Scheme
&
Syllabus
of

Bachelor of Engineering
(Computer Science and Engineering)

1st to 8th Semester

(2023-2027)

University Institute of Engineering and Technology
Panjab University, Chandigarh

COMPUTER SCIENCE AND ENGINEERING

VISION

To be recognized as an eminent department in Computer Science and Engineering education and research for the benefit of society globally.

MISSION

- To sustain world-class computing infrastructure for the enhancement of technical knowledge in the field of Computer Science and Engineering.
- To excel in research and innovation for the discovery of new knowledge and technologies.
- To produce technocrats, entrepreneurs, and business leaders of the future.
- To foster human values for national growth and life-long learning amongst all the stakeholders.

PROGRAMME B.E. CSE (UG)

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

I. Graduates will work as software professional in industry of repute.

II. Graduates will pursue higher studies and research in engineering and management disciplines.

III. Graduates will work as entrepreneurs by establishing startups to take up projects for the societal and environmental cause.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

1. The ability to use software engineering techniques to design and develop software solutions.

2. The ability to employ data science principles to extract insights and knowledge from data.

PROGRAMME OUTCOMES (POs)

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **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.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer 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 engineering practice.
7. **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.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make

effective presentations, and give and receive clear instructions.

11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering 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.
12. **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.

EXAMINATION NOTE

The Semester question paper of a subject will be of 50 marks having 7 questions of equal marks. First question, covering the whole syllabus and having questions of conceptual nature, will be compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.

Credit System:

All B.E programmes are organized around semester-based credit system of study. The credit system is based on continuous evaluation of a student's performance/progress and includes flexibility to allow a student to progress at an optimum pace suited to his/her ability or convenience, subject to fulfilling minimum requirements for continuation.

Performance/progress of a student is measured by the number of credits that he/she has earned (completed satisfactorily). Based on the course credits and grades obtained by the student, grade point average is calculated, subject to his qualification of minimum grade in each subject.

Course Credit Assignment:

Each course has a certain number of credits assigned to it depending on the associated number of lecture, tutorials and laboratory contact hours in a week. A few courses are without credit and are referred to as non credit (NC) courses.

Lectures and Tutorials: One lecture hour or one tutorial hour per week per semester is assigned one credit.

Practical / Laboratory Work: One laboratory hour per week per semester is assigned half credit.

The credits are rounded off to the nearest whole number. For each lecture or tutorial the self-study component is 1 hour/week

Earning Credits:

At the end of every course, a letter grade is awarded in each course for which a student had registered. On obtaining a pass grade (atleast 'D' grade), the student accumulates the course credits as earned credits.

Performance of a student is measured by the number of credits that he/she has earned and by the weighted grade point average. Grades obtained in audit courses are not counted

towards the calculation of grade point average. However, a pass grade ('D' grade) is essential for earning credits from an audit course.

Table 1: Grading System

Grade	Grade Point	Description
A+	10	Outstanding
A	9	Excellent
B+	8	Very Good
B	7	Good
C+	6	Average
C	5	Below average
D	4	Marginal
F	0	Very Poor
I	-	Incomplete
NP	-	Audit Pass
NF	-	Audit Fail
W	-	Withdrawal
X	-	Unsatisfactory
S	-	Satisfactory Completion

Evaluation System:-

Continuous Assessment

There shall be continuous evaluation of the student during the semester. For evaluation purpose, total marks assigned to each subject shall be distributed as:

Two Mid Semester Examination (Minor-1 and Minor-2) with 30 % of total marks assigned to the subject. Best Marks of one of these two will be considered for award of sessional.

Assignments/Class projects/ short class tests/MCQ based quizzes/projects/presentations/group discussions/ Attendance with 20% of total marks assigned to the subject.

One End Semester Examination (Major Examination) with 50 % of total marks assigned to the subject. It is compulsory to appear in End Semester Examination and secure at least 20% marks of total End semester exam marks.

If a candidate secures less than 20% marks of total End semester exam marks, he/she will be awarded F grade.

Method for the Award of Grades:

For the award of grades in a course, all component wise evaluation shall be done in terms of marks. The components include: Midterm-1 and Midterm-2 examinations, Assignments/projects/class presentations/Attendance, and End semesterexamination as per regulation 4.1. After converting the marks obtained in percentage, the grades will be assigned as per the guidelines given below:

Table 2: Grade and grade points

Sr. No.	Marks	Grade	Grade Point
1.	≥ 90	A+	10
2.	≥ 80 &< 90	A	9
3.	≥70 &< 80	B+	8
4.	≥60 &< 70	B	7
5.	≥50 &< 60	C+	6
6.	≥45 &< 50	C	5
7.	≥40 &< 45	D	4
8.	<40	F	0

Evaluation of Performance:

The performance of a student shall be evaluated in terms of two indices, viz. Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA).

SGPA is the grade point average for the semester, and CGPA is the cumulative grade point average for all the completedsemesters at any point in time.

The earned credits (E.C) are defined as the sum of course credits for course in which A+ to D grade has been obtained. For U.G students (B.E), credits from courses in which NP or S grade has been obtained are also added.

$$Points\ earned\ in\ a\ semester = \sum (Course\ Credits\ X\ Grade\ Points) for\ the\ courses\ in\ which\ A\ to\ D\ grade\ as\ been\ obtained$$

The SGPA is calculated on the basis of grades obtained in all courses, except audit courses and courses in which S/Z grade is awarded, registered for the particular semester.

$$SGPA = \frac{\sum\ (Course\ credits\ X\ Grade\ Points)\ \ for\ all\ courses\ except\ audit\ and\ \frac{S}{Z}\ grade\ Courses}{\sum\ (Course\ Credits)\quad except\ audit\ and\ \frac{S}{Z}\ grade\ Courses}$$

$$SGPA = \frac{Points\ Secured\ in\ the\ Semester}{Credits\ Registered\ the\ Semester, excluding\ audit\ and\ \ S/Z\ \ grade\ cources}$$

The CGPA is calculated as given below:

$$CGPA = \frac{\sum\ (Course\ credits\ X\ Grade\ Points)\ \ for\ all\ courses\ except\ audit\ and\ \frac{S}{Z}\ grade\ Courses}{\sum\ (Course\ Credits)\quad except\ audit\ and\ \frac{S}{Z}\ grade\ Courses}$$

CREDIT DSITRIBUTION

The curriculum of the Computer Science and Engineering Department maintains a balance of multidisciplinary domains covering technical, professional, management courses and their distribution in core, elective, and research seminars. The program curriculum is continuously revised in accordance with the changing requirements and needs of the industry and R&D.

The various components of the curriculum can be viewed under the following categories:-

- Basic Sciences (BS)
- Engineering Sciences (ES)
- Humanities and Social Sciences (HS)
- Program Core (PC)
- Program Electives (PE)
- Open Electives
- Project(s) (PW)
- Internships/Seminars (IS)

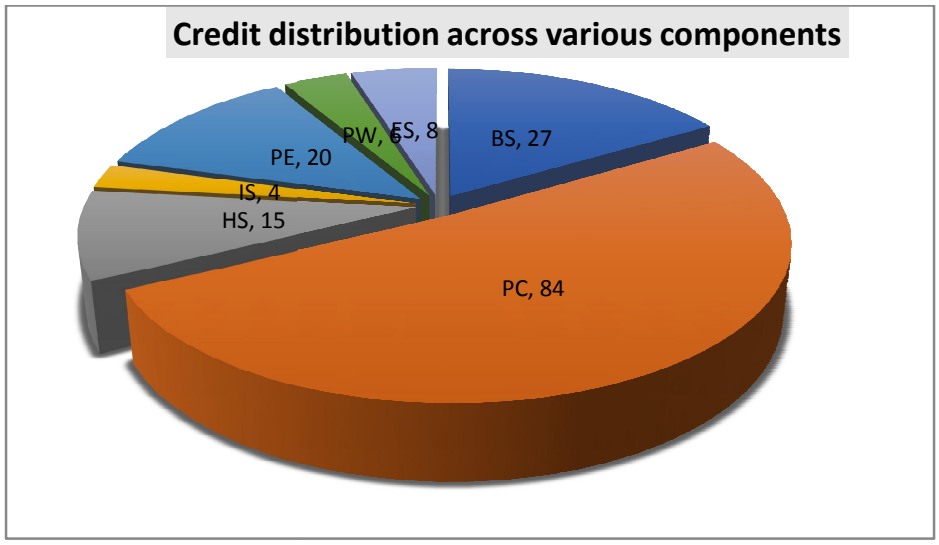

Fig 1: Credit distribution across various components

Total number of credits to be earned will be 164 distributed across various semesters as shown in Table 3.

Table 3: Semester wise distribution of credits

Semester	Credits
First	22
Second	20
Third	23
Fourth	21
Fifth	22
Sixth	21
Seventh	21
Eighth	14
Total credits	**164**

Scheme of Examination of B.E. in Computer Science & Engineering

Year: First **Semester: First**

Course Code	Course Name	Option	Hours per week			Credits	Marks		
			L	T	P		Internal Assessment	University Exam	Total
	Choice based Physics course	Theory	3	1	0	4	50	50	100
	Choice based Physics course (P)	Practical	0	0	3	1	50	-	50
ASM 101	Calculus	Theory	4	1	0	5	50	50	100
HSMC X01	Professional Communication	Theory	2	0	0	2	50	50	100
HSMC X51	Professional Communication (P)	Practical	0	0	2	1	50	-	50
ESC X53/ BTBS X01	[#]Workshop/ Fundamentals of Biotechnology	Practical Theory	0 2	0 0	4 0	2	50 50	- 50	50 100
ESC X01	Programming fundamentals	Theory	3	0	0	3	50	50	100
ESC X51	Programming fundamentals (P)	Practical	0	0	3	1	50	0	50
UHV01	Universal Human Values*	Theory	0	0	0	3*	Satisfactory / Unsatisfactory	-	-
Total			**12 / 14**	**2**	**12 / 8**	**19+3***	**400**	**200 / 250**	**600/650**

[#]Various branches can offer any one of the following two subjects Workshop/ Fundamentals of Biotechnology depending upon their branch specific requirements.

Scheme of Examination of B.E. in Computer Science & Engineering

Year: First **Semester: Second**

Course Code	Course Name	Option	Hours per week			Credits			
			L	T	P		Internal Assessment	University Exam	Total
ASC X01	Applied Chemistry	Theory	4	0	0	4	50	50	100
ASC X51	Applied Chemistry (P)	Practical	0	0	3	1	50	-	50
ASM 201	Differential Equations and Transforms	Theory	4	1	0	5	50	50	100
EEC X01	Basic Electrical and Electronics Engineering	Theory	3	0	0	3	50	50	100
EEC X51	Basic Electrical and Electronics Engineering (P)	Practical	0	0	2	1	50	-	50
ESC X04	Engineering Graphics	Theory	1	0	0	1	50	50	100
ESC X54	Engineering Graphics (P)	Practical	0	0	3	1	50	-	50
CSC 201	Object Oriented Programming	Theory	3	0	0	3	50	50	100
CSC 251	Object Oriented Programming (P)	Practical	0	0	3	1	50	-	50
HSMC X01	Environment Sciences*	Theory	0	0	0	1*	Satisfactory / Unsatisfactory	-	-
Total			**15**	**1**	**11**	**20+1***	**450**	**250**	**700**

Summer Internship/Training :

Subject Code	Subject Name	L-T-P	Contact hrs./week	Credits	Assessment
ST 251	**Product Re-engineering and Innovation**	0-0-20	20	Nil	Satisfactory / Unsatisfactory

Note: **The students will undergo a mandatory "Summer Training" of two weeks in their respective departments after their second-semester exams. It will be a non-credited mandatory course, the result of which (satisfactory/unsatisfactory) will be reflected in their second-semester mark sheet.**

***Two value-added courses namely, Universal Human Values and Environment Sciences with special credits (not to be included in CGPA evaluation) will be offered as self-study courses in BE first year. The results of these subjects as satisfactory/unsatisfactory will be reflected in the mark sheet.**

Scheme of Examination of B.E. in Computer Science & Engineering

Year: Second **Semester: Third**

S. No	Paper Code	Course Name	Scheme of Teaching			Scheme of Examination			
			L-T-P	Contact hrs/week	Credits	Theory			Practical*
						Internal Assessment	University Assessment	Total	
1	CS 301	Data Structures	3-1-0	4	4	50	50	100	-
2	CS 351	Data Structures (Practical)	0-0-3	3	1	-	-	-	50
3	CS 302	Database Systems	3-1-0	4	4	50	50	100	-
4	CS 352	Database Systems (Practical)	0-0-3	3	1	-	-	-	50
5	CS 303	Discrete Structures	3-1-0	4	4	50	50	100	-
6	CS 304	Web Technologies	3-0-0	3	3	50	50	100	
7	CS 354	Web Technologies (Practical)	0-0-3	3	1	-	-	-	50
8	CS 305	Software Engineering	3-0-0	3	3	50	50	100	
9	VAC 101	Latest Trends And technologies in Computer Science	2-0-0	2	2	50	50	100	-
Total			**17-3-9**	**29**	**23**	**100**	**300**	**600**	**150**

*Practical marks are for continuous and end semester evaluation

Scheme of Examination of B.E. in Computer Science & Engineering

Year: Second **Semester: Fourth**

S. No	Course Code	Course Name	Scheme of Teaching			Scheme of Examination			
			L-T-P	Contact hrs/week	Credits	Theory			Practical*
						Internal Assessment	University Assessment	Total	
1	CS 401	Analysis and Design of Algorithms	3-1-0	4	4	50	50	100	-
2	CS 451	Analysis and Design of Algorithms (Practical)	0-0-3	3	1		-	-	50
3	CS 402	Linear Algebra and Probability Theory	3-0-0	3	3	50	50	100	-
4	CS 403	Operating Systems	3-1-0	4	4	50	50	100	-
5	CS 453	Operating Systems (Practical)	0-0-3	3	1		-		50
6	CS 404	Computer Networks	3-1-0	4	4	50	50	100	
7	CS 454	Computer Networks (Practical)	0-0-3	3	1		-	-	50
8	CS 405	Computer Architecture and Organization	3-0-0	3	3	50	50	100	-
Total			**15-3-9**	**27**	**21**	**250**	**250**	**500**	**150**

