ADMISSION & EXAMINATION BYE-LAWS

for

Bachelor of Science (Hons) Computer Science - (B.Sc.(H))

Program Code:

CHOICE BASED CREDIT SYSTEM (CBCS)
With effect from 2022

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
School of Engineering Sciences & Technology
JAMIA HAMDARD
(DEEMED TO BE UNIVERSITY)
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1. DATES OF APPROVAL

- Approval Date of Board of Studies (BoS) meeting for the present syllabus
- Approval Date and Number of Academic Council (AC) Meeting for the present syllabus

Programme Code	Programme Name	Date of Revision
	B.Sc.(CS)	03.06.2022

SCHOOL OF EGINEERING SCIENCES AND TECHNOLOGY

Vision Statement (School Level): To become the best institution in the national and international map in terms of quality of teaching and research, technical knowledge and academics in the field Computer Science & Engineering, Electronics & Communication Engineering, Bioinformatics with sincere honesty adding values in the core aspect of students' life.

Mission Statements (3 to 4) (School Level):

MS1: To offer state-of-the-art undergraduate, postgraduate and doctoral programs in Computer Science & Engineering, Electronics and Communication Engineering & Engineering and Bioinformatics.

MS 2: To provide one of the best working environments to motivate faculty and students to work towards vision of the Department.

MS 3: To develop association with industry, other Universities/Institute/Research Laboratories and work in collaboration with them.

MS 4: To use our expertise in all the relevant disciplines for helping society in solving its real life problem.

MS 5: To develop entrepreneurship skills in the students so that they can become problem solver and innovative developer and contribute to the society by providing employment to others.

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

Vision Statement (Department/Centre Level): To become the best institution in the national and international map in terms of quality of teaching and research, technical knowledge and academics in the field Computer Science & Engineering, Electronics & Communication Engineering, Bioinformatics with sincere honesty adding values in the core aspect of students' life.

Mission Statements (3 to 4) (Department/Centre Level):

MS1: To offer state-of-the-art undergraduate, postgraduate and doctoral programs in Computer Science & Engineering, Electronics and Communication Engineering & Engineering and Bioinformatics.

MS 2: To provide one of the best working environments to motivate faculty and students to work towards vision of the Department.

MS 3: To develop association with industry, other Universities/Institute/Research Laboratories and work in collaboration with them.

MS 4: To use our expertise in all the relevant disciplines for helping society in solving its real life problem.

MS 5: To develop entrepreneurship skills in the students so that they can become problem solver and innovative developer and contribute to the society by providing employment to others.

QUALIFICATION DESCRIPTORS (QDs)

Upon the completion of Academic Programme Bachelor of Science (Hons) Computer Science - (B.Sc.(H)) students will be able to:

QD-1 The graduates will establish themselves as professionals by solving real-life problems using exploratory and analytical skills acquired in the field of Computer Science & Applications.

QD-2 The graduates will provide sustainable solutions to ever changing interdisciplinary global problems through their Research & Innovation capabilities.

QD-3 The graduates will become employable, successful entrepreneur as an outcome of this programme.

QD-4 The graduates will embrace professional code of ethics while providing solution to multidisciplinary social problems in industrial, entrepreneurial and research environment to demonstrate leadership qualities.

QD-5 Pertain ethical principles and entrust to professional ethics and responsibilities in a global economic environment.

Mapping Qualification Descriptors (QDs) with Mission Statements (MS)

	MS-1	MS-2	MS-3	MS-4	MS-5
QD-1	3	2	3	2	3
QD-2	2	1	1	3	3
QD-3	2	2	3	2	2
QD-4	1	3	2	3	2
QD-5	3	2	3	3	3

Write '3' in the box for 'High-level'mapping, 2 for 'Medium-level'mapping, 1 for 'Low-level'mapping.

2. PROGRAM LEARNING OUTCOMES (PLO)

PLO1.	Engineering Knowledge: Apply the knowledge of mathematics, science, IT fundamentals and computing to solve Computer Applications related problems.
PLO2.	Problem Analysis: Demonstrate the ability to identify, formulate and solve problems related to Computer Applications.
PLO3.	Design / Development of Solutions: Demonstrate the ability to design, analyze and interpret data and implement solutions for software based real life problems.
PLO4.	Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.
PLO5.	Modern tool usage: Create, select and apply appropriate techniques, resources, and modern IT tools including prediction and modelling to complex activities related to Computer Science with an understanding of the limitations.
PLO6.	The software developer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional IT practice.
PLO7.	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of and need for sustainable development.
PLO8.	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the Software Development practice.
PLO9.	Individual and Team Work: Function effectively as an individual and as a member or leader to diverse teams, and in multidisciplinary settings.
PLO10.	Communication: Communicate effectively on complex activities with the Software development community and with society at large, such as, being able to comprehend and write effective report and design documentation, make effective presentations, and give and receive clear instructions.
PLO11.	Project Management and Finance: Demonstrate knowledge and understanding of the Software development and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PLO12.	Life-Long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Mapping of Program Learning Outcomes (PLOs)
With Qualification Descriptors (QDs)

	QD-1	QD-2	QD-3	QD-4	QD-5
PLO-1	3	3	2	2	1
PLO-2	3	3	1	2	1
PLO-3	3	2	2	2	3
PLO-4	2	3	2	3	2
PLO-5	3	2	2	3	2
PLO-6	2	3	3	1	2
PLO-7	2	3	3	2	2
PLO-8	2	3	2	3	1
PLO-9	1	2	3	2	3
PLO-10	2	2	1	2	2
PLO-11	2	2	3	2	1
PLO-12	1	2	2	3	3

Write ‘3’ in the box for ‘High-level’ mapping, 2 for ‘Medium-level’ mapping, 1 for ‘Low-level’ mapping.

3. ADMISSION & EXAMINATION RULES

for

Bachelor of Science (Hons) Computer Science - (B.Sc.(H))

1. OBJECTIVE

To act as a feeder program for higher studies and to provide strong conceptual and theoretical background leading to skilled manpower in industrial and service sectors to meet global demands.

2. HIGHLIGHTS OF THE PROGRAM

Highlights of the course are described in the following table:

a.	*Name of the Program*	Bachelor of Science (Hons) Computer Science - (B.Sc.(H))
b.	*Nature*	Regular and Full Time
c.	*Duration*	As per the directive of UGC
d.	*Total number of credits*	60
e.	*Medium of Instruction and English Examinations*	English
f.	*Eligibility Criteria*	A candidate must have: • A candidate seeking admission to this program must have passed Senior Secondary (12^{th} Standard/Intermediate)examination with Mathematics/Computer Science/Informatics Practices as one of the passed subjects from CBSE or any other Board recognized by Jamia Hamdardas equivalent thereto, securing at least 50% marks or equivalent CGPA in aggregate. • English language from List A + Physics + Chemistry +Mathematics/ComputerScience/Informative Practices
g.	*Selection procedure*	On the basis of merit of CUET - 2022
h.	*Period of Completion*	Not more than 05 years (10 Semesters)
i.	*Commencement of the Program*	July of the every academic session

3. PROGRAM STRUCTURE

Semester-wise course structure, guidelines for teaching, practical and associated assessment of **Bachelor of Science (Hons) Computer Science - (B.Sc.(H))** programme is described in the following tables:

Course Type	Abbreviation	Credits

Program Core Course	PCC	40
Program Elective	PE	08
Open Elective	OE	08
Foundation Course	FC	12
Ability Enhancement Course	AEC	04
Skill Enhancement Elective	SEE	08
Laboratory	LAB	20
Dissertation	DISS	20
Non-Credit Course	NCC	00
Total Credits		**120**

L – T – P stands for number of contact hours as Lecture-Tutorial-Practical in a week**.**

Semester – I

Paper Code	Title of the Paper	Course Type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BSC 101	Introduction to 'C' Programming	PCC	40	60	100	3-1-0	4
BSC 102	Computer System Architecture	PCC	40	60	100	3-1-0	4
BSC 103	Mathematical Foundation of Computer Science	FC	40	60	100	3-1-0	4
BSC 104	Communication Skills	AEC	40	60	100	2-0-0	2
BSC 105	Media Information Literacy and Communication	AEC	40	60	100	2-0-0	2
BSC 106	'C' Programming Lab	LAB	40	60	100	0-0-4	2
BSC 107	Computer System Architecture Lab	LAB	40	60	100	0-0-4	2
				Total		**13-3-8**	**20**

Semester – II

Paper Code	Title of the Paper	Course Type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BSC 201	Introduction to Data Structures	PCC	40	60	100	3-1-0	4
BSC 202	Data communication and Computer Networks Basics	PCC	40	60	100	3-1-0	4
BSC 203	Fundamental Concepts of Operating Systems	PCC	40	60	100	3-1-0	4
BSC 204	Elementary Physics	FC	40	60	100	3-1-0	4
BSC 205	Data Structures Lab	LAB	40	60	100	0-0-4	2
BSC 206	Unix/Linux Lab	LAB	40	60	100	0-0-4	2
*BSC ES	Environmental Sciences	NCC	40	60	100	2-0-0	0
				Total		**14-4-8**	**20**

***This subject may be taught in both the semesters (Semester-I and Semester-II) at the discretion of the Department. However, Semester Examination will be conducted only at the end of Semester-II**

Semester – III

Paper Code	Title of the Paper	Course Type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BSC 301	Introduction to Object Oriented Programming	PCC	40	60	100	3-1-0	4
BSC 302	Introduction to Database Management System	PCC	40	60	100	3-1-0	4
BSC 303	Discrete Structures	PCC	40	60	100	3-1-0	4
	PE – 1	PE	40	60	100	3-1-0	4
BSC 304	'C++' Programming Lab	LAB	40	60	100	0-0-4	2
BSC 305	Database Management System Lab	LAB	40	60	100	0-0-4	2
				Total		**12-4-8**	**20**

Semester – IV

Paper Code	Title of the Paper	Course Type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BSC 401	Fundamentals of Probability and Statistics	FC	40	60	100	3-1-0	4
BSC 402	Introduction to Artificial Intelligence	PCC	40	60	100	3-1-0	4
	SEE – 1	SEE	40	60	100	3-1-0	4
	OE – 1	OE	40	60	100	3-1-0	4
BSC 403	Artificial Intelligence Lab	LAB	40	60	100	0-0-4	2
BSC 404	Lab based on SEE – 1	LAB	40	60	100	0-0-4	2
				Total		**12-4-8**	**20**

Semester – V

Paper Code	Title of the Paper	Course Type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BSC 501	Fundamentals of Software Engineering	PCC	40	60	100	3-1-0	4
	PE – 2	PE	40	60	100	3-1-0	4
	SEE – 2	SEE	40	60	100	3-1-0	4
	OE – 2	OE	40	60	100	3-1-0	4
BSC 502	Software Engineering Lab	LAB	40	60	100	0-0-4	2
BSC 503	Lab based on SEE – 2	LAB	40	60	100	0-0-4	2
				Total		**12-4-8**	**20**

Semester – VI

Paper Code	Title of the Paper	Course Type	Marks			L-T-P	Credits
			Internal Assessment	Viva voce	Total		
BSC 601	Industrial Project and Dissertation	DISS	300	200	500	0-0-40	20

Grand Total of Credits = 120

PROGRAM ELECTIVES (PE)

PE – 1	
BSC PE311	Introduction to Wireless Communication
BSC PE312	Introduction to Mobile Computing
BSC PE313	Web & E-Commerce Technologies
PE – 2	
BSC PE521	Introduction to Data Mining
BSC PE522	Introduction to Cloud Computing
BSC PE523	Introduction to Data Science and Big data

SKILL ENHANCEMENT ELECTIVES (SEE)

SEE – 1	
BSC SEE411	Internet and Web Technology
BSC SEE412	Programming in Visual Basic
BSC SEE413	Fundamental Concepts of Microprocessor and Arduino Programming
SEE – 2	
BSC SEE521	Introduction to Java Programming
BSC SEE522	Fundamentals of .Net Programming
BSC SEE523	PHP Programming

OPEN ELECTIVES (OE)

OE – 1	
BSC OE411	Organisational Behavior
BSC OE412	Financial Accounting
BSC OE413	Cyber Crimes & Cyber Laws
BSC OE414	MOOCS 1
OE – 2	
BSC OE511	Startup Entrepreneurship
BSC OE512	Concepts of E-Governance and Smart City
BSC OE513	Digital Marketing and E-Commerce
BSC OE514	MOOCS 2

4. MODE OF CURRICULUM DELIVERY

Mode of curriculum delivery includes classroom teaching, assignments, test, lab work, presentations, participation in relevant events and regularity.

5. ATTENDANCE

a. All students are supposed to attend every lecture and practical classes. However, the attendance requirement for appearing in the examination shall be a minimum of 75% of the classes held.
b. Each one-period teaching shall account for one attendance unit.
c. The concerned teacher will take a roll call in every scheduled class, maintains and consolidate the attendance record, which would be submitted to the Head of the Department at the conclusion of the semester.

d. Attendance on account of participation (with prior permission from the Head of the Department) in the co-curricular/extra-curricular activities can be granted by the Dean on receipt of certificates or recommendations of the respective activity issued by the Head of the Department.
e. Attendance records displayed on the Notice Board from time to time, in respect of short attendance, shall be deemed to be a proper notification and no individual notice shall be sent to the students/local guardian.
f. In case a student is found to be continuously absent from the classes without information for a period of 30 days, the concerned teacher shall report it to the Head of the Department.
g. Head of the Department may recommend for striking off the name of a student from rolls, after ensuring '**one month continuous absence**', from all the concerned teachers.
h. A student, whose name has been struck off on account of long absence may apply to the Dean for readmission within 15 days of the notice of striking off the name. The readmission shall be effected on payments of prescribed readmission fees.
i. A student with less than 75% attendance in a subject shall not be allowed to appear in that subject in the semester examination. The Head of the Department shall recommend all such cases to the Dean of the School.
j. The Dean, on the recommendation of the Head of the Department, may consider the relaxation of attendance up to 10% on account of sickness and /or any other valid reason. No application for relaxation of attendance (duly certified by a Registered Medical Practitioner/Public hospital or a competent authority) will be entertained after 15 days from the recovery from illness etc.

6. INTERNAL ASSESSMENT

a. Internal assessment, to be made by concerned teachers, will be based on unit tests, quizzes, presentation, programming test, demonstrations and assignments.
b. There will be two (2) Internal Assessment (Unit Tests) with a total of 30 marks(15 marks each). Other modes of assessment shall account for remaining 10 marks (Assignments, Attendance etc.).
c. A unit test each shall be scheduled after the completion of first and second term.
d. Dates for unit test will be announced at the beginning of the semester, by the examination coordinator.
e. The teacher concerned shall maintain a regular record of the marks obtained by students in unit tests and display the same in due course.
f. The concerned teachers shall submit the compiled internal assessment marks to the Head of the Department, on the conclusion of teaching of the current semester.
g. The Head shall display a copy of the compiled sheet, of internal assessment marks of all the papers, before forwarding it to the Controller of Examination, i.e. at the conclusion of the semester.
h. A promoted candidate, who has to reappear in the examination of a paper, will retain internal assessment marks.
i. In the case of re-admission, the candidates shall have to go through the internal assessment process afresh and shall retain nothing of the previous year.

7. SEMESTER EXAMINATION

Prescriptions for conducting semester examinations of theory and lab papers, those shall be conducted after the conclusion of each of the semesters, are presented in the following table:

S.N.	Classification	Theory	Lab
1.	Mode	Written Only	Written, Demo, Programming and viva- voce etc.
2.	Duration	02 Hours 30 minutes	03 Hours
3.	Total Marks	60 (Sixty Only)	60 (Sixty Only)

8. DISSERTATION/ INDUSTRIAL PROJECT

a. Each student of the final semester will have to go for a Dissertation/Industrial Project work either in the industry or in the Department under the guidance of one or two faculty members.
b. Period of completion of Dissertation/Industrial Project work shall be full one semester.
c. There shall normally be two supervisors-one internal and one *external (in the case of industry project form the place where the student is pursuing project-work)*.
d. All the students, who are pursuing the Dissertation/Industrial project work, shall be continuously in touch with the internal supervisor.
e. ***There shall be a mid-term evaluation of the progress*** and the internal supervisors will conduct it. However, an internal supervisor may ask the student to submit a confidential progress-report from the external supervisor *(in the case of industry project).*
f. All the candidates shall submit ***Two (02***) hard copies of the project reports that are duly approved and signed by internal as well as external *(if applicable)* supervisors.
g. An external examiner, appointed for the purpose, shall evaluate the project report.
h. The Head of the Department shall fix a date and time for viva-voce examinations, on receipt of the evaluation-report of the project reports from the external examiner.
i. Head of the Department shall forward the compiled total marks (awarded in internal assessment, project Report and Viva-voce Examination), in the project-semester of each of the candidate, to the Controller of Examination.

9. EXAMINATION

a. The performance of a student in a semester shall be evaluated through continuous class assessment and end semester examination. The continuous assessment shall be based on class tests, assignments/ tutorials, quizzes/ viva voce and attendance. The end semester examination shall be comprised of written papers, practical and viva voce, inspection of certified course work in classes and laboratories, project work, design reports or by means of any combination of these methods.
b. The marks obtained in a subject shall consist of marks allotted in end semester theory paper, practical examination and sessional work.
c. The minimum pass marks in each subject including sessional marks (Theory, Practical or Project etc.) shall be 50%.

10. PROMOTION SCHEME

a. A student will be required to clear minimum **40% of his/her papers** (including Labs; excluding non-credit papers) in a semester/annual examination to be eligible **for promotion to the next semester/year**. A student may appear in the supplementary examination after each semester/annual examination and can have a choice to appear in the backlog papers in the supplementary examination or in the subsequent regular semester/annual examination with a prescribed fee. A students detained due to shortage of attendance will repeat his/her paper in the subsequent semester concerned (even/odd).

b. A **detained** Student is not allowed to re-appear in the internal assessment (Unit test). His/her old internal assessment marks will remain same.

A student who cleared all the papers of a semester/annual examination of a programme/course will be eligible for improvement examination as per university rule.

After having passed all the SIX semesters, the students shall be eligible for the award of Bachelor of Science (Hons) Computer Science - (B.Sc.(H)) degree of JAMIA HAMDARD.

11. GRADING SYSTEM

As per University Rule

12. CALCULATION OF SGPA AND CGPA OF A STUDENT IN A SEMESTER

As per University Rule

After having passed all the SIX semesters, the students shall be eligible for the award of **Bachelor of Science (Hons) Computer Science - (B.Sc.(H))** degree of JAMIA HAMDARD**.**

13. CLASSIFICATION OF SUCCESSFUL CANDIDATES

The result of successful candidates, who fulfill the criteria for the award of **Bachelor of Science (Hons) Computer Science - (B.Sc.(H))**, shall be classified at the end of last semester, on the basis of his/her final CGPA (to be calculated as per university rule).

