduction to Parametric and Non Parametric tests. Test of significance: t-test, chi square test, ANOVA(1-way, 2-way), Repeated Measures ANOVA, ANCOVA, α-correction

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology.Patent information and databases.Geographical Indications. New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc.

Books & References:

- Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"
- Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
- Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"
- Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
- Mayall, "Industrial Design", McGraw Hill, 1992.
- Niebel, "Product Design", McGraw Hill, 1974.
- Asimov, "Introduction to Design", Prentice Hall, 1962.
- Robert P. Merges, Peter S. Menell, Mark A. Lemley, "Intellectual Property in New Technological Age", 2016.
- T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

CSI 652
Big Data Analytics

Introduction to Big Data: Platform – Traits of Big data -Challenges of Conventional Systems - Web Data – Evolution of Analytic Scalability - Analytic Processes and Tools - Analysis vs Reporting - Modern Data Analytic Tools - Statistical Concepts: Sampling Distributions - ReSampling - Statistical Inference - Prediction Error.

Data Analysis: Regression Modeling - Multivariate Analysis - Bayesian Modeling - Inference and Bayesian Networks - Support Vector and Kernel Methods - Analysis of Time Series: Linear Systems Analysis - Nonlinear Dynamics - Rule Induction - Neural Networks: Learning And Generalization - Competitive Learning - Principal Component Analysis and Neural Networks - Fuzzy Logic: Extracting Fuzzy Models from Data - Fuzzy Decision Trees - Stochastic Search Methods.

Mining Data Streams: Introduction To Streams Concepts – Stream Data Model and Architecture - Stream Computing - Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating Moments – Counting Oneness in a Window – Decaying Window - Real time Analytics Platform(RTAP) Applications - Case Studies - Real Time Sentiment Analysis, Stock Market Predictions.
Frequent Itemsets And Clustering: Mining Frequent Item sets - Market Based Model – Apriori Algorithm – Handling Large Data Sets in Main Memory – Limited Pass Algorithm – Counting Frequent Itemsets in a Stream – Clustering Techniques – Hierarchical – K-Means – Clustering High Dimensional Data – CLIQUE and PROCLUS – Frequent Pattern based Clustering Methods – Clustering in NonEuclidean Space – Clustering for Streams and Parallelism.

Frameworks And Visualization: MapReduce – Hadoop, Hive, MapR – Sharding – NoSQL Databases - S3 - Hadoop Distributed File Systems – Visualizations - Visual Data Analysis Techniques - Interaction Techniques; Systems and Analytics Applications - Analytics using Statistical packages-Approaches to modeling in Analytics – correlation, regression, decision trees, classification, association Intelligence from unstructured information-Text analytics-Understanding of emerging trends and technologies-Industry challenges and application of Analytics.

Books& References:

- Michael Berthold, David J. Hand, “Intelligent Data Analysis”, Springer, 2007.
- AnandRajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, Cambridge University Press, 2012.
- Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics”, John Wiley & sons, 2012.
- Glenn J. Myatt, “Making Sense of Data”, John Wiley & Sons, 2007
- Pete Warden, “Big Data Glossary”, O’Reilly, 2011.

CSI 653
Internet of Things

Introduction to IoT: Sensing, Actuation, Networking basics, Communication Protocols, Sensor Networks, Machine-to-Machine Communications, IoT Definition, Characteristics. IoT Functional Blocks, Physical design of IoT, Logical design of IoT, Communication models & APIs.

M2M to IoT-The Vision-Introduction, From M2M to IoT, M2M towards IoT-the global context, A use case example, Differing Characteristics. Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT.
M2M vsIoT An Architectural Overview–Building architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. Reference Architecture and Reference Model of IoT

IoT Reference Architecture- Getting Familiar with IoT Architecture, Various architectural views of IoT such as Functional, Information, Operational and Deployment. Constraints affecting design in IoT world- Introduction, Technical design Constraints.
Domain specific applications of IoT: Home automation, Industry applications, Surveillance applications, Other IoT application.