*Practical marks are for continuous and end semester evaluation

Scheme of Examination of B.E. in Computer Science & Engineering

Year: Third **Semester: Fifth**

S. No	Course Code	Course Name	Scheme of Teaching			Scheme of Examination			
			L-T-P	Contact hrs/week	Credits	Theory			Practical*
						Internal Assessment	University Assessment	Total	
1	CS 501	Natural Language Processing	3-0-0	3	3	50	50	100	-
2	CS 551	Natural Language Processing (Practical)	0-0-3	3	1		-	-	50
3	CS 502	Computer Graphics	3-0-0	3	3	50	50	100	-
4	CS 552	Computer Graphics (Practical)	0-0-3	3	1		-	-	50
5	CS 503	Artificial Intelligence	3-1-0	4	4	50	50	100	-
6	CS 553	Artificial Intelligence (Practical)	0-0-3	3	1		-		50
7	CS 504	Theory of Computation	3-1-0	4	4	50	50	100	
8	AS201	Economics	3-0-0	3	3	50	50	100	-
9	CS 555	Industrial Training (After 4thSem)	-------	-	2	50	-	50	-
Total			**15-2-9**	**26**	**22**	**300**	**250**	**550**	**150**

*Practical marks are for continuous and end semester evaluation

Scheme of Examination of B.E. in Computer Science & Engineering

Year: Third **Semester: Sixth**

S. No	Course Code	Course Name	Scheme of Teaching			Scheme of Examination			
			L-T-P	Contact hrs/week	Credits	Theory			Practical*
						Internal Assessment	University Assessment	Total	
1.	CS 601	Data Mining and Machine Learning	3-1-0	4	4	50	50	100	-
2.	CS 651	Data Mining and Machine Learning (Practical)	0-0-3	3	1	-	-	-	50
3.	CS 602	Cryptography and Network Security	3-0-0	3	3	50	50	100	-
4.	CS 603	Digital Image Processing	3-1-0	4	4	50	50	100	-
5.	CS 653	Digital Image Processing (Practical)	0-0-3	3	1	-	-	-	50
6.	CS 604	Compiler Design	3-1-0	4	4	50	50	100	-
7.		Elective-I	3-0-0	3	3	50	50	100	-
8.		Elective-I (Practical)	0-0-3	3	1	-	-	-	50
Total			**15-3-9**	**27**	**21**	**250**	**250**	**500**	**150**

*Practical marks are for continuous and end semester evaluation

Scheme of Examination of B.E. in Computer Science & Engineering

Elective-I

S. No	Course Code	Course Name	Scheme of Teaching			Scheme of Examination			
			L-T-P	Contact hrs/week	Credits	Theory			Practical*
						Internal Assessment	University Assessment	Total	
1.	CS 605A	Software Testing and Quality Assurance	3-0-0	3	3	50	50	100	-
2.	CS 655A	Software Testing and Quality Assurance (Practical)	0-0-3	3	1	-	-	-	50
3.	CS 605B	Modelling And Simulation	3-0-0	3	3	50	50	100	-
4.	CS 655B	Modelling And Simulation (Practical)	0-0-3	3	1	-	-	-	50
5.	CS 605C	Mobile Application Development	3-0-0	3	3	50	50	100	-
6.	CS 655C	Mobile Application Development (Practical)	0-0-3	3	1	-	-	-	50
7.	CS 605D	Data Acquisition and Interfacing	3-0-0	3	3	50	50	100	-
8.	CS 655D	Data Acquisition and Interfacing (Practical)	0-0-3	3	1	-	-	-	50
9.	CS 605E	Multimedia Computing	3-0-0	3	3	50	50	100	-
10.	CS 655E	Multimedia Computing (Practical)	0-0-3	3	1	-	-	-	50
11.	CS 605F	Cloud Computing	3-0-0	3	3	50	50	100	-
12.	CS 655F	Cloud Computing (Practical)	0-0-3	3	1	-	-	-	50

*Practical marks are for continuous and end semester evaluation

Scheme of Examination of B.E. in Computer Science & Engineering

Year: Fourth **Semester: Seventh**

S. No	Course Code	Course Name	Scheme of Teaching			Scheme of Examination			
			L-T-P	Contact hrs/week	Credits	Theory			Practical*
						Internal Assessment	University Assessment	Total	
1.	CS 701	Neural Networks and Deep Learning	3-1-0	4	4	50	50	100	-
2.	CS 751	Neural Networks and Deep Learning (Practical)	0-0-3	3	1	-	-	-	50
3.	CS 702	Cyber Laws and IPR	3-0-0	3	3	50	50	100	-
4.		Elective-II	3-0-0	3	3	50	50	100	-
5.		Elective-II (Practical)	0-0-3	3	1	-	-	-	50
6.		Elective-III	3-0-0	3	3	50	50	100	-
7.		Elective-III (Practical)	0-0-3	3	1	-	-	-	50
8.	CS 756	Project-I	0-0-6	6	3	100	-	100	-
9.	CS 755	Industrial Training (After 6th Semester)	---	-	2	100	-	100	-
Total			**12-1-15**	**28**	**21**	**450**	**250**	**700**	**150**

*Practical marks are for continuous and end semester evaluation

Scheme of Examination of B.E. in Computer Science & Engineering

Elective-II

S. No	Course Code	Course Name	Scheme of Teaching			Scheme of Examination			
			L-T-P	Contact hrs/week	Credits	Theory			Practical*
						Internal Assessment	University Assessment	Total	
1.	CS 703A	Software Project Management	3-0-0	3	3	50	50	100	-
2.	CS 753A	Software Project Management (Practical)	0-0-3	3	1	-	-	-	50
3.	CS 703B	Internet of Things	3-0-0	3	3	50	50	100	-
4.	CS 753B	Internet of Things (Practical)	0-0-3	3	1	-	-	-	50
5.	CS 703C	Business Intelligence	3-0-0	3	3	50	50	100	-
6.	CS 753C	Business Intelligence (Practical)	0-0-3	3	1	-	-	-	50
7.	CS 703D	Wireless Sensor Networks	3-0-0	3	3	50	50	100	-
8.	CS 753D	Wireless Sensor Networks (Practical)	0-0-3	3	1	-	-	-	50
9.	CS 703E	Sensor Systems and Application	3-0-0	3	3	50	50	100	
10.	CS 753E	Sensor Systems and Application (Practical)	0-0-3	3	1	-	-	-	50
11.	CS 703F	Soft Computing	3-0-0	3	3	50	50	100	-
12.	CS 753F	Soft Computing (Practical)	0-0-3	3	1	-	-	-	50

*Practical marks are for continuous and end semester evaluation

Scheme of Examination of B.E. in Computer Science & Engineering

Elective-III

S. No	Course Code	Course Name	Scheme of Teaching			Scheme of Examination			
			L-T-P	Contact hrs/week	Credits	Theory			Practical*
						Internal Assessment	University Assessment	Total	
1.	CS 704A	Agile Software Development	3-0-0	3	3	50	50	100	-
2.	CS 754A	Agile Software Development (Practical)	0-0-3	3	1	-	-	-	50
3.	CS 704B	Wireless and Mobile Networks	3-0-0	3	3	50	50	100	-
4.	CS 754B	Wireless and Mobile Networks (Practical)	0-0-3	3	1	-	-	-	50
5.	CS 704C	Information Retrieval and Management	3-0-0	3	3	50	50	100	-
6.	CS 754C	Information Retrieval and Management (Practical)	0-0-3	3	1	-	-	-	50
7.	CS 704D	Mobile Computing	3-0-0	3	3	50	50	100	-
8.	CS 754D	Mobile Computing (Practical)	0-0-3	3	1	-	-	-	50
9.	CS 704E	Smart System Design	3-0-0	3	3	50	50	100	-
10.	CS 754E	Smart System Design (Practical)	0-0-3	3	1	-	-	-	50

*Practical marks are for continuous and end semester evaluation

Scheme of Examination of B.E. in Computer Science & Engineering

Year: Fourth **Semester: Eighth**

S. No	Course Code	Course Name	Scheme of Teaching			Scheme of Examination			
			L-T-P	Contact hrs/week	Credits	Theory			Practical*
						Internal Assessment	University Assessment	Total	
Option 1									
1.		Elective-IV	2-0-0	2	3	50	50	100	-
2.		Elective –V	3-0-0	3	3	50	50	100	-
3.		Elective –V (Practical)	0-0-3	3	1	-	-	-	50
4.		Elective VI	3-0-0	3	3	50	50	100	-
		Elective –VI (Practical)	0-0-3	3	1	-	-	-	50
5.	CS 854	Project-II	0-0-6	6	3	-	-	100	-
Total			**8-0-12**	**20**	**14**	**150**	**150**	**400**	**100**
Option 2									
1.	CS 855	Industrial Training	---	-	14	250	250	500	-
Total			**---**	**-**	**14**	**250**	**250**	**500**	**-**

*Practical marks are for continuous and end semester evaluation

Scheme of Examination of B.E. in Computer Science & Engineering

Elective-IV

S. No	Course Code	Course Name	Scheme of Teaching			Scheme of Examination			
			L-T-P	Contact hrs/week	Credits	Theory			Practical*
						Internal Assessment	University Assessment	Total	
1.	HSM 401	Principles of Management	2-0-0	2	3	50	50	100	-
2.	HSM 402	Business Environment and Business Laws	2-0-0	2	3	50	50	100	-
3.	HSM 403	Entrepreneurship and Project Management	2-0-0	2	3	50	50	100	-
4.	HSM 404	Financial Management	2-0-0	2	3	50	50	100	-
5.	HSM 405	Marketing Management	2-0-0	2	3	50	50	100	-
6.	HSM 406	Human Resource Management	2-0-0	2	3	50	50	100	-

Scheme of Examination of B.E. in Computer Science & Engineering

Elective-V

S. No	Course Code	Course Name	Scheme of Teaching			Scheme of Examination			
			L-T-P	Contact hrs/week	Credits	Theory			Practical*
						Internal Assessment	University Assessment	Total	
1.	CS 802A	Building Enterprise Applications	3-0-0	3	3	50	50	100	-
2.	CS 852A	Building Enterprise Applications (Practical)	0-0-3	3	1	-	-	-	50
3.	CS 802B	Block chain Technologies	3-0-0	3	3	50	50	100	-
4.	CS 852B	Block chain Technologies	0-0-3	3	1	-	-	-	50
5.	CS 802C	Human Computer Interaction	3-0-0	3	3	50	50	100	-
6.	CS 852C	Human Computer Interaction (Practical)	0-0-3	3	1	-	-	-	50
7.	CS 802D	Distributed Computing	3-0-0	3	3	50	50	100	-
8.	CS 852D	Distributed Computing (Practical)	0-0-3	3	1	-	-	-	50
9.	CS 802E	Pattern Recognition	3-0-0	3	3	50	50	100	-
10.	CS 852E	Pattern Recognition (Practical)	0-0-3	3	1	-	-	-	50

Scheme of Examination of B.E. in Computer Science & Engineering

Elective-VI

S. No	Course Code	Course Name	Scheme of Teaching			Scheme of Examination			
			L-T-P	Contact hrs/week	Credits	Theory			Practical*
						Internal Assessment	University Assessment	Total	
1.	CS 803A	Network Science: Structural Analysis and Visualization	3-0-0	3	3	50	50	100	-
2.	CS 853A	Network Science: Structural Analysis and Visualization (Practical)	0-0-3	3	1	-	-	-	50
3.	CS 803B	Advance Database Systems	3-0-0	3	3	50	50	100	-
4.	CS 853B	Advance Database Systems (Practical)	0-0-3	3	1	-	-	-	50
5.	CS 803C	User Interface Technologies	3-0-0	3	3	50	50	100	-
6.	CS 853C	User Interface Technologies (Practical)	0-0-3	3	1	-	-	-	50
7.	CS 803D	Expert Systems	3-0-0	3	3	50	50	100	-
8.	CS 853D	Expert Systems (Practical)	0-0-3	3	1	-	-	-	50

*Practical marks are for continuous and end semester evaluation

Title	APPLIED PHYSICS		Credits	4
Code	ASP X01	Semester: 1	L T P	3 1 0
Max. Marks	100	Internal: - 50 External: - 50	Course Type	Basic Sciences (BS)
Pre-requisites	Physics and mathematics at 10+2 level		Contact Hours	4
Course Outcomes	On completion of this course, a student will be able to 1. Understand the methodology to describe free, damped and forced oscillations and, subsequently, to understand the behavior of these motions qualitatively as well quantitatively. 2. Understand the concepts of electromagnetic waves production and propagations in various mediums. 3. Understand the different types of polarizations, their production methods and applications 4. Understand the working principle and applications of a laser and optical fibers along with their applications.			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
Oscillations: Complete mathematical treatment for mechanical as well as electrical free, damped and forced oscillators.Simple harmonic oscillator: differential and linear equation of motion, Physical characteristics of SHM. Superposition of two SHMs executing in the same and perpendicular direction of same frequency and different frequencies, Lissajous figures. Superposition of n-SHMs . **Damped Oscillations**: differential equation of a damped oscillator and different kinds of damping, Methods of describing damping of an oscillator - logarithmic decrement, relaxation time, quality factor. **Forced Oscillations**: differential and linear equation of motion, dependence of oscillation parameters on driving frequency, power, bandwidth, Quality factor and amplification of forced oscillator, resonance in forced oscillators, vibration insulator	13
Electromagnetic Waves: Introduction to vector calculus, Maxwell equations (derivations and physical significance). Electromagnetic waves in vacuum and conducting medium, Poynting vector and Poynting theorem, Reflection and transmission of electromagnetic waves for oblique and normal incidence.	11
SECTION-B	
Polarization: Methods of polarization, double refraction, quarter and half wave plates, analysis of polarized light, Fresnel theory for optical activity, polarimeter (biquartz and Laurent's half-shade devices), babinet compensator, Kerr effect, applications of polarization in testing of materials, LCDs, 3D movies	8
Lasers and Optical Fibers: Elementary idea of LASER production, spontaneous emission, stimulated emission, Einstein's coefficients, Helium-Neon, Ruby and semiconductor lasers,	8

Applications of lasers in optical communication and storage, defense, geophysical sciences.

Basics of optical fiber - its numerical aperture, coherent and incoherent bundle, step index and graded index fiber, material dispersion, applications of fibers in sensors and communication.

Suggested Books

S. No.	Title	Authors	Publisher	Edition/ Year
1.	Physics of Vibrations and Waves	John Wiley & Sons- H.J.Pain		5th Edition
2.	Optics	Ajoy Ghatak		Latest Edition
3.	Fundamentals of Optics	F. Jenkins and H.E. White		Latest Edition
4.	Introduction to Electrodynamics,	David J. Griffiths		Latest Edition

Mapping of Course Outcomes with POs and PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	1	1			1	1	2	1		2		
CO2	3	2	1	1			1	1	2	1		2		
CO3	3	3	1	1			1	1	2	1		2		
CO4	3	2	2	1			1	1	2	1		2		

Title	APPLIED PHYSICS(Practical)		Credits	1
Code	ASP X51	Semester: 1	L T P	0 0 3
Max. Marks	50	External: Nil Internal: - 50	Course Type	Basic Sciences (BS)
Pre-requisites	Physics and mathematics at 10+2 level		Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Work with measuring/analysis instruments like vernier caliper, screw gauge, spectrometer, spherometer, cathode ray oscilloscope. 2. Perform data analysis and interpretations such as significant figures, error calculations, graphical representation of the data, calculation of slope and intercept using least square fitting method 3. Understand the concepts of oscillatory motions using the experimental demonstrations. 4. Understand the concepts of optical phenomena by performing related experiments.			
Note for Examiner	Teacher is supposed to do continuous evaluation of the student throughout the semester. The evaluation will be based on the experiments conducted in the lab by the student. The teacher may schedule multiple practical tests and multiple viva voce examinations to evaluate the students continuously. Students are supposed to maintain laboratory files for the experiments conducted.			