DETAILED SYLLABUS

Name of the Academic Program: Bachelor of Science (Hons) Computer Science - (B.Sc.(H))
Course Code: BSC-101 **Title of the Course:** Introduction to 'C' Programming
L-T-P: 3-1-0 **Credits**: 04
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

COURSE LEARNING OUTCOMES (CLOs)

After completing this Course, the students should be able to …….
CLO 1 Develop logics that will help them in writing C programs. (Cognitive level: Create)
CLO 2 Use the primitive data types, values, operators and expressions in C. (Cognitive level: Apply)
CLO 3 Develop programs using the control statements/decision structures, pointers, Arrays, strings, and loops. (Cognitive level: Create)
CLO 4 Design programs involving functions and understand about the code reusability with the help of user defined functions. (Cognitive level: Create)
CLO 5 Develop the programs using structures and file handling mechanism. (Cognitive level: Create)

Mapping of Course Learning Outcomes (COs) with Program Learning Outcomes (POs)

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO 10	PLO 11	PLO 12
CLO 1	--	1	--	--	1	--	3	--	--	--	2	**--**
CLO 2	3	--	--	2	--	--	--	--	1	--	--	**3**
CLO 3	--	3	--	--	3	--	2	--	--	3	3	**--**
CLO 4	--	--	3	3	--	3	--	2	--	--	--	**1**
CLO 5	2	2	--	2	--	--	--	--	3	--	2	**--**

Each Course Outcome (COs) may be mapped with one or more Program Learning Outcomes (PLOs). Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low-level' mapping.

Detailed Syllabus:

Unit 1: Introduction to components of a computer system (10 hours)

Memory, processor, I/O Devices, storage, operates system, Concept of assembler, compiler, interpreter, loader and linker. Programming Fundamentals: Algorithms and Flowcharts, problem solving techniques, stepwise refinement; Programming in C: features of 'C', tokens, data type, operators, expression

Unit 2: Branching Constructs (10 hours)

If-else, switch, conditional operator & go to statements; looping Constructs: white, do-while, for and Jumping statements.

Unit 3: Arrays (10 hours)

Array notation and representation, manipulating array elements, using multi-dimensional arrays. Character arrays and strings, Functions: Introduction, types of functions, functions with array, passing parameters to functions, call by value, call by reference, recursive functions.

Unit 4: Pointers (10 hours)

Operations on pointers, pointers & structures; Structures and Unions.

Unit 5: Development of efficient programs (10 hours)

Debugging, verification and testing of programs. File Management: Defining & opening a file, closing a file, input operations.

Reference Books

1. Yashvant Kenetkar (2020), *Let Us C*, 17th Edition, BPB Publications, India, 486 pages
2. Herbert Schildt (2017), C *The Complete Reference"*, 4th Edition, McGraw Hill Education, India, 832 pages.
3. Byron Gottfried (2018), *Programming with C*, 4th Edition, McGraw Hill Education, India, 718 pages.
4. Kernighan and D. Ritchie (2015), *The C Programming Language*, 2nd Edition, Pearson Education, India; 288 pages.
5. E. Balaguruswamy (2019), *Programming in ANSI C*, 8th Edition, McGraw Hill Education, India, 596 pages.

Teaching-Learning Strategies in brief

1. Teaching was conducted in online mode.
2. The students were clearly explained the proper behaviour.
3. The students must be encouraged to take active participation in the learning process.
4. The study material of whatever has been taught in the class in the form of ppt, pdf, and as well as screenshots.

Assessment methods and weightages in brief

1. By taking two sessional examinations.
2. By giving assignments.
3. By conducting class tests.
4. By taking semester examination.
5. Internal assessment (25 Marks) & Semester Examination (75 Marks) &Total Marks-100.

Name of the Academic Program: Bachelor of Science (Hons) Computer Science - (B.Sc.(H))
Course Code: BSC 102 **Title of the Course:** Computer System Architecture
L-T-P: 3-1-0 **Credits:** 04
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

COURSE LEARNING OUTCOMES (CLOs)

After completing this Course, the students should be able to
CLO1 Understand the theory and architecture of central processing unit(Cognitive level: Understand)
CLO 2 Analyze some of the design issues in terms of speed, technology, cost, performance (Cognitive level: Analyze)
CLO 3 Design a simple CPU with applying the theory concepts (Cognitive level: Create)
CLO 4 Use appropriate tools to design verify and test the CPU architecture (Cognitive level: Analyze)
CLO 5 Learn the concepts of parallel processing, pipelining and interprocessor Communication (Cognitive level: Remember)

Mapping of COURSE LEARNING OUTCOMES (CLOs) with Program Learning Outcomes (PLOs)

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO 10	PLO 11	PLO 12
CLO 1	3	--	2	1	2	2	--	--	--	1	--	1
CLO 2	3	--	--	2	--	--	2	1	1	--	1	--
CLO 3	1	1	3	2	2	2	--	--	--	1	1	1
CLO 4	--	3	1	--	2	--	--	1	1	--	1	--
CLO 5	2	--	--	2	1	2	2	2	--	1	--	2

Each Course Learning Outcome (CLO)may be mapped with one or more Program Learning Outcomes (PLOs). Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level' mapping.

Detailed Syllabus:

Unit 1: Introduction (10 hours)
Logic gates, Boolean algebra, combinational circuits, circuit simplification, flip-flops and sequential circuits, decoders, multiplexers, registers, counters and memory units.

Unit 2: Data Representation and Basic Computer Arithmetic (10 hours)
Number systems, complements, fixed and floating-point representation, character representation, addition, subtraction, magnitude comparison, and multiplication and division algorithms for integers.

Unit 3: Basic Computer Organization and Design (10 hours)

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.

Unit 4: Central Processing Unit (10 hours)

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.

Unit 5: Memory and I/O Organization (10 hours)

Cache memory, Associative memory, mapping; Input / Output: External Devices, I/O Modules, Programmed I/O, Interrupt-Driven I/O, Direct Memory Access, I/O Channels.

Reference Books

1. Authors (year), *Title of the Book*, Edition, Publishers, Place of Publication, Page Nos.
2. M. Mano, Computer System Architecture, Pearson Education 1992.
3. A. J. Dos Reis, Assembly Language and Computer Architecture using C++ and JAVA, Course Technology, 2004.
4. W. Stallings, Computer Organization and Architecture Designing for Performance, 8th Edition, Prentice Hall of India, 2009.
5. M.M. Mano, Digital Design, Pearson Education Asia, 2013.
6. Carl Hamacher, Computer Organization, Fifth edition, McGraw Hill, 2012.

Teaching - learning strategies

1. Blended learning
2. Brainstorming
3. Case study
4. Computer aided presentation
5. Computer labs/laptop instruction
6. Demonstration

Assessment methods and weightages in brief

1. By taking two sessional examinations.
2. By giving assignments.
3. By conducting class tests.
4. By taking semester examination.
5. Internal assessment (25 Marks) & Semester Examination (75 Marks) &Total Marks-100.

Name of the Academic Program: Bachelor of Science (Hons) Computer Science - (B.Sc.(H))
Course Code: BSC-103 **Title of the Course:** Mathematical Foundations of Computer Science
L-T-P: 3-1-0 **Credits**: - 04
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

COURSE LEARNING OUTCOMES (CLOs)

After completing this Course, the students should be able to:

CLO1 Understand and apply the basic mathematics to solve the problems related to algebra of matrices. (Cognitive Level: Understand)

CLO2 Describe and analysis the basic concept of differential calculus, vector calculus and solve related problems. (Cognitive Level: Analyze)

CLO3 Apply the differential calculus to compute the problems of successive differentiation and partial differentiation. (Cognitive Level: Apply)

CLO4 Discuss and demonstrate the fundamentals of curvature, asymptotes, & concavity and trace the standard curves. (Cognitive Level: Create)

CLO5 Utilize the knowledge of circle, parabola, & ellipse and apply to compute the problems related to conic sections. (Cognitive Level: Evaluate)

Mapping of COURSE LEARNING OUTCOMES (CLOs) with Program Learning Outcomes (PLOs)

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO10	PLO11	PLO12
CLO 1	3	--	2	--	3	--	1	--	--	1	3	--
CLO 2	--	2	--	2	--	--	--	--	1	--	--	2
CLO 3	2	--	3	--	1	--	2	--	--	3	--	--
CLO 4	--	--	3	--	--	3	--	2	1	--	--	**1**
CLO 5	2	--	--	--	2	--	3	--	2	--	2	--

Each Course Learning Outcome (CLO)may be mapped with one or more Program Learning Outcomes (PLOs). Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level' mapping.

Detailed Syllabus:

UNIT-1: Algebra of Matrices (10 hours)

Matrix Algebra including rank, inverse, linear system of equation, Eigen value & Caley-Hamilton Theorem; Team working and management.

UNIT-2: Introduction to Differential Calculus (10 hours)

Differentiation and partial differentiation, derivative of sum, dot product and cross product of two vectors, gradient, divergence, and curl.

UNIT-3: Successive and Partial Differentiations (10 hours)

Successive differentiation, Leibnitz theorem, partial differentiation.

UNIT-4: Differential Calculus for curvatures (10 hours)

Curvature, asymptotes, singular points, concavity, points of inflexion and tracing of Cartesian curve, Differential equation of first order.

UNIT-5: Coordinate Geometry (10 hours)

System of circles, standard equations and properties of parabola and Ellipse; General equation of second degree in two variables, tracing of conic sections, sphere.

Reference Books

1. Jain, R. K. and Iyengar, S. R. K., "Advanced Engineering Mathematics", Narosa, 2003.
2. Ramana, "Higher Engineering mathematics", TMH.
3. B.S. Grewal, "Elementary Engineering Mathematics", 34th Ed., 1998.

Teaching-Learning Strategies in brief

1. Build positive and peaceful environment in the classroom.
2. Provide testing pathway for the knowledge of the subject.
3. Provide subject materials to develop and explore different perspectives.
4. Encourage students for reasoning when solving problems.
5. Motivate the students to develop learning and thinking process.

Assessment methods and weightages in brief

1. By taking two sessional examinations.
2. By giving assignments.
3. By conducting class tests.
4. By taking semester examination.
5. Internal assessment (25 Marks) & Semester Examination (75 Marks) &Total Marks-100.

Name of the Academic Program: Bachelor of Science (Hons) Computer Science - (B.Sc.(H))
Course Code: BSC-104 **Title of the Course:** Communication Skills
L-T-P: 2-0-0 **Credits**: - 02
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

COURSE LEARNING OUTCOMES (CLOs)

After completing this Course, the students should be able to:

CLO1 To understand about the rules of Grammar (Cognitive level: Apply)
CLO 2 To study importance, types and nuances of communication in our lives. (Cognitive level: Apply)
CLO 3 To acquire effective reading, writing, speaking and listening skills (Cognitive level: Analyze)
CLO 4 To learn speaking and presentation skills (Cognitive level: Analyze)
CLO 5 To learn to write effective report and design documentation (Cognitive level: Create)

Mapping of COURSE LEARNING OUTCOMES (CLOs) with Program Learning Outcomes (PLOs)

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO 10	PLO 11	PLO 12
CLO 1	3	--	2	1	2	2	--	--	--	1	--	1
CLO 2	3	--	--	2	--	--	2	1	1	--	1	--
CLO 3	1	1	3	2	2	2	--	--	--	1	1	1
CLO 4	--	3	1	--	2	--	--	1	1	--	1	--
CLO 5	2	--	--	2	1	2	2	2	--	1	--	2

Each Course Learning Outcome (CLO)may be mapped with one or more Program Learning Outcomes (PLOs). Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level' mapping.

Detailed Syllabus:

Unit 1: Grammar, Dictionary, and Thesaurus (8 hours)
Review of English Grammar; Written and Spoken language; Common Errors in language; Punctuation (purpose, role, importance and use); Effective use of dictionary, thesaurus, encyclopedia, OED; Figures of speech.

Unit 2: Language, Phonetics, and Writing (10 hours)
Language Skills (listening, Speaking, Reading, Writing); Meaning what you mean; Listening: Effective and efficient listening in various situations (discussions, lectures, news, seminars, speech, telephone calls etc.); Speaking: Phonetics, intonation, accent,

usage; strategies for a good rhetoric; Reading: Purpose; Comprehension; Tactics and strategies for good reading; Writing: Guidelines for good writing; various writing styles (General and technical writing styles).

Unit 3: Effectiveness and Efficiency in Communication (8 hours)

Communication (purpose, role importance, elements); Effective and efficient communication; role of content, context and language; Spoken and written communication Presentation and delivery; Role of speaker and audience.

Unit 4: Presentation Skills (8 hours)

Style and body language; Discussion and presentation skills of conferences meeting, seminars.

Unit 5: Drafting the Documents (8 hours)

General and Technical documents (correspondence applications, letter, resumes, CV), drafts, essays, memos; minutes, notes, proposals, précis, reports, summary, synopsis, references, table of contents, acknowledgements, prologue, epilogue, revision; Use of Audio-Visual Aids: OHP, Slides, Charts, Computers etc.

Text Books

1. Maison, Margaret M., "Examine your English".
2. R S Sharma, "Technical Writing".

Reference Books

1. R. Sudarshanam, "Understanding Technical English".
2. Bansal, R.K. and J. B. Harrison, "Spoken English for India: A Manual of Speech and Phonetics", Hyderabad: Orient Longman, 1983.
3. Lewis, Hedwig. Body Language, "A Guide for Professionals", 2000.

Teaching-Learning Strategies in brief

1. Build positive and peaceful environment in the classroom.
2. Provide testing pathway for the knowledge of the subject.
3. Provide subject materials to develop and explore different perspectives.
4. Encourage students for reasoning when solving problems.
5. Motivate the students to develop learning and thinking process.

Assessment methods and weightages in brief

1. By taking two sessional examinations.
2. By giving assignments.
3. By conducting class tests.
4. By taking semester examination.
5. Internal assessment (25 Marks) & Semester Examination (75 Marks) &Total Marks-100.

Name of the Academic Program: Bachelor of Science (Hons) Computer Science - (B.Sc.(H))
Course Code: BSC-105 **Title of the Course:** Media and Information Literacy Communication
L-T-P: 2-0-0 **Credits**: - 02
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

COURSE LEARNING OUTCOMES (CLOs)

After completing this Course (or unit of a course) the students should be able to:
CLO1 Appraise the different perspectives on Media Education and Literacy (Cognitive level: Analyze)
CLO 2 Interpret the politics of Information Literacy (Cognitive level: Evaluate)
CLO 3 Compare and describe various types of computing devices (Cognitive level: Evaluate)
CLO 4 Assess the nature of Digital Media Content (Cognitive level: Analyze)
CLO 5 Evaluate the different orders of Digital Divide (Cognitive level: Evaluate)

Mapping of COURSE LEARNING OUTCOMES (CLOs) with Program Learning Outcomes (PLOs)

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO10	PLO11	PLO12
CLO 1	-	-	-	-	-	2	-	-	-	2	-	1
CLO 2	-	2	-	-	-	1	-	-	2	-	-	-
CLO 3	1	-	3	-	1	-	3	-	-	-	-	-
CLO 4	-	-	-	-	-	2	-	-	-	-	1	1
CLO 5	-	-	-	-	-	3	-	1	-	-	-	2

Each Course Outcome (COs) may be mapped with one or more Program Learning Outcomes (PLOs). Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low-level' mapping.

Detailed Syllabus:

Unit 1: Media Education and Literacy (8 hours)
Introduction to Media Education, History of Media Education; Perspectives on Media Education: The Inoculation Model, the Demystification Model, the Creative Participation Model.

Unit 2: Information Literacy (8 hours)
Introduction to Information Literacy, The politics of Information Literacy; The fellow Travelers to Information Literacy, Key moments in the History of Information Literacy.

Unit 3: Leveraging the Power of Computing (8 hours)

Introduction to the History of the Delivery of Computing Power; The Closeness of Computing technology, Mainframes, Micro and Personal Computers; Luggable Computers, Portable Computers, Laptop; Pocket Computers, Phones, and the Tablet; Wearable Computing and Augmented Reality Devices.

Unit 4: Digital Media Content (8 hours)

Introduction to Digital Media Content; the nature of Digital Media content; Participatory Culture; Trans media; Converged Content.

Unit 5: Digital Divides (8 hours)

Introduction to Digital Divides; First-Order Digital Divides – Access; Second-Order Digital Divides – Skills; Third-Order Digital Divides – Participation and Outcomes.

Text Books

1. Marcus Leaning, "Media and Information Literacy – An Integrated Approach for the 21st Century" Chandos Publishing (An imprint of Elsevier) 2017.

Reference Books

1. Michael C. Alewine and Mark Canada, "Introduction to Information Literacy for Students", Wiley Blackwell, 2017.
2. Forest Woody Horton Jr., "Overview of Information Literacy Resources Worldwide", UNESCO, 2013.

Teaching-Learning Strategies in brief

1. Cultivate a growth mindset.
2. Provide subject materials to develop and explore different perspectives.
3. Leverage peer-to-peer support.
4. Build positive and peaceful environment in the classroom.
5. Provide subject materials to develop and explore different perspectives.

Assessment methods and weightages in brief

1. By taking two sessional examinations.
2. By giving assignments.
3. By conducting class tests.
4. By taking semester examination.
5. Internal assessment (25 Marks) & Semester Examination (75 Marks) &Total Marks-100.

Name of the Academic Program: - Bachelor of Science (Hons) Computer Science - (B.Sc.(H))
Course Code: BSC 201 **Title of the course:** Introduction to Data Structures
L-T-P: 3-1-0 **Credit:** 04
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

COURSE LEARNING OUTCOMES (CLOs)

After completing this Course, the students should be able to:
CLO1 To impart basic Data Structure Concepts (Cognitive level: Remember)
CLO 2 To introduce the basic concepts of Stacks, Queues, Lists, Trees, and Graphs (Cognitive level: Understand)
CLO 3 To give a brief account of Searching and Sorting Techniques (Cognitive level: Understand)
CLO 4 To implement the operations on stack and queue using any programming language (Cognitive level: Create)
CLO 5 To introduce the applications of tree and graph, their categories and example (Cognitive level: Understand)

Mapping of COURSE LEARNING OUTCOMES (CLOs) with Program Learning Outcomes (PLOs)

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO 10	PLO 11	PLO 12
CLO 1	3	--	2	1	2	2	--	--	--	1	--	1
CLO 2	3	--	--	2	--	--	2	1	1	--	1	--
CLO 3	1	1	3	2	2	2	--	--	--	1	1	1
CLO 4	--	3	1	--	2	--	--	1	1	--	1	--
CLO 5	2	--	--	2	1	2	2	2	--	1	--	2

Each Course Learning Outcome (CLO)may be mapped with one or more Program Learning Outcomes (PLOs). Write '3' in the box for 'High-level 'mapping, 2 for 'Medium-level 'mapping, 1 for 'Low'-level 'mapping.