Developing IoT solutions: Introduction to Python, Introduction to different IoT tools, Introduction to Arduino and Raspberry Pi, Data Aggregation for the IoT in Smart Cities, Privacy and Security Issues in IoT.

Books & References:

- Vijay Madisetti and ArshdeepBahga, “Internet of Things (A Hands-onApproach)”, 1E, VPT
- Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle, “From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence”, 1st Edition, Academic Press
- Francis daCosta, “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, 1st Edition, Apress Publications
- CunoPfister, Getting Started with the Internet of Things, O‟Reilly

CSI 654
Data Mining & Machine Learning

Introduction to Data mining, types of Data, Data Quality, Data Processing, Measures of Similarity and Dissimilarity, Exploring Data: Data Set, Summary Statistics, Visualization. Classification: Basic Concepts, Decision Trees, Nearest Neighborhood classifier, Bayesian Classifier, Support vector Machines: Linear SVM, Separable and Non Separable case.

Association Analysis: Problem Definition, Frequent Item-set generation, rule generation, compact representation of frequent item sets, FP-Growth Algorithms.
Clustering: Over view, K-means, Agglomerative Hierarchical clustering, DBSCAN, Cluster evaluation: overview, Unsupervised Cluster Evaluation using cohesion and separation, using proximity matrix, Scalable Clustering algorithm.

Overview and Introduction to Bayes Decision Theory: Machine intelligence and applications, pattern recognition concepts classification, regression, feature selection, supervised learning class conditional probability distributions, Examples of classifiers bayes optimal classifier and error, learning classification approaches.
Linear machines: General and linear discriminants, decision regions, single layer neural network, linear separability, general gradient descent, perceptron learning algorithm, mean square criterion and widrow-Hoff learning algorithm; multi-Layer perceptrons: two-layers universal approximators, backpropagation learning, on-line, off-line error surface, important parameters.

Learning decision trees: Inference model, general domains, symbolic decision trees, consistency, learning trees from training examples entropy, mutual information, ID3 algorithm criterion, C4.5 algorithm continuous test nodes, confidence, pruning, learning with incomplete data.
Instance-based Learning: Nearest neighbor classification, k-nearest neighbor, nearest neighbor error probability, Machine learning assessment and Improvement: Statistical model selection, structural risk minimization, bootstrapping, bagging, boosting. Support Vector Machines

Books & References:

- Jiawei Han and MichelineKamber, “Data Mining: Concepts and Techniques”, 2E, Morgan Kaufmann, 2006.
- E. Alpaydin, “Introduction to Machine Learning”, Prentice Hall of India, 2006.
- T. M. Mitchell, “Machine Learning”, McGraw-Hill, 1997.
- ArunPujari, “Data Mining Techniques”, University Press, 2001
- D. Hand, H. Mannila and P. Smyth, “Principles of Data Mining”, Prentice-Hall of India, 2006
- G.K. Gupta, “Introduction to Data Mining with Case Studies”, Prentice-Hall of India, 2006

CSI 655
Cloud Computing Concepts

Overview of Computing Paradigms: Recent Trends in Computing: Distributed Computing, Cluster Computing, Grid Computing, Utility Computing, Cloud Computing, Evolution of Cloud Computing: Migrating into a Cloud
Cloud Computing Basics: Cloud Computing Overview; Characteristics; Applications; Benefits; Limitations; Challenges, SOA; Cloud Computing Service Models: Infrastructure as a Service; Platform as a Service; Software as a Service, Cloud Computing Deployment Models: Private Cloud; Public Cloud; Community Cloud; Hybrid Cloud, Major Cloud Service providers

Virtualization Concepts: Overview of Virtualization Technologies, Types of Virtualization, Benefits of Virtualization, Hypervisors VM Provisioning & Migration: VM Lifecycle, VM Provisioning Process, VM Migration Techniques
Scheduling in Cloud: Overview of Scheduling problem, Different types of scheduling, Scheduling for independent and dependent tasks, Static vs. Dynamic scheduling, Optimization techniques for scheduling

Cloud Storage: Overview; Storage as a Service, Benefits and Challenges, Storage Area Networks(SANs), Case Study of Amazon S3
Cloud Security: Infrastructure Security: Network Level Security, Host Level Security and Application Level Security; Data Security: Data Security & Privacy Issues; Identity & Access Management; Legal Issues in Cloud Computing

Mobile Cloud Computing: Overview of Mobile Cloud Computing, Advantages, Challenges, Using Smartphones with the Cloud, Offloading techniques - their pros and cons, Mobile Cloud Security.
SLA Management: Overview of SLA, Types of SLA, SLA Life Cycle, SLA Management Process

Books & References:

- RajkumarBuyya, James Broberg, AndrzejGoscinski, " Cloud Computing: Principles and Paradigms", Wiley, 2011
- Barrie Sosinsky: Cloud Computing Bible, Wiley, 2011.
- Anthony T. Velte, Toby J. Velte, and Robert Elsenpeter, "Cloud Computing: A Practical Approach", McGraw Hill, 2010.
- Judith Hurwitz, Robin Bloor, Marcia Kaufman,FernHalper, "Cloud Computing for Dummies", Wiley, 2010.
- BorkoFurht, Armando Escalante , "Handbook of Cloud Computing", Springer, 2010.

Course Code: RPE
Course Name: Research & Publication Ethics

PHILOSOPHY AND ETHICS

Introduction to philosophy: definition, nature and scope, concept, branches.

Ethics: definition, moral philosophy, nature of moral judgments and reactions.

SCIENTIFIC CONDUCT

1. Ethics with respect to science and research.
2. Intellectual honesty and research integrity.
3. Scientific misconducts: Falsification, Fabrication, and Plagiarism (FFP).
4. Redundant publications: duplicate and overlapping publications, salami slicing.
5. Selective reporting and misrepresentation of data.

PUBLICATION ETHICS

1. Publication ethics: definition, introduction and importance
2. Best practices / standards setting initiatives and guidelines: COPE, WAME, etc.
3. Conflicts of interest
4. Publication misconduct: definition, concept, problems that lead to unethical behavior and vice versa, types
5. Violation of publication ethics, authorship and contributor ship
6. Identification of publication misconduct, complaints and appeals
7. Predatory publishers and journals

PRACTICE OPEN ACCESS PUBLISHING

1. Open access publications and initiatives.
2. SHERPA/ROMEO online resource to check publisher copyright &selfarchiving policies.
3. Software tool to identify predatory publications developed by SPPU .
4. Journal finder / journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer Journal Suggester, etc.

PUBLICATION MISCONDUCT

A. Group Discussions

1. Subject specific ethical issues, FFP, authorship
2. Conflicts of interest
3. Complaints and appeals: examples and fraud from India and abroad.

B. Software tools Use of plagiarism software like Turnitin, Urkund and other open source software tools

DATABASES AND RESEARCH METRICS

A. Databases

1. Indexing databases
2. Citation databases: Web of Science, Scopus, etc.

B. Research Metrics

1. Impact Factor of journal as per Journal Citation Report, SNIP, SJR, IPP, Cite Score.
2. Metrics: h-index, g index, i10 index, altmetrics.

Books & References:

- MiroTodorovich, Paul Kurtz& Sidney Hook, “The Ethics of Teaching and Scientific Research”.
- Barbara H. Stanley, Joan E. Sieber& Gary B. Melton, “Research Ethics: A Psychological Approach”.
- Jeffrey A. Gliner, George A. Morgan, “Research Methods in Applied Settings: An Integrated Approach to Design and Analysis”, Lawrence Erlbaum Associates, 2000.
- Joel Lefkowitz, “Ethics and Values in Industrial-Organizational Psychology”, Lawrence Erlbaum Associates, 2003.