SYLLABUS

List of Experiments:

Students need to perform at least six number of experiments selecting about equal number of experiments from **Group A** and **Group B**

Group A: Optics

1. To find the wavelength of sodium light using Fresnel's biprism. **[CO1, CO2, CO4]**
2. (i) To determine the wavelength of He-Ne laser using transmission grating. **[CO1, CO2, CO4]**
   (ii) To determine the slit width using the diffraction pattern.
3. To determine the wavelength of sodium light by Newton's rings method. **[CO1, CO2, CO4]**
4. To determine the wavelength of sodium light using a diffraction grating. **[CO1, CO2, CO4]**
5. To find the specific rotation of sugar solution using a Laurant's Half shade/ Bi-quartz Polarimeter. **[CO1, CO2, CO4]**
6. To find the refractive index of a prism using spectrometer. **[CO1, CO2, CO4]**
7. To determine the wavelength of a laser using Michelson interferometer. **[CO1, CO2, CO4]**

Group B: Oscillations and Waves

8. To determine the velocity of ultrasonic waves in different liquids using ultrasonic interferometer. **[CO1, CO2, CO3]**
9. To study the frequency response and to find resonant frequencies of LCR series and parallel

circuits. Also to find the quality factor and bandwidth in LCR. **[CO1, CO2, CO3]**

10. To determine the value of acceleration due to gravity and radius of gyration using bar pendulum. **[CO1, CO2, CO3]**
11. Study of transverse and longitudinal standing waves and the measurement of the frequency of the electrically maintained Tuning fork. **[CO1, CO2, CO3]**
12. To study damping effects in the spring mass system. **[CO1, CO2, CO3]**
13. To study Lissajous figures obtained by superposition of oscillations with different frequencies and phases. **[CO1, CO2, CO3]**

Mapping of Course Outcomes with POs and PSOs

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	1	1			1	1	2	1		2		
CO2	3	2	1	1			1	1	2	1		2		
CO3	3	3	1	1			1	1	2	1		2		
CO4	3	2	1	1			1	1	2	1		2		

Title	QUANTUM PHYSICS		Credits	4
Code	ASP X02	Semester: 1	L T P	3 1 0
Max. Marks	100	Internal: - 50 External: - 50	Course Type	Basic Sciences (BS)
Pre-requisites	Physics and mathematics at 10+2 level.		Contact Hours	4
Course Outcomes	On completion of this course, a student will be able to 1. Understand the basics of the special theory of relativity and its applications. Students will be familiarized with various relativistic effects like Lorentz transformations, simultaneity, length contraction, time dilation, Doppler effect, addition of velocities, variation of mass with velocity and mass-energy relation. 2. To understand historical development of quantum mechanics and to understand the central concepts and principles in quantum mechanics, such as the Schrodinger equation, the wave function and its interpretation. 3. To apply Schrödinger theory to various systems and solve Schrodinger equation for simple potentials such as potential step, infinite and finite potential well, potential barrier and its tunneling, linear harmonic oscillator (one-dimensional) and 3-D rigid box. 4. Apply quantum mechanical concepts to understand the origin of some of the properties exhibited by solids like energy bands in solids and specific heat of solids			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
Unit I: Special Theory of Relativity Inertial and non-inertial frames of reference, Galilean transformation, Michelson Morley Experiment, Postulates of special theory of relativity, Lorentz transformation, Simultaneity, Length contraction, Time dilation, Doppler effect, Addition of velocities, variation of mass with velocity, mass-energy relation, Relativistic momentum, Minkowski space (Section 1.1 to 1.5, 1.7 to 1.9 of Book 1) **[CO1]**	8
Unit II: Origin and Postulates of Quantum Mechanics Quantum theory of light, Blackbody Radiation, Photoelectric effect, Compton effect, X-rays production, spectrum & diffraction (Bragg's law), pair production, photons & gravity, Gravitational Red Shift, Black holes, de-Broglie hypothesis, particle diffraction, uncertainty	16

principle and its applications Postulates of quantum mechanics, wave function, Born interpretation and normalization, Schrodinger theory, Time-dependent and Time-independent Schrodinger equation, Operators (Adjoint operator, Identity operator, Hermitian operator, unitary operator etc.), expectation values, Ehrenfest theorem (Sections 2.1-2.10, 3.1-3.5, 3.7-3.10, 5.1-5.7 of Book 1) **[CO2]**	
SECTION-B	
Unit III: Applications of Quantum Mechanics Particle in a box (infinite potential well), Potential step, Finite Potential Well and Barrier, Tunneling, Linear harmonic oscillator (one-dimensional), 3-D rigid box and degeneracy (Sections 5.8 – 5.11 of Book 1) **[CO3]**	8
Unit IV: Application of Quantum Mechanics to Crystalline Solids Free Electron theory of Metals (Classical and Sommerfield), Bloch's theorem for particles in a periodic potential, Kronig-Penney Model and origin of energy bands, conductors, insulators and semiconductors, Fermi level, density of states, Effective mass, Specific heat of solids (Sections 6.35-6.38, 6.40, 6.41, 7.1-7.5 of book 4 and Section 1 of Chapter 10 of Book 3 [**CO4**].	10

Suggested Books

S. No.	Title	Authors	Publisher	Edition/ Year
1.	Concepts of Modern Physics	Arthur Beiser ,Physics of Vibrations and Waves	McGraw-Hill	Latest Edition
2.	Quantum Physics of Atoms, Molecules, Solids, Nuclei and Particles	Eisberg and Resnick		Latest Edition
3.	Introduction to Solids	Leonid V. Azaroff		Latest Edition
4.	Elementary Solid state Physics)	M.Ali Omar	Pearson Education	Latest Edition
5.	Solid State Physics	C. Kittel	Wiley Eastern	Latest Edition
6.	Solid State Physics, by S.O. Pillai (New Age International)	S.O. Pillai	New Age International	Latest Edition

Mapping of Course Outcomes with POs and PSOs	COs	POs												PSOs	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
	CO1	3	2	1	1			1	1	2	1		2		
	CO2	3	2	1	1			1	1	2	1		2		
	CO3	3	3	1	1			1	1	2	1		2		
	CO4	3	2	2	1			1	1	2	1		2		

Title	QUANTUM PHYSICS(Practical)		Credits	1
Code	ASP X52	Semester: 1	L T P	0 0 3
Max. Marks	50	External: Nil Internal: - 50	Course Type	Basic Sciences (BS)
Pre-requisites	Physics and mathematics at 10+2 level		Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1.Understand the construction and working of • Measuring devices like vernier Calipers, screw gauge, spherometer etc. • Electric devices like ammeter, voltmeter, galvanometer, gaussmeter etc.(Both analog and digital) 2. Perform experiments using specialized tools and techniques to probe the phenomena of quantum mechanics like uncertainty principle, discretization of energy etc. and to verify the laws of probability and quantum statistics. 3. Experimentally determine quantum parameters like energy band gap, excitation energy, hydrogen spectrum wavelengths in visible region, Planck's constant etc. 4. Carry out the error analysis of their results and provide theoretical explanations of their results.			
Note for Examiner	Teacher is supposed to do continuous evaluation of the student throughout the semester. The evaluation will be based on the experiments conducted in the lab by the student. The teacher may schedule multiple practical tests and multiple viva voce examinations to evaluate the students continuously. Students are supposed to maintain laboratory files for the experiments conducted.			

SYLLABUS

List of Experiments

1. To study the quantized energy level of the first excited state in the Argon using the Frank-Hertz setup. **[CO2, CO3, CO4]**
2. To find the value of Planck's constant and evaluate the work function of cathode material by used of photoelectric cell. **[CO1, CO2, CO3, CO4]**
3. To study various characteristics of photo-voltaic cell: (a) Voltage-current characteristics, (b) loading characteristics, (c) power-resistance characteristics and (d) inverse square law behavior of the photo-current with distance of source of light from photo-voltaic cell **[CO1, CO2, CO4]**
4. To study the response of a photo-resistor to varying intensity of light falling on it and deduce spectral sensitivity of its semiconductor material. **[CO1, CO3, CO4]**
5. To study the Balmer Series of Hydrogen spectrum using diffraction grating and calculate Rydberg constant. **[CO1, CO3, CO4]**
6. To evaluate charge on an oil drop using Millikan's oil drop method. **[CO1, CO2, CO4]**
7. To verify Rutherford's alpha scattering formula using a mechanical model. **[CO1, CO2, CO4]**
8. To calculate charge to mass ratio of an electron using Thompsonś method. **[CO1, CO2, CO4]**

9. To determine Hall coefficient of a given semiconductor material and evaluate charge carrier type, density and mobility of charge carriers. **[CO1, CO3, CO4]**

10. To study temperature dependence of resistivity of a semiconductor using four probe method and determine the energy band gap of a given semiconductor. **[CO1, CO3, CO4]**

11. To determine the velocity of ultrasonic waves in different liquids using ultrasonic interferometer. **[CO1, CO2, CO4]**

12. To study probability theory using coins. **[CO1, CO2, CO4]**

13. To study probability and statistics using two dice. **[CO1, CO2, CO4**]

Mapping of Course Outcomes with POs and PSOs

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	1	1			1	1	2	1		2		
CO2	3	2	1	1			1	1	2	1		2		
CO3	3	3	1	1			1	1	2	1		2		
CO4	3	2	1	1			1	1	2	1		2		

Title	PHYSICS OF MATERIAL		Credits	4
Code	ASP X03	Semester: 1	L T P	3 1 0
Max. Marks	100	Internal: - 50 External: - 50	Course Type	Basic Sciences (BS)
Pre-requisites	Physics and mathematics at 10+2 level		Contact Hours	4
Course Outcomes	On completion of this course, a student will be able to 1. Qualitatively describe the bonding in materials and its effect on material properties. 2. Know about various crystal structures and defects and to correlate these to material properties. Students will be able to identify common defects in a material, different types of dislocation, their movement within the crystal leading to plastic deformation and strengthening mechanisms in materials. 3. Identify diffusion processes and their applications and know about elastic, an elastic and viscoelastic behavior of materials. 4. Understand fracture mechanics, factors that affect fatigue life and generalized creep behavior. 5. Understand phase diagrams, phase transformations, the importance of phase transformations for controlling microstructure and properties in engineering alloys. Students will also be able to understand solid state reactions and kinetic limitations in phase transformations.			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
Crystal structure: Bonding forces and energies, Primary and Secondary bonds, Space Lattices, Symmetries in a cubic lattice, Crystal Structures (cubic and hexagonal cells), Assignment of coordinates, directions and planes in crystals, Linear, Planar and Space densities in crystals, close packed morphology (Hexagonal and cubic close packing), single and polycrystalline structures, interstitial spaces (trigonal, tetrahedral and octahedral voids) Structure of ceramics (NaCl, Zinc blende, silica and silicates, diamond crystal, Graphite, Fullerenes and carbon nanotubes) Structure of polymers, crystallinity of long chain polymers Crystal Structure analysis, X-ray diffraction and Bragg's law, Experimental methods for study of X-ray diffraction pattern, Crystal Defects (Point, line, surface and volume imperfections) **[CO1,CO2]**	14
Diffusion: Diffusion mechanisms, steady state diffusion, non-steady state diffusion, factors affecting diffusion, applications based on diffusion (corrosion resistance of Duralumin, carburization of steel, decarburization of steel, doping of semiconductors) **[CO3]**	3
Elastic, Anelastic and Viscoelastic Behaviour Elastic behaviour and its atomic model, rubber like elasticity, anelastic behaviour, relaxation processes, viscoelastic behaviour. **[CO3]**	3

SECTION-B	
Plastic Deformations and strengthening mechanisms : Tensile properties (Yield strength, Tensile Strength, Ductility, Resilience, Toughness), Dislocations and plastic deformation, characteristics of dislocations, slip systems, slip in single crystals and polycrystalline materials, mechanisms of strengthening in metals (grain size reduction, solid-solution strengthening, strain hardening), recovery, recrystallization and grain growth **[CO3]**	5
Fracture, Fatigue and Creep : Fracture (Ductile and brittle fractures), principles of fracture mechanics, fracture toughness, ductile to brittle transitions Cyclic stresses, S-N curve, crack initiation and propagation, factors that affect fatigue life, environmental effects, generalized creep behavior, stress and temperature effect **[CO4]**	5
Phase Diagrams : One-Component (or Unary) Phase Diagrams, Binary Isomorphous Systems, Interpretation of Phase Diagrams, Development of Microstructure in Isomorphous Alloys, Mechanical Properties of Isomorphous Alloys ,Binary Eutectic Systems, Development of Microstructure in Eutectic Alloy, Equilibrium Diagrams Having Intermediate Phases or Compounds, Eutectic and Peritectic Reactions, the Iron-Carbon system. **[CO5**	6
Phase Transformations: Kinetics of phase transformation, kinetics of solid state reactions, Isothermal transformation diagrams, continuous cooling transformation, temper embrittlement **[CO5]**	4

Suggested Books

S. No.	Title	Authors	Publisher	Edition/ Year
1.	Material science and engineering – An Introduction	William D Callister	John Willey and Sons	6Th edition
2.	Material Science and Engineering – A First Course	V. Raghvan	Eastern economy edition	4th edition
3.	Solid State Physics	S. O. Pillai	New Age Internationa	Latest Edition
4.	Introduction to Solids	Leonid V Azaroff	Tata McGraw Hill	3rd edition.

Mapping of Course Outcomes with POs and PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	1	1	1				1			1		
CO2	3	2	1	1	2				1			2		
CO3	3	2	2	1	2							2		
CO4	3	2	1	2	1	2	1					2		
CO5	3	2	2	2	1	2	1					2		

Title	PHYSICS OF MATERIAL (Practical)		Credits	1
Code	ASP X53	Semester: 1	L T P	0 0 3
Max. Marks	50	External: Nil Internal: - 50	Course Type	Basic Sciences (BS)
Pre-requisites	Physics and mathematics at 10+2 level		Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Understand the construction and working of • Measuring devices like vernier Calipers, screw gauge, spherometer etc. • Electric devices like ammeter, voltmeter, galvanometer, gaussmeter etc. (Both analog and digital) 2. Identify and differentiate the materials based on their electrical, magnetic, thermal and optical properties. 3. Experimentally determine parameters like Elastic constants, thermal conductivity, electrical resistivity, Hall coefficient, Curie temperature, retentivity and coercivity etc. of various materials. 4. Carry out the error analysis of their results. 5. Provide a theoretical explanation of their results and make a complete and cogent report of their findings.			
Note for Examiner	Teacher is supposed to do continuous evaluation of the student throughout the semester. The evaluation will be based on the experiments conducted in the lab by the student. The teacher may schedule multiple practical tests and multiple viva voce examinations to evaluate the students continuously. Students are supposed to maintain laboratory files for the experiments conducted.			

SYLLABUS

List of Experiments

1. To study the quantized energy of the first excited state in Argon using the Frank-Hertz Set-up. **[CO1, CO2, CO3, CO4, CO5]**
2. To find the value of Planck's constant and evaluate the work function of cathode material by use of photoelectric cell.**[CO1, CO2, CO3, CO4, CO5]**
3. To study various characteristics of photovoltaic cell: (a) Voltage-current characteristics (b) loading characteristics (c) power-resistance characteristics and (d) inverse squarelaw behavior of photocurrent with distance of source of light from photovoltaic cell.**[CO1, CO2, CO3, CO4, CO5]**

4. To study the response of a photoresistor to varying intensity of light falling on it and deduce spectral sensitivity of its semiconductor material.**[CO1, CO2, CO3, CO4, CO5]**
5. To determine Hall coefficient of a semiconductor material and then evaluate the type, density and mobility of charge carrier in a given semiconductor material.**[CO1, CO2, CO3, CO4, CO5]**
6. To study the hysteresis loop of magnetic material (iron, nickel and steel) and determine its retentivity, coercivity and energy dissipated per unit volume per cycle of hysteresis.**[CO1, CO2, CO3, CO4, CO5]**
7. To study temperature dependence of resistivity of a semiconductor material using four probe method and further deduce the band gap of this semiconductor.**[CO1, CO2, CO3, CO4, CO5]**
8. To determine the Curie temperature of a ferroelectric material by measuring dielectric constant as a function of temperature.**[CO1, CO2, CO3, CO4, CO5]**
9. To determine thermal conductivity of bad conductor by using guarded plate method (Lee's disc method).**[CO1, CO2, CO3, CO4, CO5]**
10. To study the diamagnetic, paramagnetic and ferromagnetic behaviour of magnetic materials.**[CO1, CO2, CO3, CO4, CO5].**

Mapping of Course Outcomes with POs and PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	1	1			1	1	2	1		2		
CO2	3	2	1	1			1	1	2	1		2		
CO3	3	3	1	1			1	1	2	1		2		
CO4	3	2	1	1			1	1	2	1		2		
CO5	3	1	1	1			1	1	2	1		2		

Title	CALCULUS		Credits	5
Code	ASM 101	Semester: 1	L T P	4 1 0
Max. Marks	100	Internal: - 50 External: - 50	Course Type	Basic Sciences (BS)
Pre-requisites	Mathematics at 10+2 level.		Contact Hours	5
Course Outcomes	On completion of this course, a student will be able to : 1. The students are able to test the behaviour of infinite series. 2. Ability to analyze functions of more than two variables and their applications. 3. Ability to evaluate multiple integrals and apply them to practical problems. 4. Ability to apply vector calculus to engineering problems.			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
FUNCTIONS OF ONE VARIABLE Sequences and Series: Sequences, Limits of sequences, Infinite series, series of positive terms, Integral test, Comparison test, Ratio test, Root test. Alternating series, Absolute and Conditional Convergence, Leibnitz test. Power series: radius of convergence of power series, Taylor's and Maclaurin's Series. (Scope as in Chapter 10, Sections 10.1 – 10.9 of Reference 1). Integral Calculus: Length of curves, Volume (disk and washer method) and surface areas of revolution (Scope as in Chapter 6, 6.1, 6.3, 6.4 of Reference 1).	
DIFFERENTIAL CALCULUS OF FUNCTIONS OF TWO AND THREE VARIABLES Concept of limit and continuity of a function of two and three variables, Partial derivatives, total derivative, composite function, differentiation of an implicit function, chain rule, Taylor's theorem (statement only), Maxima and minima of a function of two and three variables, Lagrange's method of multipliers (Scope as in Chapter 14, Sections 14.1-14.4, 14.6-14.10 of Reference 1).	
SECTION-B	
INTEGRAL CALCULUS OF FUNCTIONS OF TWO AND THREE VARIABLES Double and triple integrals, Change of order of integration, Applications to area and volumes. (Scope as in Chapter 15, Sections 15.1-15.5, 15.7-15.8 of Reference 1).	
VECTOR DIFFERENTIAL CALCULUS Vector-valued functions and space curves and their tangents, integration, arc lengths, unit tangent vector, Curvature and torsion of a curve, Gradient of a Scalar field, Directional Derivative (Scope as in Chapter 13, Sections 13.1-13.5 Chapter 14, Section 14.5 of Reference 1).	
VECTOR INTEGRAL CALCULUS Line integrals, Vector fields, Work, Circulation and Flux, Path Independence, Potential functions and Conservative fields, Green's theorem in the plane, Surface Areas and Surface	

Integrals, Stoke's Theorem, Gauss Divergence Theorem (Statements only) (Scope as in Chapter 16 of Reference 1).

Suggested Books

S. No.	Title	Authors	Publisher	Edition/ Year
1.	Calculus	Maurice D. Weir, Joel Hass, Frank R. Giordano, Thomas	Pearson Education.	12th Edition
2.	Advanced Engineering Mathematics	E. Kreyszig.	John Wiley.	8th Edition
3.	Advanced Engineering Mathematics	Michael D. Greenberg	Pearson Education.	2nd Edition
4.	Advanced Engineering Mathematics	Wylie and Barrett	Tata McGraw Hill	Latest Edition
5.	Higher Engineering Mathematics	B. V. Ramana	Tata McGraw Hill.	Latest Edition

Mapping of Course Outcomes with POs and PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	3	2	3								1		
CO2	3	2	2	2								1		
CO3	3	2	3	3								1		
CO4	2	3	2	2								1		

Title	PROFESSIONAL COMMUNICATION		Credits	2
Code	HSMC X01	Semester: 1	L T P	2 0 0
Max. Marks	100	Internal: - 50 External: - 50	Course Type	Humanities and Social Science(HS)
Pre-requisites	Basic knowledge of English Language and Grammar		Contact Hours	2
Course Outcomes	On completion of this course, a student will be able to : 1. Understand sentence formation in English language and based on the context, to express oneself in formal and informal communication. 2. Understand and develop the four fundamental skills namely speaking , writing , listening and reading skills in English language. 3. Understand as to how communication takes place in organizations. Understand various documents used in official communication in different situations. 4. Understand as to how to use the latest channels to build a stronger and effective communication system. Understand the importance and components of Non-verbal communication and how to handle Cross-culture communication.			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
English Grammar : Subject-verb agreement , Noun-pronoun agreement , Misplaced modifiers , Articles , Prepositions , Tenses, One word substitutes , Idioms and Phrases , Active-Passive , Synonyms –Antonyms **Basic Writing Skills :** Sentence Structures, Use of phrases and clauses in sentences , Importance of proper punctuation , Creating coherence , Organizing principles of paragraphs in documents, Techniques for writing precisely , Paragraph , Essay and Letter writing. [CO 1]	11
Communication details : Four Fundamental communication methods namely Writing, Speaking, Listening and Reading ,7 Cs of Communication , Barriers to Communication [CO 2]	3
SECTION-B	
Communication in Organizations : Formal- Informal Communication, Communication Networks, Intra and Inter Firm Communication	6

Communication methods : Reports and their types , Layout of a report , writing a report ,Office notice , Memo ,Business proposals, Minutes of meeting [CO 3]	
Modes of Communication: Emerging channels of communication , Telephone and Email Etiquettes, Non-Verbal Communication, Cross culture communication, Formal Presentations [CO 4]	3

Suggested Books

S. No.	Title	Authors	Publisher	Edition/ Year
1.	Practical English Usage.	Michael Swan..	OUP	1995.
2.	Remedial English Grammar.	F.T. Wood.	Macmillan.	2007
3.	On Writing Well.	William Zinsser..	Harper Resource Book	2001
4.	Study Writing. Liz Hamp-	Lyons and Ben Heasly.	Cambridge University Press.	2006
5.	Communication Skills	Sanjay Kumar and PushpLata.	Oxford University Press	2011
6.	. Exercises in Spoken English. Parts. I-III.,	CIEFL	Hyderabad. Oxford University Press	Latest Edition

Mapping of Course Outcomes with POs and PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	-	2	2	2	-	2	1	-	3	3	3	2		
CO2	-	2	2	2	-	2	1	-	3	3	3	2		
CO3	-	2	2	2	-	2	1	-	3	3	3	2		
CO4	-	2	2	2	-	2	1	-	3	3	3	2		

Title	PROFESSIONAL COMMUNICATION (Practical)		Credits	1
Code	HSMC X51	Semester: 1	L T P	0 0 2
Max. Marks	50	External: Nil Internal: - 50	Course Type	Humanities and Social Science(HS)
Pre-requisites	Basic knowledge of English Language and Grammar		Contact Hours	2
Course Outcomes	On completion of this course, a student will be able to 1. Develop their English speaking skills and will learn how to speak clearly and effectively. 2. Overcome stage fear and communicate with people without hesitation. 3. Handle communication in various formal and informal settings. 4. Handle communication as team member. Listen and understand.			
Note for Examiner	Teacher is supposed to do continuous evaluation of the student throughout the semester. The evaluation will be based on the experiments conducted in the lab by the student. The teacher may schedule multiple practical tests and multiple viva voce examinations to evaluate the students continuously. Students are supposed to maintain laboratory files for the experiments conducted.			

SYLLABUS

Practical Oral Communication (This unit involves interactive practice sessions in Language Lab)

1. Telling something about oneself [CO1 , CO2, CO3]
2. Story Telling and Event [CO1 , CO2]
3. Listening Comprehension [CO4]
4. Pronunciation, Intonation, Stress and Rhythm [CO1, CO2, CO3]
5. Common Everyday Situations: Conversations and Dialogues [CO1, CO2,CO3]
6. Communication at Workplace [CO3 , CO4]
7. Facing an Interview [CO1, CO2]
8. Formal Presentations [CO1, CO2, CO3, CO4]

Mapping of Course Outcomes with POs and PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	-	2	2	2	-	2	1	-	3	3	3	2		

	CO2	-	2	2	2	-	2	1	-	3	3	3	2			
	CO3	-	2	2	2	-	2	1	-	3	3	3	2			
	CO4	-	2	2	2	-	2	1	-	3	3	3	2			

Title	WORKSHOP (Practical)		Credits	2
Code	ESC X53	Semester: 1	L T P	0 0 4
Max. Marks	50	External: Nil Internal: - 50	Course Type	Engineering Sciences(ES)
Pre-requisites			Contact Hours	4
Course Outcomes	On completion of this course, a student will be able to 1. Identification of hand tools. 2. Introduction of machines. 3. Application of hand tools in engineering practices. 4. Application of machines in different manufacturing processes. 5. Introduction of safety precautions/health hazards/environment effect in engineering. 6. On hand training of tools and machines.			
Note for Examiner	Teacher is supposed to do continuous evaluation of the student throughout the semester. The evaluation will be based on the experiments conducted in the lab by the student. The teacher may schedule multiple practical tests and multiple viva voce examinations to evaluate the students continuously. Students are supposed to maintain laboratory files for the experiments conducted.			

SYLLABUS

List of Experiments

1. **Welding Shop** :
   Joining Processes, Welding and its Classification, Welding Processes, Fusion Welding, Pressure Welding, Electric Arc Welding, Gas Welding, Resistance Welding, Metal Inert gas Welding, Welding Joints, Welding Positions, Welding defects, Welding Applications, Basic welding design and Procedures, identification of materials,

   Jobs: Butt Joint in Flat Position using SMAW, Lap Joint using Spot Welding, Edge Joint in Horizontal Position using SMAW, Tee Joint in Flat position using SMAW, Corner Joint in vertical position using SMAW.

   Defect Identification and marking, Edge preparation and Fillet making, Tacking, Distortion identification.

2. **Electronics Shop:**
   To know about Soldering mechanism and techniques, Familiarity with Electronic Components / symbols, Testing of electronic components, Application of Soldering, Circuit Assembly

   Jobs : Practice of Soldering and desoldering, Identification and testing of a) passive electronic components b) Active electronic components, Assembly of Regulated Power supply circuit/Soldering of Full wave rectifier..

3. **Electrical Shop:**
   Introduction of Various Electric wirings, Wiring Systems, Electrical wiring material and fitting, different type of cables, Conduit pipe and its fitting, inspection points, switches of all types, Distribution boards, M.C.B's etc., Electric Shock and its management. Electric Tools: Conversance with various tools and to carry out the following: Measurement of wire sizes using

SWG and micrometer

Identification of Phase and neutral in single phase supply

Jobs: To control a lamp with a single way switch.To control a lamp from two different places,To assemble a fluorescent lamp with its accessories

To control a lamp, fan and a three pin socket in parallel connection with single way switches

4. **Fitting Shop:**
   Introduction of Fitting, different type of operations, Tools, materials, precision instruments like Vernier caliper and Micrometer etc, Safety precautions and Practical demonstration of tools and equipments

   Jobs:To make a square from MS Flat, Punching, Cutting, Filling techniques and practice, Tapping, Counter Drilling.

5. **Smithy Shop**:
   Introduction of Smithy and Forging process, Tools and Equipment, Operations, Heat Treatment processes, Advantages, Dis-advantages, Defects and Safety precautions.

   Jobs: Drawing and Upsetting Practice using Open Hearth Furnace, Cold working process practice, Heat Treatment \: Annealing and hardening process

6. **Machine Shop:**
   Application, Function and different parts, Operations of Lathe, Type of Cutting Tools and their materials, Drill machine Types, applications and Functions. Hacksaw machines and functions, Work Holding devices and tools, chucks, Vices, machine Vices, V Block, Measuring Instruments uses, Shaper and Milling machine Applications.

   Jobs: To perform Marking, Facing, Turning,taper Turing, Grooving, Knurling, parting, Drilling, Reaming operations on lathe machine,Hacksawing practice on Power hacksaw,Shaping operation practice on Shaper.

7. **Carpentry Shop:**
   Classification of Tree, Timber. Advantages and uses of Timber, Seasoning of Wood, Tools Used, Defects and Prevention of Wood,

   Jobs: Tee Joint, Cross Joint,Tenon Joint, L Shape Joint, Practice of Wood Working Lathe, Practice on multi-purpose Planer.

8. **Foundry Shop:**
   Introduction to Foundry, Advantages and Disadvantages of castings process, Introduction to pattern and various hand tools, Ingredients of Green sands, Various Hand Molding processes, Introduction to Casting Defects.

Jobs: Identification and uses of hand tools, Preparation of Green sand in Muller, Preparation of Sand Mould of Single piece solid pattern, Split pattern, Preparation of Green sand Core, casting of a Mould and study its defects.

Suggested Books

S. No.	Title	Authors	Publisher	Edition/ Year
1.	Introduction to Basic Manufacturing Processes and Workshop Technology	Rajender Singh	New Age International Publication	Latest Edition
2.	Workshop Technology Part 1-3	Chapman	CBS Publishers	Latest Edition

Mapping of Course Outcomes with POs and PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	-	1	2	3	3	1	2	3	1	1	3	3	3
CO2	1	2	1	1	-	2	1	2	2	2	2	3	3	3
CO3	3	-	1	2	3	3	1	2	3	1	1	3	3	3
CO4	1	2	1	1	-	2	1	2	2	2	2	3	3	3
CO5	3	1	1	2	3	3	-	3	3	2	-	3	-	2
CO6	3	3	2	2	3	3	2	3	3	2	3	3	3	3

Title	FUNDAMENTALS OF BIOTECHNOLOGY		Credits	2
Code	BTBS X01	Semester: 1	L T P	2 0 0
Max. Marks	100	Internal: - 50 External: - 50	Course Type	Engineering Sciences(ES)
Pre-requisites			Contact Hours	2
Course Outcomes	On completion of this course, a student will be able to 1. To develop basic understanding about applications of biotechnology. 2. To understand the components of living systems, cells, tissues and organs. 3. To be apply the concepts of GLP and GMP in industry settings. 4. To understand and be able to apply the concept of biosafety, transport and disposal of biomedical waste.			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
Introduction to Biotechnology: definition, scope, applications in agriculture medical, food industry, bioremediation and future prospects **[CO1]**	2
Origin of Life: theories of evolution, chemical evolution, organic evolution, Oparin-Haldane hypothesis, Miller's experiment **[CO1]**	4
Cell structure and function: prokaryotic and eukaryotic cell (plant and animal cell), various cell organelles, their structure and functions **[CO2]**	4
SECTION-B	
Types of Animal Tissues: Basic structure and function of epithelial tissue, connective tissue, muscular tissue and nervous tissue **[CO2]**	4
Biological Systems: outlines of the major biological systems – digestive, circulatory, nervous, endocrine, and reproductive system **[CO2]**.	4

I**ntroduction to biosafety, bioethics and IPR in biotechnology:** concept of biosafety, need and application of biosafety in laboratories and industries, international and national norms regarding biosafety, GLP, GMP, bio-medical wastes, transportation of biological materials **[CO3, CO4]**	3

Suggested Books

S. No.	Title	Authors	Publisher	Edition/ Year
1.	RB: Biology,	Campbell, NA, Reece, JB, Urry, LA, Cain, ML, Wasserman, SA, Minorsky, PV and Jackson	Pearson/Benjamin Cummings,	8th edition,2008
2.	Microbiology	Pelczar MJ and Chan ECS (Jr):	Tata McGraw Hill Pub. Co	5th edition,2003
3.	Principles of Biochemistry,	Nelson DL and Cox MM: Lehninger	W.H. Freeman and Company, USA.	6th edition,2013
4.	: Biotechnology: Expanding Horizons,	Singh BD	Kalyani Publishers	4th edition,2012

Mapping of Course Outcomes with POs and PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	3	3	3	1	-	1	-	-	2	1	1	-
CO2	3	2	2	1	-	-	-	-	-	-	-	-	1	-
CO3	3	1	1	1	-	-	-	-	-	-	1	1	1	-
CO4	2	2	3	3	1	2	-	-	-	-	1	1	1	-

Title	PROGRAMMING FUNDAMENTALS		Credits	3
Code	ESC X01	Semester: 1	L T P	3 0 0
Max. Marks	100	Internal: - 50 External: - 50	Course Type	Program Core(PC)
Pre-requisites			Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. To develop simple algorithms for solving arithmetic and logical problems. 2. To translate the algorithms to programs using C language and their execution. 3. To implement conditional branching, iteration and recursion. 4. To demonstrate the decomposition of a problem into functions and synthesize a complete program. 5. To examine the use of arrays, pointers and structures for various problems. 6. To implement programs for use of various file handling operations.			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
Unit–1: Introduction to Programming **Introduction to components of a computer system:** Memory, processor, I/O devices, storage, operating system, concept of assembler, compiler, interpreter, loader and linker. **Concept of algorithm:** Representation of an algorithm, flowchart, Pseudocode with examples, converting algorithms to programs. **Programming Basics:** Structure of C program, writing and executing the first C program, Syntax and logical errors in compilation, object and executable code. Components of C language, standard I/O in C, data types, variables and constants, memory storage, storage classes.	6
Unit –2: Expressions and Statements **Expressions and their evaluation:** Operands and Operators, formation of expressions using arithmetic, relational, logical and bitwise operators, precedence and associativity rules , mixed operands, type conversion and evaluation of expressions. **Statements:** Simple and compound statements, Conditional Branching: if and switch statements, nested if-else, dangling else problem, use of break and default with switch. Iteration and loops: use of while, do while and for loops, nested loops, use of break and continue statements	10
Unit– 3: Arrays & Basic Algorithms	7

Arrays: Array notation and representation, manipulating array elements, using multi-dimensional arrays, character arrays and strings. **Basic Algorithms:** Searching and Sorting Algorithms (Bubble, Insertion and Selection), finding roots of equations, notion of order of complexity through example programs	
SECTION-B	
Unit–4: Functions Introduction, advantages of modularizing a program into functions, types of functions, passing parameters to functions: call by value, call by reference, passing arrays to functions, recursion with example programs.	9
Unit – 5: Structures , Union, Enums and Bit-fields Defining, declaring and usage of structures, unions and their arrays, passing structures and unions to functions, introduction to enums and bit-fields.	6
Unit – 6: Pointers and File handling **Pointers:** Introduction, declaration, applications, dynamic memory allocation (malloc, calloc, realloc, free), use of pointers in self-referential structures. **File handling:** File I/O functions, standard C pre-processors, defining and calling macros, command-line arguments.	7

Suggested Books

S. No.	Title	Authors	Publisher	Edition/ Year
1.	Schaum's Outline of Programming with C	Byron Gottfried	McGraw-Hill	Latest Edition
2.	Programming in C: A practical approach	Dr. Ajay Mittal	Pearson Education	, 2010
3.	The C programming	Kernighan Brain W. and Ritchie Dennis M	Pearson Education	Latest Edition
4.	Computer Basics and C Programming	V. Rajaraman	PHI Learning,	2015
5.	Computer Concepts and Programming in C	E Balaguruswamy	McGraw Hill	Latest Edition
6.	Computer Science- A Structured Programming Approach Using C	Behrouz A.Forouzan, Richard F. Gilberg, Thomson, Third Edition	Cengage Learning -	2007

Mapping of Course Outcomes with POs and PSOs	COs	POs												PSOs	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
	CO1	2	2	1	1	1	1	1		1			1	1	-
	CO2	2	2	1	1	1			1	1				1	-
	CO3	2	1	2	1								2		
	CO4	3	3	1	1				2				1	1	1
	CO5	3	2	2	1					1				1	1
	CO6	2	3	1	1	1			1	1			2	1	1

Title	PROGRAMMING FUNDAMENTALS (Practical)		Credits	1
Code	ESC X51	Semester: 1	L T P	0 0 3
Max. Marks	50	External: Nil Internal: - 50	Course Type	Program Core (PC)
Pre-requisites	Physics and mathematics at 10+2 level		Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. To formulate algorithms for simple problems and translate given algorithms to a working and correct program 2. To be able to develop programs using arithmetic expressions and if-then else constructs 3. To be able to execute iterative as well as recursive programs 4. To be able to demonstrate use of arrays, strings and structures for representing data and manipulate them through a program 5. To be able to implement various pointers operations and use them in defining self-referential structures. 6. To be able to create, read and write to and from simple text files			
Note for Examiner	Teacher is supposed to do continuous evaluation of the student throughout the semester. The evaluation will be based on the experiments conducted in the lab by the student. The teacher may schedule multiple practical tests and multiple viva voce examinations to evaluate the students continuously. Students are supposed to maintain laboratory files for the experiments conducted.			

SYLLABUS

Lab1: Familiarization with programming environment

Lab 2: Simple computational problems using arithmetic expressions

Lab 3: Problems involving if-then-else structures

Lab 4: Iterative problems e.g., sum of series

Lab 5: 1D Array manipulation, Arrays: searching, sorting

Lab 6: Matrix problems, String operations

Lab 7: Simple functions and parameter passing

Lab 8: Numerical methods (Root finding, numerical differentiation, numerical integration)

Lab 9: Recursive functions

Lab 10: Pointers and structures

Lab 11: File operations

Mapping of	COs	POs	PSOs	

Course Outcomes with POs and PSOs		1	2	3	4	5	6	7	8	9	10	11	12	1	2
	CO1	2	2	1	1	1	1	1		1			1	1	-
	CO2	2	2	1	1	1			1	1				1	-
	CO3	2	1	2	1								2		
	CO4	3	3	1	1				2				1	1	1
	CO5	3	2	2	1					1				1	1
	CO6	2	3	1	1	1			1	1			2	1	1

Title	UNIVERSAL HUMAN VALUES		Credits	3
Code	UHV01	Semester: 1	L T P	0 0 0
Max. Marks	Satisfactory/Unsatisfactory	Internal: - External: -	Course Type	Humanities and Social Science(HS)
Pre-requisites	Desirable – UHV-I: Universal Human Values-Introduction		Contact Hours	0
Course Outcomes	On completion of this course, a student will be able to 1. 1. To become aware of themselves, and their surroundings (family, society, nature) 2. They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relations and human nature in mind. 3. To have better critical ability. 4. To become sensitive to their commitment towards what they have understood (human values, human relationship and human society). 5. To apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.			
Note for Examiner	**This value-added course may be offered as a self-study course via MOOCs/Swayam/NPTEL portal etc. There will be internal assessment for this subject on the basis of presentation/report submission, etc.**			

SECTION-A	Hrs
Module 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education 1. Purpose and motivation for the course 2. Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration 3. Continuous Happiness and Prosperity- A look at basic Human Aspirations 4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfillment of aspirations of every human being with their correct priority 5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario 6. Method to fulfill the above human aspirations: understanding and living in harmony at various levels.	
Module 2: Understanding Harmony in the Human Being - Harmony in Myself! 1. Understanding human being as a co-existence of the sentient 'I' and the material 'Body' 2. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility 3. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer) 4. Understanding the characteristics and activities of 'I' and harmony in 'I' 5. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail. 6. Programs to ensure Sanyam and Health.	

Module 3: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship 1. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfillment to ensure mutual happiness; Trust and Respect as the foundational values of relationship 2. Understanding the meaning of Trust; Difference between intention and competence 3. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship 4. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals 5. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.	
Module 4: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence 1. Understanding the harmony in the Nature. 2. Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self regulation in nature . 3. Understanding Existence as Co-existence of mutually interacting units in all- pervasive space **4.** Holistic perception of harmony at all levels of existence.	
Module 5: Implications of the above Holistic Understanding of Harmony on Professional Ethics 1. Natural acceptance of human values 2. Definitiveness of Ethical Human Conduct 3. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order 4. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems. 5. Case studies of typical holistic technologies, management models and production systems 6. Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations 7. Sum up.	

Suggested Books				
S. No.	**Title**	**Authors**	**Publisher**	**Edition/ Year**
1.	.Human Values and Professional Ethics	R R Gaur, R Sangal, G P Bagaria,	Excel Books, New Delhi	2010
2.	Jeevan Vidya: Ek Parichaya,	A Nagaraj	Jeevan Vidya Prakashan, Amarkantak	1999.
3.	Human Values,	A.N. Tripathi	New Age Intl. Publishers, New Delhi,	2004
4.	The Story of Stuff (Book).			
5.	The Story of My Experiments with Truth -	Mohandas Karamchand Gandhi		
6.	Small is Beautiful	E. F Schumacher		
7.	Slow is Beautiful	Cecile Andrews		
8.	Economy of Permanence -	J C Kumarappa		
9.	Bharat Mein Angreji Raj -	PanditSunderlal		
10.	Rediscovering India	DharamPal		
11.	Hind Swaraj or Indian Home Rule -	Mohandas K. Gandhi		
12.	India Wins Freedom -	Maulana Abdul Kalam Azad		
13.	Vivekananda - Romain Rolland (English) Gandhi - Romain Rolland (English)			

Mapping of Course Outcomes with POs and PSOs

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1							2	2		2		2	1	-
CO2							2	2		2		2	1	-
CO3							2	2		2		2		
CO4							2	2		2		2	1	1
CO5							2	2		2		2	1	1

Title	APPLIED CHEMISTRY		Credits	4
Code	ASC X01	Semester: 2	L T P	4 0 0
Max. Marks	100	Internal: - 50 External: - 50	Course Type	Humanities and Social Science(HS)
Pre-requisites	Chemistry at 10+2 level		Contact Hours	4
Course Outcomes	On completion of this course, a student will be able to 1. The geometry and bonding in homonuclear, heteronuclear molecules and coordination compounds. Splitting of d-orbital in octahedral, tetrahedral and square planar field along with different properties of the coordination compounds. 2. How the molecules are arranged in three dimensional structure and how it leads to the phenomena of various types of isomerism. 3. The basic principles of spectroscopy and its use to determine the chemical structure. 4. The different thermodynamic laws, heat changes and energy calculations. 5. The role and mechanism of various heterogeneous and homogeneous catalysts in increasing reactions rate of many synthetically important chemical reactions. 6. The sustainable technology in design and synthesis of polymers for its variety of applications.			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
Chemical Bonding Molecular orbital theory and its applications to the formation of homonuclear (H_2, N_2) and heteronuclear diatomic molecules (NO, CO, CN), Valence bond theory as applicable to coordination compounds and its limitations. Crystal Field Theory, Splitting of octahedral, tetrahedral and square planner complexes, crystal field stabilization energies of octahedral and tetrahedral complexes and its application.	6
Stereochemistry of Organic Compounds Concept of isomerism. Types of isomerism. Optical isomerism–enantiomers, optical activity, properties of enantiomers, diastereomers, meso compounds, resolution of enantiomers, inversion, retention and racemization, R & S systems of nomenclature. Geometric isomerism– determination of configuration of geometric isomers, E & Z system of	8

nomenclature Conformational isomerism – conformational analysis of ethane and n-butane; conformations of cyclohexane, Newman projection.	
Spectroscopy Spectroscopy: UV- Introduction, Lambert-Beer's Law, selection rules, electronic transitions, Application to simple organic molecules (auxochrome, chromophore), effect of conjugation and solvent on transition of organic molecules, Woodward-Fieser Rules for calculating λmax for dienes. Infrared Spectroscop- Introduction, Principle of IR spectroscopy-Fundamental vibrations, Application to simple organic molecules (effect of masses of atoms, bond strength, nature of substituent, hydrogen bonding on IR frequency), sample preparation for IR	9
SECTION-B	
Thermodynamics Review of objectives and limitations of chemical thermodynamics, State functions, Thermodynamic equilibrium, work, heat, internal energy, enthalpy, heat capacity. Zeroth law of thermodynamics, First law of thermodynamics Reversible, isothermal and adiabatic expansion & compression of an ideal gas. Irreversible isothermal and adiabatic expansion of an ideal gas. Carnot cycle and efficiency of reversible engines, Enthalpy change and its measurement. Flame temperature, Second and third law of thermodynamics. Concept of entropy. Gibb's and Helmholtz equations. Simple numericals for calculating w, q, ΔE, ΔH and entropy	10
Catalysis Catalysis and general characteristics of a catalytic reactions, Homogeneous catalysis, Heterogenous catalysis, Acid base catalysis and Enzyme catalysis – Michealis Menten equations, Application of catalysis for industrially important processes – Hydrogenation (Wilkinson's catalyst), Hydroformylation, Acetic acid process, Wacker process	6
Polymers General introduction, classification of polymers, Mechanism of addition and condensation polymerization, Idea of number average and weight average molecular masses of polymers, Properties and uses of polystyrene, polyester, polyamide, epoxy, phenol-formaldehyde and silicon resins.	6

Suggested Books				
S. No.	**Title**	**Authors**	**Publisher**	**Edition/ Year**
1.	Atkin's Physical Chemistry	Peter Atkins, Julio de Paula	Oxford University Press	7th Ed
2	Concise Inorganic Chemistry	J D Lee	Chapman & Hall, 2003	5th Edition
3	Organic Chemistry	Joseph M. Hornback	Brooke Cole Publishing Company U.S.A.	Latest Edition
4	A Textbook of Engineering Chemistry	Shashi Chawla	Dhanpat Rai & Co. Pvt. Ltd., Delhi (2008)	Latest Edition
5	Principles of Physical Chemistry	Puri, Sharma and Pathania	W.H. Freeman & Co. 2008.	Latest Edition
6	Introductory Polymer Chemistry	G.S.Mishra	John Wiley & Sons, New York, 1993	Latest Edition
7	Introduction to spectroscopy	D. S. Pavia, G.M. Lasmpman and G.S. Kriz	Thomson learning, Indian Edition 2012.	4th Edition
8	Basic Inorganic Chemistry.	F.A. Cotton, G. Wilkinson and P.L. Gaus	John Wiley & Sons	3rd Ed
9	Inorganic Chemistry Principles of Structure and reactivity	James E. Huheey, Ellen A. Keiter and Richard L. Keiter	Pearson Edu. Asia	4th Ed
10	Organic Chemistry	S. M. Mukherji, S. P. Singh & R. P. Kapoor	Vol. 2, 1985, New Age International Pvt. Ltd	1st Edition

Mapping of Course Outcomes with POs and PSOs

COs	**Pos**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	1	-	-	-	2	-	-	-	-	1	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	1	-	-
CO3	3	-	2	-	-	-	1	-	-	-	-	1	-	-
CO4	3	2	-	2	-	-	-	-	-	-	-	1	-	-
CO5	2	-	-	-	-	-	-	-	-	-	-	1	-	-
CO6	3	2	-	-	-	-	-	-	-	-	-	1	-	-

Title	APPLIED CHEMISTRY (Practical)		Credits	1
Code	ASC X51	Semester: 2	L T P	0 0 3
Max. Marks	50	External: Nil Internal: - 50	Course Type	Humanities and Social Science(HS)
Pre-requisites	Chemistry at 10+2 level		Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Students will learn how to determine the concentration of chloride ion, concentrations of calcium ions, magnesium ions, copper ions in water even at the microscale level or at the industrial scale, and measurement of dissolved oxygen content required for the biological activity of water bodies using volumetric titrations. 2. Students will understand the principles of spectroscopy and learn how to apply them for the determination of concentration of unknown samples. 3. Students will learn and become familiar with the principles of thermochemistry and learn how to apply them to measure the heat of chemical reactions. 4. Students will be able to perform conductometric titrations and will learn how to determine the strength of acid/base by knowing the conductance value. 5. Students will learn how to set up an organic/inorganic reaction in the laboratory and will be able to perform reactions such as saponification of oil. 6. Students will also acquire a brief knowledge about the relationship between the molecular structure and material behavior of the polymer in the context of its appliance. 7. Students will learn the basic principles of thin layer chromatography and how it is used in separation of individual components from mixtures in chemical/biochemical samples.			
Note for Examiner	Teacher is supposed to do continuous evaluation of the student throughout the semester. The evaluation will be based on the experiments conducted in the lab by the student. The teacher may schedule multiple practical tests and multiple viva voce examinations to evaluate the students continuously. Students are supposed to maintain laboratory files for the experiments conducted.			
SYLLABUS				

List of Experiments:

1. Verify Lambert Beer's law using spectrophotometer and CoCl2 or K2Cr2O7 solution. **CO1**
2. To determine the strength of an acid solution by using a conductivity meter. **CO4**
3. Determination of saponification number of oil. **CO5**
4. Preparation of a phenol formaldehyde resin. **CO6**
5. Experiments on TLC (determination of Rf values and identification of various compounds). **CO7**
6. To determine the heat of neutralization of reaction. **CO3**
7. Determination of total hardness of a water sample. **CO1**
8. Determination of copper. **CO1**
9. Determination of chloride ion and dissolved O2 in water. **CO1**
10. Preparation of an inorganic complex/organic compound.**CO5**

Mapping of Course Outcomes with POs and PSOs

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	2	2		1		1	2					1		
CO2	3	2		1	3	1	1					1		
CO3	3			1		1	1					1		
CO4	3	2		1		1	1					1		
CO5	2			1		1	1					1		
CO6	3	2		1		1	1					1		

Title	DIFFERENTIAL EQUATIONS AND TRANSFORMS		Credits	5
Code	ASM 201	Semester: 2	L T P	4 1 0
Max. Marks	100	Internal: - 50 External: - 50	Course Type	Basic Sciences (BS)
Pre-requisites	Mathematics at 10+2 level		Contact Hours	5
Course Outcomes	On completion of this course, a student will be able to 1. The student will learn to solve Ordinary Differential equations and their applications to engineering problems. 2. The students will be able to apply the tools of Laplace Transforms to model engineering problems and solve the resulting differential equations. 3. Students will understand the nature and behaviour of trigonometric (Fourier) series and apply it to solve boundary value problems. 4. Students will be able to understand the formulation of partial differential equations and its solution techniques.			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
ORDINARY DIFFERENTIAL EQUATIONS Review of geometrical meaning of the differential equation, directional fields, exact differential equations(scope as in chapter 8, sections 8.1 – 8.10 of reference 5), solution of differential equations with constant coefficients; methods of differential operators (scope as in chapter 9, sections 9.1 – 9.5 of reference 5). Non-homogeneous equations of second order with constant coefficients: Solution by method of variation of parameters, reduction by order (scope as in chapter 9, section 9.7, 9.10 of reference 5). Power series method of solution (scope as in chapter 10, section 10.2 of reference 5)	
Laplace Transforms Laplace transform, Inverse transforms, shifting, transform of derivatives and integrals. Unit step function, second shifting theorem, Dirac's Delta function. Differentiation and integration of transforms. Convolution Theorem on Laplace Transforms. Application of Laplace transforms to solve ordinary differential equations with initial conditions (Scope as in Chapter	

6, Sections 6.1 – 6.6 of Reference 2).	

SECTION-B

Fourier Series and Transforms: Periodic functions, Fourier series, Even and odd series, half range expansions, Complex Fourier Series, Approximation by trigonometric polynomials. Fourier integrals, Fourier Cosine and Sine transforms, Fourier Transforms (Scope as in Chapter 11, Sections 11.1 – 11.2, 11.4-11.5, 11.7 – 11.9 of Reference 2).	
Partial Differential Equations: Partial differential equations of first order, origin, solution of linear partial differential equations of first order, Integral surfaces passing through a given curve (Scope as in Chapter 2, Sections 1, 2, 4, 5 of Reference 1).	
Boundary Value Problems: D'Alembert's solution of wave equation, separation of variables: one dimension heat and wave equation (Scope as in Chapter 12, Sections 12.1, 12.3 – 12.4, 12.6, 12.9 of Reference 2).	

Suggested Books

S. No.	Title	Authors	Publisher	Edition/ Year
1.	Elements of Partial Differential Equations	Ian N. Sneedon	McGraw Hill,Singapore 1957.	Latest Edition
2.	Advanced Engineering Mathematics	E. Kreyszig.	John Wiley.	10th edition
3.	Advanced Engineering Mathematics	Michael D. Greenberg	Pearson Education.	2nd edition
4.	Advanced Engineering Mathematics	Wylie and Barrett	Tata McGraw Hill	Latest Edition
5.	Higher Engineering Mathematics	B.V.Ramana	Tata McGraw Hill.	Latest Edition
6.	Advanced Engineering Mathematics	R. K. Jain, S. R. K. Iyenger	Narosa Publications	Latest Edition
7.	Theory and problems of Differential Equations	Frank Ayers	Shuam outline series, McGraw-Hill, Singapore, 1957	Latest Edition

Mapping of Course Outcomes with POs and PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	2	3								1		
CO2	2	3	2	2								1		
CO3	2	2	3	2								1		
CO4	2	2	3	2								1		

Title	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING		Credits	3
Code	EEC X01	Semester: 2	L T P	3 0 0
Max. Marks	100	Internal: - 50 External: - 50	Course Type	Engineering Sciences(ES)
Pre-requisites			Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Solve electric circuits using theorems and analyse AC electrical circuits. 2. Explain the basics of transformers in electric systems. 3. Explain the working principle and characteristics of semiconductor diodes. 4. Explain the working principle and characteristics of Bipolar Junction Transistors.			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
DC circuits: Voltage and current sources, KCL, KVL, Network analysis by mesh and node analysis, Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum-power transfer theorem (numerical based on these theorem).	7
AC Fundamentals: Average and RMS values of alternating quantities, solution and phasor diagram of single phase ac circuits with sinusoidal source excitation, voltages and currents in star and delta connected systems, power in a three phase system, solution of three phase balanced circuits, power and power factor measurement by two watt-meters method.	8
Transformers: Introduction, Basic Principle, EMF equation, losses, efficiency and condition for maximum efficiency, voltage regulation, open circuit and short circuit tests.	7
SECTION-B	
Semiconductor Diodes: Ideal Diode, Semiconductor materials, Energy Levels, Extrinsic materials: n and p type, Semiconductor diode: working principle, silicon semiconductor diode characteristics, Zener region and Zener diode, Si vs Ge diode characteristics, effect of temperature on the characteristics, Light Emitting Diode (working principle).	8

Diode Applications: Load Line Analysis, Series Diode Configurations with DC inputs, Parallel and Series-Parallel configurations, AND/OR gates, Sinusoidal inputs: Half wave and full wave rectifications, Clipper and clampers.	7
Bipolar Junction Transistors: Transistor construction and operation, Common-Base configuration: working principle, characteristics and applications, Common-Emitter configuration: working principle, characteristics and applications, Common-Collector configuration: working principle, characteristics and applications	8

Suggested Books

S. No.	Title	Authors	Publisher	Edition/ Year
1	Basic Electrical Engineering	T.K. Nagsarkar and M.S. Sakhija	Oxford University Press, 2004	Latest edition
2	Electric and Electronics Technology	Edward Hughes	Pearson education Publication Asia, 2003.	Latest edition
3	Electronics Devices and Circuit Theory	ROBERT BOYLESTAD LOUIS NASHELSKY	PRENTICE HALL Upper Saddle River, New Jersey Columbus, Ohio	Latest edition

Mapping of Course Outcomes with POs and PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	1	1	1	0	0	0	1	2	2	0	3	1
CO2	3	3	1	1	1	0	0	0	1	2	2	0	3	1
CO3	3	3	1	1	1	0	0	0	1	2	2	0	3	1
CO4	3	3	1	1	1	0	0	0	1	2	2	0	3	1

Title	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING (Practical)		Credits	1
Code	EEC X51	Semester: 2	L T P	0 0 2
Max. Marks	50	External: Nil Internal: - 50	Course Type	Engineering Sciences(ES)
Pre-requisites			Contact Hours	1
Course Outcomes	On completion of this course, a student will be able to 1. Solve electric circuits using theorems and solve AC electrical circuits. 2. Perform the basic tests of transformers in electric systems. 3. Find characteristics of semiconductor diodes. 4. Find characteristics of Bipolar Junction Transistors			
Note for Examiner	Teacher is supposed to do continuous evaluation of the student throughout the semester. The evaluation will be based on the experiments conducted in the lab by the student. The teacher may schedule multiple practical tests and multiple viva voce examinations to evaluate the students continuously. Students are supposed to maintain laboratory files for the experiments conducted.			

SYLLABUS

Note: Any eight experiments are to be done.

1. Measure resistance and inductive reactance of a choke coil, make a series RLC circuit using the choke coil and obtain its phasor diagram.
2. To prove Superposition and Maximum Power Transfer theorem.
3. To prove Thevenin's and Norton's theorem.
4. To find out the relationship between line current & phase current, between line voltage & phase voltage for star and delta connected loads supplied from balanced three phase supply.
5. Perform Open circuit and short circuit tests on a single phase transformer and to draw its equivalent circuit.
6. To study the V-I characteristics of a semiconductor diode.
7. To study the characteristics of a Zener diode.
8. To study the characteristics of Common-Base configuration of a BJT.
9. To study the characteristics of Common-Emitter configuration of a BJT.
10. To study the characteristics of Common-Collector configuration of a BJT.

Mapping of Course Outcomes with POs and PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	1	3	1	1	1	1	1	3	2	1	2	3	1

	CO2	2	1	3	1	1	1	1	1	3	2	1	2	3	1	
	CO3	2	1	3	1	1	1	1	1	3	2	1	2	3	1	
	CO4	2	1	3	1	1	1	1	1	3	2	1	2	3	1	

Title	ENGINEERING GRAPHICS		Credits	1
Code	ESC X04	Semester: 2	L T P	1 0 0
Max. Marks	100	Internal: - 50 External: - 50	Course Type	Engineering Sciences(ES)
Pre-requisites	Mathematics at 10+2 level		Contact Hours	1
Course Outcomes	On completion of this course, a student will be able to 1. Students will gain the ability to draw engineering views of products. 2. Ability to turn their ideas into sketches and drawings for good communication. 3. Ability to read and understand drawing symbols and conventions. 4. Ability to learn fundamental of 2 D construction related to projections of points, lines and planes. 5. Ability to draw isometric view of a given orthographic projections. 6. Ability to draw and read sectional and auxiliary drawings.			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
Introduction: Demonstrating knowledge of the theory of CAD software, Tabs and Panels, The Command Line Box, Command Tools, Starting a New Drawing , Naming a Drawing , Drawing Units, Drawing Limits, Grid and Snap, Save and Save As, Open, Close, Terminology and Conventions, Linear Dimension, Dimension Styles, Units, Aligned Dimensions, Radius and Diameter Dimensions, Angular Dimensions, Ordinate Dimensions, Baseline Dimensions, Continue Dimension, Quick Dimension, Center Mark, MLEADER and QLEADER, Text, Dimensioning Holes, Placing Dimensions, Fillets and Rounds, Polar Dimensions, Chamfers, Symbols and Abbreviations.	
Fundamentals of 2D Construction and Advanced Commands: Line-Random Points, Erase, Line-Snap Point, Line-Dynamic Inputs, Construction Line, Circle, Circle Centerlines, Polyline, Spline, Ellipse, Rectangle, Polygon, Point, Text, Move, Copy, Offset, Mirror, Array, Rotate, Trim, Extend, Break, Chamfer, Fillet, Table, OSNAP, Layer command.	
Orthographic Projections: Principles of Orthographic Projections-Conventions - Projections of Points, Projection of line- Parallel to both H.P. and V.P., Parallel to one and inclined to other, and inclined to both, contained in profile plane. True length and angle determination of straight line: Rotation method and Auxiliary plane method, Traces of a line, Difference between plane	

and lamina, Projection of lamina- Parallel to one and perpendicular to other, Perpendicular to one and inclined to other, Inclined to both reference planes.	
Projection of Regular Solids: Definition of Solids, Types of solids, and elements of solids, Projection of solids in first quadrant- with axis parallel to one and perpendicular to other, axis parallel to one inclined to other and axis inclined to both the principle planes.	
SECTION-B	
Section of Solids: Theory of Sectioning, Cutting Plane Lines, Section Lines, Hatch, Styles of Section Lines, Sectioning of Prism, Pyramid, Cone and Cylinder (Simple Cases).	
Development of Surfaces: Purpose of development, Methods of development of prism, cylinder, cone and pyramid surfaces (for right angled solids only) and development of surface of sphere.	
Isometric Projection: Classification of pictorial views, Basic Principle of Isometric projection, Difference between isometric projection and isometric drawing. Isometric projection of solids such as cube, prism, pyramid and cylinder.	

Suggested Books

S. No.	Title	Authors	Publisher	Edition/ Year
1	Engineering Graphics with AutoCAD	James Bethune	Pearson	2016
2	Fundamentals of Engg. Drawing	Warren J. Luzadder	Literary Licensing, LLC	2015
3	Engineering Drawing and Design	Cecil Jensen	Mc-Graw Hill	2012
4	Manual of Engineering Drawing	T.E. French	WENTWORTH Press	2016

Mapping of Course Outcomes with POs and PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	3	-	1	1	1		2	3	2	1	3	2
CO2	3	2	3	1	1	1	1	-	2	3	1	1	3	1
CO3	3	2	3	1	3	1	1	-	2	3	1	1	2	3
CO4	3	1	3	1	3	1	1	-	2	3	1	1	3	1
CO5	2	1	3	-	3	-	-	-	1	3	-	1	2	1
CO6	2	1	3	-	3	-	-	-	1	3	-	1	2	1

Title	ENGINEERING GRAPHICS (Practical)		Credits	1
Code	ESC X54	Semester: 2	L T P	0 0 3
Max. Marks	50	External: Nil Internal: - 50	Course Type	Engineering Sciences(ES)
Pre-requisites	Mathematics at 10+2 level		Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Ability to learn and understand basic and advanced commands of AutoCAD. 2. Ability to draw the two-dimensional drawings using different toolbars of AutoCAD. 3. Ability to understand and draw the orthographic projections. 4. Ability to draw isometric, sectional and auxiliary views using AutoCAD. 5. Ability to draw basic solid models using AutoCAD. 6. Ability to learn and use solid editing toolbars and related commands.			
Note for Examiner	Teacher is supposed to do continuous evaluation of the student throughout the semester. The evaluation will be based on the experiments conducted in the lab by the student. The teacher may schedule multiple practical tests and multiple viva voce examinations to evaluate the students continuously. Students are supposed to maintain laboratory files for the experiments conducted.			

SYLLABUS

The candidates will be required to make AutoCAD drawing sheets covering the following as per B.I.S. SP46-2003 for general engineering drawing:

1. To draw two dimensional drawings in AutoCAD by using draw, modify, dimension, layers and object-snap toolbars.
2. To draw orthographic views of points.
3. To draw orthographic views of lines and to find traces of the lines.
4. To find true length of lines using rotation as well as trapezoidal method.
5. To draw orthographic views of laminas in different positions.
6. To draw orthographic views of polyhedral solids in different positions.
7. To draw orthographic views of solids of revolution in different positions.
8. To draw sectional views of solids, true sections and apparent sections.
9. To draw isometric views of laminas and solids.
10. To draw development of polyhedral solids.
11. To draw development of solids of revolution.
12. To draw basic solid models using AutoCAD by using solids and solid editing toolbars and related commands.

Mapping of Course Outcomes with POs and PSOs	COs	POs												PSOs	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
	CO1	3	2	3	-	1	1	1		2	3	2	1	3	2
	CO2	3	2	3	1	1	1	1	-	2	3	1	1	3	1
	CO3	3	2	3	1	3	1	1	-	2	3	1	1	2	3
	CO4	3	1	3	1	3	1	1	-	2	3	1	1	3	1
	CO5	2	1	3	-	3	-	-	-	1	3	-	1	2	1
	CO6	2	1	3	-	3	-	-	-	1	3	-	1	2	1

Title	**OBJECT ORIENTED PROGRAMMING**		**Credits**	3
Code	**CSC 201**	**Semester:** 2	**L T P**	3 0 0
Max. Marks	**100**	**Internal: - 50** **External: - 50**	**Course Type**	Program Core(PC)
Pre-requisites	Programming Fundamentals.		**Contact Hours**	3
Course Outcomes	On completion of this course, a student will be able to 1. Understand core concepts of OOPs, data types, operators in program design. 2. Apply concepts of classes, inheritance, friend function, constructors & destructors, and polymorphism in C++. 3. Able to create file handling, various stream classes, and I/O operations. 4. Differentiate different types of errors in program design. Understand the exception handling mechanism in programming. 5. Examine the given problem and select suitable logic for solving the problem based on Standard Template Library. 6. Create/Develop applications for a range of problems using object-oriented programming techniques.			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
Principles of Objective Oriented Programming.	2
Tokens, Expressions and control structures, various data types, and data structures, Variable declaration, Operators and scope of operators.	4
Pointers, Functions, Classes and Objects: Prototyping, referencing the variables in functions, memory allocation for classes and objects, Array of objects, pointers to member functions.	8
Constructors and Destructors, Operator Overloading and type conversion.	4
Inheritance: Derived classes, types of inheritance, and various types of classes.	5
SECTION-B	
Virtual functions and Polymorphism.	5

I/O operations on files: Classes for files, Operations on a file, file pointers.	8
Exception Handling and Generic programming with templates: Introduction to templates, Overloading of template functions and Inheritance. Introduction to standard Template Library	9

Suggested Books

S. No.	Title	Authors	Publisher	Edition/ Year
1.	Turbo C++	Robert and Lafor	Galgotia Publications	Latest edition
2	C++ Primer Plus	Stephan & PRAT	Galgotia Publications	Latest edition
3	Object oriented programming with C++	Bala Guruswamy	Tata McGraw Hill	Latest edition
4	Object oriented Programming with ANSI and Turbo C++	Ashok N. Kamthane	Pearson Education	Latest edition

Mapping of Course Outcomes with POs and PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	-	-	2	-	-	-	1	1	-	2	3	1
CO2	2	3	2	1	2	-	-	-	1	1	-	2	3	1
CO3	1	3	2	3	3	-	-	-	1	1	-	2	3	2
CO4	1	3	2	2	3	-	-	-	1	1	1	2	3	2
CO5	-	2	2	2	2	-	-	-	2	-	-	2	3	3
CO6	-	3	3	3	3	1	1	-	1	1	1	-	3	1

Title	OBJECT ORIENTED PROGRAMMING (Practical)		Credits	1
Code	CSC 251	Semester: 2	L T P	0 0 3
Max. Marks	50	External: Nil Internal: - 50	Course Type	Program Core (PC)
Pre-requisites	Programming Fundamentals.		Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Understand and create simple programs using object-oriented features such as classes and objects in C++. 2. Create classes and extend them for code reuse. 3. Develop applications using file stream & I/O. 4. Apply template classes and exception handling in programming practice. 5. Analyze the problem statement, design, and build C++ application programs using good programming constructs of OOPs. 6. Create programs to solve complex application-oriented problems based on OOP concepts			
Note for Examiner	Teacher is supposed to do continuous evaluation of the student throughout the semester. The evaluation will be based on the experiments conducted in the lab by the student. The teacher may schedule multiple practical tests and multiple viva voce examinations to evaluate the students continuously. Students are supposed to maintain laboratory files for the experiments conducted.			

SYLLABUS

List of Experiments:

Note: Practical should be covered based on the following directions:

1. Functions, Classes and Objects
2. Constructors and Destructors
3. Operator Overloading and Type Conversion
4. Inheritance and Virtual Functions
5. Files
6. Exception Handling and Generic Programming

Mapping of Course Outcomes with POs and PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	-	-	2	-	-	-	1	1	-	2	3	1
CO2	2	3	2	1	2	-	-	-	1	1	-	2	3	1

	CO3	1	3	2	3	3	-	-	-	1	1	-	2	3	2	
	CO4	1	3	2	2	3	-	-	-	1	1	1	2	3	2	
	CO5	-	2	2	2	2	-	-	-	2	-	-	2	3	3	
	CO6	-	3	3	3	3	1	1	-	1	1	1	-	3	1	

Title	ENVIRONMENT SCIENCES		Credits	1
Code	HSMC X01	Semester: 2	L T P	0 0 0
Max. Marks	Satisfactory/Unsatisfactory	Internal: - External: -	Course Type	Humanities and Social Science(HS)
Pre-requisites			Contact Hours	

Course Outcomes	On completion of this course, a student will be able to 1. Create awareness about the importance of the environment, its basic components and identify the role of individuals in environmental conservation and sustainability. 2. Give an overview on the concept of ecology. Describe various parts and structures of ecology. Understand the interaction between social and environmental processes. Introduce methods of ecological and social science knowledge in solving environmental problems. 3. Define air pollution, list the source, and scale its effects on living and nonliving things. Evaluate the amounts of air pollutants emitted by monitoring and sampling. Find measures to substantially control the emission of air pollutants and minimize its hazardous impacts on the society. 4. Introduce key terms related to water pollution. Explain different types of water pollutants and its adverse impact on human health. Social remedies to control water pollution. 5. Discuss various types of pollutants (municipal, industrial, commercial, agricultural, hazardous solid wastes): their origin and effects. Solid waste management from collection, segregation, and disposal methods. Role of organized and unorganized sectors towards solid waste management and conservation of land above and below ground level. 6. To introduce and build an understanding of the various types of noise pollution. Explore questions relating to human activities responsible for it pollution and its socio-economical impacts. Various ways to monitor and curtain the disastrous outcomes due to noise pollution.
Note for Examiner	**This value-added course may be offered as a self-study course via MOOCs/Swayam/NPTEL portal etc. There will be internal assessment for this subject on the basis of presentation/report submission, etc.**

SYLLABUS	Hrs
General Introduction, components of the environment, environmental degradation.	4
Ecology Elements of ecology: Ecological balance and consequences of change, principles of environmental impact assessment.	3
Air pollution and control Atmospheric composition, energy balance, climate, weather, dispersion, sources and	6

effects of pollutants, primary and secondary pollutants, green house effect, depletion of ozone layer, standards and control measures.	
Water pollution and control Hydrosphere, natural water, pollutants their origin and effects, river/lake/ground water pollution, standards and control.	6
Land Pollution Lithosphere, pollutants (municipal, industrial, commercial, agricultural, hazardous solid wastes): their origin and effects, collection and disposal of solid waste, recovery and conversion methods.	6
Noise Pollution Sources, effects, standards and control.	6

Suggested Books

S. No.	Title	Authors	Publisher	Edition/ Year
1.	Introduction to Environmenta Engineering and Science	C. M. Masters	Prentice Hall of India Pvt. Ltd., 1991	Latest Edition
2.	Environmental Science	B. J. Nebel	Prentice Hall Inc., 1987	Latest Edition

Mapping of Course Outcomes with POs and PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	1	1		1							1		
CO2	2							1				1		
CO3	2		2									1		
CO4	2	1		1								1		
CO5	2	2							1			1		
CO6	1	1										1		

Title	DATA STRUCTURES		Credits	4
Code	CS 301	Semester: 3	L T P	3 1 0
Max. Marks	100	Internal: - 50 External: - 50	Course Type	Program Core(PC)
Pre-requisites	Programming Fundamentals,Object Oriented Programming		Contact Hours	4
Course Outcomes	On completion of this course, a student will be able to 5. Understand asymptotic analysis and various notations for complexity analysis of programs 6. Implement linear data structures like Linked list, stacks and queues along with various operations 7. Analyze various sorting and searching algorithms. 8. Implement trees and graph data structures along with their operations 9. Understand the concepts of multi-way search trees and hashing as search structure. 10. Implement appropriate data structure and apply these to solve various problems.			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
Complexity Analysis: Time and Space complexity of algorithms, asymptotic analysis, big O and other notations, importance of efficient algorithms, program performance measurement, data structures and Algorithms	4
Linear Lists: Abstract data type, sequential and linked representations, comparison of insertion, deletion and search operations for sequential and linked lists, list and chain classes, doubly linked lists, circular linked lists, applications of lists in bin sort, radix sort, sparse tables	8
Stacks and Queues: Abstract data types, sequential and linked implementations, representative applications such as parenthesis matching, towers of Hanoi.	4
Sorting: Bubble sort, selection sort, insertion sort, Shell sort, Quick sort, Heap sort, Merge sort; Radix sort, Analysis of the sorting methods, Selecting the top k elements.	7
SECTION-B	
Trees: Binary trees and their properties, terminology, sequential and linked implementations, tree traversal methods and algorithms, Heap data structure and its applications as priority queues, heap implementation, insertion and deletion operations, Heapsort.	7
Search & Multi-way Trees: Binary search trees, search efficiency, insertion and deletion operations, importance of balancing, AVL trees, B-trees, B+ trees	7
Graphs: Definition, terminology, directed and undirected graphs, properties, connectivity in graphs, applications, implementation – adjacency matrix and linked adjacency chains, graph traversal – breadth first and depth first, spanning trees.	5
Hashing: hashing as a search structure, hash table, collision avoidance, linear open addressing, chaining	3

Suggested Books				
S. No.	**Title**	**Authors**	**Publisher**	**Edition/ Year**
1.	Data Structures using C and C++	Y. Langsam, M. J. Augenstein, A. M. Tanenbaum	Pearson Education	2nd Edition
2.	Data Structures & Program Designin C	R. Kruse, C. L. Tondo, B.Leung, S. Mogalla	Pearson Education	2nd Edition
Recommended Books				
S. No.	**Title**	**Authors**	**Publisher**	**Edition/ Year**
1	Fundamentals of Data Structures in C++	E. Horowitz, S. Shani, D.Mehta	Universities Press	2nd Edition
2	Art of Computer Programming, Volume1: Fundamental algorithms,	Donald E. Knuth	Addison-Wesley	3rd Edition
3	Art of Computer Programming, Volume 3: Sorting and Searching,	Donald E. Knuth	Addison-Wesley	2nd Edition

Mapping of Course Outcomes with POs and PSOs

COs	**Pos**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	1	2	1	1	-	-	1	-	-	2	1	2
CO2	2	1	2	1	2	-	-	-	1	-	-	1	1	1
CO3	3	3	1	3	2	1	1	-	2	1	-	2	2	3
CO4	3	2	2	1	2	-	-	1	1	-	-	1	1	1
CO5	3	3	1	2	1	-	-	-	2	-	-	1	2	1
CO6	2	3	2	3	2	1	-	1	1	1	-	3	2	2

Title	DATA STRUCTURES (Practical)		Credits	1
Code	CS 351	Semester: 3	L T P	0 0 3
Max. Marks	50	External: Nil Internal: - 50	Course Type	Program Core(PC)
Pre-requisites			Contact Hours	3

Course Outcomes	On completion of this course, a student will be able to 5. Understand asymptotic analysis and various notations for complexity analysis of programs. 6. Implement linear data structures like Linked list, stacks and queues along with various operations. 7. Analyze various sorting and searching algorithms. 8. Implement trees and graph data structures along with their operations. 9. Understand the concepts of multi-way search trees and hashing as search structure. 10. Implement appropriate data structure and apply these to solve various problems.
Note for Examiner	Teacher is supposed to do continuous evaluation of the student throughout the semester. The evaluation will be based on the experiments conducted in the lab by the student. The teacher may schedule multiple practical tests and multiple viva voce examinations to evaluate the students continuously. Students are supposed to maintain laboratory files for the experiments conducted.

SYLLABUS

Practical should be covered based on the following directions:

1. Implementation of array operations: Traversal, Insertion & Deletion at and from a given location
2. Stacks: Implementation of Push, Pop; Conversion of Infix expression to Postfix, Evaluation ofPostfix expressions.
3. Queues: Circular Queue: Adding & deleting elements.
4. Linked list: inserting, deleting, implementation of stacks & queues using linked lists; Polynomialaddition.
5. Trees: Implementation of Binary & Binary Search Trees, Recursive and Non-recursive traversalof Trees.
6. Implementation of Graphs
7. Implementation of sorting and searching algorithms
8. Hash tables implementation: searching, inserting and deleting

Mapping of Course Outcomes with POs and PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	1	2	1	1	-	-	1	-	-	2	1	2
CO2	2	1	2	1	2	-	-	-	1	-	-	1	1	1
CO3	3	3	1	3	2	1	1	-	2	1	-	2	2	3
CO4	3	2	2	1	2	-	-	1	1	-	-	1	1	1
CO5	3	3	1	2	1	-	-	-	2	-	-	1	2	1
CO6	2	3	2	3	2	1	-	1	1	1	-	3	2	2

Title	DATABASE SYSTEMS		Credits	4
Code	CS 302	Semester: 3	L T P	3 1 0
Max. Marks	100	Internal: - 50 External: - 50	Course Type	Program Core(PC)
Pre-requisites	Introduction to Computer Science and Engineering, ProgrammingFundamentals		Contact Hours	4
Course Outcomes	On completion of this course, a student will be able to 1. Understand, appreciate and effectively explain the underlying concepts of Program-Data Independence, Data models for database systems, Database Schema and Database Instances. 2. Design Entity-Relationship Diagrams for enterprise level databases. 3. Construct queries using SQL and Relational formal query languages. 4. Apply different Normal forms to design the Database. 5. Evaluate various Transactions Processing Techniques, Concurrency Control Protocols and Recovery algorithms. 6. Identify suitable Indices and Hashing mechanisms for effective storage and retrieval of data.			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
Introduction to Database Systems: File Systems Versus a DBMS, Advantages of a DBMS, Components of DBMS, Describing and Storing Data in a DBMS, Database System Architecture, Data abstraction, Data independence, Schemas.	6
Physical Data Organization: Fixed length and Variable Length Records, File Organizations and Indexing, Index Data Structures, Hashing, B-trees, Clustered Index, Sparse Index, Dense Index.	3
Data Models: Relational Model, Network Model, Hierarchical Model, ER Model: Entities, Attributes and Entity Sets, Relationships and Relationship Sets, Constraints, Weak Entities, Class Hierarchies, Aggregation, Conceptual Database Design with the ER Model, Comparison of Models.	4
The Relational Model: Introduction to the Relational Model, ER to Relational Model Conversion, Integrity Constraints over Relations, Enforcing Integrity Constraints, Relational Algebra, Relational Calculus, Querying Relational Data.	4
Relational Query Languages: SQL: Basic SQL Query, Creating Table and Views, SQL as DML, DDL and DCL, SQL Algebraic Operations, Nested Queries, Aggregate Operations, Cursors, Dynamic SQL, Integrity Constraints in SQL, Triggers and Active Database, Relational Completeness, Basic Query Optimization Strategies, Algebraic Manipulation and Equivalences.	6
SECTION-B	
Database Design: Functional Dependencies, reasoning about Functional Dependencies, Normal Forms, Schema Refinement, First, Second and Third Normal Forms, BCNF, Multi-valued Dependency, Join Dependency, Fourth and Fifth Normal Forms, Domain Key Normal Forms, Decompositions	6
Transaction Management:	6

ACID Properties, Serializability, Concurrency Control, Concurrency problems: Dirty read, Lost update, Incorrect summary, Lock Management, Locking Protocols: Two phase, Time stamp, Validation based, Multiversion and Granularity based, Deadlocks Handling.	
Backup and Recovery: Types of Database Failures, Types of Database Recovery, Recovery Techniques: Deferred Update, Immediate Update, Shadow Paging, Checkpoints, Buffer Management.	6
Database Protection: Threats, Access Control Mechanisms, Discretionary Access Control, Grant and Revoke, Mandatory Access Control, Bell LaPadula Model, Role Based Security, Firewalls, Encryption and Digital Signatures.	4

Suggested Books

S. No.	Title	Authors	Publisher	Edition/ Year
1.	Fundamentals of Database Systems	Ramez Elmasri, Shamkant Navathe	Pearson Education	Fifth Edition

Recommended Books

S. No.	Title	Authors	Publisher	Edition/ Year
1	An Introduction to DatabaseSystems	C.J. Date	Pearson Education	Eighth Edition
2	Database Management Systems	Alexis Leon, MathewsLeon		Latest Edition
3	Database Systems Concepts,Design and Applications	S. K. Singh	Pearson Education	Latest Edition
4	Database Management Systems	RaghuRamakrishnan, Johannes Gehrke	Tata McGraw-Hill	Latest Edition
5	System Concepts	Abraham Silberschatz, Henry F. Korth, S.Sudarshan	Tata McGraw-Hill	Latest Edition

Mapping of Course Outcomes with POs and PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	2	2	2	1	-	-	-	2	3	2	1	3
CO2	2	2	2	2	1	1	1	-	-	2	2	2	1	3
CO3	2	2	2	1	3	2	2	1	-	1	2	3	2	3
CO4	1	2	2	2	2	2	-	1	-	-	2	2	1	**3**
CO5	2	2	3	2	2	2	2		2	1	2	3	2	3
CO6	1	2	2	2	3	2	2	1	1	2	1	2	2	3

Title	DATABASE SYSTEM (Practical)		Credits	1
Code	CS 352	Semester: 3	L T P	0 0 3
Max. Marks	50	External: Nil Internal: - 50	Course Type	Program Core(PC)
Pre-requisites			Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Design and implement a database schema for a given problem-domain. 2. Apply normalization to the given database. 3. Evaluate the database using SQL DML/DDL/DCL/TCL commands. 4. Declare and enforce integrity constraints on a database using a state-of-the-art RDBMS. 5. Develop PL/SQL programs including stored procedures, stored functions, cursors, triggers and packages. 6. Design and build a GUI application using a 4GL.			
Note for Examiner	Teacher is supposed to do continuous evaluation of the student throughout the semester. The evaluation will be based on the experiments conducted in the lab by the student. The teacher may schedule multiple practical tests and multiple viva voce examinations to evaluate the students continuously. Students are supposed to maintain laboratory files for the experiments conducted.			

SYLLABUS

Practical should be covered based on the following directions:

1. Introduction to SQL: Types of SQL commands:DDL, DML, DCL, TCL, Use of CREATE AS USER_CONSTRAINTS,TAB, SPOOL
2. Data Constraints and its types: Naming of a Constraint, Types of Constraints: Column level, Table level, Primary key, Foreign key, Unique, Not Null, Check, Default, Behaviors of foreign key table: On delete/Update Restrict, On delete/Update Cascade, On delete/Update Set Null, Integrity constraints via Alter Table command
3. SQL Operators and functions: Operators: Arithmetic, Logical, Relational, Functions:String functions, Numeric functions, Aggregate functions, Date functions
4. Order By, Group by and Having statements
5. Subqueries: Nested queries (Single row, Multi row), Correlated queries
6. Joins:Cross Join, Natural Join, Inner Join, Outer Join(left ,right and full)
7. Views: Types: Materialised and View Resolution, Features/Advantages, Create View, Drop View using single table, Multiple Tables, Insert/update/delete in views
8. Indexes: Types: Unique, Duplicate, simple, Composite, Create, Drop Index (on single column, multiple columns)
9. Sequence: Create, Drop, Alter Sequence
10. Introduction to PL/SQL, Syntax of PL/SQL, Control structures in PL/SQL and their syntax, writing PL/SQL programs for various problems.
11. Subprograms in PL/SQL: Introduction to Procedures: Syntax of Procedures, Write procedure, Introduction to Functions: Syntax of Functions, Write functions
12. Triggers in PL/SQL, Introduction to Triggers, Advantages and disadvantages of triggers, Syntax of Triggers, Types of Triggers, Before event Triggers, After event Triggers, Row Trigger, Statement trigger, Hybrid Trigger, Write programs to demonstrate all types of trigger
13. Cursors in PL/SQL: Introduction, Advantages and Disadvantages of cursor, Types of cursors:Implicit and Explicit Cursors, Create Implicit and Explicit cursors to demonstrate functionality of all 4 attributes
14. Package in PL/SQL: Introduction to Package, Package Specification, Package Body,

Advantages, Disadvantages, Create and Drop Package

15. Exception Handling : System defined Exception handling, User defined Exception handling , Write Programs to demonstrate exception handling

Mapping of Course Outcomes with POs and PSOs

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	2	2	2		2	2	-	1	1	1	2	3	2	3
CO2	2	2	2	2	2	-	-	2	1	-	1	2	1	3
CO3	2	2	2	1	3	2	-	2	2		2	3	2	3
CO4	1	1	1	2	2	1	-	3	1		2	2	2	3
CO5	2	2	2	1	3	-	-	-	1		2	2	2	3
CO6	3	3	3	1	3	3	3	-	3	3	3	3	3	3

Title	DISCRETE STRUCTURES		Credits	4
Code	CS 303	Semester: 3	L T P	3 1 0
Max. Marks	100	Internal: - 50 External: - 50	Course Type	Basic Sciences (BS)
Pre-requisites			Contact Hours	4
Course Outcomes	On completion of this course, a student will be able to 1. Understand sets and perform operations and algebra on sets. 2. Identify relations as well as functions and determine their properties. 3. Apply mathematical reasoning to solve problems and evaluate methods of proof used for program proving. 4. Interpret counting principles and recurrence relations. 5. Analyze graphs as well as trees and identify their basic properties to model and solve real world problems. 6. Describe the properties of algebraic structures.			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
Set theory: Definition of sets and proof by induction; Peano postulates; Relations; representation of relations by graphs; properties of relations; equivalence relations and partitions; Partial orderings; Posets; Linear and well-ordered sets.	9
Functions: Mappings; injection and surjections; composition of functions; inverse functions; special functions; pigeonhole principle.	5
Mathematical reasoning: Propositions; negation disjunction and conjunction; implication and equivalence; truth tables; predicates; quantifiers; natural deduction; rules of Inference; methods of proofs used in program proving.	9
SECTION-B	
Combinatorics: Elementary combinatorics; counting techniques; recurrence relation; generating functions.	6
Graph Theory: Introduction, Graphs Multigraph, Isomorphic Graph, Homeomorphic Graphs, Paths and Circuits, Shortest Paths in weighted Graphs, Eulerian and Hamiltonian Paths and Circuits, Konigsberg Bridge, Complete, Regular, Bipartite Graphs, Planar Graphs, Graph Coloring, Graph Traversal Techniques. Trees, Binary Search Trees, Complete & Extended Binary Trees.	10
Groups: Definition and elementary properties of groups, semigroups, monoids, rings, fields and lattices.	6

Suggested Books

S. No.	Title	Authors	Publisher	Edition/ Year
1.	Elements of Discrete Mathematics	C.L.Liu, D P Mohapatra	Tata McGraw Hill	Third Edition
2	Discrete Mathematics andapplications	K.H.Rosen,	Tata McGraw Hill	Seventh Edition

3	Discrete Mathematics, McGrawHill,	Lipschutz	McGraw Hill	LatestEdition
4	Discrete Mathematical Structures,	B. Kolman, R. C. Busby and S. C. Ross	PHI	Latest Edition

Mapping of Course Outcomes with POs and PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	2	-	-	1	1	1	-	-	-	2	2	2
CO2	3	3	2	-	-	1	1	1	-	-	-	2	2	2
CO3	3	3	2	-	-	1	1	1	-	-	-	2	2	2
CO4	3	3	2	-	-	1	1	1	-	-	-	2	2	2
CO5	3	3	2	-	-	1	1	1	-	-	-	2	2	2

Title	WEB TECHNOLOGIES		Credits	3
Code	CS 304	Semester: 3	L T P	3 0 0
Max. