FOUR YEAR UNDER-GRADUATE PROGRAMME (FYUGP)

COOCH BEHAR PANCHANAN BARMA UNIVERSITY

DEPARTMENT OF COMPUTER SCIENCE

UNDERGRADUATE PROGRAMME
(Courses effective from Academic Year 2023-24)

SYLLABUS OF COURSES TO BE OFFERED

Major, Minor & MDC

Disclaimer: The **FYUGP** syllabus is uploaded as given by the Faculty concerned to the Academic Council. The same has been approved as it is by the Academic Council on 01.08.2023. Any query may kindly be addressed to the concerned Faculty.

Undergraduate Programme Secretariat

Preamble

The University Grants Commission (UGC) has initiated several measures to bring equity, efficiency and excellence in the Higher Education System of country. The important measures taken to enhance academic standards and quality in higher education include innovation and improvements in curriculum, teaching-learning process, examination and evaluation systems, besides governance and other matters.

The UGC has formulated various regulations and guidelines from time to time to improve the higher education system and maintain minimum standards and quality across the Higher Educational Institutions (HEIs) in India. The academic reforms recommended by the UGC in therecent past have led to overall improvement in the higher education system. However, due to lot of diversity in the system of higher education, there are multiple approaches followed by universities towards examination, evaluation and grading system. While the HEIs must have the flexibility and freedom in designing the examination and evaluation methods that best fits the curriculum, syllabi and teaching-learning methods, there is a need to devise a sensible system for awarding the grades based on the performance of students. Presently the performance of the students is reported using the conventional system of marks secured in the examinations or grades or both. The conversion from marks to letter grades and the letter grades used vary widely across the HEIs in the country. This creates difficulty for the academia and the employers to understand and infer the performance of the students graduating from different universities and colleges based on grades.

The grading system is considered to be better than the conventional marks system and hence it has been followed in the top institutions in India and abroad. So it is desirable to introduce uniform grading system. This will facilitate student mobility across institutions within and across countries and also enable potential employers to assess the performance of students. To bring in the desired uniformity, in grading system and method for computing the cumulative grade point average (CGPA) based on the performance of students in the examinations, the UGC has formulated these guidelines.

FOUR YEAR UNDER-GRADUATE PROGRAMME (FYUGP)
IN
COMPUTER SCIENCE,
COOCH BEHAR PANCHANAN BARMA UNIVERSITY

INTRODUCTION:

The introduction of the National Education Policy (NEP) 2020 has been one of the biggest highlights in the Indian education system. It is a comprehensive policy that emphasizes multidisciplinary & multimode approaches, and education backed by Technology. The NEP has transformed the administrative structure of the educational system in India. It focuses on skill development in order to help students succeed in life. Keeping in mind the NEP 2020, Commerce education, with continuous revision of the curriculum will develop the creative potential of each individual and create new career growth opportunities. The Bachelor of Commerce Degree of Cooch Behar Panchanan University adapted as per the recommendations of NEP 2020 is of either three or four-years duration with multiple entry/exit options within the period with appropriate certification/diploma/degree. Introducing holistic and multi-disciplinary under-graduate education that would develop all capacities of human beings- intellectual, aesthetic, social, physical, emotional, ethical in an integrated manner.

AIMS OF FOUR YEAR UNDER-GRADUATE PROGRAMME (FYUGP) IN COMPUTER SCIENCE:

The aims of Four Year Under-Graduate Programme (FYUGP) in Computer Science are:

1. To equip students with practical and hands-on skills required in software industry, human relations and many other sub disciplines of computer science so as to ensure their place in the job market and in practice.
2. To acquaint the students with the basic and advanced concepts and theories of various computer science subjects aimed at building a solid base for higher learning, research and practice.
3. To develop capabilities of the students to critically evaluate issues and the emerging trends influencing the field of Computer Science.
4. To familiarize students with the changes evidenced in the use of technology in modern trade and e-commerce in general and more specifically in the practices of each of the sub-disciplines
5. To acquaint the students in recent developments in the fields of software industry, e-commerce and thereby, to encourage entrepreneurial spirit in them to go for their own start-ups.
6.

Programme Learning Outcomes:

Upon completion of the program, graduates will be able to:

1. Design, develop, and maintain computer systems and software applications using various programming languages and tools.
2. Develop and manage database management systems.
3. Develop and implement computer networks.
4. Analyze algorithms and data structures.
5. Develop and implement cloud computing solutions.
6. Develop and implement artificial intelligence solutions.
7. Apply mathematical and computational thinking and analysis to solve computer science problems.
8. Understand and analyze ethical and professional issues related to computer science.
9. Communicate effectively with team members and stakeholders.
10. Continuously update their knowledge and skills in the rapidly evolving field of computer science.

CBPBU_ NCCF_Course Structure_2023-24

1ST YR				2ND YR				3RD YR				4TH YR				4TH YR (WITH RESEARCH)			
1ST SEM	**C**	**2ND SEM**	**C**	**3RD SEM**	**C**	**4TH SEM**	**C**	**5TH SEM**	**C**	**6TH SEM**	**C**	**7TH SEM**	**C**	**8TH SEM**	**C**	**7TH SEM**	**C**	**8TH SEM**	**C**
Major-1	6	Major -2	6	Major-3	6	Major-5	6	Major-7	6	Major-10	6	**Major -13***	**6**	**Major- 17**	**6**	**Major - 13**	**6**	**Major-17**	**6**
Minor-1	6	Minor-2	6	Major-4	6	Major-6	6	Major-8	6	Major-11	6	**Major-14**	**6**	**Major-18**	**6**	**Major-14**	**6**	**Major-18**	**6**
MDC-1	3	VAC-1	3	Minor-3	6	Minor-4	6	Major-9	6	Major-12	6	**Minor-5**	**6**	**Minor-6**	**6**	**Minor-5**	**6**	**Minor-6**	**6**
SEC-1	3	SEC-2	3	SEC-3	3	AEC-2	4	MDC-3	3	VAC-2	3	**Major-15****	**6**	**Major- 19**	**6**	**Major- 15****	**6**	**Major-19**	**6**
AEC-1	4	INTRN	**4**	MDC-2	3							**Major- 16**	**6**			**Major-16**	**6**		
	22		**22**		**24**		**22**		**21**		**21**		**30**		**24**		**30**		**24**
		44				**46**				**42**				**54**				**54**	
132 (3 Year)																			
Total Credit= 186 (4 Year Hons)																			
Total Credit= 186 (4 Year Hons with Research)																			

DISCIPLINARY MAJOR (HONOUS SUBJECT): Appendix I

The major courses would provide a student to pursue in-depth study of a particular subject or discipline.

- 19 Major papers (2 in 1st year, 4 in 2nd year, 6 in 3rd year, 7 in 4th year)
- 4Year UG Degree Honours with Research will have 19 Major subjects & 4Year UG Degree Honours will also have 19 Major papers.
- In the 4th Year (7th semester) each student has to study one Major paper (Major -13*) on Research Methodologies and Ethics which will be common for all 4 year Honors students irrespective of whether they take Research or not).
- Students pursuing 4 year Honours will have to take one seminar based Major Paper (Major-15**).
- Students pursuing 4 year Honours with Research will have to carry out dissertation of total 12 credits in 4th year (Major-16 in 7th semester and Major-19 in 8th semester). During 7th semester for Major-16, student has to submit a progress report during term end examination, on the Dissertation topic (Evaluation=100 marks). During the end of 8th semester for Major-19, student has to submit a Final Dissertation report on the same topic (Evaluation=100 marks).
- A seminar paper (Major-15**) comprising of 6 credits will also being undertaken by these students during 7th semester.
- Major 14# (7th semester) and Major-18# (8th semester) will be Electives related to Disciplines, which can be chosen from a pool of courses.

➢ **MINOR-: Appendix II**

Students need to choose any two Minor Discipline/Subjects, each comprising of 3 papers (Two Minors in 1st year, two in 2nd Year and two in 4th Year)

- Each Minor discipline will have 3 papers, follow the below mentioned minor subject combinations:

Minor subject combinations for Science Discipline

1. Chemistry (Major):- Minors-(i) Mathematics **(1st, 2nd and 7th semester)** (ii) Physics or Computer Science **(3rd, 4th and 8th semester)**
2. Mathematics (Major):- Minors-(i) Physics **(1st, 2nd and 7th semester)** (ii) Chemistry or Computer Science **(3rd , 4th and 8th semester)**
3. Physics (Major):- Minors-:- (i) Mathematics **(1st, 2nd and 7th semester)** (ii) Chemistry or Computer Science **(3rd, 4th and 8th semester)**
4. Computer Science (Major):- Minors:- (i) Mathematics **(1st, 2nd and 7th semester)** (ii) Physics or Chemistry **(3rd , 4th and 8th semester)**
5. Botany (Major):- Minors- i) Chemistry **(1st, 2nd and 7th semester)** ii) Zoology or Physiology **(3rd , 4th and 8th semester)**
6. Zoology (Major):- Minors- i) Chemistry **(1st, 2nd and 7th semester)** ii) Botany or Physiology **(3rd , 4th and 8th semester)**
7. Physiology (Major):- Minors- i) Chemistry **(1st, 2nd and 7th semester)** ii) Zoology or Botany **(3rd , 4th and 8th semester)**

Minor subject combinations for Arts & Humanities Discipline (Minor shall never be same as Major discipline)

1. Bengali/ English/Sanskrit/Arabic/Philosophy/Sociology/Physical Education (1st, 2nd and 7th semester)
2. History /Economics/Political Sciences/Education/Geography/Mathematics for Geography & Economics Major (3rd, 4th and 8th semester)

[A candidate pursuing Major in a subject will not be allowed to take up the same subject as Minor.

A candidate pursuing Major in a Language subject will be allowed to take another Language subject as a Minor Subject.]

Minor subject combinations for Commerce Discipline

i. Principles and Practices of Management (1st Semester)
ii. Microeconomics (2nd Semester)
iii. Business Regulatory Framework (3rd Semester)
iv. Macro Economics (4th Semester)
v. Advance Statistics and Operation Research (7th Semester)
vi. Corporate Social Responsibility and Corporate Ethics (8th Semester)

Minor subject combinations for Business Administration Discipline

1. Accounting for Managers (1st Semester)
2. Entrepreneurship Development (2nd Semester)
3. Business Regulatory Framework (3rd Semester)
4. Income Tax Laws and Practice (4th Semester)
5. Business Environment (7th Semester)
6. E-Commerce and Digital Marketing (8th Semester)

Minor subject combinations for Business Management Discipline

1. Persona Management Soft Skill and Personality development (1st Semester)
2. Front Office Operations (2nd Semester)
3. Business Organization and Organizational Behavior (3rd Semester)
4. Entrepreneurship Development (4th Semester)
5. Retail management & Visual Merchandising (7th Semester)
6. Tourism Planning and Development (8th Semester)

- **MULTIDISCIPLINARY COURSE: Appendix III= 3 MDC papers; MDC-1 (1st Semester), MDC-2 (3rd Semester), MDC-3 (5th Semester)**

  Students have to choose any one Discipline/Subject as MDC, comprising of 3 papers, which should not be similar to their major or minor or even any subject which they had in their Higher Secondary. For each Discipline/Subject there will be three MDC.

- # SKILL ENHANCEMENT COURSES

  Skill Enhancement Courses are aimed at imparting practical skills, hands-on-training, soft skills etc. to enhance the employability of students.

  SEC (three SEC courses; each SEC subject will have 3 papers, each in 1st, 2nd and 3rd semester)

  Subjects as specified in Appendix IV
  [Any person having professional skill to train students irrespective of his/her educational qualifications can teach SEC courses]

  Each student has to choose any one SEC subject comprising of three papers in 1st, 2nd and 3rd semester.
  Other SEC subjects may be included depending on the infrastructural and manpower facilities available in the colleges in subsequent semester.

- **ABILITY ENHANCEMENT COURSES: Appendix V= AEC (two AEC papers; one in 1st Semester & one in 4th Semester)-**

  These courses are introduced to achieve competency in Modern Indian Language (MIL) and in English language with special emphasis on language and communication skills.

  Modern Indian Language (MIL)-Bengali or Hindi or Sanskrit or Alternative English in 1st Semester & Basics in English in 4th Semester

- **VALUE ADDED COURSE (Common for all UG): Appendix VI = VAC (2 VAC Papers common to all)**

  The courses aim at establishing the students to acquire and demonstrate the knowledge and understanding of contemporary India with its historical perspective, the goals and policies of national development, constitutional values and fundamental rights and duties, environmental science and education and Health & Wellness.

  VAC-1: Environmental Studies (emphasis on management & sustainable development)

  VAC-2: Constitution of India and Health & Wellness [Gr-A-Constitution of India (emphasis on values, fundamental rights & duties) and Gr-B-Health & Wellness (emphasis on physical, social, intellectual, spiritual and mental wellbeing)]

- **INTERNSHIP (INTRN): (To be carried out at 2nd semester)**

A course requiring students to participate in a professional activity or work experience, or cooperative education activity with an entity external to the education institution, normally under the supervision of an expert of the given external entity. A key aspect of internship is induction into actual work situations. All students will also undergo internships in a firm, industry, or organization or training in labs or community engagement & services or field based learning/minor projects with faculty and researchers in their own or other HEIs/research institutions during the summer term. **NSS activities (apart from Regular/ Special NSS activities) may also be considered in the Internship during summer term.**
Students need to submit to the respective College a certificate of completion of Internship as per the prescribed format provided by the University. And on the basis of the remark mentioned on the certificate, the final evaluation will be done by the college (50 marks).

- **RESEARCH PROJECT/DISSERTATION= DISSETRN (2 Research papers, one at each 7th and 8th semester)**

  Students who secure 75% marks and above in the First 6 semesters and wish to undertake research at the UG level can choose a Research stream in the 4th year. Students need to carry out dissertation under the guidance of a recognized PhD Supervisor of University/College.

- Selection of Major or Minor courses depends on the availability of that particular course has been taught in the respective colleges.

- Introduction of New Major courses by the college are subject to approval by the WB State Council of Higher Education followed by University. Upgradation of existing subjects of Program courses of CBCS system to Major course are subject to approval by the WB State Council of Higher Education followed by University.

Detailed Credit Distribution Structure

The term '**credit'** refers to the weightage given to a course, usually in terms of the number of instructional hours per week assigned to it. This explains why usually 'credit' is taken to mean '**credit hours'**. The credits also determine the volume of course contents and delivery of Course such as lectures, tutorials, projects, practical, assignments etc.

For the purpose of credit determination, instruction is divided into three components:

- **Lectures (*L*)** - Classroom lectures of one-hour duration.
- **Tutorials (*T*)** - Special, elaborate instructions on specific topics (from Lectures) of one- hour duration.
- **Practical's (*Pr*)** - Laboratory or field exercises in which the student has to do experiments or other practical work of two-hour duration.

Notes

- Students **exiting the programme after securing 44 credits with completion of Internship** during summer/vacation term or internship / Apprenticeship **will be awarded a 1 year Under Graduate Certificate** in the relevant Discipline / Subject.
- Students **exiting the programme after securing 90 credits with completion of Internship** during summer/vacation term or internship / Apprenticeship **will be awarded a 2 Year Under Graduate Diploma** in the relevant Discipline /subject.
- Modalities regarding the offering of internship / Apprenticeship to be finalized by the respective colleges and to be intimated to the University, in case of any exit.
- Students who want to undertake 3-year UG programme will be **awarded a 3 Year Under Graduate Degree** in the relevant Discipline /Subject upon **securing 132 credits**.
- Students will be **awarded a 4 Year Under Graduate Degree (with Honours)** in the relevant Discipline /Subject provided they **secure 186 credits.**
- Students will be **awarded a 4Year Under Graduate Degree (Honours with Research) Degree** in the relevant Discipline /Subject provided they **secure 186 credits**.

TEACHING LEARNING PROCESS:

The programme allows to use varied pedagogical methods and techniques both within classroom and beyond.

- Lecture
- Tutorial
- Power point presentation
- Project Work/Dissertation
- Group Discussion
- Seminars/conferences
- Field and industry visits and Report/Excursions
- Mentoring and Counselling
- Micro Teaching
- Case Study
- Role Playing
- Workshops/Hands-on learning

TEACHING LEARNING TOOLS:

- Smart Boards
- Desktop Computers with latest Commerce Related Softwares
- Projector
- LCD Monitor
- WLAN
- White/Green/Black Board

ASSESSMENT TECHNIQUES:

- Home Assignment
- Class Assignments
- Group Discussions
- Field Tour/Industrial Visit
- Seminars
- Project Report
- Class Presentation: Oral/Poster/Power point
- In semester examinations
- End Semester examinations

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COOCH BEHAR PANCHANAN BARMA UNIVERSITY, COOCH BEHAR-736101, WEST BENGAL, INDIA

FYUGP Structure as per UGC Credit Framework of December, 2023

Year	Semester	Course	Title of the Course	Total Credit
Year 01	1st Semester	Major-1	Computer Fundamental & Digital Logic	4
			Computer Fundamental & Digital Logic LAB	2
		Minor 1	Mathematics	6
		MDC-1	MDC-1	3
		SEC1	SEC-1	3
		AEC1	Bengali or Hindi or Sanskrit or Alternative English	4
				22
	2nd Semester	Major-2	Introduction to Programming using C	4
			Introduction to Programming using C LAB	2
		Minor 2	Mathematics	6
		VAC1	Environmental Studies	3
		SEC2	SEC-2	3
		Internship		4
				22
The students on exit shall be awarded Undergraduate Certificate (COMPUTER SCIENCE) after securing the requisite 44 Credits in Semester 1 and 2 provided they secure 4 credits in work based vocational courses offered during summer term or internship / Apprenticeship in addition to 6 credits from skill based courses earned during 1st and 2nd Semester				
Year 02	3rd Semester	Major-3	Data Structure & Algorithm	4
			Data Structure & Algorithm LAB	2
		Major-4	Computer Organization & Architecture	6
		Minor- 3	Physics or Chemistry	6
		MDC–2	MDC–2	3
		SEC–3	SEC–3	3
				24
	4th Semester	Major-5	Design and Analysis of Algorithms	6
		Major-6	Introduction to Programming using Python	4
			Introduction to Programming using Python LAB	2
		Minor 4	Physics or Chemistry	6
		AECC-2	Basics in English	4
				22
Grand Total (Semester I, II,III and IV)				**90**
The students on exit shall be awarded Undergraduate Diploma (Computer Science) after securing the requisite 90 Credits on completion of Semester IV provided they secure additional 4 credit in skill based vocational courses offered during First Year or Second Year summer term				

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FYUGP Structure as per UGC Credit Framework of December, 2023

Year	Semester	Course	Title of the Course	Total Credit
Year 03	5th Semester	Major-7	Database Management System	4
			Database Management System LAB	2
		Major-8	Operating Systems	6
		Major-9	Software Engineering	6
		MDC-3	MDC-3	3
				21
	6th Semester	Major-10	Object Oriented Programming with JAVA	4
			Object Oriented Programming with JAVA LAB	2
		Major-11	Formal Language &Automata Theory	6
		Major-12	Computer Networks	6
		VAC1	Constitution of India and Health & Wellness	3
				21
				42
The students on exit shall be awarded Undergraduate DEGREE (COMPUTER SCIENCE) after securing the requisite 132 Credits on completion of Semester VI				
4TH YEAR HONOURS				
Year 04 Undergraduate DEGREE (HONOURS)	7th Semester	Major-13	Research Methodologies and Ethics	6
		Major-14	Elective-I (chose any one from the pool of courses)	6
			A) Artificial Intelligence	
			B) Machine Learning	
			C) Cloud Computing	
		Major-15	Minor Project/Seminar	6
		Major-16	Compiler Design	6
		Minor 5	Mathematics	6
				30
	8th Semester	Major-17	Cryptography and Network Security	6
		Major-18	Elective-II (chose any one from the pool of courses)	6
			A) Soft Computing	
			B) Big Data Analysis	
			C) Deep Learning	
		Major-19	Digital Image Processing	4
			Digital Image Processing with lab	2
		Minor 6	Physics or Chemistry	6
				24
Grand Total (Semester I, II,III,IV,V and VI)				**186**
The students on exit shall be awarded Undergraduate DEGREE(HONOURS) in Computer Science after securing the requisite 186 Credits on completion of Semester VIII				

COOCH BEHAR PANCHANAN BARMA UNIVERSITY, COOCH BEHAR-736101, WEST BENGAL, INDIA

FYUGP Structure as per UGC Credit Framework of December, 2023

4TH YEAR HONOURS (WITH RESEARCH)

4TH YEAR HONOURS WITH RESEARCH				
Year 04 Undergraduate DEGREE (HONOURS)	7th Semester	**Major-13**	Research Methodologies and Ethics	6
		Major-14	Elective-I (chose any one from the pool of courses)	6
			A) Artificial Intelligence	
			B) Machine Learning	
			C) Cloud Computing	
		Major-15	Minor Project/Seminar	6
		Major-16	Research – 1(dissertation)	6
		Minor 5	Mathematics	6
				30
	8th Semester	**Major-17**	Cryptography and Network Security	6
		Major-18	Elective-II (chose any one from the pool of courses)	6
			A) Soft Computing	
			B) Big Data Analysis	
			C) Deep Learning	
		Major-19	Research – 2 (dissertation)	6
		Minor 6	Physics or Chemistry	6
				24
Grand Total (Semester I, II,III,IV,V and VI)				**186**
The students on exit shall be awarded Undergraduate DEGREE (HONOURS WITH RESEARCH) in Computer Science after securing the requisite 186 Credits on completion of Semester VIII				

Note: -
Abbreviations Used:

- C = Core/Major
- MDC = Multi Disciplinary Course
- AEC = Ability Enhancement Course
- SEC = Skill Enhancement Course
- VAC = Value Added Course

General Information and Guidelines:

1. L = Lecture, T = Tutorial and P = Practical

2. Distribution of Marks for Major/Minor :

End Semester Examination	(THEORY)	**75**	OR (THEORY)	**50** + (PRACTICAL)	**25**
Continuous Evaluation		**10**			**10**
Assignments		**10**			**10**
Attendance		**05**			**05**
Total		**100**			**100**

3. Distribution of Marks for **MDC/VAC/SEC/ AEC** :

End Semester Examination	**35**
Continuous Evaluation	**10**
Attendance	**05**
Total	**50**

4. **Modes of Continuous Evaluation:** The department or faculty concern can chose any method or any combination of the following options:

   - One Sessional Examination -
   - Group Discussion
   - Assignment
   - Seminar Presentation on any of the relevant topics
   - Micro Teaching

Note: Universities may include more options or delete some from this list **Important:**

1. **Each University/Institute should provide a brief write-up about each paper outlining the salient features, utility, learning objectives and prerequisites.**
2. **University/Institute can add/delete some experiments of similar nature in the Laboratory papers.**
3. **The size of the practical group for practical papers is recommended to be10-15 students.**
4. **The size of tutorial group for papers without practical is recommended to be 8-10 students.**

University/Institute can add to the list of reference books given at the end of each paper.

DISCIPLINARY MAJOR (HONOUS SUBJECT) = Major (MAJOR) : (Credit: 06 each)

- **19 Major papers (2 in 1st year, 4 in 2nd year, 6 in 3rd year, 7 in 4th year)**

Thus, 4Year UG HONOURS Degree without Research will have 19 Major subjects

List of Papers:

1. **Major-1** **Computer Fundamentals and Digital Logic**
2. **Major-2** **Introduction to Programming using C**
3. **Major-3** **Data Structure & Algorithm**
4. **Major-4** **Computer Organization & Architecture**
5. **Major-5** **Design and Analysis of Algorithms**
6. **Major-6** **Introduction to Programming using Python LAB**
7. **Major-7** **Database Management System**
8. **Major-8** **Operating Systems**
9. **Major-9** **Software Engineering**
10. **Major-10** **Object Oriented Programming with JAVA**
11. **Major-11** **Formal Language &Automata Theory**
12. **Major-12** **Computer Networks**
13. **Major-13** **Research Methodologies and Ethics**
14. **Major-14** **Elective-I (chose any one from the pool of courses)**
    E1-A) Artificial Intelligence
    E1-B) Machine Learning
    E1-C) Cloud Computing
15. **Major-15** **Minor Project/Seminar**
16. **Major-16** **Compiler Design**
17. **Major-17** **Cryptography and Network Security**
18. **Major-18** **Elective-II (chose any one from the pool of courses)**
    E2-A) Soft Computing
    E2-B) Big Data Analysis
    E2-C) Deep Learning
19. **Major-19** **Digital Image Processing**

- **4Year UG Degree Honours with Research will have 19 Major subjects & 4Year UG Degree Honours will also have 19 Major papers**

Thus, 4Year UG HONOURS Degree with Research will have 19 Major subjects

List of Papers:

1. **Major-1** **Computer Fundamentals and Digital Logic**
2. **Major-2** **Introduction to Programming using C**
3. **Major-3** **Data Structure & Algorithm**
4. **Major-4** **Computer Organization & Architecture**
5. **Major-5** **Design and Analysis of Algorithms**
6. **Major-6** **Introduction to Programming using Python LAB**
7. **Major-7** **Database Management System**
8. **Major-8** **Operating Systems**
9. **Major-9** **Software Engineering**
10. **Major-10** **Object Oriented Programming with JAVA**
11. **Major-11** **Formal Language &Automata Theory**
12. **Major-12** **Computer Networks**
13. **Major-13** **Research Methodologies and Ethics**
14. **Major-14** **Elective-I (chose any one from the pool of courses)**
    E1-A) Artificial Intelligence
    E1-B) Machine Learning
    E1-C) Cloud Computing
15. **Major-15** **Minor Project/Seminar**
16. **Major-16** **Research – 1 (dissertation)**
17. **Major-17** **Cryptography and Network Security**
18. **Major-18** **Elective-II (chose any one from the pool of courses)**
    E2-A) Soft Computing
    E2-B) Big Data Analysis
    E2-C) Deep Learning
19. **Major-19** **Research – 2 (dissertation)**

MINOR= Minor (MINOR)- (Credit: 06 each)

To gain a broader understanding beyond the major discipline

Students need to choose any two Minor Discipline/Subjects, each comprising of 3 papers (Two Minors in 1st year, two in 2nd Year and two in 4th Year)

List of Papers :

1. **Minor -3 Introduction to Programming using Python**
2. **Minor -4 Data Structure & Algorithm**
3. **Minor -6 Operating Systems**

MULTIDISCIPLINARY COURSE= 3 MDC papers; MDC-1 (1st Semester), MDC-2 (3rd Semester), MDC-3 (5th Semester) (Credit: 03 each)

Students have to choose any one disciplines as MDC, which should not be similar to their major or minor or even any subject which they had in their Higher Secondary. For each Discipline there will be one MDC.

List of Papers :

1. **MDC -1 Computer Fundamentals and its Applications**
2. **MDC -2 Office Management Tools**
3. **MDC -3 Computer Networks and Internet Technologies**

COMPUTER SCIENCE

MAJOR COURSE

BACHELOR OF SCIENCE PROGRAMME (FYUGP)DETAILED SYLLABUS OF 1ST SEMESTER

Title of the Course : **Computer Fundamental & Digital Logic**
Course Code : **CSC-MAJ-1**
Nature of the Course : **MAJOR - 1**
Course Credit : **06credit (Theory-04, Practical-02)**

UNITS	COURSE CONTENTS	L	T	P	Total Hours
I	**Introduction to Computers & Problem solving** Generation of Computers; Computer system : Basic Block Diagram, Super Mainframe, Mini &Personal Computer, Nomenclature, Software : Systems and Application; Hardware & Software; Algorithms : Definition, essential features; Complexity : notation, time & space; Computability & correctness concepts; Structured programming concepts; Process of problem solving, Flowcharts and Pseudo codes	**04**	02		06
II	**Number System & Arithmetic** Number System : Positional, binary, octal, decimal, hexadecimal and their representations, Methods of conversion from one base to another, sign magnitude, l's complement; 2's complement; Binary Arithmetic; Fixed & floating point numbers: representation, biased exponent, range & precision, errors, overflow, underflow, BCD arithmetic	04	02		06
III	**Boolean Algebra** Concepts of propositional logic; Boolean algebra: definitions, postulates, properties, simplification of logical expressions using properties and maps (up to 4 variables), Min-term, Max-term expressions; Logic gates: AND OR, NOT, XOR, Combinational circuits, Simple logic design using logic gates. Simplification by Boolean theorems, don't care condition, Venn diagram. SSI, MSI, LSI and VLSI circuits	04	04		08
IV	**Logic Families** Introduction to digital logic family such as RTL, DTL, TTL, ECL, CMOS, IIR, HTL etc., their comparative study, Basic circuit, performance characteristics.	05		10	15
V	**Combinational Logic** Half adder, Full adder, parallel adder, half subtractor, full subtractor, 4-bit binary adder cum subtractor, Multiplexer, Demultiplexer, Decoder, BCD to seven segment Decoder, Encoders.	05		10	15
V1	**Sequential Circuit:** Set-reset latches, D-flip-flop, R-S flip-flop, J-K flip-flop, Master slave flip-flop, edge triggered flip-flop, T flip-flop, Synchronous/Asynchronous counter, Up/down synchronous counter, Ripple Counter, Applications of counter, Serial in/Serial out shift register, Parallel in/Serial out shift register, Serial in/parallel out shift register, parallel in/ parallel out shift register, Bi-directional register, Applications of register.	05		05	10
	Total	27	08	25	60

Suggested Readings

1. "Digital Logic and Computer Design", M. Morris Mano, Pearson Publication
2. “An Introduction to Digital Computer Design”, Rajaraman V. & Radhakrishnan, PHI.
3. “Digital Principles & Applications”, Malvino & Leach, TMH
4. “Digital Circuits and Design”, S. Salivahanan, S. Arivazhagan, Oxford University Press
5. Givone: digital Principles &design, TMH
6. Malvino: Digital Principles &application TMH
7. Jain : Modern Digital Electronics 2/e TMH
8. Digital Integrated Electronics- H.Taub & D.Shilling, Mc Graw Hill
9. Digital Technology- Virendra Kumar, New Age

Computer Fundamental & Digital Logic Lab:

Students are advised to do laboratory/practical practice not limited to, but including the following types of problems:

List of Experiments:

1. General study of Basic & Universal gates
   a) AND b) OR c) NOT d) NOR e) NAND f) XOR g) XNOR
2. Simple Boolean Expression using Basic gates and Universal gates:

A . (B+A) + B.A
XZ + X’ Y Z
A + B [AC + (B + C’) D]
3. Design Half-Adder, Full-Adder, Half-Subtractor, Full-Subtractor Circuit.
4. Parallel Adder (2-bit, 3-bit) Circuit.
5. Implement logic functions in SOP form using Multiplexer.
6. Implement De-multiplexer.
7. Implement 7- Segment Display with Decoder.
8. Implement Parity Generator (Odd & Even)
9. Implement Magnitude Comparator (1-bit, 2-bit, 3-bit)
10. Circuit design and implementation of Decoder (2x4)
11. Circuit design and implementation of Encoder (4x2)
12. Circuit design and implementation of an expression using decoders.

BACHELOR OF SCIENCE PROGRAMME (FYUGP)DETAILED SYLLABUS OF 2ND SEMESTER

Title of the Course : **Introduction to Programming using C**
Course Code : **CSC-MAJ-2**
Nature of the Course : **MAJOR - 2**
Course Credit : **06credit (Theory-04, Practical-02)**

UNITS	COURSE CONTENTS	L	T	P	Total Hours
I	**Introduction to C** Overview of Procedural Programming, using main function, structure of a C program, Compiling and Executing Simple Programs in C, use of #include, #define	**02**		02	06
II	**Data Types, Variables, Constants, Operators and Basic I/O** Declaring, Defining and Initializing Variables, Scope and extent of Variables, Using Named Constants, Keywords, Data Types, Casting of Data Types, Operators (Arithmetic, Logical, Relational, Increment/Decrement, Conditional, Bitwise, and special operators), Using Comments in programs, Formatted and Console I/O, storage classes; auto, extern, register	04		02	06
III	**Expressions, Conditional Statements, and Iterative Statements** Understanding Operator Precedence and associativity in Expressions, Conditional Statements (if construct, switch-case construct), Understanding syntax and utility of Iterative Statements (while, do-while, and for loops), Use of break and continue in Loops, Using Nested Statements (Conditional as well as Iterative)	04		04	08
IV	**Understanding Functions** Utility of functions, Types of Functions, Functions returning value, Void functions, Inline Functions, Return type of functions, Parameters of functions; (formal and actual), Declaration and Definition of Functions, Command Line Arguments, Parameters in Functions, Functions with variable number of Arguments, Call by Value, Call by Reference,	05		05	10
V	**Implementation of Arrays and Strings** Creating and Using One Dimensional Arrays (Declaring and Defining an Array, Initializing an Array, accessing individual elements in an Array, manipulating array elements using loops), Types of arrays (integer, float and character arrays / Strings), Two-dimensional Arrays (Declaring, Defining and Initializing Two-Dimensional Array, Working with Rows and Columns), Introduction to Multi-dimensional arrays	05		10	15
V1	**User-defined Data Types (Structures and Unions)** Understanding utility of structures and unions, Declaring, initializing, and using simple structures and unions, manipulating individual members of structures and unions, Array of Structures, Individual data members as structures, Passing and returning structures from functions, Structure with union as members, Union with structures as members. **File I/O** Opening and closing a file, Reading and writing Text Files, Using put(), get(), read() and write() functions, Random access in files,	07		10	15
	Total	27		33	60

Suggested Readings

1. "The C Programming Language ANSI C Version", Kernighan & Ritchie, Prentice Hall Software Series
2. "ANSI C - Made Easy", Herbert Schildt, Osborne McGraw-Hill
3. "Learning to Program in C", N. Kantaris, Babani
4. "C - The Complete Reference", Herbert Schildt, Osborne McGraw-Hill
5. "Programming in C", Reema Thareja, Oxford University Press
6. "A First Course in Programming With C", T. Jeyapoovan, Vikas Publishing House
7. "Let Us C", Yashavant P. Kanetkar, BPB Publications
8. Tennence W.Pratt, “Programming languages design and implementation”, Prentice Hall of India.
9. Allen B. Tucker, “Programming Languages”, Tata McGraw Hill.
10. Gottfried BS – Programming with C, TMH pub.
11. Balagurusamy: ANSI C TMH

Introduction to Programming using C Lab

Students are advised to do laboratory/practical practice not limited to, but including the following types of problems:

List of Experiments:

1. WAP to perform input/output of all basic data types.
2. WAP to enter two numbers and find their sum.
3. WAP to reverse a number.
4. WAP to Swap Two Numbers (using and without using a third variable).
5. WAP to check whether a number is even or odd
6. WAP to compute the factors of a given number.
7. WAP to enter marks of five subjects and calculate total, average and percentage.
8. WAP to print the sum and product of digits of an integer.
9. WAP to check whether a character is vowel or consonant
10. WAP to find the largest among three numbers
11. WAP to compute the sum of the first ‘n’ terms of the following series

S =1-2+3-4+5… .....n

S = 1+1/2+1/3+1/4+……n

13. WAP to print a triangle of stars as follows (take number of lines from user):

* * * * * * * * * * * * * * *	* * * * * * * * * * * * * * *	* * * * * * * * * * * * * * *	* * * * * * * * * * * * * * *	* * * * * * * * * * * * * * *	* * * * * * * * * * * * * * *
1 1 2 1 2 3 1 2 3 4 1 2 3 4 5	5 4 5 3 4 5 2 3 4 5 1 2 3 4 5	1 2 2 3 3 3 4 4 4 4 5 5 5 5 5	5 4 4 3 3 3 2 2 2 2 1 1 1 1 1	1 2 3 4 5 6 7 8 9 10 11 12 13 14	1 1 2 1 1 2 3 2 1 1 2 3 4 3 2 1 1 2 3 4 5 4 3 2 1
A A B A B C A B C D A B C D E	E D E C D E B C D E A B C D E	P Q R S T Q R S T R S T S T T	P P P P P Q Q Q Q R R R S S T	P P P P P Q Q Q Q R R R S S T	A A B A B C A B C D A B C D E

14. WAP to find the factors of a number.
15. WAP to display the Fibonacci series.
16. WAP to find the factorial of a number.
17. WAP to check if a number is prime or not.
18. WAP to check if a number is Armstrong or not.
19. WAP to check if a number is Perfect or not.
20. WAP to print all the prime numbers within a given range.
21. WAP to print all the Armstrong numbers within a given range.
22. WAP to create and display an array.
23. WAP to perform following actions on an array entered by the user: a) Print the even-valued elements
b) Print the odd-valued elements
c) Calculate and print the sum and average of the elements of array
d) Print the maximum and minimum element of array
e) Remove the duplicates from the array
f) Print the array in reverse order

24. WAP for addition of two matrices.
25. WAP to find the sum of the diagonals of a matrix.
26. WAP to check if a matrix is symmetric or not.
27. WAP for matrix multiplication.
28. WAP which takes the radius of a circle as input from the user, passes it to another function that computes the area and the circumference of the circle and displays the value of area and circumference from the main() function.

29. WAP to find the length of a string.
30. WAP to concatenate two strings entered by the user.
31. WAP to find if a character is present in a string or not.
32. WAP to reverse a string.

33. WAP to check if a string is palindrome or not.
34. WAP to convert all lowercase characters to uppercase
35. WAP to convert all uppercase characters to lowercase
36. WAP to calculate number of vowels in a string.
37. Create a structure Student containing fields for Roll No., Name, Class, Year and Total Marks. Create 10 students and store them in a file.
38. Write a program to retrieve the student information from file created in previous question and print it in following format:

Roll No. Name Marks

39. WAP to copy the contents of one text file to another file, after removing all whitespaces.
40. WAP to Write a Sentence to a File.
41. WAP to Read a Line From a File and Display it.

BACHELOR OF SCIENCE PROGRAMME (FYUGP)DETAILED SYLLABUS OF 3RD SEMESTER

Title of the Course : **Data Structure & Algorithm**
Course Code : **CSC-MAJ-3**
Nature of the Course : **MAJOR - 3**
Course Credit : **06credit (Theory-04, Practical-02)**

UNITS	COURSE CONTENTS	L	T	P	Total Hours
I	**Arrays** Single and Multi-dimensional Arrays, Sparse Matrices (Array and Linked Representation)	**02**		**02**	**04**
II	**Linked Lists** Singly, Doubly and Circular Lists (Array and Linked representation); Normal and Circular representation of Stack in Lists; Self Organizing Lists; Skip Lists	**04**		**04**	**08**
III	**Stacks** Implementing single / multiple stack/s in an Array; Prefix, Infix and Postfix expressions, Utility and conversion of these expressions from one to another; Applications of stack; Limitations of Array representation of stack	**02**		**02**	**04**
IV	**Queues** Array and Linked representation of Queue, De-queue, Priority Queues	**02**		**02**	**04**
V	**Recursion** Developing Recursive Definition of Simple Problems and their implementation; Advantages and Limitations of Recursion; Understanding what goes behind Recursion (Internal Stack Implementation)	**02**		**02**	**04**
VI	**Trees** Introduction to Tree as a data structure; Binary Trees (Insertion, Deletion , Recursive and Iterative Traversals on Binary Search Trees); Threaded Binary Trees (Insertion, Deletion, Traversals); Height-Balanced Trees (Various operations on AVL Trees).	**05**		**05**	**10**
VII	**Graph Theory** Basic Terminology, Models and Types, multigraphs and weighted graphs, Graph Representation, Graph Isomorphism, Connectivity, Euler and Hamiltonian Paths and Circuits, Planar Graphs, Graph Coloring, Trees, Basic Terminology and properties of Trees, Introduction to Spanning Trees Kruskal's Algorithm; Prim's Algorithm; DFS; BFS. Cut Set : Fundamental Cut Set and Cut Vertices. Planar and Dual Graphs; Matrix Representation of Graphs (Adjacency and Incidence Matrices) ; Network ; Flow Augmenting Path ; Ford-Fulkerson Algorithm for Maximum Flow ; Floyd Algorithm ;	**05**		**05**	**10**
VIII	**Searching and Sorting** Linear Search, Binary Search, Comparison of Linear and Binary Search, Selection Sort, Insertion Sort, Insertion Sort, Shell Sort, Comparison of Sorting Techniques	**04**		**04**	**08**

IX	**Hashing** Introduction to Hashing, Deleting from Hash Table, Efficiency of Rehash Methods, Hash Table Reordering, Resolving collusion by Open Addressing, Coalesced Hashing, Separate Chaining, Dynamic and Extendible Hashing, Choosing a Hash Function, Perfect Hashing Function	**04**		**04**	**08**
	Total	**30**		**30**	**60**

Suggested Readings

1. Adam Drozdek, "Data Structures and algorithm in C++", Third Edition, Cengage Learning,2012.
2. SartajSahni, Data Structures, "Algorithms and applications in C++", Second Edition, Universities Press, 2011.
3. Aaron M. Tenenbaum, Moshe J. Augenstein, YedidyahLangsam, "Data Structures Using C and C++:, Second edition, PHI, 2009.
4. Robert L. Kruse, "Data Structures and Program Design in C++", Pearson.
5. D.S Malik, Data Structure using C++,Second edition, Cengage Learning, 2010.
6. Mark Allen Weiss, "Data Structures and Algorithms Analysis in Java", Pearson Education, 3rd edition, 2011
7. Aaron M. Tenenbaum, Moshe J. Augenstein, YedidyahLangsam, "Data Structures Using Java, 2003.
8. Robert Lafore, "Data Structures and Algorithms in Java, 2/E", Pearson/ Macmillan Computer Pub,2003
9. John Hubbard, "Data Structures with JAVA", McGraw Hill Education (India) Private Limited; 2 edition, 2009
10. Goodrich, M. and Tamassia, R. "Data Structures and Algorithms Analysis in Java", 4th Edition, Wiley
11. Herbert Schildt, "Java The Complete Reference (English) 9th Edition Paperback", Tata McGraw Hill, 2014.
12. D. S. Malik, P.S. Nair, "Data Structures Using Java", Course Technology, 2003

Data Structure & Algorithm Lab

Students are advised to do laboratory/practical practice not limited to, but including the following types of problems:

List of Experiments

1. Write a program to search an element from a list. Give user the option to perform Linear or Binary search. Use Template functions.
2. WAP using templates to sort a list of elements. Give user the option to perform sorting using Insertion sort, Bubble sort or Selection sort.
3. Implement Linked List using templates. Include functions for insertion, deletion and search of a number, reverse the list and concatenate two linked lists (include a function and also overload operator +).
4. Implement Doubly Linked List using templates. Include functions for insertion, deletion and search of a number, reverse the list.
5. Implement Circular Linked List using templates. Include functions for insertion, deletion and search of a number, reverse the list.
6. Perform Stack operations using Linked List implementation.
7. Perform Stack operations using Array implementation. Use Templates.
8. Perform Queues operations using Circular Array implementation. Use Templates.
9. Create and perform different operations on Double-ended Queues using Linked List implementation.
10. WAP to scan a polynomial using linked list and add two polynomial.
11. WAP to calculate factorial and to compute the factors of a given no. (i)using recursion, (ii) using iteration
12. (ii) WAP to display fibonacci series (i)using recursion, (ii) using iteration
13. WAP to calculate GCD of 2 number (i) with recursion (ii) without recursion
14. WAP to create a Binary Search Tree and include following operations in tree:
15. Insertion (Recursive and Iterative Implementation)
16. Deletion by copying
17. Deletion by Merging
18. Search a no. in BST
19. Display its preorder, postorder and inorder traversals Recursively
20. Display its preorder, postorder and inorder traversals Iteratively
21. Display its level-by-level traversals
22. Count the non-leaf nodes and leaf nodes
23. Display height of tree
24. Create a mirror image of tree
25. Check whether two BSTs are equal or not
26. WAP to convert the Sparse Matrix into non-zero form and vice-versa.
27. WAP to reverse the order of the elements in the stack using additional stack.
28. WAP to reverse the order of the elements in the stack using additional Queue.
29. WAP to implement Diagonal Matrix using one-dimensional array.
30. WAP to implement Lower Triangular Matrix using one-dimensional array.
31. WAP to implement Upper Triangular Matrix using one-dimensional array.
32. WAP to implement Symmetric Matrix using one-dimensional array.

33. WAP to create a Threaded Binary Tree as per inorder traversal, and implement operations like finding the successor / predecessor of an element, insert an element, inorder traversal.
34. WAP to implement various operations on AVL Tree.

Title of the Course : **Computer Organization & Architecture**
Course Code : **CSC-MAJ-4**
Nature of the Course : **MAJOR - 4**
Course Credit : **06credit (Theory-06)**

UNITS	COURSE CONTENTS	L	T	P	Total Hours
I	**Introduction** Review of Pipelining, Examples of some pipeline in modern processors, pipeline hazards, data hazards, control hazards. Techniquesto handle hazards, performance improvement with pipelines and effect of hazards on the performance. Vector processors- Use and effectiveness, memory to memory vector architectures, vector register architecture, vector length and stride issues, compiler effectiveness in vector processors. SISD, MISD, MIMD, Single instruction multiple data stream (SIMD) architectures. Array processors, comparison with vector processors, example of array processors such as MMX Technology.	**06**	02		08
II	**Data Representation and Basic Computer Arithmetic** Number systems, complements, fixed and floating pointrepresentation, character representation, addition, subtraction, magnitude comparison, multiplication and division algorithms for integers	06	02		08
III	**Basic Computer Organization and Design** Computer registers, bus system, instruction set, timing and control, instruction cycle, memory reference, input-output and interrupt, Interconnection Structures, Bus Interconnection design of basic computer	08	04		12
IV	**Central Processing Unit** Register organization, arithmetic and logical micro-operations, stack organization, micro programmed control. Instruction formats, addressing modes, instruction codes, machine language, assembly language, input output programming, RISC, CISC architectures, pipelining and parallel architecture.	08	04		12
V	**Memory Organization** Cache memory, Associative memory, mapping	06	04		10
V1	**Input-Output Organization** Input / Output: External Devices, I/O Modules, Programmed I/O, Interrupt-Driven I/O, Direct Memory Access, I/O Channels.	06	04		10
	Total	40	20		60

Suggested Readings

1. M. Mano, Computer System Architecture, Pearson Education 1992
2. A. J. Dos Reis, Assembly Language and Computer Architecture using C++ and JAVA, Course Technology, 2004
3. W. Stallings, Computer Organization and Architecture Designing for Performance, 8th Edition, Prentice Hall of India, 2009
4. Digital Design, M.M. Mano, Pearson Education Asia

BACHELOR OF SCIENCE PROGRAMME (FYUGP)DETAILED SYLLABUS OF 4TH SEMESTER

Title of the Course : **Design and Analysis of Algorithms**
Course Code : **CSC-MAJ-5**
Nature of the Course : **MAJOR - 5**
Course Credit : **06credit (Theory-06)**

UNITS	COURSE CONTENTS	L	T	P	Total Hours
I	**Introduction** Basic Design and Analysis techniques of Algorithms, Correctness of Algorithm	**06**	02		08
II	**Algorithm Design Techniques** Iterative techniques, Divide and Conquer, Dynamic Programming, Greedy Algorithms.	06	02		08
III	**Sorting and Searching Techniques** Elementary sorting techniques-Bubble Sort, Insertion Sort, Merge Sort, Advanced Sorting techniques - Heap Sort, Quick Sort, Sorting in Linear Time - Bucket Sort, Radix Sort and Count Sort, Searching Techniques, Medians & Order Statistics, complexity analysis;	06	02		08
IV	**Lower Bounding Techniques** Decision Trees	06	02		08
V	**Balanced Trees** Red-Black Trees	06	02		08
V1	**Advanced Analysis Technique** Amortized analysis	06	04		10
VII	**Graphs** Graph Algorithms-Breadth First Search, Depth First Search and its Applications, Minimum Spanning Trees	06	04		10
	Total	42	18		60

Suggested Readings

1. T.H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein Introduction to Algorithms, PHI, 3rd Edition 2009
2. Sarabasse& A.V. Gelder Computer Algorithm - Introduction to Design and Analysis, Publisher - Pearson 3rd Edition 1999

Title of the Course : **Introduction to Programming using Python**
Course Code : **CSC-MAJ-6**
Nature of the Course : **MAJOR - 6**
Course Credit : **06credit (Theory-04, Practical-02)**

UNITS	COURSE CONTENTS	L	T	P	Total Hours
I	**Introduction** History, Features, Setting up path, Working with Python, Basic Syntax, Variable and Data Types, Operator	02		**03**	05
II	**Conditional Statements** If, If- else, Nested if-else, Looping, For, While, Nested loops **Control Statements** Break, Continue, Pass	02		03	05
III	**String Manipulation** Accessing Strings, Basic Operations, String slices, Function and Methods	02		03	05
IV	**Lists** Introduction, Accessing list, Operations, Working with lists, Function and Methods	02		03	05
V	**Tuple** Introduction, Accessing tuples, Operations, Working, Functions and Methods	02		04	06
VI	**Dictionaries** Introduction, Accessing values in dictionaries, Working with dictionaries, Properties	02		04	06
VII	**Functions** Defining a function, Calling a function, Types of functions, Function Arguments, Anonymous functions, Global and local variables	02		04	06
VIII	**Modules** Importing module, Math module, Random module, Packages, Composition, Input-Output Printing on screen, Reading data from keyboard, Opening and closing file, Reading and writing files, Functions	02		04	06
IX	**Exception Handling** Exception, Exception Handling, Except clause, Try? finally clause, User Defined Exceptions	02		06	08
X	**Introduction to NumPy, Pandas, Matplotlib**. Exploratory Data Analysis (EDA), Data Science life cycle, Descriptive Statistics, Basic tools (plots, graphs and summary statistics) of EDA, Philosophy of EDA. Data Visualization: Scatter plot, bar chart, histogram, boxplot, heat maps, etc.	02		06	08
	Total	20		40	60

Suggested Readings

1. Allen B. Downey, "Think Python", 2nd edition, SPD/O'Reilly, 2016.
2. R. Nageswara Rao, "Core Python Programming", Dreamtech Press.
3. Zed A. Shaw, "Learn Python 3 the Hard Way", Addison-Wesley.
4. Brett Slatkin, "Effective Python", Addison-Wesley.
5. Taneja Sheetal, Kumar Naveen, "Python Programming A Modular Approach", Pearson

Introduction to Programming using Python Lab

Students are advised to do laboratory/practical practice not limited to, but including the following types of problems:

List of Experiments

1. Write a Python program that accepts radius of a circle and prints its area.
2. Write a Python program to compute simple interest and compound interest.
3. Write a Python program to generate 3 random integers between 100 and 999 which is divisible by 5.
4. Write a Python program to input three numbers and display largest / smallest number.
5. Write a python program to input a number and check the number is prime number or not.
6. Write a Python program to display the Fibonacci sequence up to n -th term.
7. Write a python program to input a year and check the year is leap year or not.
8. Write a Python program to input a string and determine whether it is a palindrome or not; convert the case of characters in a string.
9. Write a Python program to compute the greatest common divisor and least common multiple of two integers.
10. Input a list of numbers and swap elements at the even location with the elements at the odd location.
11. Write a Python program to generate the following patterns using nested loops:

12345
1234
123
12
1

12. Write a Python program to input a number and check the number is Armstrong number or not.
13. Write a Python program to find sum of the series: s = 1 + x + x2 + x3 …… + xn (Input the values of x and n)
14. Write a Python program to input a string having some digits. Write a program to calculate the sum of digits present in this string.
15. Write a Python program to search for an element in a given list of numbers.
16. Write a Python program to count the frequency of a given element in a list of numbers.
17. Write a Python program to check if the elements in the first half of a tuple are sorted in ascending order or not.
18. Write a Python program to create a dictionary with the roll number, name and marks of n students in a class and display the names of students who have marks above 75.
19. Write a Python program to sort a list using Bubble sort.
20. Write a Python program to sort a list using Insertion sort.

BACHELOR OF SCIENCE PROGRAMME (FYUGP)DETAILED SYLLABUS OF 5TH SEMESTER

Title of the Course : **Database Management System**

Course Code : **CSC-MAJ-7**

Nature of the Course : **MAJOR - 7**

Course Credit : **06credit (Theory-04, Practical-02)**

UNITS	COURSE CONTENTS	L	T	P	Total Hours
I	**Database Architecture:** Introduction to Database system applications. Characteristics and Purpose of database approach. People associated with Database system. Data models. Database schema. Database architecture. Data independence. Database languages, interfaces, and classification of DBMS.	**06**		04	10
II	**E-R Model:** Entity-Relationship modeling: E – R Model Concepts: Entity, Entity types, Entity sets, Attributes, Types of attributes, key attribute, and domain of an attribute. Relationships between the entities. Relationship types, roles and structural constraints, degree and cardinality ratio of a relationship. Weak entity types, E -R diagram.	06		04	10
III	**Relational Data Model:** Relational model concepts. Characteristics of relations. Relational model constraints: Domain constrains, key constraints, primary & foreign key constraints, integrity constraints and null values. Relational Algebra: Basic Relational Algebra operations. Set theoretical 12 Page 8 of 32 operations on relations. JOIN operations Aggregate Functions and Grouping. Nested Sub Queries-Views. Introduction to PL/SQL & programming of above operations in PL/SQL	06		04	10
IV	**Data Normalization:** Anomalies in relational database design. Decomposition. Functional dependencies. Normalization. First normal form, Second normal form, Third normal form. Boyce-Codd normal form.	06		04	10
V	**Query Processing Transaction Management:** Introduction Transaction Processing. Single user & multiuser systems. Transactions: read & write operations. Need of concurrency control: The lost update problem, Dirty read problem. Types of failures. Transaction states. Desirable properties (ACID properties) of Transactions. Concurrency Control Techniques: Locks and Time stamp Ordering. Deadlock & Starvation.	04		02	06
VI	**File Structure and Indexing:** Operations on files, File of Unordered and ordered records, overview of File organizations, Indexing structures for files(Primary index, secondary index, clustering index), Multilevel indexing using B and B+ trees.	04		02	06
VII		04		04	08
	Total	36		24	60

Suggested Readings

1. Fundamentals of Database Systems, Ramez Elamassri, Shankant B. Navathe, 7th Edition, Pearson, 2015
2. An Introduction to Database Systems, Bipin Desai, Galgotia Publications, 2010.
3. Introduction to Database System, C J Date, Pearson, 1999.
4. Database Systems Concepts, Abraham Silberschatz, Henry Korth, S.Sudarshan, 6 th Edition, McGraw Hill, 2010.
5. Database Management Systems, Raghu Rama Krishnan and Johannes Gehrke, 3 rd Edition, McGraw Hill, 2002

Title of the Course : **Operating Systems**
Course Code : **CSC-MAJ-8**
Nature of the Course : **MAJOR - 8**
Course Credit : **06credit (Theory-06)**

Module	COURSE CONTENTS	L	T	P	Total Hours
I	**Introduction to Operating Systems** Definition and functions of an OS, OS types: Batch, Multi- programming, Multi-tasking, Time-sharing, Real-time, Distributed, OS as resource manager, OS architecture & kernel types (monolithic, microkernel, hybrid), System calls and OS services	**06**	02		08
II	**Process Management** Process concept, process states, PCB, Process scheduling: preemptive & non-preemptive, Scheduling algorithms: FCFS, SJF, Priority, Round Robin, Multilevel Queue, Context switching, Threads: user-level & kernel-level	09	03		12
III	**Inter-Process Communication & Synchronization** Race conditions & critical sections, Mutual Exclusion, Synchronization mechanisms: mutex, semaphores, monitors, Classical problems: Producer–Consumer, Readers–Writers, Dining Philosophers, Deadlocks: prevention, avoidance (Banker's algorithm), detection, recovery	09	03		12
IV	**Memory Management** Memory hierarchy & management strategies, Contiguous allocation, fragmentation (internal & external), Paging, segmentation, Virtual memory: demand paging, page replacement algorithms (FIFO, LRU, Optimal), Thrashing	09	03		12
V	**File Systems** File concepts, attributes, operations, File access methods: sequential, direct, indexed. Directory structure, File system mounting, allocation methods (contiguous, linked, indexed), Free space management	06	02		08
V1	**I/O Systems & Protection** I/O hardware, I/O communication techniques (programmed, interrupt-driven, DMA), I/O scheduling, OS security & protection: authentication, authorization, access control, Disk Structure, Disk scheduling-FCFS, SSTF, SCAN, C-SCAN, Overview of modern OS trends (mobile OS, cloud OS, virtualization)	06	02		08
	Total	45	15		60

Reference books:

1. **Operating System Concepts –** *Abraham Silberschatz, Peter B. Galvin, Greg Gagne*, Wiley
2. **Modern Operating Systems –** *Andrew S. Tanenbaum, Herbert Bos,* Pearson
3. **Operating Systems: Internals and Design Principles –** *William Stallings*, Pearson
4. **Operating Systems: A Concept-based Approach –** *D.M. Dhamdhere*, McGraw Hill
5. **Operating Systems –** *Achyut S. Godbole, Atul Kahate,* McGraw Hill

Title of the Course : **Software Engineering**

Course Code : **CSC-MAJ-9**

Nature of the Course : **MAJOR - 9**

Course Credit : **06credit (Theory-06)**

UNITS	COURSE CONTENTS	L	T	P	Total Hours
I	**Introduction** The Evolving Role of Software, Software Characteristics, Changing Nature of Software, Software Engineering as a Layered Technology, Software Process Framework, Framework and Umbrella Activities, Process Models, Capability Maturity Model Integration (CMMI).	**06**	04		10
II	**Requirement** Analysis Software Requirement Analysis, Initiating Requirement Engineering Process, Requirement Analysis and Modeling Techniques, Flow Oriented Modeling, Need for SRS, Characteristics and Components of SRS.	06	04		10
III	**Software** Project Management Estimation in Project Planning Process, Project Scheduling.	06	04		10
IV	**Risk Management** Software Risks, Risk Identification, Risk Projection and Risk Refinement, RMMM Plan.	06	04		10
V	**Quality Management** Quality Concepts, Software Quality Assurance, Software Reviews, Metrics for Process and Projects.	04	02		06
VI	**Design Engineering** Design Concepts, Architectural Design Elements, Software Architecture, Data Design at the Architectural Level and Component Level, Mapping of Data Flow into Software Architecture, Modeling Component Level Design.	04	02		06
VII	**Testing Strategies & Tactics** Software Testing Fundamentals, Strategic Approach to Software Testing, Test Strategies for Conventional Software, Validation Testing, System Testing, Black-Box Testing, White-Box Testing and their type, Basis Path Testing	04	04		08
	Total	36	24		60

Recommended Books:

1. R.S. Pressman, Software Engineering: A Practitioner's Approach (7th Edition), McGraw- Hill, 2009.

2. P Jalote, An Integrated Approach to Software Engineering (2nd Edition), Narosa Publishing House, 2003.

3. K.K. Aggarwal and Y. Singh, Software Engineering (revised 2nd Edition), New Age International Publishers, 2008.

4. I. Sommerville, Software Engineering (8th edition), Addison Wesle, 2006.

5. D. Bell, Software Engineering for Students (4th Edition), Addison-Wesley, 2005.

6. R. Mall, Fundamentals of Software Engineering (2nd Edition), Prentice-Hall of India, 2004.

BACHELOR OF SCIENCE PROGRAMME (FYUGP)DETAILED SYLLABUS OF 6TH SEMESTER

Title of the Course : **Object Oriented Programming with JAVA**
Course Code : **CSC-MAJ-10**
Nature of the Course : **MAJOR - 10**
Course Credit : **06credit (Theory-04, Practical-02)**

Module	COURSE CONTENTS	L	T	P	Total Hours
I	**Introduction to Java and OOP Concepts** Overview of Java, Features, JDK, JVM, JRE, Java program structure; Basics of OOP: classes, objects, methods, encapsulation, abstraction, polymorphism, inheritance; Java naming conventions.	**06**		02	08
II	**Data Types, Operators, and Control Structures** Primitive data types, variables, constants, operators, type casting; Decision making (`if`, `switch`), loops (`for`, `while`, `do-while`), break & continue; Arrays (1D & 2D).	09		03	12
III	**Classes, Objects, and Methods** Defining classes & objects; Constructors & constructor overloading; Method overloading; Static members; Passing objects as parameters; this keyword; Garbage collection & finalize().	06		02	08
IV	**Inheritance and Polymorphism** Single & multilevel inheritance; super keyword; Method overriding; Dynamic method dispatch; Abstract class, Interface; final keyword; Multiple inheritance via interfaces.	06		02	08
V	**Exception Handling and Packages (5 Lectures)** Types of exceptions, try-catch-finally, throw & throws, user-defined exceptions; Creating and using packages; Access modifiers; Introduction to Java API packages (java.lang, java.util).	06		02	08
VI	**File Handling and Collections Framework (4 Lectures)** File I/O using File, FileReader, FileWriter, BufferedReader, BufferedWriter; Serialization; Collections Framework basics: ArrayList, HashMap, HashSet.	06		02	08
VII	**GUI Programming Basics (4 Lectures)** Introduction to AWT & Swing; Containers, components, layout managers; Event handling; Simple GUI applications.	06		02	08
	Total	45		15	60

Text Books

1. Herbert Schildt, *Java: The Complete Reference*, McGraw-Hill.
2. E. Balagurusamy, *Programming with Java: A Primer*, McGraw-Hill.
3. Paul Deitel & Harvey Deitel, *Java: How to Program*, Pearson.
4. Y. Daniel Liang, *Introduction to Java Programming*, Pearson.
5. R.K Das – "Core Java For Beginners" – VIKAS PUBLISHING
6. Ivor Horton's Beginning Java 2 SDK – Wrox
7. Mahesh P. Bhave & Sunil A. Patekar, Programming with Java, Pearson Education India.
8. Kogent Learning Solutions Inc., Java 2: The Complete Reference, Dreamtech Press.

Object Oriented Programming with JAVA LAB

Students are advised to do laboratory/practical practice not limited to, but including the following types of problems:

List of Experiments

1 Setting up JDK, writing, compiling, and executing simple Java programs.
2 Programs using decision-making and looping constructs.
3 Array manipulation programs (1D & 2D).
4 Programs on classes and objects.
5 Programs using constructors, method overloading, and this keyword.
6 Programs on single and multilevel inheritance, method overriding.
7 Programs using interfaces and abstract classes.
8 Programs on exception handling (built-in & user-defined exceptions).
9 Creating and using packages.
10 File I/O programs (text file reading/writing, serialization).
11 Programs using Java Collections (ArrayList, HashMap, etc.).
12 Simple GUI applications using Swing (buttons, text fields, event handling).

Title of the Course : **Formal Language &Automata Theory**

Course Code : **CSC-MAJ-11**

Nature of the Course : **MAJOR - 11**

Course Credit : **06credit (Theory-06)**

UNITS	COURSE CONTENTS	L	T	P	Total Hours
I	**Introduction to Automata Theory** Definition of automaton, Alphabet, Language, Finite Automaton (DFA, NFA, Epsilon-NFA, Mealy Machine, Moore Machine), Construction of Finite Automata from language, Conversion of NFA to DFA, Minimization of DFA, Construction of Mealy and Moore Machines from language, Inter-conversion of Mealy and Moore Machines	**06**	04		10
II	**Families of Formal Languages** Regular expressions, Examples of regular expressions, Identities of regular expressions, Testing whether a language is regular or not, Examples of regular languages	06	04		10
III	**Grammar** Definition, Chomsky's Classification of Grammars, Grammar as a generator of languages, Elimination of parameters from CFG (null productions, unit productions, useless symbols), Representation of CFG (CNF, GNF)	06	04		10
IV	**Context-free languages and pushdown automata:** Context-free grammars (CFG) and languages (CFL), Chomsky and Greibach normal forms, nondeterministic pushdown automata (PDA) and equivalence with CFG, parse trees, ambiguity in CFG, pumping lemma for context-free languages, deterministic pushdown automata, closure properties of CFLs.	06	04		10
V	**Context-sensitive languages:** Context-sensitive grammars (CSG) and languages, linear bounded automata and equivalence with CSG.	06	04		10
V1	Turing machines: The basic model for Turing machines (TM), Turing recognizable(recursively enumerable) and Turing-decidable (recursive) languages and their closure properties, variants of Turing machines, nondeterministic TMs and equivalence with deterministic TMs, unrestricted grammars and equivalence with Turing machines, TMsas enumerators.	06	04		10
	Total	36	24		60

Suggested Readings

1. Introduction to Automata Theory, Languages, and Computation by John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, 3rd Edition, Pearson.
2.Harry R. Lewis and Christos H. Papadimitriou, Elements of the Theory of Computation, Pearson Education Asia.
3.Dexter C. Kozen, Automata and Computability, Undergraduate Texts in Computer Science, Springer.
4. Michael Sipser, Introduction to the Theory of Computation, PWS Publishing.
5. John Martin, Introduction to Languages and The Theory of Computation, Tata McGraw Hill.
6. Theory of Computer Science (Automata, Languages & Computation) by K L P Misra & N Chandrasekharan, 3rd Edition, PHI.
7. Switching and Finite Automata Theory by Zvi Kohavi, Niraj.K.Jha, 3rd Edition, TMH.
8. Formal Language and Automata, P. Linz, Narosa

Title of the Course : **Computer Networks**
Course Code : **CSC-MAJ-12**
Nature of the Course : **MAJOR - 12**
Course Credit : **06credit (Theory-06)**

UNITS	COURSE CONTENTS	L	T	P	Total Hours
I	Evolution of Computer Networking, Types of Network, Applications of Computer Networks, Network Hardware: LANs, MANs, WANs, networks topologies, Protocols & standards-Network Devices, Design Issues for the Layers, Connection-Oriented and Connectionless Services, Service Primitives, The Relationship of Services to Protocols.	**08**	**02**		10
II	The OSI reference model- TCP/IP Reference Model. Physical Layer: transmission media- Analog Transmission- Digital transmission	06	**02**		08
III	Data Link Layer Design Issues-Services provided to the Network Layer-Framing-Error Control-Flow Control- Error Detection and Correction- Block coding, Hamming Distance, CRC; Elementary Data Link Protocols- Sliding Window Protocols- Multiple Access Protocols-An overview of IEEE Standard for LANs, MAC Address.	10	**02**		12
IV	Introduction to Network Layer – Services – Circuit Switching Vs Packet Switching-Packet Switched Networks-Types of Routing-routing algorithms-congestion control algorithms-Network Protocols-IP- IPV4, IPV6, Subnets, Gateways- Congestion Avoidance in Network Layer.	10	**02**		12
V	Transport Layer: Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm.	08	**02**		10
V1	Application Layer: Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP)	06	**02**		08
	Total	52	**12**		60

Books and References:

1. Data communication and Networking (Fourth Edition)- Behrouz A Forouzan (Tata Mcgraw Hill)
2. Computer Networks (Fifth Edition) – Andrew S. Tanenbaum
3. Computer Networking A Top-Down Approach (Fifth Edition)-James F. Kurose-Keith W. Ross
4. Computer Networks – Protocols, Standards and Interfaces (Second Edition) – Uyless Black
5. Computer Networking and the Internet (5th edition),Fred Halsall, Addison Wesley

4TH YEAR HONOURS

BACHELOR OF SCIENCE PROGRAMME (FYUGP)DETAILED SYLLABUS OF 7TH SEMESTER

Title of the Course : **Research Methodologies and Ethics**
Course Code : **CSC-MAJ-13**
Nature of the Course : **MAJOR - 13**
Course Credit : **06credit (Theory-06)**

UNITS	COURSE CONTENT	L	T	P	TOTAL HOURS
I	**Introduction to Research Methodology:** • Meaning and objectives of research • Types of research: Fundamental, Applied, Descriptive, Analytical, Quantitative & Qualitative • Research in Computer Science: Trends, applications, and case studies • The research process: Problem identification, formulation of research questions, hypothesis setting	8	2		10
II	**Research Design and Literature Survey:** • Research design: Exploratory, Descriptive, Experimental, Case study approaches • Review of Literature: Purpose, sources (journals, conference papers, digital libraries, indexing services like Scopus, Web of Science, IEEE Xplore) • Tools for literature survey: Google Scholar, ResearchGate, Zotero, Mendeley • Plagiarism and academic integrity • Research gap identification and problem statement formulation	10	2		12
III	**Data Collection and Analysis:** • Methods of data collection: Primary vs Secondary data • Tools & techniques: Surveys, questionnaires, interviews, experiments, observation • Data analysis: Quantitative techniques (statistics, hypothesis testing, regression, ANOVA), Qualitative analysis (coding, categorization, thematic analysis) • Use of software: MS Excel, SPSS, Python (NumPy, Pandas, Matplotlib) for data analysis • Interpretation of results	10	2		12
IV	**Research Documentation and Presentation:** • Structure of a research report/thesis: Title, Abstract, Introduction, Literature Review, Methodology, Results, Discussion, Conclusion, References • Referencing styles: APA, IEEE, MLA • Citation management tools (Mendeley, EndNote, Zotero) • Preparing research proposals • Research presentations: Writing research papers, conference presentations, poster preparation • Technical writing and use of LaTeX	10	2		12

V	**Research Ethics and Professional Practices:** • Research ethics: Honesty, integrity, objectivity, confidentiality • Plagiarism: Types, consequences, detection tools (Turnitin, Urkund) • Intellectual Property Rights (IPR): Patents, copyrights, trademarks, open-source licensing • Ethics in Computer Science: Data privacy, security, algorithmic bias, AI ethics • Ethical issues in software development, digital divide, cyber laws in India • Case studies on research misconduct and ethical dilemmas	12	2		14
	TOTAL	50	10		60

Where, L: Lecture, T: Tutorial, P: Practical

Books and References:

1. C.R. Kothari, Gaurav Garg (2019). Research Methodology: Methods and Techniques (4th Revised Edition). New Age International Publishers, New Delhi.
2. Ranjit Kumar (2019). Research Methodology: A Step-by-Step Guide for Beginners (5th Edition). SAGE Publications, London.
3. Wayne C. Booth, Gregory G. Colomb, Joseph M. Williams, Joseph Bizup, William T. FitzGerald (2016). The Craft of Research (4th Edition). The University of Chicago Press, Chicago.
4. Deborah J. Rumsey (2016). Statistics for Dummies (2nd Edition). Wiley Publishing, Hoboken, NJ.
5. W. Lawrence Neuman (2014). Social Research Methods: Qualitative and Quantitative Approaches (7th Edition). Pearson Education, Essex.
6. David B. Resnik, Adil E. Shamoo (2015). Responsible Conduct of Research (3rd Edition). Oxford University Press, New York.
7. IEEE Computer Society – IEEE Code of Ethics & Publication Guidelines. IEEE Digital Library (https://www.ieee.org/publications/standards/ethics.html).
8. Association for Computing Machinery (ACM) – ACM Code of Ethics and Professional Conduct. ACM Digital Library (https://www.acm.org/code-of-ethics).

Title of the Course : **Elective- I (EI-A) Artificial Intelligence**

Course Code : **CSC-MAJ-14 (EI-A)**

Nature of the Course : **MAJOR - 14 (EI-A)**

Course Credit : **06credit (Theory-06)**

UNITS	COURSE CONTENT	L	T	P	TOTAL HOURS
I	**Introduction** Overview of Artificial intelligence- Problems of AI, AI technique, Tic - Tac - Toe problem	03	02		05
II	**Intelligent Agents** Agents & environment, nature of environment, structure of agents, goal based agents, utility based agents, learning agents.	03	02		05
III	**Problem Solving and Search techniques:** Problems, Problem Space & search: Defining the problem as state space search, production system, problem characteristics, issues in the design of search programs. Solving problems by searching :problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, depth limited search, bidirectional search, comparing uniform search strategies.	03	02		05
IV	**Heuristic search strategies:** Greedy best-first search, A* search, memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, simulated annealing search, local beam search, genetic algorithms; constraint satisfaction problems, local search for constraint satisfaction problems.	03	02		05
V	**Adversarial search:** Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, additional refinements, iterative deepening.	03	02		05
VI	**Knowledge & reasoning:** Knowledge representation issues, representation & mapping, approaches to knowledge representation, issues in knowledge representation.	03	02		05
VII	**Using predicate logic :** Representing simple fact in logic, representing instant & ISA relationship, computable functions & predicates, resolution, natural deduction.	03	02		05
VIII	**Representing knowledge using rules:** Procedural verses declarative knowledge, logic programming, forward verses backward reasoning, matching, control knowledge	03	02		05
IX	**Probabilistic reasoning:** Representing knowledge in an uncertain domain, the semantics of Bayesian networks, Dempster-Shafer theory, Fuzzy sets & fuzzy logics.	03	02		05
X	**Planning:** Overview, components of a planning system, Goal stack planning, Hierarchical planning, other planning techniques.	03	02		05
XI	**Learning and Expert Systems:** Forms of learning, inductive learning, learning decision trees, explanation based learning, learning using relevance information, neural net learning & genetic learning. Representing and using domain knowledge, expert system shells, knowledge acquisition.	05	05		10
	TOTAL	25	25		60

Where, L: Lecture, T: Tutorial, P: Practical

Books and References:

1. DAN.W. Patterson, Introduction to A.I and Expert Systems – PHI, 2007.
2. Russell &Norvig, Artificial Intelligence-A Modern Approach, LPE, Pearson Prentice Hall, 2nd edition, 2005.
3. Rich & Knight, Artificial Intelligence – Tata McGraw Hill, 2nd edition, 1991.
4. W.F. Clocksin and Mellish, Programming in PROLOG, Narosa Publishing House, 3rd edition, 2001.
5. Ivan Bratko, Prolog Programming for Artificial Intelligence, Addison-Wesley, Pearson Education, 3rd edition, 2000.
6. Introduction to Artificial Intelligence & Expert Systems, Patterson, PHI
7. Logic & Prolog Programming, Saroj Kaushik, New Age International
8. Expert Systems, Giarranto, VIKAS

Title of the Course : **Elective- I (EI-B) Machine Learning**
Course Code : **CSC-MAJ-14 (EI-B)**
Nature of the Course : **MAJOR - 14 (EI-B)**
Course Credit : **06credit (Theory-06)**

UNITS	COURSE CONTENT	L	T	P	TOTAL HOURS
I	**Introduction to Machine Learning & Data Preparation:** Introduction to Analytics and Machine Learning, Framework for Developing Machine Learning Models, Prepare the Data for Machine Learning Algorithms, Data Cleaning, Handling Text and Categorical Attributes, Handling Missing Values, Exploration of Data using Visualization, Types of Machine Learning Systems.	7	1		8
II	**Linear Regression**: Linear regression, Gradient Descent Algorithm for Linear Regression Model, Polynomial model, Regularization, Multi-Collinearity, Logistic Regression.	6	1		7
III	**Classification**: Training a Binary Classifier, Measuring Performance, Using Linear Regression for Classification, Using Logistic Regression, Multiclass Classifier, Multi-label Classification, Multi-output Classification	6	2		8
IV	**Perceptron and Neural Foundations:** Biological Neuron and Artificial Neuron, The Perceptron Model, Perceptron Training Rule, Limitations of Perceptron, Introduction to Multilayer Perceptron (MLP), Activation Functions (ReLU, Sigmoid, Tanh), Gradient Descent & Backpropagation (basic overview).	4	1		5
V	**Some Supervised Machine Learning Algorithms:** k-Nearest Neighbors (KNN), Naive Bayes Classifiers, Decision Trees, Ensembles of Decision Trees: Random Forests, Kernelized Support Vector Machines, Model Evaluation and Improvement.	9	2		11
VI	**Dimensionality Reduction:** Dimensionality Reduction, Feature Extraction, and Manifold Learning, Principal Component Analysis (PCA), Randomized PCA, Incremental PCA, Kernel PCA, Selecting a Kernel and Tuning Hyper-parameters, Other Dimensionality Reduction Techniques.	8	2		10
VII	**Unsupervised Learning**: **Clustering** K-Means, Image Segmentation using clustering, Creating Product Segments Using Clustering, Finding Optimal Number of Clusters Using Elbow Curve Method, Normalizing the Features, Hierarchical Clustering, Compare the Clusters Created by K-Means and Hierarchical Clustering, Anomaly Detection using Gaussian Mixtures, Assessment Metrics for Clustering Algorithms..	10	2		12
	TOTAL	49	11		60

Where, L: Lecture, T: Tutorial, P: Practical

Books and References:

1. Machine Learning by Tom Mitchell, McGraw Hill Education.
2. Christopher Bishop. Pattern Recognition and Machine Learning. 2e.
3. Devi V.S.; Murty, M.N. (2011) Pattern Recognition: An Introduction, Universities Press, Hyderabad.
4. R. O. Duda, P. E. Hart and D. G. Stork, Pattern Classification, Wiley, 2000.
5. Ethem Alpaydin – Introduction to Machine Learning, 4th Edition, MIT Press, 2020.
6. Shai Shalev-Shwartz and Shai Ben-David – Understanding Machine Learning: From Theory to Algorithms, Cambridge University Press, 2014.
7. Kevin P. Murphy – Machine Learning: A Probabilistic Perspective, MIT Press, 2012.
8. Trevor Hastie, Robert Tibshirani, Jerome Friedman – The Elements of Statistical Learning: Data Mining, Inference, and Prediction, Springer, 2nd Edition, 2009.
9. Ian Goodfellow, Yoshua Bengio, Aaron Courville – Deep Learning, MIT Press, 2016.
10. Aurélien Géron – Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 3rd Edition, O'Reilly, 2022.

Title of the Course : **Elective- I (EI-C) Cloud Computing**
Course Code : **CSC-MAJ-14 (EI-C)**
Nature of the Course : **MAJOR - 14 (EI-C)**
Course Credit : **06credit (Theory-06)**

UNITS	COURSE CONTENT	L	T	P	TOTAL HOURS
I	**Computing Paradigms & Introduction to Cloud :** • Evolution of Computing Paradigms: HPC, Parallel, Distributed, Cluster, Grid, Cloud, Bio, Mobile, Quantum, Optical, Nano Computing • Motivation & Need for Cloud Computing: Business Drivers, Technical Drivers, Cost Models • NIST Definition, Five Essential Characteristics, Four Deployment Models (Public, Private, Hybrid, Community) • Cloud as a Service & Cloud as a Platform, Service-Oriented Architecture (SOA) in Cloud • Case Studies: Comparing Cloud vs Traditional IT Models	8	4		**12**
II	**Cloud Fundamentals & Architecture:** • Principles of Cloud Computing, Virtualization Concepts & Types (Full, Para, Hardware-assisted, OS-level) • Cloud Layered Architecture – Physical, Virtualization, Service, Application • Anatomy of the Cloud, Network Connectivity in Cloud • Cloud Application Models: Web Apps, Enterprise Apps, Mobile Apps • Practical Case Study: AWS & GCP Architectural Overview	8	2		10
III	**Cloud Management & Migration:** • Cloud Infrastructure Management: Resource Provisioning, Monitoring, SLA Management • Cloud Security Management: Authentication, Authorization, Identity Management • Application Lifecycle Management in Cloud • Phases of Migration – Assessment, Planning, Migration, Testing, Optimization • Migration Approaches – Rehost, Refactor, Revise, Rebuild, Replace • Migration Tools Overview (AWS Migration Hub, Azure Migrate, GCP Transfer Service)	10	2		12
IV	**Cloud Service Models:** • IaaS – Characteristics, Suitability, Pros/Cons, Providers (AWS EC2, GCP Compute Engine, Azure VM) • PaaS – Characteristics, Suitability, Pros/Cons, Providers (Google App Engine, AWS Elastic Beanstalk, Azure App Services) • SaaS – Characteristics, Suitability, Pros/Cons, Providers (Google Workspace, Salesforce, Office 365) • Other Models – FaaS, DBaaS, STaaS, NaaS, KaaS	10	2		12
V	**Cloud Platforms & Providers:** • AWS: EC2, S3, Lambda, RDS, SQS • GCP: Compute Engine, Cloud Storage, BigQuery, AI/ML APIs • Microsoft Azure: VM, Blob Storage, Functions, DevOps • IBM Cloud, Salesforce, VMware, Rackspace • Trends & Future Directions: Edge Computing, Multi-cloud, Kubernetes, Cloud-native Apps	12	2		14
	TOTAL	48	12		60

Where, L: Lecture, T: Tutorial, P: Practical

Books and References:

1. Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, Mastering Cloud Computing, McGraw-Hill Education.
2. Kai Hwang, Geoffrey C. Fox, Jack J. Dongarra, Distributed and Cloud Computing, Elsevier.
3. George Reese Cloud Application Architectures, First Edition, O‟Reilly Media 2009.
4. Cloud Computing and SOA Convergence in Your Enterprise A Step-by-Step Guide by David S. Linthicum from Pearson 2010.
5. Cloud Computing 2 nd Edition by Dr. Kumar Saurabh from Wiley India 2012.
6. Thomas Erl, Ricardo Puttini, Zaigham Mahmood, Cloud Computing: Concepts, Technology & Architecture, Pearson.
7. Official Documentation of AWS, GCP, and Azure.

Title of the Course	**: Minor Project/Seminar**
Course Code	**: CSC-MAJ-15**
Nature of the Course	**: MAJOR - 15**
Course Credit	**: 06credit (Practical-06)**

A seminar paper (Major-15**) comprising of 6 credits will also being undertaken by these students during 7th semester.

Title of the Course : **Compiler Design**
Course Code : **CSC-MAJ-16**
Nature of the Course : **MAJOR - 16**
Course Credit : **06credit (Theory-06)**

Where, L: Lecture, T: Tutorial, P: Practical

Module	COURSE CONTENTS	L	T	P	Total Hours
I	**Introduction to Compilers** Compiler structure and functions, Analysis of source program, Phases of a compiler: lexical analysis, syntax analysis, semantic analysis, intermediate code generation, code optimization, code generation, Cousins of the compiler: interpreter, assembler, loader, linker	**06**	02		08
II	**Lexical Analysis** Role of lexical analyzer, Tokens, patterns, lexemes, Input buffering and buffering techniques, Specification of tokens using regular expressions, Recognition of tokens (Finite Automata – NFA, DFA, conversion NFA→DFA), Lex tools (LEX basics)	09	03		12
III	**Syntax Analysis (Parsing)** Role of parser, Context-free grammar (CFG), derivations, parse tree, ambiguity, Top-down parsing: recursive descent, LL(1) parsing, Bottom-up parsing: operator precedence, LR(0), SLR(1), LALR(1), Error handling in parsers, Parser generators (YACC)	09	03		12
IV	**Syntax Directed Translation & Intermediate Code Generation** Syntax-directed definitions & translation schemes, synthesized and inherited attributes, S attributed definition and L attributed definition, type checking, Postfix notation, three-address code (TAC), quadruples, triples, Translation of expressions (arithmetic, Boolean), Control flow statements translation, Backpatching	09	03		12
V	**Code Optimization** Principal sources of optimization, Peephole optimization, Optimization of basic blocks, Loop optimization techniques (loop invariant code motion, strength reduction, induction variable elimination), Machine-independent vs. machine-dependent optimizations	06	02		08
V1	**Code Generation** Issues in code generation, Register allocation & assignment, Instruction selection and ordering, Runtime storage organization: static vs. dynamic, Garbage collection (basic concepts)	06	02		08
	Total	45	15		60

Books and References:

1. Compilers: Principles, Techniques, and Tools – Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman
2. Compiler Design in C – Allen I. Holub

BACHELOR OF SCIENCE PROGRAMME (FYUGP)DETAILED SYLLABUS OF 8TH SEMESTER

Title of the Course : **Cryptography and Network Security**
Course Code : **CSC-MAJ-17**
Nature of the Course : **MAJOR - 17**
Course Credit : **06credit (Theory-06)**

Module	COURSE CONTENTS	L	T	P	Total Hours
I	**Attacks on Computers & Computer Security** Introduction, Need for Security, Security approaches, Principles of Security, Types of attack.	**06**	02		08
II	**Cryptography: Concepts & Techniques** Introduction, Plaintext & Cipher text, Substitution Techniques, Transposition Techniques, Encryption & Decryption, Symmetric & Asymmetric key Cryptography, Key Range & Key Size	09	03		12
III	Symmetric Key Algorithm Introduction, Algorithm types & Modes, Overview of Symmetric Key Cryptography, DES(Data Encryption Standard) algorithm, IDEA(International Data Encryption Algorithm) algorithm, RC5(Rivest Cipher 5) algorithm	06	02		08
IV	Asymmetric Key Algorithm, Digital Signature and RSA Introduction, Overview of Asymmetric key Cryptography, RSA algorithm, Symmetric & Asymmetric key Cryptography together, Digital Signature, Basic concepts of Message Digest and Hash Function (Algorithms on Message Digest and Hash function not required).	06	02		08
V	Internet Security Protocols, User Authentication Basic Concepts, SSL protocol, Authentication Basics, Password, Authentication Token, Certificate based Authentication, Biometric Authentication.	06	02		08
VI	Electronic Mail Security Basics of mail security, Pretty Good Privacy, S/MIME	06	02		08
VII	Firewall Introduction, Types of firewall, Firewall Configurations, DMZ Network	06	02		08
	Total	45	15		60

Where, L: Lecture, T: Tutorial, P: Practical

Books and References:

1. “Cryptography and Network Security”, William Stallings, 2nd Edition, Pearson Education Asia
2. “Network Security private communication in a public world”, C. Kaufman, R. Perlman and M. Speciner, Pearson
3. Cryptography & Network Security: Atul Kahate, TMH.
4. “Network Security Essentials: Applications and Standards” by William Stallings, Pearson
5. “Designing Network Security”, Merike Kaeo, 2nd Edition, Pearson Books
6. “Building Internet Firewalls”, Elizabeth D. Zwicky, Simon Cooper, D. Brent Chapman, 2nd Edition, Oreilly
7. “Practical Unix & Internet Security”, Simson Garfinkel, Gene Spafford, Alan Schwartz, 3rd Edition, Oreilly

Title of the Course : **Elective- II (EII-A) Soft Computing**
Course Code : **CSC-MAJ-18 (EII-A)**
Nature of the Course : **MAJOR - 18 (EII-A)**
Course Credit : **06credit (Theory-06)**

UNITS	COURSE CONTETS	L	T	P	Total Hours
I	**Soft Computing (SC)** as Key Methodology for Designing of Intelligent Systems Structure and Constituents of Soft Computing Comparative Characteristics of the Constituents of SC Intelligent Combinations of the Components of SC Artificial neural network: Introduction, characteristics- learning methods – taxonomy – Evolution of neural networks - basic models - important technologies - applications.	05	05		10
II	**NEURAL NETWORKS** McCulloch-Pitts neuron - linear separability - hebb network - supervised learning network: perceptron networks - adaptive linear neuron, multiple adaptive linear neurons, BPN, RBF, TDNN- associative memory network: auto-associative memory network, hetero-associative memory network, BAM, hopfield networks, iterative auto associative memory network & iterative associative memory network – unsupervised learning networks: Kohonen self- organizing feature maps, ART network.	10	10		20
III	**FUZZY LOGIC** Membership functions: features, fuzzification, methods of membership value assignments- Defuzzification: lambda cuts - methods - fuzzy arithmetic and fuzzy measures: fuzzy arithmetic - extension principle - fuzzy measures - measures of fuzziness -fuzzy integrals. Fuzzy rule base and approximate reasoning: truth values and tables, fuzzy propositions, formation of rules-decomposition of rules, aggregation of fuzzy rules, fuzzy reasoning-fuzzy inference systems-overview of fuzzy expert system-fuzzy decision making.	10	05		15
IV	**GENETIC ALGORITHM** Genetic algorithm- Introduction - biological background - traditional optimization and search techniques - Genetic basic concepts - operators – Encoding scheme – Fitness evaluation –crossover - mutation - genetic programming – multilevel optimization – real life problem- advances in GA.	04	04		8
V	**HYBRID SOFT COMPUTING TECHNIQUES** Neuro-fuzzy hybrid systems - genetic neuro hybrid systems - genetic fuzzy hybrid and fuzzy genetic hybrid systems - simplified fuzzy ARTMAP	05	02		7
	Total	34	26		60

Where, L: Lecture, T: Tutorial, P: Practical

Books and References:

1. S.N.Sivanandam and S.N.Deepa,,Principles of Soft Computing,,3rd Edition Wiley India Pvt Ltd, 2018.
2. J.S.R.Jang, C.T. Sun and E.Mizutani, Neuro-Fuzzy and Soft Computing, 2nd Edition PHI / Pearson Education 2014.
3. S.Rajasekaran and G.A.Vijayalakshmi Pai, Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis & Applications, 4th edition,Prentice-Hall of India Pvt. Ltd., 2016.
4. David E. Goldberg, Genetic Algorithm in Search Optimization and Machine Learning, 2nd Edition, Pearson Education India, 2013.

Title of the Course : **Elective- II (EII-B) Big Data Analysis**

Course Code : **CSC-MAJ-18 (EII-B)**

Nature of the Course : **MAJOR - 18 (EII-B)**

Course Credit : **06credit (Theory-06)**

UNITS	COURSE CONTENT	L	T	P	TOTAL HOURS
I	**Foundations of Big Data**: • Introduction to Big Data – Evolution, Definition, Characteristics (Volume, Velocity, Variety, Veracity, Value) • Big Data Ecosystem and Applications (Business, Scientific, Social, Healthcare, IoT) • Traditional vs Big Data Computing • Big Data Architecture and Components • Distributed File Systems, CAP Theorem, BASE Properties	8	2		10
II	**Hadoop Ecosystem & HDFS:** • Hadoop Overview and History • Hadoop Distributed File System (HDFS) – Architecture, Blocks, Namenode, Datanode, Secondary Namenode • Hadoop YARN – Architecture and Resource Management • MapReduce Programming Model – Concepts, Word Count Example, Combiners, Partitioners • Hadoop Ecosystem Tools: Hive, Pig, Sqoop, Oozie	8	2		10
III	**Big Data Frameworks & Data Processing with Spark:** • Motivation for Apache Spark • Spark Ecosystem Components (Spark Core, Spark SQL, Spark Streaming, MLlib, GraphX) • Spark RDDs, Transformations and Actions • Spark DataFrames and Datasets • Spark vs Hadoop MapReduce – Comparative Study	8	2		10
IV	**NoSQL and Big Data Storage Models:** • Limitations of Relational Databases for Big Data • Introduction to NoSQL Databases – Key-Value, Column-oriented, Document-oriented, Graph Databases • Case Studies: HBase, Cassandra, MongoDB, Neo4j • Data Consistency Models and Trade-offs	8	2		10
V	**Big Data Analytics & Machine Learning:** • Data Preprocessing for Big Data (Cleaning, Normalization, Feature Selection)	8	2		10

	• Big Data Analytics Pipeline • Machine Learning with Big Data – Scalable Algorithms • Using MLlib in Spark – Classification, Clustering, Regression • Recommendation Systems (Collaborative Filtering, Content-based Filtering)				
VI	**Real-Time & Streaming Big Data Processing:** • Real-time Big Data Applications (IoT, Finance, Healthcare, Smart Cities) • Apache Kafka – Architecture, Producers, Consumers, Streams API • Apache Flume – Data Ingestion • Spark Streaming, Structured Streaming Concepts • Lambda and Kappa Architectures for Real-time Big Data	8	2		10
	TOTAL	48	12		60

Where, L: Lecture, T: Tutorial, P: Practical

Books and References:

1. Rajkumar Buyya, Rodrigo N. Calheiros, Amir Vahid Dastjerdi – Big Data: Principles and Paradigms, Elsevier, 2016.
2. Tom White – Hadoop: The Definitive Guide, O'Reilly, 4th Edition, 2015.
3. Viktor Mayer-Schönberger & Kenneth Cukier – Big Data: A Revolution That Will Transform How We Live, Work, and Think, Eamon Dolan/Mariner Books, 2014.
4. Benjamin Bengfort, Jenny Kim, Michelle Brush – Fundamentals of Data Engineering: Plan and Build Robust Data Systems, O'Reilly, 2022.
5. Nathan Marz & James Warren – Big Data: Principles and Best Practices of Scalable Realtime Data Systems, Manning, 2015.
6. Krish Krishnan – Data Warehousing in the Age of Big Data, Morgan Kaufmann, 2013.
7. Manish Kumar – Learning Apache Kafka, 2nd Edition, Packt Publishing, 2018.
8. Jules S. Damji, Brooke Wenig, Tathagata Das, Denny Lee – Learning Spark: Lightning-Fast Big Data Analysis, O'Reilly, 2nd Edition, 2020.
9. Seema Acharya & Subhasini Chellappan – Big Data and Analytics, Wiley India, 2015.

Title of the Course : **Elective- II (EII-C) Deep Learning**
Course Code : **CSC-MAJ-18 (EII-C)**
Nature of the Course : **MAJOR - 18 (EII-C)**
Course Credit : **06credit (Theory-06)**

UNITS	COURSE CONTENT	L	T	P	TOTAL HOURS
I	**Foundations of Deep Learning:** • (Partial) History of Deep Learning, Deep Learning Success Stories • McCulloch Pitts Neuron, Thresholding Logic, Perceptrons, Perceptron Learning Algorithm • Multilayer Perceptrons (MLPs), Representation Power of MLPs, Sigmoid Neurons • Gradient Descent, Feedforward Neural Networks, Representation Power of Feedforward Neural Networks	8	2		10
II	**Neural Networks and Optimization**: • FeedForward Neural Networks, Backpropagation • Gradient Descent (GD), Momentum Based GD, Nesterov Accelerated GD • Stochastic GD, AdaGrad, RMSProp, Adam • Eigenvalues and eigenvectors, Eigenvalue Decomposition, Basis.	8	2		10
III	**Data Representation and Unsupervised Learning**: • Principal Component Analysis and its interpretations, Singular Value Decomposition • Autoencoders and relation to PCA, Regularization in autoencoders • Denoising autoencoders, Sparse autoencoders, Contractive autoencoders	8	2		10
IV	**Regularization and Practical Improvements:** • Regularization: Bias Variance Tradeoff, L2 regularization, Early stopping, Dataset augmentation, Parameter sharing and tying • Injecting noise at input, Ensemble methods, Dropout • Greedy Layerwise Pre-training. • Better activation functions, Better weight initialization methods, Batch Normalization	8	2		10
V	**Word Embeddings and Convolutional Neural Networks:** • Learning Vectorial Representations of Words • Convolutional Neural Networks • LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet • Visualizing Convolutional Neural Networks, Guided Backpropagation, Deep Dream, Deep Art, Fooling Convolutional Neural Networks	8	2		10

VI	**Recurrent Neural Networks and Attention Mechanisms:** • Recurrent Neural Networks • Backpropagation Through Time (BPTT), Vanishing and Exploding Gradients, Truncated BPTT • GRU, LSTMs • Encoder Decoder Models, Attention Mechanism, Attention over images	8	2		10
VII	**Unsupervised Learning**: **Clustering** K-Means, Image Segmentation using clustering, Creating Product Segments Using Clustering, Finding Optimal Number of Clusters Using Elbow Curve Method, Normalizing the Features, Hierarchical Clustering, Compare the Clusters Created by K-Means and Hierarchical Clustering, Anomaly Detection using Gaussian Mixtures, Assessment Metrics for Clustering Algorithms..	8	2		10
	TOTAL	48	12		60

Where, L: Lecture, T: Tutorial, P: Practical

Books and References

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville – Deep Learning, MIT Press, 2016.
2. Richard O. Duda, Peter E. Hart, David G. Stork – Pattern Classification, Wiley-Interscience, 2nd Edition, 2000.
3. Charu C. Aggarwal – Neural Networks and Deep Learning: A Textbook, Springer, 2018. (Indian origin author, Columbia Univ.)
4. S. N. Sivanandam & S. Sumathi – Introduction to Neural Networks using MATLAB 6.0, McGraw Hill, 2006. (Indian authors, good for fundamentals + practicals)
5. Rajalingappaa Shanmugamani – Deep Learning for Computer Vision, Packt Publishing, 2018. (Indian author, application-focused)
6. François Chollet – Deep Learning with Python, Manning, 2nd Edition, 2021. (Creator of Keras, hands-on approach)
7. Michael Nielsen – Neural Networks and Deep Learning, Determination Press, 2015. (Free online + great beginner reference)
8. Charu C. Aggarwal – Deep Learning: Foundations and Concepts, Springer, 2023. (latest work by Aggarwal, broader perspective)
9. Aurélien Géron – Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, O'Reilly, 3rd Edition, 2022. (practical coding reference)

Title of the Course : **Digital Image Processing**
Course Code : **CSC-MAJ-19**
Nature of the Course : **MAJOR - 19**
Course Credit : **06credit (Theory-04, Practical-02)**

Module	COURSE CONTENTS	L	T	P	Total Hours
I	**Introduction to Digital Image Processing** Digital image fundamentals, Image sensing & acquisition (camera, scanner basics), Basic concepts: pixels, resolution, intensity, gray levels, Sampling and quantization, Human visual system basics	06	02		08
II	**Image Enhancement in Spatial Domain** Neighbour of pixels, connectivity, Distance measure, Basic gray-level transformations: contrast stretching, thresholding, intensity transformations, Histogram processing (equalization, specification), Spatial filtering: smoothing, sharpening, Laplacian, high-boost filtering	09	03		12
III	**Image Enhancement in Frequency Domain** Fourier Transform, Frequency domain filtering: low-pass, high-pass, band-pass filters, Homomorphic filtering	06	02		08
IV	**Image Restoration and Compression** Image degradation model (blur, noise types: Gaussian, salt & pepper), Restoration techniques: inverse filtering, Wiener filtering, Image compression: basics of redundancy, JPEG/MPEG overview, lossless vs lossy methods	06	02		08
V	**Image Segmentation** Edge detection: Sobel, Prewitt, Canny operators, Thresholding (global, adaptive, Otsu's method), Region growing and region splitting & merging, Watershed segmentation	09	03		12
VI	**Morphological Image Processing & Applications** Binary morphology: erosion, dilation, opening, closing, Morphological algorithms: boundary extraction, hole filling, connected components, Case studies & applications like face detection, medical imaging, object recognition	09	03		12
	Total	45	15		60

Where, L: Lecture, T: Tutorial, P: Practical

Books and References

1. **Digital Image Processing – Rafael C. Gonzalez, Richard E. Woods (Pearson)**
2. **Fundamentals of Digital Image Processing – Anil K. Jain (PHI)**
3. **Hands on image Processing with Python—Sandipan Dey**

Digital Image Processing Lab

Students are advised to do laboratory/practical practice not limited to, but including the following types of problems:

List of Experiments

Introduction to Digital Image Processing

1. Write a program in python to read and display an image in different formats (BMP, JPEG, PNG).
2. Convert a given color image into:
    - Grayscale
    - Binary (threshold-based)
    - Negative image
3. Perform image resizing (scaling up & scaling down).
4. Explore image properties (resolution, dimensions, histogram).

Image Enhancement in Spatial Domain

5. Implement contrast stretching and logarithmic transformation.
6. Apply histogram equalization to enhance contrast.
7. Implement smoothing filters: mean, median, Gaussian filter.
8. Implement sharpening filters: Laplacian, high-boost filtering.

Image Enhancement in Frequency Domain

9. Write a program to compute the 2D Fourier Transform of an image and display its magnitude spectrum.
10. Apply low-pass and high-pass filtering in the frequency domain.
11. Implement homomorphic filtering to enhance illumination and contrast.

Image Restoration and Compression

12. Add different types of noise (Gaussian, salt & pepper) to an image.
13. Remove noise using filters: mean, median, Wiener filtering.
14. Implement image blurring and apply inverse filtering to restore.
15. Use to compress an image in JPEG format and compare file sizes.

Image Segmentation & Representation

16. Implement edge detection using Sobel, Prewitt, and Canny operators.
17. Perform image thresholding using:

- Global thresholding
- Otsu's method
- Adaptive thresholding

18. Implement region growing segmentation.
19. Extract and represent object boundaries using chain codes.

Morphological Image Processing & Applications

20. Implement erosion and dilation operations on binary images.
21. Apply opening and closing operations for noise removal.
22. Extract boundaries of objects using morphological methods.
23. Implement connected component labeling to count objects in an image.
24. Mini Project (choose one from the following but not limited to):

- Face detection using OpenCV Haar cascades
- License plate detection
- Medical image noise removal
- Basic handwritten digit recognition (MNIST dataset)

4TH YEAR HONOURS
(WITH RESEARCH)

BACHELOR OF SCIENCE PROGRAMME (FYUGP) DETAILED SYLLABUS OF 7TH SEMESTER

Title of the Course : **Research Methodologies and Ethics**
Course Code : **CSC-MAJ-13**
Nature of the Course : **MAJOR - 13**
Course Credit : **06credit (Theory-06)**

UNITS	COURSE CONTENT	L	T	P	TOTAL HOURS
I	**Introduction to Research Methodology:** • Meaning and objectives of research • Types of research: Fundamental, Applied, Descriptive, Analytical, Quantitative & Qualitative • Research in Computer Science: Trends, applications, and case studies • The research process: Problem identification, formulation of research questions, hypothesis setting	8	2		10
II	**Research Design and Literature Survey:** • Research design: Exploratory, Descriptive, Experimental, Case study approaches • Review of Literature: Purpose, sources (journals, conference papers, digital libraries, indexing services like Scopus, Web of Science, IEEE Xplore) • Tools for literature survey: Google Scholar, ResearchGate, Zotero, Mendeley • Plagiarism and academic integrity • Research gap identification and problem statement formulation	10	2		12
III	**Data Collection and Analysis:** • Methods of data collection: Primary vs Secondary data • Tools & techniques: Surveys, questionnaires, interviews, experiments, observation • Data analysis: Quantitative techniques (statistics, hypothesis testing, regression, ANOVA), Qualitative analysis (coding, categorization, thematic analysis) • Use of software: MS Excel, SPSS, Python (NumPy, Pandas, Matplotlib) for data analysis • Interpretation of results	10	2		12
IV	**Research Documentation and Presentation:** • Structure of a research report/thesis: Title, Abstract, Introduction, Literature Review, Methodology, Results, Discussion, Conclusion, References • Referencing styles: APA, IEEE, MLA • Citation management tools (Mendeley, EndNote, Zotero) • Preparing research proposals • Research presentations: Writing research papers, conference presentations, poster preparation • Technical writing and use of LaTeX	10	2		12

V	**Research Ethics and Professional Practices:** • Research ethics: Honesty, integrity, objectivity, confidentiality • Plagiarism: Types, consequences, detection tools (Turnitin, Urkund) • Intellectual Property Rights (IPR): Patents, copyrights, trademarks, open-source licensing • Ethics in Computer Science: Data privacy, security, algorithmic bias, AI ethics • Ethical issues in software development, digital divide, cyber laws in India • Case studies on research misconduct and ethical dilemmas	12	2		14
	TOTAL	50	10		60

Where, L: Lecture, T: Tutorial, P: Practical

Books and References:

9. C.R. Kothari, Gaurav Garg (2019). Research Methodology: Methods and Techniques (4th Revised Edition). New Age International Publishers, New Delhi.
10. Ranjit Kumar (2019). Research Methodology: A Step-by-Step Guide for Beginners (5th Edition). SAGE Publications, London.
11. Wayne C. Booth, Gregory G. Colomb, Joseph M. Williams, Joseph Bizup, William T. FitzGerald (2016). The Craft of Research (4th Edition). The University of Chicago Press, Chicago.
12. Deborah J. Rumsey (2016). Statistics for Dummies (2nd Edition). Wiley Publishing, Hoboken, NJ.
13. W. Lawrence Neuman (2014). Social Research Methods: Qualitative and Quantitative Approaches (7th Edition). Pearson Education, Essex.
14. David B. Resnik, Adil E. Shamoo (2015). Responsible Conduct of Research (3rd Edition). Oxford University Press, New York.
15. IEEE Computer Society – IEEE Code of Ethics & Publication Guidelines. IEEE Digital Library (https://www.ieee.org/publications/standards/ethics.html).
16. Association for Computing Machinery (ACM) – ACM Code of Ethics and Professional Conduct. ACM Digital Library (https://www.acm.org/code-of-ethics).

Title of the Course : **Elective- I (EI-A) Artificial Intelligence**

Course Code : **CSC-MAJ-14 (EI-A)**

Nature of the Course : **MAJOR – 14 (EI-A)**

Course Credit : **06credit (Theory-06)**

UNITS	COURSE CONTENT	L	T	P	TOTAL HOURS
I	**Introduction** Overview of Artificial intelligence- Problems of AI, AI technique, Tic - Tac - Toe problem	03	02		05
II	**Intelligent Agents** Agents & environment, nature of environment, structure of agents, goal based agents, utility based agents, learning agents.	03	02		05
III	**Problem Solving and Search techniques:** Problems, Problem Space & search: Defining the problem as state space search, production system, problem characteristics, issues in the design of search programs. Solving problems by searching :problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, depth limited search, bidirectional search, comparing uniform search strategies.	03	02		05
IV	**Heuristic search strategies:** Greedy best-first search, A* search, memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, simulated annealing search, local beam search, genetic algorithms; constraint satisfaction problems, local search for constraint satisfaction problems.	03	02		05
V	**Adversarial search:** Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, additional refinements, iterative deepening.	03	02		05
VI	**Knowledge & reasoning:** Knowledge representation issues, representation & mapping, approaches to knowledge representation, issues in knowledge representation.	03	02		05
VII	**Using predicate logic :** Representing simple fact in logic, representing instant & ISA relationship, computable functions & predicates, resolution, natural deduction.	03	02		05
VIII	**Representing knowledge using rules:** Procedural verses declarative knowledge, logic programming, forward verses backward reasoning, matching, control knowledge	03	02		05
IX	**Probabilistic reasoning:** Representing knowledge in an uncertain domain, the semantics of Bayesian networks, Dempster-Shafer theory, Fuzzy sets & fuzzy logics.	03	02		05
X	**Planning:** Overview, components of a planning system, Goal stack planning, Hierarchical planning, other planning techniques.	03	02		05
XI	**Learning and Expert Systems:** Forms of learning, inductive learning, learning decision trees, explanation based learning, learning using relevance information, neural net learning & genetic learning. Representing and using domain knowledge, expert system shells, knowledge acquisition.	05	05		10
	TOTAL	25	25		60

Where, L: Lecture, T: Tutorial, P: Practical

Books and References:

1. DAN.W. Patterson, Introduction to A.I and Expert Systems – PHI, 2007.
2. Russell &Norvig, Artificial Intelligence-A Modern Approach, LPE, Pearson Prentice Hall, 2nd edition, 2005.
3. Rich & Knight, Artificial Intelligence – Tata McGraw Hill, 2nd edition, 1991.
4. W.F. Clocksin and Mellish, Programming in PROLOG, Narosa Publishing House, 3rd edition, 2001.
5. Ivan Bratko, Prolog Programming for Artificial Intelligence, Addison-Wesley, Pearson Education, 3rd edition, 2000.
6. Introduction to Artificial Intelligence & Expert Systems, Patterson, PHI
7. Logic & Prolog Programming, Saroj Kaushik, New Age International
8. Expert Systems, Giarranto, VIKAS

Title of the Course : **Elective- I (EI-B) Machine Learning**
Course Code : **CSC-MAJ-14 (EI-B)**
Nature of the Course : **MAJOR – 14 (EI-B)**
Course Credit : **06credit (Theory-06)**

UNITS	COURSE CONTENT	L	T	P	TOTAL HOURS
I	**Introduction to Machine Learning & Data Preparation:** Introduction to Analytics and Machine Learning, Framework for Developing Machine Learning Models, Prepare the Data for Machine Learning Algorithms, Data Cleaning, Handling Text and Categorical Attributes, Handling Missing Values, Exploration of Data using Visualization, Types of Machine Learning Systems.	7	1		8
II	**Linear Regression**: Linear regression, Gradient Descent Algorithm for Linear Regression Model, Polynomial model, Regularization, Multi-Collinearity, Logistic Regression.	6	1		7
III	**Classification**: Training a Binary Classifier, Measuring Performance, Using Linear Regression for Classification, Using Logistic Regression, Multiclass Classifier, Multi-label Classification, Multi-output Classification	6	2		8
IV	**Perceptron and Neural Foundations:** Biological Neuron and Artificial Neuron, The Perceptron Model, Perceptron Training Rule, Limitations of Perceptron, Introduction to Multilayer Perceptron (MLP), Activation Functions (ReLU, Sigmoid, Tanh), Gradient Descent & Backpropagation (basic overview).	4	1		5
V	**Some Supervised Machine Learning Algorithms:** k-Nearest Neighbors (KNN), Naive Bayes Classifiers, Decision Trees, Ensembles of Decision Trees: Random Forests, Kernelized Support Vector Machines, Model Evaluation and Improvement.	9	2		11
VI	**Dimensionality Reduction:** Dimensionality Reduction, Feature Extraction, and Manifold Learning, Principal Component Analysis (PCA),Randomized PCA, Incremental PCA, Kernel PCA, Selecting a Kernel and Tuning Hyper-parameters, Other Dimensionality Reduction Techniques.	8	2		10
VII	**Unsupervised Learning**: **Clustering** K-Means, Image Segmentation using clustering, Creating Product Segments Using Clustering, Finding Optimal Number of Clusters Using Elbow Curve Method, Normalizing the Features, Hierarchical Clustering, Compare the Clusters Created by K-Means and Hierarchical Clustering, Anomaly Detection using Gaussian Mixtures, Assessment Metrics for Clustering Algorithms..	10	2		12
	TOTAL	49	11		60

Where, L: Lecture, T: Tutorial, P: Practical

Books and References:

11. Machine Learning by Tom Mitchell, McGraw Hill Education.
12. Christopher Bishop. Pattern Recognition and Machine Learning. 2e.
13. Devi V.S.; Murty, M.N. (2011) Pattern Recognition: An Introduction, Universities Press, Hyderabad.
14. R. O. Duda, P. E. Hart and D. G. Stork, Pattern Classification, Wiley, 2000.
15. Ethem Alpaydin – Introduction to Machine Learning, 4th Edition, MIT Press, 2020.
16. Shai Shalev-Shwartz and Shai Ben-David – Understanding Machine Learning: From Theory to Algorithms, Cambridge University Press, 2014.
17. Kevin P. Murphy – Machine Learning: A Probabilistic Perspective, MIT Press, 2012.
18. Trevor Hastie, Robert Tibshirani, Jerome Friedman – The Elements of Statistical Learning: Data Mining, Inference, and Prediction, Springer, 2nd Edition, 2009.
19. Ian Goodfellow, Yoshua Bengio, Aaron Courville – Deep Learning, MIT Press, 2016.
20. Aurélien Géron – Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 3rd Edition, O'Reilly, 2022.

Title of the Course : **Elective- I (EI-C) Cloud Computing**
Course Code : **CSC-MAJ-14 (EI-C)**
Nature of the Course : **MAJOR – 14 (EI-C)**
Course Credit : **06credit (Theory-06)**

UNITS	COURSE CONTENT	L	T	P	TOTAL HOURS
I	**Computing Paradigms & Introduction to Cloud :** • Evolution of Computing Paradigms: HPC, Parallel, Distributed, Cluster, Grid, Cloud, Bio, Mobile, Quantum, Optical, Nano Computing • Motivation & Need for Cloud Computing: Business Drivers, Technical Drivers, Cost Models • NIST Definition, Five Essential Characteristics, Four Deployment Models (Public, Private, Hybrid, Community) • Cloud as a Service & Cloud as a Platform, Service-Oriented Architecture (SOA) in Cloud • Case Studies: Comparing Cloud vs Traditional IT Models	8	4		**12**
II	**Cloud Fundamentals & Architecture:** • Principles of Cloud Computing, Virtualization Concepts & Types (Full, Para, Hardware-assisted, OS-level) • Cloud Layered Architecture – Physical, Virtualization, Service, Application • Anatomy of the Cloud, Network Connectivity in Cloud • Cloud Application Models: Web Apps, Enterprise Apps, Mobile Apps • Practical Case Study: AWS & GCP Architectural Overview	8	2		10
III	**Cloud Management & Migration:** • Cloud Infrastructure Management: Resource Provisioning, Monitoring, SLA Management • Cloud Security Management: Authentication, Authorization, Identity Management • Application Lifecycle Management in Cloud • Phases of Migration – Assessment, Planning, Migration, Testing, Optimization • Migration Approaches – Rehost, Refactor, Revise, Rebuild, Replace • Migration Tools Overview (AWS Migration Hub, Azure Migrate, GCP Transfer Service)	10	2		12
IV	**Cloud Service Models:** • IaaS – Characteristics, Suitability, Pros/Cons, Providers (AWS EC2, GCP Compute Engine, Azure VM) • PaaS – Characteristics, Suitability, Pros/Cons, Providers (Google App Engine, AWS Elastic Beanstalk, Azure App Services) • SaaS – Characteristics, Suitability, Pros/Cons, Providers (Google Workspace, Salesforce, Office 365) • Other Models – FaaS, DBaaS, STaaS, NaaS, KaaS	10	2		12
V	**Cloud Platforms & Providers:** • AWS: EC2, S3, Lambda, RDS, SQS • GCP: Compute Engine, Cloud Storage, BigQuery, AI/ML APIs • Microsoft Azure: VM, Blob Storage, Functions, DevOps • IBM Cloud, Salesforce, VMware, Rackspace • Trends & Future Directions: Edge Computing, Multi-cloud, Kubernetes, Cloud-native Apps	12	2		14
	TOTAL	48	12		60

Where, L: Lecture, T: Tutorial, P: Practical

Books and References:

1. Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, Mastering Cloud Computing, McGraw-Hill Education.
2. Kai Hwang, Geoffrey C. Fox, Jack J. Dongarra, Distributed and Cloud Computing, Elsevier.
3. George Reese Cloud Application Architectures, First Edition, O‟Reilly Media 2009.
4. Cloud Computing and SOA Convergence in Your Enterprise A Step-by-Step Guide by David S. Linthicum from Pearson 2010.
5. Cloud Computing 2 nd Edition by Dr. Kumar Saurabh from Wiley India 2012.
6. Thomas Erl, Ricardo Puttini, Zaigham Mahmood, Cloud Computing: Concepts, Technology & Architecture, Pearson.
7. Official Documentation of AWS, GCP, and Azure.

Title of the Course	**: Minor Project/Seminar**
Course Code	**: CSC-MAJ-15**
Nature of the Course	**: MAJOR - 15**
Course Credit	**: 06credit (Practical-06)**

Students pursuing 4 year Honours without Research will have to take three extra Major Papers, where one of the Major paper (Major-15**) can be seminar based paper

Title of the Course	**: Research – 1(dissertation)**
Course Code	**: CSC-MAJ-16**
Nature of the Course	**: MAJOR - 16**
Course Credit	**: 06credit (Practical-06)**

Students pursuing 4 year Honours with Research will have to carry out dissertation of total 12 credits in 4 th year (Major-16 in 7th semester and Major-19 in 8th semester). During 7 th semester for Major-16, student has to submit a progress report during term end examination, on the Dissertation topic (Evaluation=100 marks). During the end of 8th semester for Major-19, student has to submit a Final Dissertation report on the same topic (Evaluation=100 marks).

BACHELOR OF SCIENCE PROGRAMME (FYUGP)DETAILED SYLLABUS OF 8TH SEMESTER

Title of the Course : **Cryptography and Network Security**
Course Code : **CSC-MAJ-17**
Nature of the Course : **MAJOR - 17**
Course Credit : **06credit (Theory-06)**

Where, L: Lecture, T: Tutorial, P: Practical

Module	COURSE CONTENTS	L	T	P	Total Hours
I	**Attacks on Computers & Computer Security** Introduction, Need for Security, Security approaches, Principles of Security, Types of attack.	**06**	02		08
II	**Cryptography: Concepts & Techniques** Introduction, Plaintext & Cipher text, Substitution Techniques, Transposition Techniques, Encryption & Decryption, Symmetric & Asymmetric key Cryptography, Key Range & Key Size	09	03		12
III	Symmetric Key Algorithm Introduction, Algorithm types & Modes, Overview of Symmetric Key Cryptography, DES(Data Encryption Standard) algorithm, IDEA(International Data Encryption Algorithm) algorithm, RC5(Rivest Cipher 5) algorithm	06	02		08
IV	Asymmetric Key Algorithm, Digital Signature and RSA Introduction, Overview of Asymmetric key Cryptography, RSA algorithm, Symmetric & Asymmetric key Cryptography together, Digital Signature, Basic concepts of Message Digest and Hash Function (Algorithms on Message Digest and Hash function not required).	06	02		08
V	Internet Security Protocols, User Authentication Basic Concepts, SSL protocol, Authentication Basics, Password, Authentication Token, Certificate based Authentication, Biometric Authentication.	06	02		08
VI	Electronic Mail Security Basics of mail security, Pretty Good Privacy, S/MIME	06	02		08
VII	Firewall Introduction, Types of firewall, Firewall Configurations, DMZ Network	06	02		08
	Total	45	15		60

Where, L: Lecture, T: Tutorial, P: Practical

Books and References:

1. “Cryptography and Network Security”, William Stallings, 2nd Edition, Pearson Education Asia
2. “Network Security private communication in a public world”, C. Kaufman, R. Perlman and M. Speciner, Pearson
3. Cryptography & Network Security: Atul Kahate, TMH.
4. “Network Security Essentials: Applications and Standards” by William Stallings, Pearson
5. “Designing Network Security”, Merike Kaeo, 2nd Edition, Pearson Books
6. “Building Internet Firewalls”, Elizabeth D. Zwicky, Simon Cooper, D. Brent Chapman, 2nd Edition, Oreilly
7. “Practical Unix & Internet Security”, Simson Garfinkel, Gene Spafford, Alan Schwartz, 3rd Edition, Oreilly

Title of the Course : **Elective- II (EII-A) Soft Computing**

Course Code : **CSC-MAJ-18 (EII-A)**

Nature of the Course : **MAJOR - 18 (EII-A)**

Course Credit : **06credit (Theory-06)**

UNITS	COURSE CONTETS	L	T	P	Total Hours
I	**Soft Computing (SC)** as Key Methodology for Designing of Intelligent Systems Structure and Constituents of Soft Computing Comparative Characteristics of the Constituents of SC Intelligent Combinations of the Components of SC Artificial neural network: Introduction, characteristics- learning methods – taxonomy – Evolution of neural networks - basic models - important technologies - applications.	05	05		10
II	**NEURAL NETWORKS** McCulloch-Pitts neuron - linear separability - hebb network - supervised learning network: perceptron networks - adaptive linear neuron, multiple adaptive linear neurons, BPN, RBF, TDNN- associative memory network: auto-associative memory network, hetero-associative memory network, BAM, hopfield networks, iterative auto associative memory network & iterative associative memory network – unsupervised learning networks: Kohonen self- organizing feature maps, ART network.	10	10		20
III	**FUZZY LOGIC** Membership functions: features, fuzzification, methods of membership value assignments- Defuzzification: lambda cuts - methods - fuzzy arithmetic and fuzzy measures: fuzzy arithmetic - extension principle - fuzzy measures - measures of fuzziness -fuzzy integrals. Fuzzy rule base and approximate reasoning: truth values and tables, fuzzy propositions, formation of rules-decomposition of rules, aggregation of fuzzy rules, fuzzy reasoning-fuzzy inference systems-overview of fuzzy expert system-fuzzy decision making.	10	05		15
IV	**GENETIC ALGORITHM** Genetic algorithm- Introduction - biological background - traditional optimization and search techniques - Genetic basic concepts - operators – Encoding scheme – Fitness evaluation –crossover - mutation - genetic programming – multilevel optimization – real life problem- advances in GA.	04	04		8
V	**HYBRID SOFT COMPUTING TECHNIQUES** Neuro-fuzzy hybrid systems - genetic neuro hybrid systems - genetic fuzzy hybrid and fuzzy genetic hybrid systems - simplified fuzzy ARTMAP	05	02		7
	Total	34	26		60

Where, L: Lecture, T: Tutorial, P: Practical

Suggested Readings

1. S.N.Sivanandam and S.N.Deepa,,Principles of Soft Computing,,3rd Edition Wiley India Pvt Ltd, 2018.
2. J.S.R.Jang, C.T. Sun and E.Mizutani, Neuro-Fuzzy and Soft Computing, 2nd Edition PHI / Pearson Education 2014.
3. S.Rajasekaran and G.A.Vijayalakshmi Pai, Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis & Applications, 4th edition,Prentice-Hall of India Pvt. Ltd., 2016.
4. David E. Goldberg, Genetic Algorithm in Search Optimization and Machine Learning, 2nd Edition, Pearson Education India, 2013.

Title of the Course : **Elective- II (EII-B) Big Data Analysis**

Course Code : **CSC-MAJ-18 (EII-B)**

Nature of the Course : **MAJOR - 18 (EII-B)**

Course Credit : **06credit (Theory-06)**

UNITS	COURSE CONTENT	L	T	P	TOTAL HOURS
I	**Foundations of Big Data**: • Introduction to Big Data – Evolution, Definition, Characteristics (Volume, Velocity, Variety, Veracity, Value) • Big Data Ecosystem and Applications (Business, Scientific, Social, Healthcare, IoT) • Traditional vs Big Data Computing • Big Data Architecture and Components • Distributed File Systems, CAP Theorem, BASE Properties	8	2		10
II	**Hadoop Ecosystem & HDFS:** • Hadoop Overview and History • Hadoop Distributed File System (HDFS) – Architecture, Blocks, Namenode, Datanode, Secondary Namenode • Hadoop YARN – Architecture and Resource Management • MapReduce Programming Model – Concepts, Word Count Example, Combiners, Partitioners • Hadoop Ecosystem Tools: Hive, Pig, Sqoop, Oozie	8	2		10
III	**Big Data Frameworks & Data Processing with Spark:** • Motivation for Apache Spark • Spark Ecosystem Components (Spark Core, Spark SQL, Spark Streaming, MLlib, GraphX) • Spark RDDs, Transformations and Actions • Spark DataFrames and Datasets • Spark vs Hadoop MapReduce – Comparative Study	8	2		10
IV	**NoSQL and Big Data Storage Models:** • Limitations of Relational Databases for Big Data • Introduction to NoSQL Databases – Key-Value, Column-oriented, Document-oriented, Graph Databases • Case Studies: HBase, Cassandra, MongoDB, Neo4j • Data Consistency Models and Trade-offs	8	2		10

V	**Big Data Analytics & Machine Learning:** • Data Preprocessing for Big Data (Cleaning, Normalization, Feature Selection) • Big Data Analytics Pipeline • Machine Learning with Big Data – Scalable Algorithms • Using MLlib in Spark – Classification, Clustering, Regression • Recommendation Systems (Collaborative Filtering, Content-based Filtering)	8	2		10
VI	**Real-Time & Streaming Big Data Processing:** • Real-time Big Data Applications (IoT, Finance, Healthcare, Smart Cities) • Apache Kafka – Architecture, Producers, Consumers, Streams API • Apache Flume – Data Ingestion • Spark Streaming, Structured Streaming Concepts • Lambda and Kappa Architectures for Real-time Big Data	8	2		10
	TOTAL	48	12		60

Where, L: Lecture, T: Tutorial, P: Practical

Books and References:

1. Rajkumar Buyya, Rodrigo N. Calheiros, Amir Vahid Dastjerdi – Big Data: Principles and Paradigms, Elsevier, 2016.
2. Tom White – Hadoop: The Definitive Guide, O'Reilly, 4th Edition, 2015.
3. Viktor Mayer-Schönberger & Kenneth Cukier – Big Data: A Revolution That Will Transform How We Live, Work, and Think, Eamon Dolan/Mariner Books, 2014.
4. Benjamin Bengfort, Jenny Kim, Michelle Brush – Fundamentals of Data Engineering: Plan and Build Robust Data Systems, O'Reilly, 2022.
5. Nathan Marz & James Warren – Big Data: Principles and Best Practices of Scalable Realtime Data Systems, Manning, 2015.
6. Krish Krishnan – Data Warehousing in the Age of Big Data, Morgan Kaufmann, 2013.
7. Manish Kumar – Learning Apache Kafka, 2nd Edition, Packt Publishing, 2018.
8. Jules S. Damji, Brooke Wenig, Tathagata Das, Denny Lee – Learning Spark: Lightning-Fast Big Data Analysis, O'Reilly, 2nd Edition, 2020.
9. Seema Acharya & Subhasini Chellappan – Big Data and Analytics, Wiley India, 2015.

Title of the Course : **Elective- II (EII-C) Deep Learning**
Course Code : **CSC-MAJ-18 (EII-C)**
Nature of the Course : **MAJOR - 18 (EII-C)**
Course Credit : **06credit (Theory-06)**

UNITS	COURSE CONTENT	L	T	P	TOTAL HOURS
I	**Foundations of Deep Learning:** • (Partial) History of Deep Learning, Deep Learning Success Stories • McCulloch Pitts Neuron, Thresholding Logic, Perceptrons, Perceptron Learning Algorithm • Multilayer Perceptrons (MLPs), Representation Power of MLPs, Sigmoid Neurons • Gradient Descent, Feedforward Neural Networks, Representation Power of Feedforward Neural Networks	8	2		10
II	**Neural Networks and Optimization**: • FeedForward Neural Networks, Backpropagation • Gradient Descent (GD), Momentum Based GD, Nesterov Accelerated GD • Stochastic GD, AdaGrad, RMSProp, Adam • Eigenvalues and eigenvectors, Eigenvalue Decomposition, Basis.	8	2		10
III	**Data Representation and Unsupervised Learning:** • Principal Component Analysis and its interpretations, Singular Value Decomposition • Autoencoders and relation to PCA, Regularization in autoencoders • Denoising autoencoders, Sparse autoencoders, Contractive autoencoders	8	2		10
IV	**Regularization and Practical Improvements:** • Regularization: Bias Variance Tradeoff, L2 regularization, Early stopping, Dataset augmentation, Parameter sharing and tying • Injecting noise at input, Ensemble methods, Dropout • Greedy Layerwise Pre-training. • Better activation functions, Better weight initialization methods, Batch Normalization	8	2		10
V	**Word Embeddings and Convolutional Neural Networks:** • Learning Vectorial Representations of Words • Convolutional Neural Networks • LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet • Visualizing Convolutional Neural Networks, Guided Backpropagation, Deep Dream, Deep Art, Fooling Convolutional Neural Networks	8	2		10

VI	**Recurrent Neural Networks and Attention Mechanisms:** • Recurrent Neural Networks • Backpropagation Through Time (BPTT), Vanishing and Exploding Gradients, Truncated BPTT • GRU, LSTMs • Encoder Decoder Models, Attention Mechanism, Attention over images	8	2		10
VII	**Unsupervised Learning**: **Clustering** K-Means, Image Segmentation using clustering, Creating Product Segments Using Clustering, Finding Optimal Number of Clusters Using Elbow Curve Method, Normalizing the Features, Hierarchical Clustering, Compare the Clusters Created by K-Means and Hierarchical Clustering, Anomaly Detection using Gaussian Mixtures, Assessment Metrics for Clustering Algorithms..	8	2		10
	TOTAL	48	12		60

Where, L: Lecture, T: Tutorial, P: Practical

Books and References

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville – Deep Learning, MIT Press, 2016.
2. Richard O. Duda, Peter E. Hart, David G. Stork – Pattern Classification, Wiley-Interscience, 2nd Edition, 2000.
3. Charu C. Aggarwal – Neural Networks and Deep Learning: A Textbook, Springer, 2018. (Indian origin author, Columbia Univ.)
4. S. N. Sivanandam & S. Sumathi – Introduction to Neural Networks using MATLAB 6.0, McGraw Hill, 2006. (Indian authors, good for fundamentals + practicals)
5. Rajalingappaa Shanmugamani – Deep Learning for Computer Vision, Packt Publishing, 2018. (Indian author, application-focused)
6. François Chollet – Deep Learning with Python, Manning, 2nd Edition, 2021. (Creator of Keras, hands-on approach)
7. Michael Nielsen – Neural Networks and Deep Learning, Determination Press, 2015. (Free online + great beginner reference)
8. Charu C. Aggarwal – Deep Learning: Foundations and Concepts, Springer, 2023. (latest work by Aggarwal, broader perspective)
9. Aurélien Géron – Hand-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, O'Reilly, 3rd Edition, 2022. (practical coding reference)

Title of the Course	**: Research – 2 (dissertation)**
Course Code	**: CSC-MAJ-19**
Nature of the Course	**: MAJOR - 19**
Course Credit	**: 06credit (Practical-06)**

Students pursuing 4 year Honours with Research will have to carry out dissertation of total 12 credits in 4 th year (Major-16 in 7th semester and Major-19 in 8th semester). During 7 th semester for Major-16, student has to submit a progress report during term end examination, on the Dissertation topic (Evaluation=100 marks). During the end of 8th semester for Major-19, student has to submit a Final Dissertation report on the same topic (Evaluation=100 marks).

COMPUTER SCIENCE

MINOR COURSE

BACHELOR OF SCIENCE PROGRAMME (FYUGP)DETAILED SYLLABUS OF 3RD SEMESTER

Title of the Course : Introduction to Programming using Python
Course Code : CSC-MIN-3
Nature of the Course : MINOR - 3
Course Credit : 06credit (Theory-04, Practical-02)

UNITS	COURSE CONTENTS	L	T	P	Total Hours
I	**Introduction** History, Features, Setting up path, Working with Python, Basic Syntax, Variable and Data Types, Operator	02		**03**	05
II	**Conditional Statements** If, If- else, Nested if-else, Looping, For, While, Nested loops	02		03	05
III	**Control Statements** Break, Continue, Pass	02		03	05
IV	**String Manipulation** Accessing Strings, Basic Operations, String slices, Function and Methods	02		03	05
V	**Lists** Introduction, Accessing list, Operations, Working with lists, Function and Methods	02		04	06
VI	**Tuple** Introduction, Accessing tuples, Operations, Working, Functions and Methods	02		04	06
VII	**Dictionaries** Introduction, Accessing values in dictionaries, Working with dictionaries, Properties	02		04	06
VIII	**Functions** Defining a function, Calling a function, Types of functions, Function Arguments, Anonymous functions, Global and local variables	02		06	08
IX	**Modules** Importing module, Math module, Random module, Packages, Composition, Input-Output Printing on screen, Reading data from keyboard, Opening and closing file, Reading and writing files, Functions	02		06	08
	Total	18		42	60

Suggested Readings

1. Allen B. Downey, "Think Python", 2nd edition, SPD/O'Reilly, 2016.
2. R. Nageswara Rao, "Core Python Programming", Dreamtech Press.
3. Zed A. Shaw, "Learn Python 3 the Hard Way", Addison-Wesley.
4. Brett Slatkin, "Effective Python", Addison-Wesley.
5. Taneja Sheetal, Kumar Naveen, "Python Programming A Modular Approach", Pearson

BACHELOR OF SCIENCE PROGRAMME (FYUGP)DETAILED SYLLABUS OF 4TH SEMESTER

Title of the Course : Data Structure & Algorithm
Course Code : CSC-MIN-4
Nature of the Course : MINOR - 4
Course Credit : 06credit (Theory-04, Practical-02)

UNITS	COURSE CONTENTS	L	T	P	Total Hours
I	**Arrays** Single and Multi-dimensional Arrays, Sparse Matrices (Array and Linked Representation)	**02**		02	04
II	**Linked Lists** Singly, Doubly and Circular Lists (Array and Linked representation); Normal and Circular representation of Stack in Lists; Self Organizing Lists; Skip Lists	04		06	10
III	**Stacks & Queues** Implementing single / multiple stack/s in an Array; Prefix, Infix and Postfix expressions, Utility and conversion of these expressions from one to another; Applications of stack; Limitations of Array representation of stack Array and Linked representation of Queue, De-queue, Priority Queues	04		05	09
IV	**Recursion** Developing Recursive Definition of Simple Problems and their implementation; Advantages and Limitations of Recursion; Understanding what goes behind Recursion (Internal Stack Implementation)	02		03	05
V	**Trees** Introduction to Tree as a data structure; Binary Trees (Insertion, Deletion , Recursive and Iterative Traversals on Binary Search Trees); Threaded Binary Trees (Insertion, Deletion, Traversals); Height-Balanced Trees (Various operations on AVL Trees).	07		05	12
VI	**Graph** Basic Terminology, Models and Types, multigraphs and weighted graphs, Graph Representation, Graph Isomorphism, Connectivity, Euler and Hamiltonian Paths and Circuits, Planar Graphs, Graph Coloring, Trees, Basic Terminology and properties of Trees, Introduction to Spanning Trees Kruskal's Algorithm ; Prim's Algorithm ; DFS ; BFS. Ford-Fulkerson Algorithm for Maximum Flow ; Floyd Algorithm ;	07		05	12

VII	**Searching and Sorting** Linear Search, Binary Search, Comparison of Linear and Binary Search, Selection Sort, Insertion Sort, Insertion Sort, Shell Sort, Comparison of Sorting Techniques	04		04	08
	Total	30		30	60

Suggested Readings

1. Adam Drozdek, "Data Structures and algorithm in C++", Third Edition, Cengage Learning,2012.
2. SartajSahni, Data Structures, "Algorithms and applications in C++", Second Edition, Universities Press, 2011.
3. Aaron M. Tenenbaum, Moshe J. Augenstein, YedidyahLangsam, "Data Structures Using C and C++:, Second edition, PHI, 2009.
4. Robert L. Kruse, "Data Structures and Program Design in C++", Pearson.
5. D.S Malik, Data Structure using C++,Second edition, Cengage Learning, 2010.
6. Mark Allen Weiss, "Data Structures and Algorithms Analysis in Java", Pearson Education, 3rd edition, 2011
7. Aaron M. Tenenbaum, Moshe J. Augenstein, YedidyahLangsam, "Data Structures Using Java, 2003.
8. Robert Lafore, "Data Structures and Algorithms in Java, 2/E", Pearson/ Macmillan Computer Pub,2003
9. John Hubbard, "Data Structures with JAVA", McGraw Hill Education (India) Private Limited; 2 edition, 2009
10. Goodrich, M. and Tamassia, R. "Data Structures and Algorithms Analysis in Java", 4th Edition, Wiley
11. Herbert Schildt, "Java The Complete Reference (English) 9th Edition Paperback", Tata McGraw Hill, 2014.
12. D. S. Malik, P.S. Nair, "Data Structures Using Java", Course Technology, 2003.

Data Structure & Algorithm Lab

Students are advised to do laboratory/practical practice not limited to, but including the following types of problems:

List of Experiments

1. Write a program to search an element from a list. Give user the option to perform Linear or Binary search. Use Template functions.
2. WAP using templates to sort a list of elements. Give user the option to perform sorting using Insertion sort, Bubble sort or Selection sort.
3. Implement Linked List using templates. Include functions for insertion, deletion and search of a number, reverse the list and concatenate two linked lists (include a function and also overload operator +).
4. Implement Doubly Linked List using templates. Include functions for insertion, deletion and search of a number, reverse the list.
5. Implement Circular Linked List using templates. Include functions for insertion, deletion and search of a number, reverse the list.
6. Perform Stack operations using Linked List implementation.
7. Perform Stack operations using Array implementation. Use Templates.
8. Perform Queues operations using Circular Array implementation. Use Templates.
9. Create and perform different operations on Double-ended Queues using Linked List implementation.
10. WAP to scan a polynomial using linked list and add two polynomial.
11. WAP to calculate factorial and to compute the factors of a given no. (i)using recursion, (ii) using iteration
12. (ii) WAP to display fibonacci series (i)using recursion, (ii) using iteration
13. WAP to calculate GCD of 2 number (i) with recursion (ii) without recursion
14. WAP to create a Binary Search Tree and include following operations in tree:
15. Insertion (Recursive and Iterative Implementation)
16. Deletion by copying
17. Deletion by Merging
18. Search a no. in BST
19. Display its preorder, postorder and inorder traversals Recursively
20. Display its preorder, postorder and inorder traversals Iteratively
21. Display its level-by-level traversals
22. Count the non-leaf nodes and leaf nodes
23. Display height of tree
24. Create a mirror image of tree
25. Check whether two BSTs are equal or not
26. WAP to convert the Sparse Matrix into non-zero form and vice-versa.
27. WAP to reverse the order of the elements in the stack using additional stack.
28. WAP to reverse the order of the elements in the stack using additional Queue.
29. WAP to implement Diagonal Matrix using one-dimensional array.
30. WAP to implement Lower Triangular Matrix using one-dimensional array.
31. WAP to implement Upper Triangular Matrix using one-dimensional array.
32. WAP to implement Symmetric Matrix using one-dimensional array.
33. WAP to create a Threaded Binary Tree as per inorder traversal, and implement operations like finding the successor / predecessor of an element, insert an element, inorder traversal.
34. WAP to implement various operations on AVL Tree.

BACHELOR OF SCIENCE PROGRAMME (FYUGP)DETAILED SYLLABUS OF 8TH SEMESTER

Title of the Course : Operating Systems
Course Code : CSC-MIN-6
Nature of the Course : MINOR - 6
Course Credit : 06credit (Theory-04, Practical-02)

Module	COURSE CONTENTS	L	T	P	Total Hours
I	**Introduction to Operating Systems** Definition and functions of an OS, OS types: Batch, Multi- programming, Multi-tasking, Time-sharing, Real-time, Distributed, OS as resource manager, OS architecture & kernel types (monolithic, microkernel, hybrid), System calls and OS services	06		02	08
II	**Process Management** Process concept, process states, PCB, Process scheduling: preemptive & non-preemptive, Scheduling algorithms: FCFS, SJF, Priority, Round Robin, Multilevel Queue, Context switching, Threads: user-level & kernel-level	09		03	12
III	**Inter-Process Communication & Synchronization** Race conditions & critical sections, Mutual Exclusion, Synchronization mechanisms: mutex, semaphores, monitors, Classical problems: Producer–Consumer, Readers–Writers, Dining Philosophers, Deadlocks: prevention, avoidance (Banker's algorithm), detection, recovery	09		03	12
IV	**Memory Management** Memory hierarchy & management strategies, Contiguous allocation, fragmentation (internal & external), Paging, segmentation, Virtual memory: demand paging, page replacement algorithms (FIFO, LRU, Optimal), Thrashing	09		03	12
V	**File Systems** File concepts, attributes, operations, File access methods: sequential, direct, indexed. Directory structure, File system mounting, allocation methods (contiguous, linked, indexed), Free space management	06		02	08
VI	**I/O Systems & Protection** I/O hardware, I/O communication techniques (programmed, interrupt-driven, DMA), I/O scheduling, OS security & protection: authentication, authorization, access control, Disk Structure, Disk scheduling-FCFS, SSTF, SCAN, C-SCAN, Overview of modern OS trends (mobile OS, cloud OS, virtualization)	06		02	08
	Total	**45**		**15**	**60**

Suggested Readings

1. **Operating System Concepts –** *Abraham Silberschatz, Peter B. Galvin, Greg Gagne*, Wiley
2. **Modern Operating Systems –** *Andrew S. Tanenbaum, Herbert Bos,* Pearson
3. **Operating Systems: Internals and Design Principles –** *William Stallings*, Pearson
4. **Operating Systems: A Concept-based Approach –** *D.M. Dhamdhere*, McGraw Hill
5. **Operating Systems –** *Achyut S. Godbole, Atul Kahate,* McGraw Hill

List of Experiments:

1. Basics of UNIX commands and Implementation of Shell Programming.
2. Implementation of Process and thread (Life cycle of process): (i) Process creation and Termination; (ii) Thread creation and Termination.
3. Implementation of CPU Scheduling. (i) FCFS, (ii) SJF, (iii) Shortest Remaining Time First and (iv) Priority based.
4. Implementation of CPU Scheduling: (i) Round Robin (ii) Longest Job First and (iii) Longest Remaining Time First (LRTF).
5. Implementation of CPU Scheduling: (i) Highest Response Ratio Next (HRRN) and (ii) Multilevel Queue.
6. Producer-Consumer Problem using Semaphores and Reader Writer Problem.
7. Simulate algorithm for deadlock prevention and detection.
8. Simulate the algorithm for deadlock avoidance and study about deadlock recovery.
9. Simulate memory allocation methods: (i) Best Fit, (ii) Worst Fit and (iii) Next Fit.
10. Simulate page replacement algorithms: FIFO, LRU and Optimal.
11. Implementation of Disk Scheduling using FCFS, SCAN and C-SCAN algorithm.
12. Implementation of Disk Scheduling using LOOK, C-LOOK and SSTF algorithm.

COMPUTER SCIENCE

MULTIDISCIPLINARY COURSE

BACHELOR OF SCIENCE PROGRAMME (FYUGP)DETAILED SYLLABUS OF 1ST SEMESTER

Title of the Course : **Computer Fundamentals and its Applications**
Course Code : **CSC-MDC-1**
Nature of the Course : **MDC - 1**
Course Credit : **03 credit (Theory - 03)**

UNITS	COURSE CONTENT	L	T	P	TOTAL HOURS
I	**Computer Basics:** What is Computer, Basic Applications of Computer; Components of Computer System, Central Processing Unit (CPU), VDU, Keyboard and Mouse, Other input/output Devices, Computer Memory, Concepts of Hardware and Software; Concept of Computing, Data and Information; Applications of Information Electronics & Communication Technology (IECT); Connecting keyboard, mouse, monitor and printer to CPU and checking power supply.	**7**	**4**		**11**
II	**Operating System:** What is an Operating System; Basics of Popular Operating Systems; The User Interface, Using Mouse; Using right Button of the Mouse and Moving Icons on the screen, Use of Common Icons, Status Bar, Using Menu and Menu-selection, Running an Application, Viewing of File, Folders and Directories, Creating and Renaming of files and folders, Opening and closing of different Windows; Using help; Creating Short cuts, Basics of O.S Setup; Common utilities.	**4**	**8**		**12**
III	**Introduction to DOS**: Files, Directories, Drives, using extensions and wildcards, Basic DOS commands: (CLS, DIR, COPY, CMD, CD, MKDIR, DEL, TIME, REN), Booting, warm boot, cold boot, concept of BIOS Algorithm, Algorithm for simple problems, Flowchart: Components of a flowchart, Drawing flowcharts for simple problems, Structure of a program, types of languages: unstructured, structured, procedure oriented, object oriented	**6**	**6**		**12**
IV	**Networking Basics**: Introduction; Types of network: LAN, MAN, WAN; Concept of Addressing scheme; IP; IP setup in a workstation; DHCP; Wifi	**4**	**6**		**10**
		21	**24**		**45**

Where, L: Lecture, T: Tutorial, P: Practical

Suggested Readings

1. "Computer Fundamentals: Architecture and Organization", B. Ram, New Age International Publisher
2. "Computer Fundamentals", P. K. Sinha, BPB Publications
3. "Fundamentals of Computers", V. Rajaraman&NeeharikaAdabala, Prentice Hall India Learning Private Limited
4. “Data Communication & Networking”, BA Forouzan, McGraw Hill

BACHELOR OF SCIENCE PROGRAMME (FYUGP) DETAILED SYLLABUS OF 3RD SEMESTER

Title of the Course : **Office Management Tools**
Course Code : **CSC-MDC-2**
Nature of the Course : **MDC - 2**
Course Credit : **03 credit (Theory - 03)**

UNITS	COURSE CONTENTS	L	T	P	TOTAL HOURS
I	**Understanding Word Processing:** Word Processing Basics; Opening and Closing of documents; Textcreation and Manipulation; Formatting of text; Table handling; Spell check, language setting and thesaurus; Printing of word document.	**05**		**10**	**15**
II	**Using Spread Sheet:** Basics of Spreadsheet; Manipulation of cells; Formulas and Functions; Editing of Spread Sheet, printing of Spread Sheet.	**05**		**10**	**15**
III	**Making small presentation:** Basics of presentation software; Creating Presentation; Preparation and Presentation of Slides; Slide Show; Taking printouts of presentation / handouts.	**05**		**10**	**15**
	Total	**15**		**30**	**45**

Where, L =Lecture, T =Tutorial, P =Practical

Suggested Software packages:
MS-Office Software

Reference Books:-

1. Microsoft Office 2016 A Beginner's Guide to Microsoft Office, Author: Matthew Conner
2. Microsoft Office 2019 Step by Step, Author: Joan Lambert, Curtis Frye
3. Office 365 All-in-One For Dummies, Author: Peter Weverka, Timothy L. Warner

Recommended Experiment:

1. Create a **telephone directory**.

- The heading should be 16-point Arial Font in bold
- The rest of the document should use 10-point font size
- Other headings should use 10-point Courier New Font.
- The footer should show the page number as well as the date last updated.

2. Design a time-table form for your college.
- The first line should mention the name of the college in 16-point Arial Font and should be bold.
- The second line should give the course name/teacher's name and the department in 14- point Arial.
- Leave a gap of 12-points.
- The rest of the document should use 10-point Times New Roman font.
- The footer should contain your specifications as the designer and date of creation.

3. Create the following one page documents.

(a) Compose a note inviting friends to a get-together at your house, including a list of things to bring with them.
(b) Design a certificate in landscape orientation with a border around the document.

4. Create the following document: A newsletter with a headline and 2 columns in portrait orientation, including at least one image surrounded by text.

5. Convert following text to a table, using comma as delimiter Type the following as shown (do not bold).

Color, Style, Item Blue,
A980, Van Red, X023, Car
Green, YL724, Truck
Name, Age, Sex Bob, 23,
M Linda, 46,
F Tom, 29, M

6. Prepare a grocery list having four columns (Serial number, the name of the product, quantity and price) for the month of April, 06.

- Font specifications for Title (Grocery List): 14-point Arial font in bold and italics.
- The headings of the columns should be in 12-point and bold.
- The rest of the document should be in 10-point Times New Roman.
- Leave a gap of 12-points after the title.

7. XYZ Publications plans to release a new book designed as per your syllabus. Design the first page of the book as per the given specifications.
(a) The title of the book should appear in bold using 20-point Arial font.
(b) The name of the author and his qualifications should be in the center of the page in 16- point Arial font.
(c) At the bottom of the document should be the name of the publisher and address in 16- point Times New Roman.
(d) The details of the offices of the publisher (only location) should appear in the footer.
8. Create the following one page documents.
a) Design a Garage Sale sign.
b) Make a sign outlining your rules for your bedroom at home, using a numbered list.
9. Enter the following data into a table given on the next page.

Salesperson	**Dolls**	**Trucks**	**Puzzles**
Amit	1327	1423	1193
Shivi	1421	3863	2934
Om	5214	3247	5467
Ananya	2190	1278	1928
Anupama	1201	2528	1203
Maharshi	4098	3079	2067

Add a column Region (values: S, N, N, S, S, S) between the Salesperson and Dolls columns to the given table Sort your table data by Region and within Region by Salesperson in ascending order:

Practical List for Spreadsheet

Q1. Create a student worksheet containing roll numbers, names and total marks. Open a document in Word and insert the excel worksheet using:-

i) Copy/Paste
ii) Embedding
iii) Linking

Q2. The term wise marks for APS class of 20 students are stored in 3 separate sheets named terml, term2 and term3. Create 4th worksheet that contains student names and their total and average marks for the entire year. Give proper headings using headers. Make the column headings bold and italic. The 4th worksheet should contain college name as the first line. Make it bold, italic and center it.

Q3. Using a simple pendulum, plot 1-T and 1-T^2 graph.

I	t1	t2	t3	Mean(t)	T=t/20	T_2
70						
80						
90						
100						

Q4. Consider the following employee worksheet:-

Full Name (First Last)	Grade 1/2/3	Basic Salary	HRA	PF	Gross	Net	(VA) Vehicle Allowance

HRA is calculated as follows:

Grade	HRA %(of Basic)
1	40%
2	35%
3	30%

Gross = Basic + HRA + VA Net = Gross -PF PF is 8% for all Grades

VA is 15000, 10000 and 7000 for Grades 1, 2 and 3.

i) Find max, min and average salary of employees in respective Grade
ii) Count no. of people where VA>HRA
iii) Find out most frequently occurring grade.
iv) Extract records where employee name starts with "A" has HRA>10000
v) Print Grade wise report of all employees with subtotals of net salary and also grand totals. Use subtotal command.
vi) Extract records where Grade is 1 or 2 and salary is between 10000 and 20000 both inclusive.

Q5. In a meeting of a marketing department of an organization it has been decided that price of selling an item is fixed at Rs40. It was resolved to increases the sell of more of more items and getting the profit of Rs40,000/.Use Goal Seek of find out how many items you will have to sell to meet your profit figure.

Q6. To study the variation in volume with pressure for a sample of an air at constant temperature by plotting a graph for P - V and P-I/V. Sample

observations are:-

Pressure(P)	Volume (V)	I/V	PV	P/V
75	20			
78.9	19			
83.3	18			
88.2	17			

Q7. Plot the chart for marks obtained by the students (out of 5) vs. frequency (total number of students in class is 50).

Q8. Create the following worksheet(s) containing an year wise sale figure of five salesmen in Rs.

Salesman	2002	2003	2004	2005
MOHAN	10000	12000	20000	50000
MITRA	15000	18000	50000	60000
SHIKHA	20000	22000	70000	70000
ROHIT	30000	30000	100000	80000
MANGLA	40000	45000	125000	90000

Apply the following Mathematical & Statistical functions:

i) Calculate the commission for each salesman under the condition :-

a) If total sales is greater than Rs. 3, 00,000/-, then commission is 10% of total sale made by the salesman.

b) Otherwise, 4% of total sale.

ii) Calculate the maximum sale made by each salesman.

iii) Calculate the maximum sale made in each year.

iv) Calculate the minimum sale made by each salesman.

v) Calculate the minimum sale made in each year.

vi) Count the no. of sales persons.

vii) Calculate the cube of sales made by Mohan in the year 2002.

viii) Find the difference in sales by salesman Mitra between the year 2002 and 2003. Find the absolute value of difference.

ix) Also calculate the Mode, Stddev, Variance, Median for the sale made by each salesman.

ix) Calculate the year wise Correlation coefficient between the sales man Mohan and Mitra year wise

Q9. The following table gives an year wise sale figure of five salesmen in Rs.

Salesman	2000	2001	2002	2003
S1	10000	12000	20000	50000
S2	15000	18000	50000	60000
S3	20000	22000	70000	70000
S4	30000	30000	100000	80000
S5	40000	45000	125000	90000

i) Calculate total sale year wise.

ii) Calculate the net sales made by each salesman

iii) Calculate the commission for each salesman under the condition :-

c) If total sales is greater than Rs. 4, 00,000/-, then commission is 5% of total sale made by the salesman.

d) Otherwise, 2% of total sale.

iv) Calculate the maximum sale made by each salesman.

v) Calculate the maximum sale made in each year.

vi) Draw a bar graph representing the sale made by each salesman.

S.No.	Name	PH	CH	BY	MT	CS	Total Marks	%	Grade

vii) Draw a pie graph representing the sale made by salesmen in year 2001.

10. Consider the following worksheet for APS 1st year students:-

1Grade is calculated as follows:-

If % >=90 If % Grade A
>=80 & <90 If % Grade B
>=70 & <80 If % Grade C
>=60 & <70 Grade D
Otherwise

students will be declared fail.

i) Calculate Grade using if function

ii) Sort the data according to total marks

iii) Apply filter to display the marks of the students having more than 65% marks.

iv) Draw a pie chart showing % marks scored in each subject by the topper of the class.

v) Draw the doughnut chart of the data as in (iv)

vi) Enter the S.No. of a student and find out the Grade of the student using VLOOKUP.

vii) Extract all records where name

a) Begins with “A”

b) Contains “A”

c) Ends with “A”

Practical List for presentation:

1. Create five Power point slides. Each slide should support different format. In these slides explain areas of applications of IT. Make slide transition time as 10 seconds.
2. Create five Power Point slides to give advantages/disadvantages of computer, application of computers and logical structure of computer.
3. Create five Power Point slides detailing the process of internal assessment. It should be a self running demo.

BACHELOR OF SCIENCE PROGRAMME (FYUGP) DETAILED SYLLABUS OF 5TH SEMESTER

Title of the Course : Computer Networks and Internet Technologies
Course Code : CSC-MDC-3
Nature of the Course : MDC - 3
Course Credit : 03 credit (Theory - 03)

UNITS	COURSE CONTENTS	L	T	P	TOTAL HOURS
I	**Computer Networks:** Introduction to computer network, Data communication, Components of data communication, data transmission mode, data communication measurement, LAN, MAN, WAN, wireless LAN, internet, intranet, extranet.	03	02		05
II	**Network Models:** Client/ server network and Peer-to-peer network, OSI, TCP/IP, layers and functionalities.	02	02		04
III	**Transmission Media:** Introduction, Guided Media: Twisted pair, Coaxial cable, Optical fiber. Unguided media: Microwave, Radio frequency propagation, Satellite.	04	02		06
IV	**LAN Topologies:** Ring, bus, star, mesh and tree topologies.	04	02		06
V	**Network Devices:** NIC, repeaters, hub, bridge, switch, gateway and router	04	02		06
VI	**Internet Terms:** Web page, Home page, website, internet browsers, URL, Hypertext, ISP, Web server, download and upload, online and offline.	04	02		06
VII	**Internet Applications:** www, telnet, ftp, e-mail, social networks, search engines, Video Conferencing, e-Commerce, m-Commerce, VOIP, blogs.	04	02		06
VIII	**Introduction to Web Design:** Introduction to hypertext markup language (html) Document type definition, creating web pages, lists, hyperlinks, tables, web forms, inserting images, frames, hosting options and domain name registration. Customized Features: Cascading style sheet (css) for text formatting and other manipulations.	03	03		06
	Total	28	17		45

Where, L =Lecture, T =Tutorial, P =Practical

Reference Books:-

1. Computer networks - Tannenbaum
2. Data Communication and Networking - Forouzan - Tata McGraw Hill.
3. D.R. Brooks, An Introduction to HTML and Javascript for Scientists and Engineers, Springer W. Willard, 4.HTML A Beginner's Guide, Tata McGraw-Hill Education, 2009.
4. J. A. Ramalho, Learn Advanced HTML 4.0 with DHTML, BPB Publications, 2007