Detailed Syllabus:

Unit 1: Introduction (10 hours)
Data Representation of data, Data types, ADTs and Data Structures, linear and non – linear data structures.
Unit 2: Arrays (10 hours)
Arrays, Structures, and Lists Single and multidimensional arrays, Structures, Static and Dynamic implementation of arrays, Creation, insertion and deletion of linked list, doubly list, circular list etc.
Unit 3: Stack and its operations Stacks and its application (10 hours)

Definition and examples, Implementing Push and Pop operations, Stack using dynamic memory allocation, Use of stack in problem solving, infix, prefix and postfix notations and conversions, Recursion using stack.

Unit 4: Queues (10 hours)

Definition and examples, Sequential and dynamic implementation, Implementation of Insert and remove operations.

Unit 5: Tree, Graph, Searching and Sorting Introduction to tree and graph, Searching techniques (10 hours)

Linear Search, Binary Search, Sorting: Bubble Sort, Quick Sort, Merge Sort, Insertion Sort, Selection Sort.

Reference Books

1. Horowitz, Sahni, Freed, "Fundamentals of Data Structures in C", Silicon Press
2. Kruse R., "Data Structures and Program Design in C", Pearson Education India.
3. Aaron M. Tenenbaum, Moshe J. Augenstein, YedidyahL angsam, "Data Structures Using C and C++, Second edition, PHI, 2009

Teaching-Learning Strategies in brief

1. Cultivate a growth mindset.
2. Provide subject materials to develop and explore different perspectives.
3. Leverage peer-to-peer support.
4. Build positive and peaceful environment in the classroom.
5. Provide subject materials to develop and explore different perspectives.

Assessment methods and weightages in brief

1. By taking two sessional examinations.
2. By giving assignments.
3. By conducting class tests.
4. By taking semester examination.
5. Internal assessment (25 Marks) & Semester Examination (75 Marks) &Total Marks-100.

Name of the Academic Program: - Bachelor of Science (Hons) Computer Science - (B.Sc.(H))
Course Code: BSC 202 **Title of the Course:** Data Communication and Computer Networks Basics
L-T-P: 3-1-0 **Credits**: - 04
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

COURSE LEARNING OUTCOMES (CLOs)

After completing this Course, the students should be able to:

CLO 1 Use and implement Computer Networks and the basic components of a Network system. Illustrate the OSI and TCP/IP models, Demonstrate the functions of each layer (Cognitive Level: Apply)

CLO 2 Discover various communication systems. Illustrate the working of signaling methods and Transmission media (Cognitive Level: Create)

CLO 3 Compare and Contrast the concepts of switching techniques. Types of Internet connections (Cognitive Level: Analyze)

CLO 4 Apply the elements and protocols of the Data link layer. Illustrate various error and flow control techniques. (Cognitive Level: Apply)

CLO 5 Apply the protocols of Transport & Application Layer, Employ the concepts of DNS, E-mail and WWW (Cognitive Level: Apply)

Mapping of COURSE LEARNING OUTCOMES (CLOs) with Program Learning Outcomes (PLOs)

Course Outcomes	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	--	1	--	--	1	--	--	--	3	--	2	--
CLO2	2	--	--	2	--	--	3	--	1	--	--	3
CLO3	--	--	3	--	--	--	2	--	--	3	--	--
CLO4	--	--	3	--	--	3	--	2	--	--	--	**1**
CLO5	2	--	--	--	2	--	2	--	2	--	2	--

Each Course Learning Outcome (CLO)may be mapped with one or more Program Learning Outcomes (PLOs). Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level' mapping.

Detailed Syllabus:

Unit 1: Introduction to Computer Networks (10 hours)
Network definition; network topologies; network classifications; network protocol; layered network architecture; overview of OSI reference model; overview of TCP/IP protocol suite;

Unit 2: Introduction to Data Communication (10 hours)
Analog and digital signal; data-rate limits; digital to digital line encoding schemes; pulse code modulation; parallel and serial transmission; digital to analog modulation-; multiplexing techniques- FDM, TDM; transmission media.

Unit 3: Switching Techniques (10 hours)

Circuit switching; packet switching- connectionless datagram switching, connection-oriented virtual circuit switching; dial-up modems; digital subscriber line; cable TV for data transfer.

Unit 4: Data Link Layer and Multiple Access Protocols (10 hours)

Error detection and error correction techniques; data-link control- framing and flow control; error recovery protocols- stop and wait ARQ, go-back-n ARQ; Point to Point Protocol on Internet; Routing: routing algorithms; network layer protocol of Internet- IP protocol, Internet control protocols.

Unit 5: Transport and Application Layer Functions and Protocols (10 hours)

Transport services- error and flow control, Connection establishment and release three-way handshake; Overview of DNS protocol; overview of WWW &HTTP protocol.

Text Books

1. B. A. Forouzan: Data Communications and Networking, Fourth edition, THM, 2007.

Reference Books

1. Andrew S Tanenbaum: Computer Networks, 4th Edition, Pearson Education
2. William Stallings: Data and computer communications, 7th Edition Pearson Education

Teaching-Learning Strategies in brief:

1. Provide visuals, illustrations, explanations etc.
2. Provide basic and advanced knowledge about the subject.
3. Providing LMS to access study materials across various devices.
4. Encourage the students to ask more & more questions.
5. Motivate the students to develop critical & strategic thinking

Assessment methods and weightages in brief

1. By taking two sessional examinations.
2. By giving assignments.
3. By conducting class tests.
4. By taking semester examination.
5. Internal assessment (25 Marks) & Semester Examination (75 Marks) &Total Marks-100.

Name of the Academic Program: Bachelor of Science (Hons) Computer Science - (B.Sc.(H))
Course Code: BSC 203 **Title of the Course**: Fundamental Concepts of Operating Systems
L-T-P: 3-1-0 **Credits:** 04
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

COURSE LEARNING OUTCOMES (CLOs)

After completing this Course, the students should be able to:
CLO1 Understand the creation of processes and threads and explain the mechanisms of OS to handle processes and their communication. (Cognitive level: Understand)
CLO 2 Apply the algorithms for process scheduling in terms of CPU utilization, compute and analyze efficiency in terms of -Throughput, Turnaround Time, Waiting Time, Response Time (Cognitive level: Analyze)
CLO 3 Discuss, classify and design algorithms for optimal allocation of memory to be processed by increasing memory utilization and the access time. (Cognitive level: Understand)
CLO 4 Apply various Page Replacement Algorithms on a given input string and explain the mechanisms involved in memory and storage management in operating system. (Cognitive level: Apply)
CLO 5 Understand different File Systems and Directory Structures. (Cognitive level: Understand)

Mapping of COURSE LEARNING OUTCOMES (CLOs) with Program Learning Outcomes (PLOs)

	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	3	--	2	1	2	2	--	--	--	1	--	1
CLO2	3	--	--	2	--	--	2	1	1	--	1	--
CLO3	1	1	3	2	2	2	--	--	--	1	1	1
CLO4	--	3	1	--	2	--	--	1	1	--	1	--
CLO5	2	--	--	2	1	2	2	2	--	1	--	2

Each Course Learning Outcome (CLO)may be mapped with one or more Program Learning Outcomes (PLOs). Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level' mapping.

Detailed Syllabus:

Unit 1: Introduction to Operating Systems (10 hours)
Overview of Operating System: Computer System Structure, Operating Systems Structure, Operating System functions; Computing Environments: Traditional Computing, Client-Server Computing, Peer-to-Peer Computing, Web based Computing, and Mobile Computing.
Unit 2: Process Management (10 hours)

Process Management: Process Concept, Process Scheduling, Inter Process Communication, Multithreading; Scheduling Algorithms: FCFS, SJF, RR, and Priority.

Unit 3: Deadlocks and Synchronization (10 hours)

Deadlocks: introduction, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock; Process Synchronization: The Critical-Section Problem, Semaphores, Classic Problems of Synchronization.

Unit 4: Memory Management (10 hours)

Memory management: Swapping, Contiguous Memory Allocation, Paging, Structure of the Page Table, Segmentation; Virtual Memory Management: Demand Paging, Page Replacement Algorithms, Thrashing.

Unit 5: Storage Management (10 hours)

Storage Management: File System, File Concept, Access Method, Directory and Disk Structure, File Sharing; Secondary-Storage Structure: Overview of Mass-Storage Structure, Disk Structure, Disk Scheduling; I/0 Systems: Overview, I/O Hardware, Application I/O Interface.

Text Books

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne: Operating System Concepts. 8th Edition, John Wiley and Sons.

Reference Books

1. William Stallings: Operating Systems Internals and Design Principles, 6th Edition, Prentice Hall.
2. Andrew S Tanenbaum: Modern Operating Systems, 3rd Edition, Prentice Hall.

Teaching-Learning Strategies in brief

1. Cultivate a growth mindset.
2. Provide subject materials to develop and explore different perspectives.
3. Leverage peer-to-peer support.
4. Build positive and peaceful environment in the classroom.
5. Provide subject materials to develop and explore different perspectives.

Assessment methods and weightages in brief

1. By taking two sessional examinations.
2. By giving assignments.
3. By conducting class tests.
4. By taking semester examination.
5. Internal assessment (25 Marks) & Semester Examination (75 Marks) &Total Marks-100.

Name of the Academic Program: Bachelor of Science (Hons) Computer Science - (B.Sc.(H))
Course Code: BSC 204 **Title of the Course:** Elementary Physics
L-T-P: 3-1-0 **Credits:** 04
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

COURSE LEARNING OUTCOMES (CLOs)

After completing this Course, the students should be able to
CLO1 To have basic understanding of crucial elementary sub-fields: Electromagnetic Theory,Wave Optics, Fiber Optics, Lasers and Semiconductor Physics. (Cognitive level: Understand)
CLO 2 To have reasonably detailed analytical skills required for the basic understanding of the sub-fields (Cognitive level: Evaluate)
CLO 3 To have information on modern applications in the sub-fields (Cognitive level: Understand)
CLO 4 To be able to solve simple numericals and draw qualitative diagrams on the covered topics in the course (Cognitive level: Evaluate)
CLO 5 To be able to logically explain the working mechanism of pn junction diode, lasers and optical signal transmission (Cognitive level: Evaluate)

Mapping of COURSE LEARNING OUTCOMES (CLOs) with Program Learning Outcomes (PLOs)

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO 10	PLO 11	PLO 12
CLO 1	3	--	2	1	2	2	--	--	--	1	--	1
CLO 2	3	--	--	2	--	--	2	1	1	--	1	--
CLO 3	1	1	3	2	2	2	--	--	--	1	1	1
CLO 4	--	3	1	--	2	--	--	1	1	--	1	--
CLO 5	2	--	--	2	1	2	2	2	--	1	--	2

Each Course Learning Outcome (CLO)may be mapped with one or more Program Learning Outcomes (PLOs). Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level' mapping.

Detailed Syllabus:

Unit 1: Electromagnetic Theory (10 hours)
Motion of charged particles in crossed electric and magnetic fields, Velocity selector, Gauss law, continuity equation, Inconsistency in Ampere's law, Maxwell's equations.

Unit 2: Wave Optics (10 hours)
Superposition of waves, Interference of light, Young's double slit experiment, Intensity analysis and fringe width in Young's double slit experiment, Introductory ideas about diffraction of light.

Unit 3: Fiber Optics (10 hours)

Total internal reflection, Numerical aperture, step index and graded index fibers, attenuation and dispersion in optical fibers (Qualitative only), applications of optical fibers, optical communication (Block diagram only).

Unit 4: Lasers (10 hours)

Einstein's theory of matter radiation interaction and A and B coefficients, amplification of light by population inversion, different types of lasers: He-Ne, Ruby, Properties of laser beams: monochromaticity, coherence, directionality and brightness, Applications of lasers.

Unit 5: Semiconductor Physics (10 hours)

Energy bands in solids, Intrinsic and extrinsic semiconductors, P-N junction, Forward and reverse bias, V-I characteristics, Mobility of electrons and holes, Drift velocity, Electrical conductivity, resistivity, Zener diode: mechanism, application, avalanche and zener breakdown.

Reference Books

1. Malik and Singh, "Engineering Physics", Mc Graw Hill, 2017
2. Ghatak, "Optics", McGraw Hill Education, 2012
3. David Griffiths, "Introduction to Electrodynamics"
4. D. Neamen, D. Biswas, "Semiconductor Physics and Devices," McGraw Hill Education

Teaching-Learning Strategies in brief

1. Cultivate a growth mindset.
2. Provide subject materials to develop and explore different perspectives.
3. Leverage peer-to-peer support.
4. Build positive and peaceful environment in the classroom.
5. Provide subject materials to develop and explore different perspectives.

Assessment methods and weightages in brief

1. By taking two sessional examinations.
2. By giving assignments.
3. By conducting class tests.
4. By taking semester examination.
5. Internal assessment (25 Marks) & Semester Examination (75 Marks) &Total Marks-100.

Name of the Academic Program: Bachelor of Science (Hons) Computer Science - (B.Sc.(H))
Course Code: BSC ES **Title of the Course:** Environmental Studies
L-T-P: 2-0-0 **Credits:** 00
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

COURSE LEARNING OUTCOMES (CLOs)

After the completion of the course, the student would be able to:
CLO1 Get the information about ecosystem and also about its functions like Food chain, Ecological pyramids etc. (Cognitive level: Understand)
CLO 2 Get the knowledge about the different types of resources like land, water, mineral and energy and also about the effects of environment by the usage of these resources. (Cognitive level: Understand)
CLO 3 Gain the knowledge about the ecosystem diversity, its values and also about the importance of the endemic species and different techniques involved in its conservation (Cognitive level: Understand)
CLO 4 Gain the knowledge about the different types of pollutions and their control technologies, Waste water treatment, Bio medical waste management etc. (Cognitive level: Understand)
CLO 5 Get the complete information about EIA- Environmental Impact Assessment, Sustainable developmental activities, environmental policies and regulations, awareness among people about protection of wild life, forest and other natural resources. (Cognitive level: Understand)

Mapping of COURSE LEARNING OUTCOMES (CLOs) with Program Learning Outcomes (PLOs)

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO 10	PLO 11	PLO 12
CLO 1	3	--	2	1	2	2	--	--	--	1	--	1
CLO 2	3	--	--	2	--	--	2	1	1	--	1	--
CLO 3	1	1	3	2	2	2	--	--	--	1	1	1
CLO 4	--	3	1	--	2	--	--	1	1	--	1	--
CLO 5	2	--	--	2	1	2	2	2	--	1	--	2

Each Course Learning Outcome (CLO)is mapped with one or more Program Learning Outcomes (PLOs); where in '3' denotes 'High-level' mapping, 2 denotes 'Medium-level' mapping, and 1 denotes 'Low'-level' mapping.

Detailed Syllabus:

Unit 1: Introduction to environmental studies (8 hours)

Multidisciplinary nature of environmental studies; Scope and importance; Concept of sustainability and sustainable development

Unit 2: Concept of ecology and ecosystem (8 hours)

Structure and function of ecosystem; Energy flow in an ecosystem; food chains, food webs; Basic concept of population and community ecology; ecological succession

Unit 3: Natural Resources (8 hours)

Concept of Renewable and Non-renewable resources; Land resources, Land degradation, soil erosion and desertification; Deforestation; Water: Use and over-exploitation of surface and ground water, floods, droughts

Unit 4: Environmental Pollution (8 hours)

Environmental pollution: concepts and types; Air, water, soil, noise and marine pollution-causes, effects and controls; Concept of hazards waste and human health risks; Solid waste management: Control measures of Municipal, biomedical and e-waste

Unit 5: Case study (10 hours)

Discussion of real-life cases that have an impact on the natural environment

Text/ Reference Books

1. Asthana, D. K. (2006). Text Book of Environmental Studies. S. Chand Publishing.
2. Basu, M., Xavier, S. (2016). Fundamentals of Environmental Studies, Cambridge University Press, India

Teaching-Learning Strategies in brief:

1. Build positive environment in the classroom.
2. Provide concrete basic and advanced knowledge of the subject.
3. Solve problems based on the basic & advanced concepts of the subject.
4. Encourage to the students to ask more & more questions.
5. Motivate to the students to develop critical & strategic thinking.

Assessment methods and weightages:

1. By taking two sessional examinations.
2. By giving assignments.
3. By conducting class tests.
4. By taking semester examination.
5. Internal assessment (25 Marks) & Semester Examination (75 Marks) &Total Marks-100.

Name of the Academic Program: Bachelor of Science (Hons) Computer Science - (B.Sc.(H))
Course Code: BSC 301 **Title of the Course:** Discrete Structures
L-T-P: 3-1-0 **Credits**: 04
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

COURSE LEARNING OUTCOMES (CLOs)

Upon successful completion of this course, students will be able to:

CLO1 Differentiate between different programming approaches and its pros and cons. (Cognitive level: Understand)

CLO 2 Recognize features of object-oriented design such as encapsulation, polymorphism, inheritance, and composition of systems based on object identity. (Cognitive level: Understand)

CLO 3 Name and apply some common object-oriented design patterns and analyses real world problems to use the features of OOP. (Cognitive level: Analyze)

CLO 4 Know how to reuse the code and apply polymorphism in programing. (Cognitive level: Understand)

CLO 5 Enhances their logical ability to optimize their programming skills and create state of art software to solve real-world problems. (Cognitive level: Apply)

Mapping of COURSE LEARNING OUTCOMES (CLOs) with Program Learning Outcomes (PLOs)

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO 10	PLO 11	PLO 12
CLO 1	3	--	2	1	2	2	--	--	--	1	--	1
CLO 2	3	--	--	2	--	--	2	1	1	--	1	--
CLO 3	1	1	3	2	2	2	--	--	--	1	1	1
CLO 4	--	3	1	--	2	--	--	1	1	--	1	--
CLO 5	2	--	--	2	1	2	2	2	--	1	--	2

Each Course Outcome (COs) may be mapped with one or more Program Learning Outcomes (PLOs). Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low-level' mapping.

Detailed Syllabus:

Unit 1: Principles of Object-Oriented Programming (OOP) (10 hours)

Concepts of procedure, structured, and object-oriented programming; features and advantage of OOP methodologies, Applications of OOP.

Unit 2: Characteristics of OOP languages (10 hours)

Objects, Classes, Data Abstraction, Encapsulation, Inheritance, Reusability, Polymorphism and Operator Overloading, Function Overloading, Function Overriding, Message Passing between Objects.

Unit 3: Introduction to C++ (10 hours)

Keywords, Data types, Constants, Variables, Expressions and Statements, Operators; Control Statements: if, if-else, switch-case; Repetitive Statements: for, while, do-while; Pointers, Arrays and Strings, Reference variable, Scope Resolution Operator, Namespaces, Break and Continue, Storage Classes, Structure and Union, Enumeration.

Unit 4: Functions in C++ (10 hours)

Parameter Passing, Recursive Function, Friend Functions and Classes, Inline Functions, Function Overloading, Function Overriding, Operator Overloading and Type Conversion; Classes and Objects; Constructors and Destructors, this-pointer, new and delete.

Unit 5: Inheritance and special concepts of C++ (10 hours)

Single Inheritance, Multilevel inheritance, Multiple inheritance, Hierarchical Inheritance, Hybrid Inheritance; Pointers, Virtual Functions and Polymorphism, Introduction of Exception Handling, Templates, Streams and File Handling.

Text books

1. E Balaguruswamy, "Object oriented programming with C++", Eighth Edition, Tata McGraw Hill.

Reference books

1. E Bjarne Stroustrup, "The C++ Programming Language", Special Edition, Pearson Education.
2. Bruce Eckel, "Thinking in C++", 2nd Edition, Pearson Education

Teaching-Learning Strategies in brief

This course will be of a minimum of 40 contact hours, which typically include interactive group teaching, co-curriculars, individual meetings, and in-class presentations and exams. Students will receive individualized developmental feedback on their works for this course. Moreover, students are required to attend and participate in all the formal and timetabled sessions for this course. Besides these, students are also expected to manage their directed learning and independent study in support of the course.

Assessment methods and weightages in brief

1. By taking two sessional examinations.
2. By giving assignments.
3. By conducting class tests.
4. By taking semester examination.
5. Internal assessment (25 Marks) & Semester Examination (75 Marks) &Total Marks-100.

Name of the Academic Program: Bachelor of Science (Hons) Computer Science - (B.Sc.(H))

Course Code: BSC 302 **Title of the Course**: Introduction to Database Management System

L-T-P: 3-1-0 **Credits:** 04

(L=Lecture hours, T=Tutorial hours, P=Practical hours)

COURSE LEARNING OUTCOMES (CLO):

Upon successful completion of this course, students will be able to

CLO1 Analyze database concepts, different database models, and database management systems (Cognitive Level : Analyze)

CLO 2 Design the databases for a given specification of the requirement using ER method (Cognitive Level :Create)

CLO 3 Develop SQL (Structured Query Language) statements to create, manipulate, and query databases. (Cognitive Level : Apply)

CLO 4 Identify database management issues including data integrity, security, and recovery. (Cognitive Level : (Analyze)

CLO 5 Design and develop Enterprise database (Cognitive Level : Create)

Mapping of COURSE LEARNING OUTCOMES (CLOs) with Program Outcomes (PLOs)

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO10	PLO11	PLO12
CLO 1	3	--	2	1	2	2	--	--	--	1	--	1
CLO 2	3	--	--	2	--	--	2	1	1	--	1	--
CLO 3	1	1	3	2	2	2	--	--	--	1	1	1
CLO 4	--	3	1	--	2	--	--	1	1	--	1	--
CLO 5	2	--	--	2	1	2	2	2	--	1	--	2

Each Course Outcome (COs) may be mapped with one or more Program Learning Outcomes (PLOs). Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low-level' mapping.

Unit 1: Introduction & Database System Architecture (10 hours)

Overview of Database Management System, DBMS architecture, Characteristics of database approach, Various views of data, data models, Schemes, data independence, Advantages of DBMS over file processing systems, Responsibility of database administrator, Introduction to Database Languages & Environments.

Unit 2: E-R Modeling (10 hours)

Entity types, Entity set, attribute and key, relationships, relation types, roles and structural constraints, weak entities, enhanced E-R and object modeling, Sub classes; Super classes, inheritance, specialization and generalization.

Unit 3: Relational Data Model **(10 hours)**

Relational model concepts, relational constraints, relational algebra SQL: SQL queries, programming using SQL. EER and ER to relational mapping: Data base design using EER to relational language.

Unit 4: Transaction Processing Concepts **(10 hours)**

Transaction system, testing of serializability, Serializability of schedules, Conflict & view serializable schedule, recoverability, Recovery from transaction failures, log-based recovery, Checkpoints, deadlock handling.

Unit 5: Data Normalization **(10 hours)**

Functional Dependencies, Normal form up to 3rd normal form. Concurrency Control Techniques: Concurrency control, locking Techniques for concurrency control, Time stamping protocols for concurrency control, validation-based protocol, multiple granularity, Multi-version Schemes, Recovery with concurrent transaction.

Text books

1. Abraham Silberschatz, Henry Korth, S.Sudarshan, "Database Systems Concepts", McGraw-Hill.
2. Date C J, "An Introduction to Database System", Addison Wesley.

Reference books

1. R. Elmasri, S. Navathe, "Fundamentals of Database Systems", Pearson Education.
2. Jim Melton, Alan Simon, "Understanding the new SQL: A complete Guide", Morgan Kaufmann Publishers.
3. A.K.Majumdar, P. Bhattacharya, "Database Management Systems", TMH.

Teaching-Learning Strategies in brief

1. Build positive environment in the classroom.
2. Provide concrete basic and advanced knowledge of the subject.
3. Solve problems based on the basic & advanced concepts of the subject.
4. Encourage to the students to ask more & more questions.
5. Motivate to the students to develop critical & strategic thinking.

Assessment methods and weightages in brief

1. By taking two sessional examinations.
2. By giving assignments.
3. By conducting class tests.
4. By taking semester examination.
5. Internal assessment (25 Marks) & Semester Examination (75 Marks) &Total Marks-100.

Name of the Academic Program: Bachelor of Science (Hons) Computer Science - (B.Sc.(H))
Course Code: BSC 303 **Title of the Course:** Discrete Structures
L-T-P: 3-1-0 **Credits**: 04
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

COURSE LEARNING OUTCOMES (CLOs)

After completing this Course, the students should be able to:
CLO1 Express a given logic sentence in terms of predicates, logical connectives, and quantifiers (Cognitive Level: Apply)
CLO 2 Derive the solution for a given problem using deductive logic and prove the solution based on logical inferences (Cognitive Level: Create)
CLO 3 Classify the algebraic structure for a given a mathematical problem. (Cognitive Level:Understand)
CLO 4 Evaluate Boolean functions and simplify expressions using the properties of Boolean algebra. (Cognitive Level: Evaluate)
CLO 5 Perform operations and algebra on sets, determine properties of relations, identify functions, and determine their properties. . (Cognitive Level: Understand)

Mapping of COURSE LEARNING OUTCOMES (CLOs) with Program Learning Outcomes (PLOs)

	PLO 1	**PLO 2**	**PLO 3**	**PLO 4**	**PLO 5**	**PLO 6**	**PLO 7**	**PLO 8**	**PLO 9**	**PLO1 1**	**PLO1 2**
CLO 1	3	--	2	1	2	2	--	--	--	1	--
CLO 2	3	--	--	2	--	--	2	1	1	--	1
CLO 3	1	1	3	2	2	2	--	--	--	1	1
CLO 4	--	3	1	--	2	--	--	1	1	--	1
CLO 5	2	--	--	2	1	2	2	2	--	1	--
CO6	3	--	2	1	2	2	--	--	--	1	--

Each Course Learning Outcome (CLO)may be mapped with one or more Program Learning Outcomes (PLOs). Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level' mapping.

Detailed Syllabus:

Unit 1: Introduction to prepositional calculus (10 hours)
Introduction to prepositional calculus: Statements, logical operations; truth tables of logical identities, Equivalence of logical identities, Tautologies and contradiction, Negation and De Morgan's law, Conditional and biconditional; Introduction to Boolean algebra: Basic definition and theorems, Boolean expressions, Sum-Of-Products form.
Unit 2: Sets and related operations (10 hours)

Cardinality, Union, Intersection, Complement, Difference, Symmetric Difference, Cartesian Product, subset, superset, power set. Venn diagram, Algebra of Sets, Duality; Properties of operators: commutative, associative, distributive; De Morgan's law, Standard sets.

Unit 3: Relations and their properties (10 hours)

Properties of relation: reflexive, irreflexive, symmetric, asymmetric, antisymmetric, transitive; Matrix of relations, relations represented as digraph, Equivalence relation, partition and equivalence class.

Unit 4: Functions and its properties (10 hours)

Types of functions: One-to-one, onto, into, everywhere defined, Domain and range, Invertible functions, Composition of functions.

Unit 5: Introduction to recurrence relation (10 hours)

Homogeneous and non-homogeneous recurrence relations, Order and degree of a recurrence relation, Formulation of recurrence relations, Characteristic relation, Solution of recurrence relations.

Reference Books

1. Keneth H. Rosen, *"Discrete Mathematics and Its Applications"*, TMH.
2. C.L. Liu, *"Elements of Discrete Mathematics",* TMH
3. Kolman, Busby & Ross, *"Discrete Mathematical Structures"*, PHI
4. Narsingh Deo *"Graph Theory With Application to Engineering and Computer Science"*, PHI.
5. J. P. Trembly & P. Manohar, *"Discrete Mathematical Structures with Applications to Computer Science"*, McGraw Hill.

Teaching-Learning Strategies in brief

This course will be of a minimum of 40 contact hours, which typically include interactive group teaching, co-curriculars, individual meetings, and in-class presentations and exams. Students will receive individualised developmental feedback on their works for this course. Moreover, students are required to attend and participate in all the formal and timetabled sessions for this course. Besides these, students are also expected to manage their directed learning and independent study in support of the course.

Assessment methods and weightages in brief

1. By taking two sessional examinations.
2. By giving assignments.
3. By conducting class tests.
4. By taking semester examination.
5. Internal assessment (25 Marks) & Semester Examination (75 Marks) &Total Marks-100.

Name of the Academic Program: Bachelor of Science (Hons) Computer Science - (B.Sc.(H))
Course Code: BSC PE311 **Title of the Course:** Introduction to Wireless (Communication-PE-1)
L-T-P: 3-1-0 **Credits:** 04
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

COURSE LEARNING OUTCOMES (CLOs)

After completing this Course, the students should be able to:
CLO1 An understanding on functioning of wireless communication system and evolution of different wireless communication systems and standards. (Cognitive level: Understand)
CLO 2 An ability to compare recent technologies used for wireless communication. (Cognitive level: Analyze)
CLO 3 An ability to explain the architecture, functioning, protocols, capabilities and application of various wireless communication networks. (Cognitive level: Evaluate)
CLO 4 An ability to explain multiple access techniques for Wireless Communication (Cognitive level: Analyze)
CLO 5 An ability to evaluate design challenges, constraints and security issues associated with Ad-hoc wireless networks. (Cognitive level: Evaluate)

Mapping of COURSE LEARNING OUTCOMES (CLOs) with Program Learning Outcomes (PLOs)

	PLO 1	**PLO 2**	**PLO 3**	**PLO 4**	**PLO 5**	**PLO 6**	**PLO 7**	**PLO 8**	**PLO 9**	**PLO 10**	**PLO 11**	**PLO 12**
CLO 1	3	--	2	1	2	2	--	--	--	1	--	1
CLO 2	3	--	--	2	--	--	2	1	1	--	1	--
CLO 3	1	1	3	2	2	2	--	--	--	1	1	1
CLO 4	--	3	1	--	2	--	--	1	1	--	1	--
CLO 5	2	--	--	2	1	2	2	2	--	1	--	2

Each Course Learning Outcome (CLO)may be mapped with one or more Program Learning Outcomes (PLOs). Write '3' in the box for 'High-level 'mapping, 2 for 'Medium-level 'mapping, 1 for 'Low'-level 'mapping.

Detailed Syllabus:

Unit 1: Introduction (10 hours)
Introduction to Basic Principles Liberalization of communications Industry, Digitalization of content, changes in spectrum management, cellular reuse, drive towards broadband, Evolution of mobile communications, mobile radio systems- Examples, trends in cellular radio and personal communications.
Unit 2: Cellular Concept (10 hours)

Cellular Concept Frequency reuse, channel assignment, hand off, Interference and system capacity, tracking and grade of service, Improving Coverage and capacity in Cellular systems. Cellular telephony: frequency reuse principle, transmitting, receiving, roaming, GSM network architecture, GSM channel structure, GPRS.

Unit 3: Propagation Models (10 hours)

Mobile radio propagation Free space propagation model, reflection, diffraction, scattering, link budget design, Outdoor Propagation models, Indoor propagation models, small scale Multipath propagation, Impulse model, small scale Multipath measurements, parameters of Mobile multipath channels, types of small-scale fading, statistical models for multipath fading channels.

Unit 4: Second & Third Gen Networks (10 hours)

Second and Third Generation Wireless Networks and Standards WLL, Bluetooth. AMPS, GSM, IS-95 and DECT Satellite networks: orbits, footprint, categories of satellites. Multiple Access Techniques: FDMA, TDMA, CDMA, SDMA, Capacity of Cellular CDMA and SDMA.

Unit 5: Mobile Internet Key Services (10 hours)

Introducing the Mobile Internet Key Services for the mobile Internet, Business opportunities. WAP: the Mobile Internet Standard: Challenges and Pitfalls, Overview of the Wireless Application Protocol, Implementing WAP Services: The Wireless Markup Language, Enhanced WML: WML Script and WTAI

Reference books

1. W.C.Y.Lee, "Mobile Communications Engineering: Theory and applications", Second Edition, McGraw-Hill International, 1998.
2. Stephen G. Wilson, "Digital Modulation and Coding", Pearson Education, 2003.

Teaching-Learning Strategies in brief:

1. Cultivate a growth mindset.
2. Provide subject materials to develop and explore different perspectives.
3. Leverage peer-to-peer support.
4. Build positive and peaceful environment in the classroom.
5. Provide subject materials to develop and explore different perspectives.

Assessment methods and weightages in brief:

1. By taking two sessional examinations.
2. By giving assignments.
3. By conducting class tests.
4. By taking semester examination.
5. Internal assessment (25 Marks) & Semester Examination (75 Marks) &Total Marks-100.

Name of the Academic Program: - Bachelor of Science (Hons) Computer Science - (B.Sc.(H))
Course Code: BSC-401 **Title of the Course:** Fundamentals of Probability and Statistics
L-T-P: 3-1-0 **Credits**: - 04
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

COURSE LEARNING OUTCOMES (CLOs)

After completing this Course, the students should be able to:

CLO1 Understand and apply the fundamental concept of probability in computer science. (Cognitive Level: Understand)

CLO2 Discuss and solve the problems related to probability, probability distributions. (Cognitive Level: Create)

CLO3 Analyze and compute the problems associated with measure of central tendency like mean, mode and median. (Cognitive Level: Analyze)

CLO4 Define and solve the problems related to measures of dispersions like range, mean deviation, standard deviation. (Cognitive Level: Evaluate)

CLO5 Understand and apply the principles of correlation and regression in real life or practical problems. (Cognitive Level: Apply)

Mapping of COURSE LEARNING OUTCOMES (CLOs) with Program Learning Outcomes (PLOs)

	PLO 1	**PLO 2**	**PLO 3**	**PLO 4**	**PLO 5**	**PLO 6**	**PLO 7**	**PLO 8**	**PLO 9**	**PLO 10**	**PLO 11**	**PLO 12**
CLO 1	3	--	2	1	2	2	--	--	--	1	--	1
CLO 2	3	--	--	2	--	--	2	1	1	--	1	--
CLO 3	1	1	3	2	2	2	--	--	--	1	1	1
CLO 4	--	3	1	--	2	--	--	1	1	--	1	--
CLO 5	2	--	--	2	1	2	2	2	--	1	--	2

Each Course Learning Outcome (CLO)may be mapped with one or more Program Learning Outcomes (PLOs). Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level' mapping.

Detailed Syllabus:

UNIT-1: Overview of Probability (10 hours)
Introduction, Events & Different Types of Events, Addition & Multiplication Law, Conditional Probability, Bayes' Theorem.

UNIT-2: Probability Distribution (10 hours)
Random Variables, Expectation of Discrete Random Variables & Its Properties Continuous & Discrete Probability Function, Binomial, Poison & Normal Distribution.

UNIT-3: Measures of Central Tendency (10 hours)

Definition, Function & Scope of Statistics, Arithmetic Mean, Weighted A.M., Median, Mode, Geometric & Harmonic Mean and Their Merits & Demerits.

UNIT-4: Measures of Variation (10 hours)

Measures of Variation: Range, The Interquartile Range or Quartile Deviation, Average (Mean), Deviation Standard Deviation, Coefficient of Variation, Skew ness, Moments & Kurtosis.

UNIT-5: Correlation and Regression Analysis (10 hours)

Introduction, Karl Pearson's Coefficient of Correlation, Rank Correlation Coefficient, Regression Analysis: Difference Between Correlation & Regression, Regression Lines, Regression Equations, Regressions Coefficient.

Reference Books

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

2. N.P. Bali and Manish Goyal, A textbook of Engineering Mathematics, Laxmi Publications, Reprint, 2010.

3. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003 (Reprint).

4. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.

Teaching-Learning Strategies in brief

1. Build positive and peaceful environment in the classroom.
2. Provide testing pathway for the knowledge of the subject.
3. Provide subject materials to develop and explore different perspectives.
4. Encourage students for reasoning when solving problems.
5. Motivate the students to develop learning and thinking process.

Assessment methods and weightages in brief

1. By taking two sessional examinations.
2. By giving assignments.
3. By conducting class tests.
4. By taking semester examination.
5. Internal assessment (25 Marks) & Semester Examination (75 Marks) &Total Marks-100.

Name of the Academic Program: Bachelor of Science (Hons) Computer Science - (B.Sc.(H))
Course Code: BSC 402 **Title of the Course:** Introduction to Artificial Intelligence
L-T-P: 3-1-0 **Credits:** 04
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

COURSE LEARNING OUTCOMES (CLOs)

After completing this Course, the students should be able to:
CLO1 Develop a basic understanding of the building blocks of AI as presented in terms of intelligent agents: Search, inference and logic. (Cognitive level: Create)
CLO 2 To have an understanding of the basic issues of knowledge representation and blind and heuristic search, as well as an understanding of other topics such as minimax, resolution, etc. that play an important role in AI programs. (Cognitive level: Understand)
CLO 3 To have a basic understanding of some of the more advanced topics of AI such as learning, natural language processing, agents and robotics, expert systems, and planning. (Cognitive level: Understand)
CLO 4 To understand the basic of knowledge representation using propositional logic and in programming, introduction of uncertainty and probability (Cognitive level: Understand)
CLO 5 To apply decision tree, neural network and natural language processing concepts in the context of artificial intelligence. (Cognitive level: Apply)

Mapping of COURSE LEARNING OUTCOMES (CLOs) with Program Learning Outcomes (PLOs)

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO 10	PLO 11	PLO 12
CLO 1	3	--	2	1	2	2	--	--	--	1	--	1
CLO 2	3	--	--	2	--	--	2	1	1	--	1	--
CLO 3	1	1	3	2	2	2	--	--	--	1	1	1
CLO 4	--	3	1	--	2	--	--	1	1	--	1	--
CLO 5	2	--	--	2	1	2	2	2	--	1	--	2

Each Course Learning Outcome (CLO)may be mapped with one or more Program Learning Outcomes (PLOs). Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level' mapping.

Detailed Syllabus:

Unit 1: Overview of Artificial Intelligence (10 hours)

Introduction to AI, Importance of AI, AI and its related field, AI techniques, Criteria for success; Scope of Artificial Intelligence, intelligent agents; Expert systems.

Unit 2: Problem Solving (10 hours)

Problems, problem space and search: Defining the problem as a state space search, Production system and its characteristics, Issues in the design of the search problem, Solving Problems by Searching, heuristic search techniques, constraint satisfaction problems, stochastic search methods.

Unit 3: Game Playing and Knowledge (10 hours)

Minimax, alpha-beta pruning; Knowledge: Definition and importance of knowledge, Knowledge representation, Various approaches used in knowledge representation, Issues in knowledge representation**.**

Unit 4: Knowledge Representation and Reasoning (10 hours)

Building a Knowledge Base: Propositional logic, first order logic, situation calculus, theorem proving in First Order Logic; Planning, partial order planning; Uncertain Knowledge and Reasoning, Probabilities, Bayesian Networks.

Unit 5: Learning (10 hours)

Overview of different forms of learning, Learning Decision Trees, Neural Networks; Introduction to Natural Language Processing.

Reference books

1. D.W. Patterson, "Introduction to AI and Expert Systems", PHI
2. Nils J Nilsson,"Artificial Intelligence -A new Synthesis" Harcourt Asia Ltd
3. E. Rich and K. Knight: Artificial intelligence, TMH

Teaching-Learning Strategies in brief

Initially classes were held offline, later the classes were held online via Google meet. The links are being generated and sent to classes in the initial period of session which has the provision recurrent occurrence throughout the session. The slides using Microsoft PPT, video via Loom and live lectures were considered for transformation of knowledge. To make student involved, question answer sessions were encouraged.

Assessment methods and weightages in brief

1. By taking two sessional examinations.
2. By giving assignments.
3. By conducting class tests.
4. By taking semester examination.
5. Internal assessment (25 Marks) & Semester Examination (75 Marks) &Total Marks-100.

Name of the Academic Program: Bachelor of Science (Hons) Computer Science - (B.Sc.(H))
Course Code: BSC SEE411 **Title of the Course:** Internet and Web Technology
L-T-P: 3-1-0 **Credits:** 04
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

COURSE LEARNING OUTCOMES (CLOs)

CLO1 Understand fundamental tools and technologies and protocols governing the web (Cognitive level: Understand)
CLO 2 Analyze a web page and identify its elements and attributes. (Cognitive level: Analyze)
CLO 3 Build dynamic web pages using JavaScript (Client side programming). (Cognitive level: Create)
CLO 4 Create web pages using HTML and Cascading Style Sheets. (Cognitive level: Create)
CLO 5 Develop an understanding of electronic commerce and emerging internet trends. (Cognitive level: Create)

Mapping of COURSE LEARNING OUTCOMES (CLOs) with Program Learning Outcomes (PLOs)

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO 10	PLO 11	PLO 12
CLO 1	3	--	2	1	2	2	--	--	--	1	--	1
CLO 2	3	--	--	2	--	--	2	1	1	--	1	--
CLO 3	1	1	3	2	2	2	--	--	--	1	1	1
CLO 4	--	3	1	--	2	--	--	1	1	--	1	--
CLO 5	2	--	--	2	1	2	2	2	--	1	--	2

Each Course Learning Outcome (CLO)may be mapped with one or more Program Learning Outcomes (PLOs). Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level' mapping.

Detailed Syllabus:

Unit 1: Introduction to Internet and WWW (10 hours)
Introduction to Internet: History of World Wide Web; Protocols governing the web; Understanding the Internet: syntax of URLs, web page and browsers, search engine; Introduction to Cyber Laws in India.
Unit 2: Internet Applications (10 hours)
Internet applications: FTP, Telnet, Email, Chat; Internet addressing: identification of each computer using domain name and IP addresses, DNS.
Unit 3: Formatting Web Pages (10 hours)

Introduction to HTML, XML, DHTML and CSS; Formatting Web Pages with the help of different HTML tags, HTML table, HTML form; using CSS for formatting different objects; using DHTML for dynamic designing of web page.

Unit 4: Java Script (10 hours)

Introduction to Javascript: Advantages of Javascript, Javascript Syntax, documents, forms, Datatype, Variable, Array, Operator and Expression, Looping Constructor, Event Handling, cookies.

Unit 5: E-Commerce and emerging trends (10 hours)

E-Commerce and security issues; Emerging trends: Internet telephony, virtual reality over the web, etc.; Intranet and extranet; firewall design issues.

Reference Books

1. Raymond Greenlaw and Ellen Hepp, "Fundamentals of Internet and World Wide Web", TMH.
2. Ivan Bayross, "Web Technologies Part II", BPB Publications.
3. Thomas A Powell, "HTML The Complete Reference", Tata McGraw Hill Publications.
4. Burdman, "Collaborative Web Development", Addison Wesley.

Teaching-Learning Strategies in brief

1. Computer Aided Presentation
2. Computer Labs/Laptop Instruction
3. Demonstration
4. Direct Instruction

Assessment methods and weightages in brief

1. By taking two sessional examinations.
2. By giving assignments.
3. By conducting class tests.
4. By taking semester examination.
5. Internal assessment (25 Marks) & Semester Examination (75 Marks) &Total Marks-100.

Name of the Academic Program: - Bachelor of Science (Hons) Computer Science - (B.Sc.(H))
Course Code: BSC-501 **Title of the Course:** Fundamentals of Software Engineering
L-T-P: 3-1-0 **Credits**: - 04
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

COURSE LEARNING OUTCOMES (CLOs)

After completing this Course, the students should be able to:
CLO1 Ability to perform Feasibility analysis for Software Project. (Cognitive level: Analyze)
CLO 2 To concentrate more on the efficiency of the designed Software (Cognitive level: Analyze)
CLO 3 Students should be able to manage and plan the Software development processes(Cognitive level: Evaluate)
CLO 4 Analyze that how the different quality attributes effect the nature of Software being designed(Cognitive level: Analyze)
CLO 5 Optimize the implementation and maintenance of the Software delivered. (Cognitive level: Analyze)

Mapping of COURSE LEARNING OUTCOMES (CLOs) with Program Learning Outcomes (PLOs)

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO10	PLO11	PLO12
CLO 1	3	--	2	1	2	2	--	--	--	1	--	1
CLO 2	3	--	--	2	--	--	2	1	1	--	1	--
CLO 3	1	1	3	2	2	2	--	--	--	1	1	1
CLO 4	--	3	1	--	2	--	--	1	1	--	1	--
CLO 5	2	--	--	2	1	2	2	2	--	1	--	2

Each Course Learning Outcome (CLO)may be mapped with one or more Program Learning Outcomes (PLOs). Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level' mapping.

Detailed Syllabus:

Unit 1: Software and Software Engineering (10 hours)
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)
Unit 2: Software Requirement Analysis (10 hours)

Software Requirement Analysis, Initiating Requirement Engineering Process, Requirement Analysis and Modeling Techniques, Flow Oriented Modeling, Need for SRS, Characteristics and Components of SRS.

Unit 3: Software Development Management (10 hours)

Estimation in Project Planning Process, Project Scheduling, Software Risks, Risk Identification, Risk Projection and Risk Refinement, RMMM Plan, Quality Concepts, Software Quality Assurance, Software Reviews, Metrics for Process and Projects.

Unit 4: Design Engineering (10 hours)

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.

Unit 5: Software Testing Strategies & Tactics (10 hours)

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.

Reference Books

1. Pressman S.Roger, Software Engineering, Tata McGraw-Hill.
2. Yogesh Singh, Software Testing, Cambridge University Press.2011.
3. Sommervillelan, Software Engineering, 5th ed., Addison Wesley-2000.
4. Fairley Richard, Software, Software Engineering Concepts, Tata McGraw-Hill.
5. Jalote Pankaj, An integrated approach to software engineering, Narosa Publishing House.

Teaching-Learning Strategies in brief

1. Build positive and peaceful environment in the classroom.
2. Provide testing pathway for the knowledge of the subject.
3. Provide subject materials to develop and explore different perspectives.
4. Encourage students for reasoning when solving problems.
5. Motivate the students to develop learning and thinking process.

Assessment methods and weightages in brief

1. By taking two sessional examinations.
2. By giving assignments.
3. By conducting class tests.
4. By taking semester examination.
5. Internal assessment (25 Marks) & Semester Examination (75 Marks) &Total Marks-100.

Name of the Academic Program: - Bachelor of Science (Hons) Computer Science - (B.Sc.(H))
Course Code: BSC PE312 **Title of the Course:** Introduction to Mobile Computing
L-T-P: 3-1-0 **Credits**: - 04
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

COURSE LEARNING OUTCOMES (CLOs)

CLO 1. To study the basics of wireless, cellular technology. (Cognitive level: Understand)
CLO 2. To analyse the working of Mobile IP, ad hoc network. (Cognitive level: Analyze)
CLO 3. To understand features of mobile operating systems. (Cognitive level: Understand)
CLO 4. To know J2ME, SDK, android that helps the mobile application development. (Cognitive level: Analyze)
CLO 5. To understand the use of M-Commerce application (Cognitive level: Understand)

Mapping of COURSE LEARNING OUTCOMES (CLOs) with Program Learning Outcomes (PLOs)

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO10	PLO11	PLO12
CLO 1	3	--	2	1	2	2	--	--	--	1	--	1
CLO 2	3	--	--	2	--	--	2	1	1	--	1	--
CLO 3	1	1	3	2	2	2	--	--	--	1	1	1
CLO 4	--	3	1	--	2	--	--	1	1	--	1	--
CLO 5	2	--	--	2	1	2	2	2	--	1	--	2

Each Course Learning Outcome (CLO)may be mapped with one or more Program Learning Outcomes (PLOs). Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level' mapping.

Unit 1: Mobile communication Introduction (10 hours)

Basics of Communication Technologies, Mobile handsets, Wireless Communications and Server Applications, Cell phone System, Types of Telecommunication Networks, Components of wireless communication system, Architecture of mobile telecommunication system,

Unit 2: GSM (10 hours)

Introduction to Mobile Computing and Wireless Networking, Define Mobile Computing, Mobile Computing vs. Wireless Networking, Mobile Computing Application, Characteristics of Mobile Computing, Structure of Mobile Computing Application, Cellular

Mobile Communication, Generation of Cellular Communication Technologies, Global System for Mobile communications (GSM).

Unit 3: MANET and DHCP (10 hours)

Mobile IP and Mobile Ad Hoc Networks (MANET) Mobile IP, Packet Delivery, Desirable features of Mobile IP, Key mechanism used in Mobile IP, Route Optimization, Dynamic Host Configuration Protocol(DHCP), significance of DHCP

Unit 4: Operating Systems (10 hours)

Operating Systems for Mobile Computing, A Few Basic Concepts, Special Constraints and Requirements of Mobile OS, A Survey of Commercial Mobile Operating Systems, Windows Mobile, Palm OS, Symbian OS, iOS, Android, Blackberry OS, A Comparative study of Mobile OS, OS for sensor Network.

Unit 5: Emerging Mobile Communication Technology (10 hours)

Mobile Application Development and Protocols Mobile Devices as Web Clients, HDML (Handheld Markup Language), WAP, J2ME - J2ME Configuration, Android Application Development - Software Development Kit (SDK), Features of SDK, Android Application Components, Android Software stack Structure, Advantages of Android. Mobile Commerce, Application of M-Commerce, Business to Consumer(B2C) Applications, Business to Business (B2B) Applications, Structure of M-Commerce, Pros and Cons of M-Commerce, Mobile Payment System, Mobile Payment Schemes, Desirable properties of a Mobile Payment system, Mobile Payment solutions, Process of Mobile Payment, Security Issues.

Text books:

1. Fundamentals of Mobile Computing, Prasant Kumar Pattanaik, Rajib Mall, Second Edition, PHI, ISBN: 978-81-203-5181-3

Reference books:

1. Mobile Computing, ASOKE TALUKDER HASAN AHMED ROOPA R YAVAGAL,Second Edition.Mc GrawHill.

Teaching-Learning Strategies in brief

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2. Provide testing pathway for the knowledge of the subject.
3. Provide subject materials to develop and explore different perspectives.
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Assessment methods and weightages in brief

1. By taking two sessional examinations.
2. By giving assignments.
3. By conducting class tests.
4. By taking semester examination.
5. Internal assessment (25 Marks) & Semester Examination (75 Marks) &Total Marks-100.

Name of the Academic Program: - Bachelor of Science (Hons) Computer Science - (B.Sc.(H))
Course Code: BSC PE313 **Title of the Course:** Web & E-Commerce Technologies
L-T-P: 3-1-0 **Credits**: - 04
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

COURSE LEARNING OUTCOMES (CLOs)

CLO 1. To introduce the concepts of various web technologies. (Cognitive level: Understand)
CLO 2. To impart knowledge related with website designing. (Cognitive level: Remember)
CLO 3. To introduce the concept of E-commerce. (Cognitive level: Understand)
CLO 4. To explain how payments are made on e-commerce sites. (Cognitive level: Remember)
CLO 5. To explain the role of encryption in e-commerce. (Cognitive level: Remember)

Mapping of COURSE LEARNING OUTCOMES (CLOs) with Program Learning Outcomes (PLOs)

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO10	PLO11	PLO12
CLO 1	2	--	2	1	3	2	--	--	--	1	--	1
CLO 2	--	--	--	2	--	--	2	1	1	--	1	--
CLO 3	1	1	3	2	2	2	--	--	--	1	1	1
CLO 4	--	3	1	--	2	--	--	1	1	--	1	--
CLO 5	2	--	--	2	1	2	2	2	--	1	--	2

Each Course Learning Outcome (CLO)may be mapped with one or more Program Learning Outcomes (PLOs). Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level' mapping.

Unit 1: Web Technologies (10 hours)

Introduction to WWW : Protocols, application and development tools, the web browser, What is server, choices, setting up UNIX and Linux web servers. Introduction to HTML : The development process, Html tags and simple HTML forms, web site structure. Style sheets : Need for CSS, introduction to CSS, basic syntax and structure, using CSS, background images, colors and properties.

Unit 2: Encryption (10 hours)

World Wide Web & Security, Encryption, Transaction security, Secret Key Encryption, Public Key Encryption, Virtual Private Network (VPM), Implementation Management Issues.

Unit 3: E-commerce Introduction (10 hours)

What is E-Commerce, Forces behind E-Commerce Industry Framework, Brief history of ECommerce, Architectural framework . Network Infrastructure for E-Commerce Network Infrastructure for E-Commerce, Market forces behind I Way, Component of I way Access Equipment, Global Information Distribution Network, Broad band Telecommunication.

Unit 4: Electronic Payments (10 hours)

Overview of Electronics payments, Digital Token based Electronics payment System, Smart Cards, Credit Card I Debit Card based EPS, Emerging financial Instruments, Home Banking, Online Banking.

Unit 5: Net Commerce (10 hours)

EDA, EDI Application in Business, Legal requirement in E -Commerce, Introduction to supply Chain Management, CRM, issues in Customer Relationship Management

Text books:

1. Steven Holzner,"HTML Black Book", Dremtech press.
2. Web Technologies, Black Book, Dreamtech Press
3. Web Applications : Concepts and Real World Design, Knuckles, Wiley-India
4. Internet and World Wide Web How to program, P.J. Deitel & H.M. Deitel Pearson.
5. Greenstein and Feinman, "E-Commerce", TMH
6. Ravi Kalakota, Andrew Whinston, "Frontiers of Electronic Commerce", Addision Wesley
7. Denieal Amor, " The E-Business Revolution", Addision Wesley
8. Diwan, Sharma, "E-Commerce" Excel
9. Bajaj & Nag, "E-Commerce: The Cutting Edge of Business", TMH

Teaching-Learning Strategies in brief

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5. Motivate the students to develop learning and thinking process.

Assessment methods and weightages in brief

1. By taking two sessional examinations.
2. By giving assignments.
3. By conducting class tests.
4. By taking semester examination.
5. Internal assessment (25 Marks) & Semester Examination (75 Marks) &Total Marks-100.

Name of the Academic Program: - Bachelor of Science (Hons) Computer Science - (B.Sc.(H))
Course Code: BSC PE521 **Title of the Course:** Introduction to Data Mining
L-T-P: 3-1-0 **Credits**: - 04
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

COURSE LEARNING OUTCOMES (CLOs)

CLO 1. To identify the scope and necessity of Data Mining. (cognitive Level: Evaluate)
CLO 2. Describe the designing of Data Mining Techniques. (Cognitive Level: Understand)
CLO 3. To develop ability to understand various algorithms based on data mining tools. (Cognitive Level: Create)
CLO 4. To develop and apply critical thinking, problem-solving, and decision-making skills. (Cognitive Level: Create)
CLO 5. To discover interesting patterns, analyze supervised and unsupervised models and estimate the accuracy of the algorithms. (Cognitive Level: Analyze)

Mapping of COURSE LEARNING OUTCOMES (CLOs) with Program Learning Outcomes (PLOs)

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO10	PLO11	PLO12
CLO 1	--	--	2	1	3	2	--	--	--	1	--	1
CLO 2	2	--	--	2	--	--	2	1	1	--	1	--
CLO 3	1	1	--	2	--	2	--	--	--	1	1	1
CLO 4	--	3	1	--	2	--	--	1	1	--	1	--
CLO 5	2	--	--	2	1	2	2	2	--	1	--	2

Each Course Learning Outcome (CLO)may be mapped with one or more Program Learning Outcomes (PLOs). Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level' mapping.

Unit 1: Data Mining Concepts (10 hours)
Data mining primitives, Basics of data mining, Data Mining Functionalities, Classification of Data Mining Systems, Architectures of data mining system.

Unit 2: Association Rules In Large Databases (10 hours)
Association Rule Mining, Mining Single Dimensional Boolean Association Rules from Transactional Databases, Mining Multilevel Association Rules from Transaction Databases, Mining multidimensional Association Rules from Relational Databases and Data Warehouses, From Association Mining to Correlation Analysis, Constraint Based Association Mining.

Unit 3: Classification And Prediction (10 hours)

Issues Regarding Classification and Prediction, Classification by Decision Tree Induction, Bayesian Classification, Classification by Back propagation, Classification Based on Concepts from Association Rule Mining, Other Classification Methods, Prediction, Classifier Accuracy.

Unit 4: Cluster Analysis In Data Mining (10 hours)

Types of Data in Cluster Analysis. A Categorization of Major Clustering Methods, Partitioning Methods, Density Based Methods, Grid Based Methods, Model Based Clustering Methods, Outlier Analysis.

Unit 5: Data Warehousing and various Issues in Data Mining (10 hours)

Introduction to Data Warehouse, Data warehousing and its characteristics, Online analytical processing (OLAP), characteristics of OLAP system, Scalability and data management issues in data mining algorithms, measures of interestingness

Text Books:

1. Pang-Ning Tan, Michael Steinbach, Vipin Kumar, Introduction to Data Mining, Pearson Education.2005.
2. Richard Roiger, Michael Geatz, Data Mining: A Tutorial Based Primer, Pearson Education 2003.

Reference books:

1. G.K. Gupta, Introduction to Data Mining with Case Studies, PHI, 2006.
2. Soman K P, Diwakar Shyam, Ajay V Insight into Data Mining: Theory and Practice, PHI, 2006.

Teaching-Learning Strategies in brief

1. Build positive and peaceful environment in the classroom.
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3. Provide subject materials to develop and explore different perspectives.
4. Encourage students for reasoning when solving problems.
5. Motivate the students to develop learning and thinking process.

Assessment methods and weightages in brief

1. By taking two sessional examinations.
2. By giving assignments.
3. By conducting class tests.
4. By taking semester examination.
5. Internal assessment (25 Marks) & Semester Examination (75 Marks) &Total Marks-100.

Name of the Academic Program: - Bachelor of Science (Hons) Computer Science - (B.Sc.(H))
Course Code: BSC PE522 **Title of the Course:** Introduction to Cloud Computing
L-T-P: 3-1-0 **Credits**: - 04
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

COURSE LEARNING OUTCOMES (CLOs)

On completion of this course the students will be able to:

CLO 1. Analyze the trade-offs between deploying applications in the cloud and over the local infrastructure. (Cognitive Level: Analyze)
CLO 2. Compare the advantages and disadvantages of various cloud computing platforms. (Cognitive Level: Analyze)
CLO 3. Deploy applications over commercial cloud computing infrastructures such as Amazon Web Services, Windows Azure, and GoogleApp Engine. (Cognitive Level: Create)
CLO 4. Analyze the performance, scalability, and availability of the underlying cloud technologies and software. (Cognitive Level: Analyze)
CLO 5. Identify security and privacy issues in cloud computing. (Cognitive Level: Analyze)
CLO 6. Solve a real-world problem using cloud computing through group collaboration. (Cognitive Level: Evaluate)

Mapping of COURSE LEARNING OUTCOMES (CLOs) with Program Learning Outcomes (PLOs)

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO10	PLO11	PLO12
CLO 1	3	--	2	3	--	2	--	--	--	1	--	2
CLO 2	--	--	--	2	--	--	2	1	1	--	1	--
CLO 3	1	1	3	2	2	2	--	--	--	1	1	1
CLO 4	--	3	1	--	2	--	--	1	1	--	1	--
CLO 5	2	--	--	2	1	2	2	2	--	1	--	2

Each Course Learning Outcome (CLO)may be mapped with one or more Program Learning Outcomes (PLOs). Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level' mapping.

Unit 1: Introduction (10 hours)

Cloud-definition, benefits, usage scenarios, History of Cloud Computing - Cloud Architecture. Cloud service providers, Benefits and limitations of Cloud Computing.Definition, characteristics, components, Cloud service provider, the role of networks in Cloud computing, Cloud computing platforms - IaaS: Amazon EC2, PaaS: Google App Engine, Microsoft Azure, SaaS.

Unit 2: Computing (10 hours)

Cluster Computing, Grid Computing, Grid Computing Versus Cloud Computing, Key Characteristics of Cloud Computing. Cloud Models: Benefits of Cloud Models, Public Cloud, Private Cloud, Hybrid Cloud, Community Cloud, Shared Private Cloud, Dedicated Private Cloud, and Dynamic Private Cloud. Types of Cloud services: Software as a Service - Platform as a Service – Infrastructure as a Service - Database as a Service- Monitoring as a Service – Communication as services. Service providers- Google App Engine, Amazon EC2, Microsoft Azure, Sales force.

Unit 3: Virtualization (10 hours)

Virtualization concepts , Server virtualization, Storage virtualization, Storage services, Network virtualization, Service virtualization, Virtualization management, Virtualization technologies and architectures, virtual machine, Measurement and profiling of virtualized applications. Hypervisors: KVM, Xen, VMware hypervisors and their features.

Unit 4: Cloud file system (10 hours)

Cloud file systems: GFS and HDFS, BigTable, HBase and Dynamo. MapReduce and extensions: Parallel computing, the map-Reduce model, Parallel efficiency of MapReduce, Relational operations using Map-Reduce, Enterprise batch processing using MapReduce.

Unit 5: Cloud Security (10 hours)

Cloud security fundamentals, Vulnerability assessment tool for cloud, Privacy and Security in cloud. Cloud computing security architecture: General Issues, Trusted Cloud computing, Secure Execution Environments and Communications, Micro - architectures; Identity Management and Access control, Autonomic security, Security challenges : Virtualization security management - virtual threats, VM Security Recommendations, VM - Specific Security techniques, Secure Execution Environments and Communications in cloud.

Text Books:

1. Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010
2. Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wile, 2011.
3. Cloud Computing: Principles, Systems and Applications, Editors: Nikos Antonopoulos, Lee Gillam, Springer, 2012

Reference books:

1. Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, Wiley-India, 2010
2. Gautam Shroff, Enterprise Cloud Computing Technology Architecture Applications, 2010.
3. Toby Velte, Anthony Velte, Robert Elsenpeter, Cloud Computing, A Practical

Teaching-Learning Strategies in brief

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3. Provide subject materials to develop and explore different perspectives.

4. Encourage students for reasoning when solving problems.
5. Motivate the students to develop learning and thinking process.

Assessment methods and weightages in brief

1. By taking two sessional examinations.
2. By giving assignments.
3. By conducting class tests.
4. By taking semester examination.
5. Internal assessment (25 Marks) & Semester Examination (75 Marks) &Total Marks-100.

Name of the Academic Program: - Bachelor of Science (Hons) Computer Science - (B.Sc.(H))
Course Code: BSC PE523 **Title of the Course:** Introduction to Data Science & Big Data
L-T-P: 3-1-0 **Credits**: - 04
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

COURSE LEARNING OUTCOMES (CLOs)

Upon successful completion of this course, students will be able to
CLO 1. Understand fundamental tools and technologies od Data Science. (Cognitive Level: Understand)
CLO 2. Analyze Big Data issues and identify solutions (Cognitive Level: Analyze)
CLO 3. Use basic data visualization techniques using Tableau and Power BI, etc. (Cognitive Level: Create)
CLO 4. Will learn basics of No SQL (Cognitive Level: Learn)
CLO 5. Familiar with Hadoop and its related technologies (Cognitive Level: Understand)

Mapping of COURSE LEARNING OUTCOMES (CLOs) with Program Learning Outcomes (PLOs)

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO10	PLO11	PLO12
CLO 1	3	--	2	1	2	2	--	--	--	1	--	1
CLO 2	3	--	--	2	--	--	2	1	1	--	1	--
CLO 3	1	1	3	2	2	2	--	--	--	1	1	1
CLO 4	--	3	1	--	2	--	--	1	1	--	1	--
CLO 5	2	--	--	2	1	2	2	2	--	1	--	2

Each Course Learning Outcome (CLO)may be mapped with one or more Program Learning Outcomes (PLOs). Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level' mapping.

Unit 1: Understanding Big Data (10 hours)

What is big data, why big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies, introduction to Hadoop, open source technologies, cloud and big data mobile business intelligence, Crowd sourcing analytics, inter and trans firewall analytics

Unit 2: No SQL Data Management (10 hours)

Introduction to No SQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schema less databases, materialized views, distribution models, sharding, master-slave replication, peer-peer replication, sharding and replication, consistency, relaxing consistency, version stamps, mapreduce, partitioning and combining, composing map-reduce calculations

Unit 3: Basics Of Hadoop (10 hours)

Data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, design of Hadoop distributed file system (HDFS), HDFS concepts, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization, Avro file-based data structures.

Unit 4: Map Reduce Applications (10 hours)

Map Reduce workflows, unit tests with MRUnit, test data and local tests – anatomy of Map Reduce job run, classic Map-reduce, YARN, failures in classic Map-reduce and YARN, job scheduling, shuffle and sort, task execution, MapReduce types, input formats, output formats.

Unit 5: Hadoop Related Tools (10 hours)

Hbase, data model and implementations, Hbase clients, Hbase examples– praxis. Cassandra, cassandra data model, cassandra examples, cassandra clients, Hadoop integration. Pig, Grunt, pig data model, Pig Latin, developing and testing Pig Latin scripts. Hive, data types and file formats, Hive QL data definition, HiveQL data manipulation – Hive QL queries

Text Books:

1. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
2. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2012.
3. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012. 5. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.

Reference Books:

1. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012. 7. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
2. Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilley, 2010.
3. Alan Gates, "Programming Pig", O'Reilley, 2011.

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Assessment methods and weightages in brief

1. By taking two sessional examinations.
2. By giving assignments.
3. By conducting class tests.
4. By taking semester examination.
5. Internal assessment (25 Marks) & Semester Examination (75 Marks) &Total Marks-100.

Name of the Academic Program: - Bachelor of Science (Hons) Computer Science - (B.Sc.(H))
Course Code: BSC SEE411 **Title of the Course:** Internet and Web Technology
L-T-P: 3-1-0 **Credits**: - 04
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

COURSE LEARNING OUTCOMES (CLOs)

Upon successful completion of this course, students will be able to:

CLO 1. Understand fundamental tools and technologies and protocols governing the web. (Cognitive Level: Understand)
CLO 2. Analyze a web page and identify its elements and attributes. (Cognitive Level: Analyze)
CLO 3. Create web pages using HTML and Cascading Style Sheets. (Cognitive Level: Create)
CLO 4. Build dynamic web pages using JavaScript (Client side programming). (Cognitive Level: Create)
CLO 5. Develop an understanding of electronic commerce and emerging internet trends. (Cognitive Level: Create)

Mapping of COURSE LEARNING OUTCOMES (CLOs) with Program Learning Outcomes (PLOs)

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO10	PLO11	PLO12
CLO 1	3	--	2	1	2	2	--	--	--	1	--	1
CLO 2	3	--	--	2	--	--	2	1	1	--	1	--
CLO 3	1	1	3	2	2	2	--	--	--	1	1	1
CLO 4	--	3	1	--	2	--	--	1	1	--	1	--
CLO 5	2	--	--	2	1	2	2	2	--	1	--	2

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Unit 1: Introduction to Internet and WWW (10 hours)

Introduction to Internet: History of World Wide Web; Protocols governing the web; Understanding the Internet: syntax of URLs, web page and browsers, search engine; Introduction to Cyber Laws in India.

Unit 2: Internet Applications (10 hours)

Internet applications: FTP, Telnet, Email, Chat; Internet addressing: identification of each computer using domain name and IP addresses, DNS.

Unit 3: Formatting Web Pages (10 hours)

Introduction to HTML, XML, DHTML and CSS; Formatting Web Pages with the help of different HTML tags, HTML table, HTML form; using CSS for formatting different objects; using DHTML for dynamic designing of web page.

Unit 4: JavaScript (10 hours)

Introduction to Javascript: Advantages of Javascript, Javascript Syntax, documents, forms, Datatype, Variable, Array, Operator and Expression, Looping Constructor, Event Handling, cookies.

Unit 5: E-Commerce and emerging trends (10 hours)

E-Commerce and security issues; Emerging trends: Internet telephony, virtual reality over the web, etc.; Intranet and extranet; firewall design issues.

Text Books:

1. Raymond Greenlaw and Ellen Hepp, "Fundamentals of Internet and World Wide Web", TMH.
2. Ivan Bayross, "Web Technologies Part II", BPB Publications.

Reference Books:

1. Thomas A Powell, "HTML The Complete Reference", Tata McGraw Hill Publications.
2. Burdman, "Collaborative Web Development", Addison Wesley.

Teaching-Learning Strategies in brief

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3. Provide subject materials to develop and explore different perspectives.
4. Encourage students for reasoning when solving problems.
5. Motivate the students to develop learning and thinking process.

Assessment methods and weightages in brief

1. By taking two sessional examinations.
2. By giving assignments.
3. By conducting class tests.
4. By taking semester examination.
5. Internal assessment (25 Marks) & Semester Examination (75 Marks) &Total Marks-100.

Name of the Academic Program: - Bachelor of Science (Hons) Computer Science - (B.Sc.(H))
Course Code: BSC SEE412 **Title of the Course:** Programming in Visual Basic
L-T-P: 3-1-0 **Credits**: - 04
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

COURSE LEARNING OUTCOMES (CLOs)

CLO 1. Students will be able to implement syntax rules in visual basic programs. (Cognitive Level: Create)
CLO 2. Students will have the understanding of variables and data types used in program development. (Cognitive Level: Understand)
CLO 3. Students will be able to apply decision structures for determining different operations, apply loop structures to perform repetitive tasks. (Cognitive Level: Understand)
CLO 4. Students will be able to debug codes written in VB language. (Cognitive Level: Anayze)
CLO 5. Students will be able to develop mini projects based on user interactivity, logical relations among different data etc. (Cognitive Level: Create)

Mapping of COURSE LEARNING OUTCOMES (CLOs) with Program Learning Outcomes (PLOs)

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO10	PLO11	PLO12
CLO 1	3	--	2	1	2	2	--	--	--	1	--	1
CLO 2	3	--	--	2	--	--	2	1	1	--	1	--
CLO 3	1	1	3	2	2	2	--	--	--	1	1	1
CLO 4	--	3	1	--	2	--	--	1	1	--	1	--
CLO 5	2	--	--	2	1	2	2	2	--	1	--	2

Each Course Learning Outcome (CLO)may be mapped with one or more Program Learning Outcomes (PLOs). Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level' mapping.

Unit 1: Introduction to VB (10 hours)

Visual & Non-Visual programming, Procedural, Object-Oriented, Object-Based and Event-Driven Programming Languages, VB as Even-Driven and Object-Based Language, VB Environment: Menu bar, Toolbar, Project explorer, Toolbox, Properties Window, Form Designer, Form Layout, Immediate window, Default Controls in Tool Box Visual Development and Event Driven programming.

Unit 2: Basics of Programming (10 hours)

Variables: Declaring Variables, Types of variables, Converting Variables Types, User Defined Data Types, Forcing Variable Declaration, Scope & Lifetime of Variables; Constants: Named & Intrinsic, Operators: Arithmetic, Relational & Logic.

Unit 3: Decision Statements in VB (10 hours)

If statement, if-then-else, select-case; Looping Statements in VB: do-loop, for-next, while-wend; Exit statement, Nested Control Structure; Arrays: Declaring and using Arrays, One-dimensional, Two-dimensional and Multi-dimensional Arrays, Static and Dynamic arrays, Array of Arrays.

Unit 4: Procedures (10 hours)

General & Event Procedures, Subroutines, Functions, Calling Procedures, Arguments - Passing Mechanisms, Optional Arguments, Named Arguments, Functions Returning Custom Data Types Simple Program Development in VB such as Sum of Numbers, Greatest among Numbers, Checking Even/Odd Number, HCF of Two Numbers, Generate Prime Numbers, Generate Fibonacci Series, Factorial of a Number, Searching, Sorting, etc.

Unit 5: VB Objects and Monitoring Mouse Activity (10 hours)

Dialog Boxes, Common Controls, Menus, MDI Forms, Testing, Debugging and Optimization, Working with Graphics. Monitoring Mouse Activity: File handling, File system controls, File system objects, DLL Servers.

Text/Reference Books:

1. Steven Holzner, Visual Basic 6 Programming: Black Book, Dreamtech Press.
2. Evangelos Petroutsos, Mastering Visual Baisc 6, BPB Publications.
3. Julia Case Bradley & Anita C. Millspaugh, Programming in Visual Basic 6.0, Tata McGraw- Hill Edition.
4. KMichael Halvorson, Step by Step Microsoft Visual Basic 6.0 Professional, PHI.

Teaching-Learning Strategies in brief

1. Build positive and peaceful environment in the classroom.
2. Provide testing pathway for the knowledge of the subject.
3. Provide subject materials to develop and explore different perspectives.
4. Encourage students for reasoning when solving problems.
5. Motivate the students to develop learning and thinking process.

Assessment methods and weightages in brief

1. By taking two sessional examinations.
2. By giving assignments.
3. By conducting class tests.
4. By taking semester examination.
5. Internal assessment (25 Marks) & Semester Examination (75 Marks) &Total Marks-100.

Name of the Academic Program: - Bachelor of Science (Hons) Computer Science - (B.Sc.(H))
Course Code: BSC SEE413 **Title of the Course:** Fundamental Concepts of Microprocessor and Arduino Programming
L-T-P: 3-1-0 **Credits**: - 04
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

COURSE LEARNING OUTCOMES (CLOs)

The students will be able to:

CLO 1. Learn the Basic of microprocessor and its architecture. (Cognitive Level: Understand)
CLO 2. Learn the Arduino programming language and IDE (Cognitive Level: Understand)
CLO 3. Program basic Arduino examples. (Cognitive Level: Understand)
CLO 4. Prototype circuits and connect them to the Arduino(Cognitive Level: Create)
CLO 5. Connect the Arduino microcontroller to a serial terminal to understand communication and stand-alone use . (Cognitive Level: Apply)

Mapping of COURSE LEARNING OUTCOMES (CLOs) with Program Learning Outcomes (PLOs)

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO10	PLO11	PLO12
CLO 1	--	--	2	--	2	1	--	3	--	1	--	1
CLO 2	3	--	--	2	--	--	2	1	1	--	1	--
CLO 3	2	1	--	2	--	2	--	--	--	1	1	3
CLO 4	--	3	1	--	2	--	--	1	1	--	1	--
CLO 5	2	--	--	2	1	--	3	2	--	1	--	2

Each Course Learning Outcome (CLO)may be mapped with one or more Program Learning Outcomes (PLOs). Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level' mapping.

Unit 1: Fundamentals of Microprocessor (10 hours)

Fundamental of Microprocessor, Components of microprocessor, Evolution of processors, Microprocessor system architecture, Memory Organization, Microprocessor 8085: Features, Architecture, Block Diagram, General Purpose Registers, Register Pairs, Flags, Special Purpose Resisters, Stack Pointer, Program Counter, Types of Buses, Multiplexed Address Bus and Data Bus, Generation of Control Signals, Pin Description of Microprocessor 8085, Introduction sets, Different Types of Microcontrollers, Embedded Microcontrollers, Processor Architectures, Harvard vs.

Princeton, CISC vs. RISC Architectures, Microcontroller Memory ypes, Microcontroller Features, Clocking, I/O Pins, Interrupts, Timers, Peripherals.

Unit 2: Introduction to AVR (10 hours)

Introduction to AVR Microcontroller, Architecture, Pin configuration, Memory organization, Input /Output Ports, Counter and Timers, Serial communication, interrupts. Instruction set, Addressing modes, Development tools, Assembler Directives, Programming based on Arithmetic & Logical Operations, I/O parallel and serial ports, Timers & Counters, and ISR. Develop real time software and hardware for embedded systems using AVR ATMega32 Microcontroller.

Unit 3: Arduino (10 hours)

Arduino family, Hardware prototyping, Arduino software architecture, Arduino integrated development environment (IDE), Arduino drivers, Features of Arduino Microcontroller, Architecture of Arduino, Different boards of Arduino, Arduino Interfacing and Applications. Introduction to programming, Arduino native library and other libraries, Basic development steps, Arduino data types Variables and constants, Operators, Control Statements, Arrays, Functions, I/O functions, timer.

Unit 4: Arduino Communications (10 hours)

Arduino Communications: Serial monitor, Basics of Serial communication RS232, serial peripheral interface SPI, USB, Firmware for shift register, Firmware for RGB LED's. Pulse-width modulation concept, LCD display circuit, Firmware generating vibrations, Firmware controlling the stepper motor, coding the firmware for Bluetooth and Wi-Fi Module.

Unit 5: Interactive Devices (10 hours)

Anatomy of an Interactive Device like Sensors and Actuators, A2D converters and their comparison, Blinking an LED, LCD Display, Driving a DC and stepper motor, Temperature sensors, Serial Communications, Sending Debug Information from Arduino to Your Computer, Sending Formatted Text and Numeric Data from Arduino, Receiving Serial Data in Arduino, Sending Multiple Text Fields from Arduino in a Single Message, Receiving Multiple Text Fields in a Single Message in Arduino. Light controlling with PWM. Arduino Projects.

Text Books:

1. The AVR Microcontroller and Embedded Systems Using Assembly and C, By Muhammad Ali Mazidi, Sarmad Naimi and Sepehr Naimi, Pearson Education.
2. Michael J. Pont, Embedded C AddisonWesley,Pearson Education Limited, 2002.
3. An Embedded Software Primer - David E. Simon, Pearson Education.
4. "Beginning Arduino", Michal Mc Roberts, Second Edition
5. Michal Mc Roberts "Beginning Arduino" Second Edition, Technology in Action
6. Massimo Banzi, "Getting started with Arduino" 2nd Edition, Orelly 2011

Teaching-Learning Strategies in brief

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5. Motivate the students to develop learning and thinking process.

Assessment methods and weightages in brief

1. By taking two sessional examinations.
2. By giving assignments.
3. By conducting class tests.
4. By taking semester examination.
5. Internal assessment (25 Marks) & Semester Examination (75 Marks) &Total Marks-100.

Name of the Academic Program: - Bachelor of Science (Hons) Computer Science - (B.Sc.(H))
Course Code: BSC SEE521 **Title of the Course:** Introduction to Java Programming
L-T-P: 3-1-0 **Credits**: - 04
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

COURSE LEARNING OUTCOMES (CLOs)

CLO 1. Understand Java Programming concept and various rule. (Cognitive Level : Understand)
CLO 2. Read and understand Java-based software code of medium-to-high complexity. (Cognitive Level : Understand)
CLO 3. Use standard Java's API's when writing applications. (Cognitive Level : Evaluate)
CLO 4. Understand the basic principles of creating Java application (Cognitive Level : Understand)
CLO 5. Understand the fundamental concepts of Object-Oriented Programming through Java language (Cognitive Level : Understand)

Mapping of COURSE LEARNING OUTCOMES (CLOs) with Program Learning Outcomes (PLOs)

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO10	PLO11	PLO12
CLO 1	3	--	2	3	--	2	--	--	--	2	--	3
CLO 2	--	--	--	2	--	--	2	1	1	--	1	--
CLO 3	1	1	3	3	--	2	--	--	--	1	1	2
CLO 4	--	3	1	--	2	--	--	1	1	--	1	--
CLO 5	2	--	--	2	1	--	3	2	--	1	--	2

Each Course Learning Outcome (CLO)may be mapped with one or more Program Learning Outcomes (PLOs). Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level' mapping.

Unit 1: Introduction to Java (10 hours)

Java Architecture and Features, Understanding the semantic and syntax differences between C++ and Java, Compiling and Executing a Java Program, Variables, Constants, Keywords Data Types, Operators (Arithmetic, Logical and Bitwise) and Expressions, Comments, Doing Basic Program Output, Decision Making Constructs (conditional statements and loops) and Nesting, Java Methods (Defining, Scope, Passing and Returning Arguments, Type Conversion and Type and Checking, Built-in Java Class Methods).

Unit 2: Arrays, Strings and I/O (10 hours)

Creating & Using Arrays (One Dimension and Multi-dimensional), Referencing Arrays Dynamically, Java Strings: The Java String class, Creating & Using String Objects,

Manipulating Strings, String Immutability & Equality, Passing Strings To & From Methods, String Buffer Classes. Simple I/O using System out and the Scanner class, Byte and Character streams, Reading/Writing from console and files.

Unit 3: Object-Oriented Programming Overview (10 hours)

Principles of Object-Oriented Programming, Defining & Using Classes, Controlling Access to Class Members, Class Constructors, Method Overloading, Class Variables & Methods, Objects as parameters, final classes, Object class, Garbage Collection. Inheritance: (Single Level and Multilevel, Method Overriding, Dynamic Method Dispatch, Abstract Classes), Interfaces and Packages, Extending interfaces and packages, Package and Class Visibility, Using Standard Java Packages (util, lang, io, net), Wrapper Classes, Autoboxing/Unboxing, Enumerations and Metadata.

Unit 4: Exception Handling, Threading, Networking Database Connectivity (10 hours)

Exception types, uncaught exceptions, throw, built-in exceptions, Creating your own exceptions; Multi-threading: The Thread class and Runnable interface, creating single and multiple threads, Thread prioritization, synchronization and communication, suspending/resuming threads. Using java.net package, Overview of TCP/IP and Datagram programming. Accessing and manipulating databases using JDBC.

Unit 5: Applets and Event Handling (10 hours)

Java Applets:Introduction to Applets, Writing Java Applets, Working with Graphics, Incorporating Images & Sounds. Event Handling Mechanisms,Listener Interfaces, Adapter and Inner Classes. The design and Implementation of GUIs using the AWT controls, Swing components of Java Foundation Classes such as labels, buttons, textfields, layout managers, menus, events and listeners; Graphic objects for drawing figures such as lines, rectangles, ovals, using different fonts. Overview of servlets

Text Books:

1. Programming with Java, E Balagurusamy, Second edition, TMH.
2. Java -The Complete Reference, Patrick Naughton and Herbertz Schidt.
3. Core Java Volume-I and II 2nd edition-Sun MicroSystem.

Reference books:

1. The Java Programming Language, Ken Arnold, James Gosling, David Homes.
2. Cay S. Horstmann, GaryCornell, "Core Java 2 Volume 1 ,9th Edition,Printice Hall.
3. Bruce Eckel, "Thinking in Java", 3rd Edition, PHI, 2002.

Teaching-Learning Strategies in brief

1. Build positive and peaceful environment in the classroom.
2. Provide testing pathway for the knowledge of the subject.
3. Provide subject materials to develop and explore different perspectives.
4. Encourage students for reasoning when solving problems.
5. Motivate the students to develop learning and thinking process.

Assessment methods and weightages in brief

1. By taking two sessional examinations.
2. By giving assignments.
3. By conducting class tests.
4. By taking semester examination.
5. Internal assessment (25 Marks) & Semester Examination (75 Marks) &Total Marks-100.

Name of the Academic Program: - Bachelor of Science (Hons) Computer Science - (B.Sc.(H))
Course Code: BSC SEE522 **Title of the Course:** Fundamentals of .Net Programming
L-T-P: 3-1-0 **Credits**: - 04
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

COURSE LEARNING OUTCOMES (CLOs)

Upon successful completion of this course, students will be able to:

CLO 1. Develop applications using ASP.NET IDE. Develop simple web page using built in Objects (Cognitive Level: Create)
CLO 2. Use controls available with the IDE platform of ASP.NET for given purpose (Cognitive Level: Apply)
CLO 3. Apply Styles, themes and Master pages in ASP.NET Web applications(Cognitive Level: Apply)
CLO 4. Develop programs using session management and user's preference in ASP.NET. (Cognitive Level: Create)
CLO 5. Describe Objects of ADO.NET(Cognitive Level: Evaluate)

Mapping of COURSE LEARNING OUTCOMES (CLOs) with Program Learning Outcomes (PLOs)

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO10	PLO11	PLO12
CLO 1	3	--	2	1	2	2	--	--	--	1	--	1
CLO 2	3	--	--	2	--	--	2	1	1	--	1	--
CLO 3	1	1	3	2	2	2	--	--	--	1	1	1
CLO 4	--	3	1	--	2	--	--	1	1	--	1	--
CLO 5	2	--	--	2	1	2	2	2	--	1	--	2

Each Course Learning Outcome (CLO)may be mapped with one or more Program Learning Outcomes (PLOs). Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level' mapping.

Unit 1: Introduction to .NET Framework and C (10 hours)
Introduction to .NET Framework: Introduction to Microsoft Visual studio for .Net framework. components of Framework and describe CLR,

Unit 2: C, .NET and ADO.NET (10 hours)
Microsoft .NET framework Overview, .Net framework Architecture, .Net Framework components and functionalities

Unit 3: Windows Forms and Controls in details (10 hours)
ASP.net: Client-Server architecture, Basics of ASP.NET , Differences between ASP.NET and Classic ASP

Unit 4: Connectivity ASP.NET - Themes and Master Pages (10 hours)
Web Applications, develop applications using ASP.NET IDE, creating a New Web Project (ASP.NET), Building Web Sites, set up of work environment, start page, the menu system, toolbars, the new project dialog box, graphical designer, code designer.

Unit 5: Managing State (10 hours)
Styles, Themes and Master pages: Apply Styles, themes and Master pages in ASP.NET Web applications, How Themes Work, Creating Multiple Skins for the Same Control, How Master page and Content pages are connected

Test Books
1. ASP.NET: The Complete Reference Books Matthew Macdonald McGraw Hill education

Reference Books
1. Programming in Visual Basic. NET Julia Case Bradley, Anita C. Millspaugh McGraw Hill, latest edition

Teaching-Learning Strategies in brief
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5. Motivate the students to develop learning and thinking process.

Assessment methods and weightages in brief
1. By taking two sessional examinations.
2. By giving assignments.
3. By conducting class tests.
4. By taking semester examination.
5. Internal assessment (25 Marks) & Semester Examination (75 Marks) &Total Marks-100.

Name of the Academic Program: - Bachelor of Science (Hons) Computer Science - (B.Sc.(H))
Course Code: BSC SEE523 **Title of the Course:** PHP Java Programming
L-T-P: 3-1-0 **Credits**: - 04
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

COURSE LEARNING OUTCOMES (CLOs)

Upon successful completion of this course, students will be able to:
CLO 1. Understand how server-side programming works on the web.(Cognitive Level: Understand)
CLO 2. PHP Basic syntax for variable types and calculations. .(Cognitive Level: Understand)
CLO 3. Creating conditional structures .(Cognitive Level: Create)
CLO 4. Storing data in arrays. Understanding POST and GET in form submission .(Cognitive Level: Apply)
CLO 5. Using PHP built-in functions and creating custom functions. .(Cognitive Level: Apply)

Mapping of COURSE LEARNING OUTCOMES (CLOs) with Program Learning Outcomes (PLOs)

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO10	PLO11	PLO12
CLO 1	--	--	2	1	--	2	--	--	--	1	--	2
CLO 2	2	--	--	2	--	--	2	1	1	--	1	--
CLO 3	3	1	--	3	--	2	--	--	--	1	1	3
CLO 4	--	3	1	--	2	--	--	1	1	--	1	--
CLO 5	2	--	--	2	1	--	--	2	--	1	--	1

Each Course Learning Outcome (CLO)may be mapped with one or more Program Learning Outcomes (PLOs). Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level' mapping.

Unit 1: Introduction to PHP (10 hours)
Java PHP introduction, inventions and versions, important tools and software requirements (like Web Server, Database, Editors etc.), PHP with other, technologies, scope of PHP, Basic Syntax, PHP variables and constants, Types of data in PHP , Expressions, scopes of a variable (local, global), PHP Operators : Arithmetic, Assignment, Relational , Logical operators, Bitwise , ternary and MOD operator. PHP
operator Precedence and associativity

Unit 2: Handling HTML form with PHP (10 hours)

Capturing Form Data, GET and POST form methods Dealing with multi value fields, Redirecting a form after submission. PHP conditional events and Loops: PHP IF Else conditional statements (Nested IF and Else), Switch case, while, For, and Do While Loop, Goto, Break, Continue and exit.

Unit 3: PHP Functions (10 hours)

Function, Need of Function, declaration and calling of a function, PHP Function with arguments, Default Arguments in Function, Function argument with call by value, call by reference, Scope of Function Global and Local.

Unit 4: Connectivitys String Manipulation and Regular Expression (10 hours)

Creating and accessing String , Searching & Replacing String, Formatting, joining and splitting String , String Related Library functions, Use and advantage of regular expression over inbuilt function, Use of preg_match(), preg_replace(), preg_split() functions in regular expression.

Unit 5: Array (10 hours)

Anatomy of an Array ,Creating index based and Associative array, Accessing array, Looping with Index based array, with associative array using each() and foreach(), Some useful Library function.

Text Books:

1. PHP : The Complete Reference, Steven Holzner, Mcgraw Higher Ed.
2. PHP Beginner's Practical Guide, Pratiyush Guleria, Bpb publications.
3. Web Programming With Php And Mysql: A Practical Guide, Max Bramer, Springer.

Teaching-Learning Strategies in brief

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Assessment methods and weightages in brief

1. By taking two sessional examinations.
2. By giving assignments.
3. By conducting class tests.
4. By taking semester examination.
5. Internal assessment (25 Marks) & Semester Examination (75 Marks) &Total Marks-100.

Name of the Academic Program: - Bachelor of Science (Hons) Computer Science - (B.Sc.(H))
Course Code: BSC OE411 **Title of the Course:** Organisational Behaviour
L-T-P: 3-1-0 **Credits**: - 04
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

COURSE LEARNING OUTCOMES (CLOs)

CLO 1. To understand the conceptual framework of the discipline of OB and its practical applications in the organisational set up. .(Cognitive Level: Understand)
CLO 2. To deeply understand the role of individual, groups and structure in achieving organizational goals effectively and efficiently. .(Cognitive Level: Understand)
CLO 3. To critically evaluate and analyse various theories and models that contributes in the overall understanding of the discipline. .(Cognitive Level: Evaluate)
CLO 4. To develop creative and innovative ideas that could positively shape the organisations. .(Cognitive Level: Create)
CLO 5. To accept and embrace in working with different people from different cultural and diverse background in the workplace. .(Cognitive Level: Evaluate)

Mapping of COURSE LEARNING OUTCOMES (CLOs) with Program Learning Outcomes (PLOs)

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO10	PLO11	PLO12
CLO 1	1	--	2	--	3	2	--	--	--	1	--	--
CLO 2	2	--	--	2	--	--	2	1	1	--	1	--
CLO 3	--	1	3	2	2	2	--	--	--	1	1	3
CLO 4	--	3	1	--	2	--	--	1	1	--	1	--
CLO 5	2	--	--	2	1	--	3	2	--	1	--	2

Each Course Learning Outcome (CLO)may be mapped with one or more Program Learning Outcomes (PLOs). Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level' mapping.

Unit 1: Fundamentals of OB (10 hours)
Fundamentals and goals of Organisational Behavior, Models of Organisational Behavior, Emerging aspects of Organisational Behavior

Unit 2: Value, Attitude and Motivation (10 hours)
Attitude, Values, Job Satisfaction; Motivation and its importance, Theories of Motivation: Maslow's Need Hierarchy Theory, Mc Gregor's Theory X and Theory Y

Unit 3: Personality and Perception (10 hours)

Concept of Personality, Determinants of personality, Type A and Type B assessment of personality; Concept of Perception, Errors and distortions in perception

Unit 4: Group Dynamics and Leadership (10 hours)

Concept of Group, Stages of group building; Leadership, Leadership Styles, Leader Vs Manager

Unit 5: Stress and Conflict (10 hours)

Concept, symptoms, sources of stress: Individual level, Group level, Organizational level stressors; Burnout; Concept of conflict, Conflict Management

Text Books

1. Essentials of Organizational Behaviour, Stephen P Robbins, Timothy A Judge; latest edition
2. Organisational Behavior Book by K. Aswathappa; latest edition

Reference Books

1. Organisation Theory and Behaviour, T N Chhabra, B P Singh; latest edition

Teaching-Learning Strategies in brief

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5. Motivate the students to develop learning and thinking process.

Assessment methods and weightages in brief

1. By taking two sessional examinations.
2. By giving assignments.
3. By conducting class tests.
4. By taking semester examination.
5. Internal assessment (25 Marks) & Semester Examination (75 Marks) &Total Marks-100.

Name of the Academic Program: - Bachelor of Science (Hons) Computer Science - (B.Sc.(H))
Course Code: BSC OE412 **Title of the Course:** Financial Accounting
L-T-P: 3-1-0 **Credits**: - 04
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

COURSE LEARNING OUTCOMES (CLOs)

CLO 1. Students should be able to conceptually define accounting and bookkeeping. (Cognitive Level: Remember)
CLO 2. Identify the accounting rules required for business enterprises. (Cognitive Level: Analyze)
CLO 3. Apply the accounting rules in determining financial results. (Cognitive Level: Apply)
CLO 4. Connect knowledge and record business changes. (Cognitive Level: Evaluate)
CLO 5. Compare the specificity of different accounts within the accounting policies. (Cognitive Level: Analyze)

Mapping of COURSE LEARNING OUTCOMES (CLOs) with Program Learning Outcomes (PLOs)

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO10	PLO11	PLO12
CLO 1	--	--	2	1	--	2	--	--	--	1	--	2
CLO 2	2	--	--	2	--	--	2	1	1	--	1	--
CLO 3	3	1	--	3	--	2	--	--	--	1	1	3
CLO 4	--	3	1	--	2	--	--	1	1	--	1	--
CLO 5	2	--	--	2	1	--	--	2	--	1	--	1

Each Course Learning Outcome (CLO)may be mapped with one or more Program Learning Outcomes (PLOs). Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level' mapping.

Unit 1: Concept of Financial Accounting (10 hours)
Need, development, and definition of accounting; Bookkeeping and accounting; Persons interested in accounting; Disclosures; Branches of accounting; Objectives of accounting

Unit 2: Accounting Principles (10 hours)

International Accounting Standards (only outlines); Accounting principles; Accounting Standards in India

Unit 3: Accounting Transactions (10 hours)

Accounting Cycle; Journal; Rules of debit and credit; Compound journal entry; Opening entry; Relationships between Journal and Ledger; Rules regarding posting; Trial balance; Sub divisions of journal

Unit 4: Capital and Revenue (10 hours)

Classification of income; Classification of expenditure; Classification of receipts Accounting concepts of income; Accounting concepts and income measurement; Expired costs and income measurement Final Accounts; Manufacturing account; Trading account; Profit and loss account; Balance Sheet; Adjustment entries

Unit 5: Depreciation & Reserves (10 hours)

Concept of depreciation; Causes of depreciation; Depreciation, depletion, amortization, and dilapidation; Depreciation accounting; Methods of recording depreciation; Methods for providing depreciation; Depreciation of different assets; Depreciation of replacement cost; Depreciation accounting as per accounting standard; Depreciation accounting; Provisions and reserves

Text books:

1. T S Grewal, Double Entry Book Keeping, latest edition
2. Sandeep Garg, Accounting Financial Accounting, latest edition

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5. Motivate the students to develop learning and thinking process.

Assessment methods and weightages in brief

1. By taking two sessional examinations.
2. By giving assignments.
3. By conducting class tests.
4. By taking semester examination.
5. Internal assessment (25 Marks) & Semester Examination (75 Marks) &Total Marks-100.

Name of the Academic Program: - Bachelor of Science (Hons) Computer Science - (B.Sc.(H))
Course Code: BSC OE413 **Title of the Course:** Cyber Crimes & Cyber Laws
L-T-P: 3-1-0 **Credits**: - 04
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

COURSE LEARNING OUTCOMES (CLOs)

CLO 1. Describe laws governing cyberspace and analyze the role of Internet Governance in framing policies for Internet security. (Cognitive Level: Understand)
CLO 2. Discuss different types of cybercrimes and analyze legal frameworks of different countries to deal with these cybercrimes. (Cognitive Level: Remember)
CLO 3. Explain the importance of jurisdictional boundaries and identify the measures to overcome cross jurisdictional cyber-crimes. (Cognitive Level: Understand)
CLO 4. Illustrate the importance of ethics in legal profession and determine the appropriate ethical and legal behavior according to legal frameworks. (Cognitive Level: Analyze)
CLO 5. Demonstrate knowledge about Intellectual Property and International aspects of Cyber Laws. (Cognitive Level: Remember)

Mapping of COURSE LEARNING OUTCOMES (CLOs) with Program Learning Outcomes (PLOs)

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO10	PLO11	PLO12
CLO 1	--	--	2	1	--	2	--	--	--	1	--	2
CLO 2	2	--	--	2	--	--	2	1	1	--	1	--
CLO 3	3	1	--	3	--	2	--	--	--	1	1	3
CLO 4	--	3	1	--	2	--	--	1	1	--	1	--
CLO 5	2	--	--	2	1	--	--	2	--	1	--	1

Each Course Learning Outcome (CLO)may be mapped with one or more Program Learning Outcomes (PLOs). Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level' mapping.

Unit 1: Introduction (10 hours)
Introduction to IT laws & Cyber Crimes Internet, Hacking, Cracking, Viruses, Virus Attacks, Software Piracy.

Unit 2: Email investigation (10 hours)
E-Mail Investigation E-Mail Tracking, IP Tracking, E-Mail Recovery, Encryption and Decryption methods, Search and Seizure of Computers.

Unit 3: Cyber Crime (10 hours)

Introduction to Cyber Crime Investigation Cyber Forensics, Investigation Tools, e-Discovery, Digital Evidence Collection, Evidence Preservation, Forensics Tools and Softwares, Recovering deleted evidences, Password Cracking, Cyber Security.

Unit 4: Intellectual property (10 hours)

Intellectual property, Legal System of Information Technology Social Engineering, Mail Bombs, Bug Exploits, Law of Intellectual Property: Copy Right Act, Trade and Merchandise Act, Patent Act, Domain Name Disputes, Cyber- Squatting.

Unit 5: EDI (10 hours)

International Perspective of Cyber Law Electronic Data Interchange, EDI: Concept and legal Issues. Electronic Signature Law's of Major Countries, Cryptography Laws, Cyber Law's of Major Countries.

Text books:

1. Chris Reed and John Angel, "Computer Law", OUP, New York, 2007.
2. Justice Yatindra Singh, "Cyber laws", Uiversal Law publishing Co, New Delhi, 2012.
3. SK Verma and Raman Mittal, "Legal dimensions of cyber space", Indian Law Institute, New Delhi, 2004.
4. SR Bhansali, "Information Technology Act 2000", University book house pvt. Ltd., Jaipur.

Teaching-Learning Strategies in brief

1. Build positive and peaceful environment in the classroom.
2. Provide testing pathway for the knowledge of the subject.
3. Provide subject materials to develop and explore different perspectives.
4. Encourage students for reasoning when solving problems.
5. Motivate the students to develop learning and thinking process.

Assessment methods and weightages in brief

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5. Internal assessment (25 Marks) & Semester Examination (75 Marks) &Total Marks-100.

Name of the Academic Program: - Bachelor of Science (Hons) Computer Science - (B.Sc.(H))
Course Code: BSC OE511 **Title of the Course:** Startup Entrepreneurship
L-T-P: 3-1-0 **Credits**: - 04
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

COURSE LEARNING OUTCOMES (CLOs)

CLO 1. To be able to understand basic concepts associated to entrepreneurship. (Cognitive Level: Understand)
CLO 2. To gain an insight about available sources of finance (Cognitive Level: Remember)
CLO 3. Know various scehmes available by government for startups(Cognitive Level: Remember)
CLO 4. Able to develop their own startups (Cognitive Level: Create)
CLO 5. Learn competitive edge (Cognitive Level: Remember)

Mapping of COURSE LEARNING OUTCOMES (CLOs) with Program Learning Outcomes (PLOs)

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO10	PLO11	PLO12
CLO 1	--	--	2	--	2	1	--	3	--	1	--	1
CLO 2	3	--	--	2	--	--	2	1	1	--	1	--
CLO 3	2	1	--	2	--	2	--	--	--	1	1	3
CLO 4	--	3	1	--	2	--	--	1	1	--	1	--
CLO 5	2	--	--	2	1	--	3	2	--	1	--	2

Each Course Learning Outcome (CLO)may be mapped with one or more Program Learning Outcomes (PLOs). Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level' mapping.

Unit 1: Introduction to Entrepreneurship (10 hours)

Meaning and concept of entrepreneurship, the history of entrepreneurship development, role of entrepreneurship in economic development, agencies in entrepreneurship management and future of entrepreneurship, Meaning of entrepreneur, the skills required to be an entrepreneur, the entrepreneurial decision process, and role models, mentors and support system.

Unit 2: Business Opportunity Identification and Planning (10 hours)

Capturing Business ideas, methods of generating ideas, and opportunity recognition, Preparing a Business Plan: Meaning and significance of a business plan, components of a business plan, and feasibility study

Unit 3: Financing the New Venture (10 hours)

Importance of new venture financing, types of ownership securities, venture capital, types of debt securities, determining ideal debt-equity mix, and financial institutions and banks

Unit 4: Launching and Managing the New Venture (10 hours)

Choosing the legal form of new venture, protection of intellectual property, and marketing the new venture, Characteristics of high growth new ventures, strategies for growth, and building the new venture capital

Unit 5: Harvesting Rewards (10 hours)

Exit strategies for entrepreneurs, bankruptcy, and succession and harvesting strategy

Text Books:

1. Fundamentals of Entrepreneurship and Small Business Management, Vasant Desai, Himalaya Publishing House.

Teaching-Learning Strategies in brief

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Assessment methods and weightages in brief

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3. By conducting class tests.
4. By taking semester examination.
5. Internal assessment (25 Marks) & Semester Examination (75 Marks) &Total Marks-100.

Name of the Academic Program: - Bachelor of Science (Hons) Computer Science - (B.Sc.(H))
Course Code: BSC OE512 **Title of the Course:** Concepts of E-Governance and Smart City
L-T-P: 3-1-0 **Credits**: - 04
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

COURSE LEARNING OUTCOMES (CLOs)

Upon completion of the course students should be able to:

CLO 1. This course is designed to give exposure to project management tools and techniques applicable for planning, controlling & monitoring of Smart Infrastructure and Cities. (Cognitive Level: Remember)

CLO 2. This course would also enable to develop insight for managing project risks, uncertainties and complexities of smart cities project. (Cognitive Level: Remember)

CLO 3. Understanding of road map for Planning Smart Cities and benchmarking their performance for Indian context. (Cognitive Level: Understand)

CLO 4. Understand basic principles and concept of green as well as energy efficient buildings as a part of Smart, sustainable development. (Cognitive Level: Understand)

CLO 5. Optimizing/designing the green building system and use of sustainable materials. (Cognitive Level: Analyze)

Mapping of COURSE LEARNING OUTCOMES (CLOs) with Program Learning Outcomes (PLOs)

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO10	PLO11	PLO12
CLO 1	--	--	2	--	2	1	--	3	--	1	--	1
CLO 2	3	--	--	2	--	--	2	1	1	--	1	--
CLO 3	2	1	--	2	--	2	--	--	--	1	1	3
CLO 4	--	3	1	--	2	--	--	1	1	--	1	--
CLO 5	2	--	--	2	1	--	3	2	--	1	--	2

Each Course Learning Outcome (CLO)may be mapped with one or more Program Learning Outcomes (PLOs). Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level' mapping.

Unit 1: Smart Cities Planning & Development (10 hours)

Introduction to City Planning, Understanding Smart Cities, Dimensions of Smart Cities, Smart Cities –Global Standards and Performance Benchmarks, Practice Codes, India "100 Smart Cities" Policy and Mission, Financing Smart Cities Development, Governance of Smart Cities.

Unit 2: Introduction to Smart Cities (10 hours)

Introduction to Smart Cities, Philosophy & Concepts of Project Management, Phases, Stages of Project & their Approval Status, The PERT Model, Project Cost Analysis

Unit 3: Solar Energy for Smart Cities (10 hours)

Conventional vs. Smart, City components, Energy demand, Green approach to meet Energy demand, Index of Indian cities towards smartness – a statistical analysis.Extranets. Energy scenarios of conventional cities, Consequences, Alternative resources, Reliability on predictability scale, Solar options, PV and thermal; Singular or hybrid.

Unit 4: Green Buildings in Smart Cities (10 hours)

Sustainability, Green Buildings, Rating System of Green Building, Energy Efficient Building, Energy Saving System in Buildings.

Unit 5: PV Technology and Smart Grid (10 hours)

Introduction to PV technology, PV of various scale for smart city applications, Energy efficiency, Policies of Solar PV in smart domains (RPO, REC, Carbon credit, etc.), Structure of Smart Grid, Indian Perspective, Advantage & limitation, Volume of Capital flow, Evaluation/integration of large volume Renewable in Smart grid.

Text Books:

1.Smart Cities (The MIT Press Essential Knowledge series)
2.Introduction to Smart Cities by Anil Kumar, Pearson.
3. Smart City Governance by Alois Paulin

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Assessment methods and weightages in brief

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2. By giving assignments.
3. By conducting class tests.
4. By taking semester examination.
5. Internal assessment (25 Marks) & Semester Examination (75 Marks) &Total Marks-100.

Name of the Academic Program: - Bachelor of Science (Hons) Computer Science - (B.Sc.(H))
Course Code: BSC OE513 **Title of the Course:** Digital Marketing & E-Commerce
L-T-P: 3-1-0 **Credits**: - 04
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

COURSE LEARNING OUTCOMES (CLOs)

Upon completion of the course students should be able to:
CLO 1. Analyze the impact of E-commerce on business models and strategy(Cognitive Level: Analyze)
CLO 2. Describe the major types of E-commerce(Cognitive Level: Remember)
CLO 3. Explain the process that should be followed in building an E-commerce presence(Cognitive Level: Remember)
CLO 4. Identify the key security threats in the E-commerce environment(Cognitive Level: Evaluate)
CLO 5. Describe how procurement and supply chains relate to B2B E-commerce(Cognitive Level: Remember)

Mapping of COURSE LEARNING OUTCOMES (CLOs) with Program Learning Outcomes (PLOs)

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO10	PLO11	PLO12
CLO 1	--	--	2	--	2	1	--	3	--	1	--	1
CLO 2	3	--	--	2	--	--	2	1	1	--	1	--
CLO 3	2	1	--	2	--	2	--	--	--	1	1	3
CLO 4	--	3	1	--	2	--	--	1	1	--	1	--
CLO 5	2	--	--	2	1	--	3	2	--	1	--	2

Each Course Learning Outcome (CLO)may be mapped with one or more Program Learning Outcomes (PLOs). Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level' mapping.

Unit 1: History, Nature and Impact of E-Commerce (10 hours)
Introduction to E-Business and E-Commerce, Types of e-Commerce, e-Business Models, Internet Marketing and e-Tailing, benefits and limitations of e-Commerce

Unit 2: E-Commerce Essentials (10 hours)
Introduction to Internet and its application, Intranet and Extranets. World Wide Web, Internet Architectures, Internet Applications, Business Applications on Internet, E-Shopping, Electronic Data Interchange, Components of Electronic Data Interchange

Unit 3: Marketing management (10 hours)

Intoduction to marketing, Marketing mix, Marketing environment, Consumer behaviour, STP

Unit 4: Digital Marketing (10 hours)

Concept of Digital Marketing, Search Engine Optimisation, Email marketing, Mobile marketing

Unit 5: Social Media Marketing (10 hours)

Social media marketing, Affiliate marketing

Text Books:

1. Dr. Sushila Madan, E-Commerce, Scholar TechPress, latest edition
2. Dr. Shivani Arora, E-Commerce, Taxmann, latest edition
3. Phillip Kotler, Marketing 4.0, Wiley publishers, latest edition

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Assessment methods and weightages in brief

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5. Internal assessment (25 Marks) & Semester Examination (75 Marks) &Total Marks-100.

Name of the Academic Program: - Bachelor of Science (Hons) Computer Science - (B.Sc.(H))
Course Code: BSC SEE521 **Title of the Course:** Introduction to Java Programming
L-T-P: 3-1-0 **Credits**: - 04
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

COURSE LEARNING OUTCOMES (CLOs)

After completing this Course, the students should be able to:
CLO1. To identify and apply the scope and need of Java Programming (Cognitive Level: Apply)
CLO2. To develop ability to understand various algorithms based on Java Programming. (Cognitive Level: Create)
CLO3. To apply the best coding effectively practices and to identify and use the language specific feature available us a library function(Cognitive Level: Apply)
CLO4. To understand the design of Java applications based on Object Oriented Programming Principles. (Cognitive Level: Understand)
CLO5.To learn backend component development in a java-based application. (Cognitive Level: Understand)

Mapping of COURSE LEARNING OUTCOMES (CLOs) with Program Learning Outcomes (PLOs)

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CLO1	--	--	2	--	3	1	--	3	--	1	--	2
CLO2	1	--	--	2	--	--	2	1	1	--	1	--
CLO3	2	1	--	2	--	3	--	--	--	1	1	3
CLO4	--	3	1	--	2	--	--	1	1	--	1	--
CLO5	2	--	--	3	1	--	3	2	--	1	--	2

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Detailed Syllabus:

Unit 1: Introduction to Java (10 hours)
Java Architecture and Features, Understanding the semantic and syntax differences between C++ and Java, Compiling and Executing a Java Program, Variables, Constants,

Keywords Data Types, Operators (Arithmetic, Logical and Bitwise) and Expressions, Comments, Doing Basic Program Output, Decision Making Constructs (conditional statements and loops) and Nesting, Java Methods (Defining, Scope, Passing and Returning Arguments, Type Conversion and Type and Checking, Built-in Java Class Methods).

Unit 2: Arrays, Strings and I/O (10 hours)

Creating & Using Arrays (One Dimension and Multi-dimensional), Referencing Arrays Dynamically, Java Strings: The Java String class, Creating & Using String Objects, Manipulating Strings, String Immutability & Equality, Passing Strings To & From Methods, String Buffer Classes. Simple I/O using System out and the Scanner class, Byte and Character streams, Reading/Writing from console and files.

Unit 3: Object-Oriented Programming Overview (10 hours)

Principles of Object-Oriented Programming, Defining & Using Classes, Controlling Access to Class Members, Class Constructors, Method Overloading, Class Variables & Methods, Objects as parameters, final classes, Object class, Garbage Collection. Inheritance: (Single Level and Multilevel, Method Overriding, Dynamic Method Dispatch, Abstract Classes), Interfaces and Packages, Extending interfaces and packages, Package and Class Visibility, Using Standard Java Packages (util, lang, io, net), Wrapper Classes, Autoboxing/Unboxing, Enumerations and Metadata.

Unit 4: Exception Handling, Threading, Networking Database Connectivity(10 hours)

Exception types, uncaught exceptions, throw, built-in exceptions, Creating your own exceptions; Multi-threading: The Thread class and Runnable interface, creating single and multiple threads, Thread prioritization, synchronization and communication, suspending/resuming threads. Using java.net package, Overview of TCP/IP and Datagram programming. Accessing and manipulating databases using JDBC.

Unit 5: Applets and Event Handling (10 hours)

Java Applets: Introduction to Applets, Writing Java Applets, Working with Graphics, Incorporating Images & Sounds. Event Handling Mechanisms, Listener Interfaces, Adapter and Inner Classes. The design and Implementation of GUIs using the AWT controls, Swing components of Java Foundation Classes such as labels, buttons, text fields, layout managers, menus, events and listeners; Graphic objects for drawing figures such as lines, rectangles, ovals, using different fonts. Overview of servlets

Text Books

4. Programming with Java, E Balagurusamy, Second edition, TMH.
5. Java -The Complete Reference, Patrick Naughton and Herbertz Schidt.
6. Core Java Volume-I and II 2nd edition-Sun MicroSystem.

Reference books

4. The Java Programming Language, Ken Arnold, James Gosling, David Homes.
5. Cay S. Horstmann, GaryCornell, "Core Java 2 Volume 1 ,9th Edition,Printice Hall.
6. Bruce Eckel, "Thinking in Java", 3rd Edition, PHI, 2002.

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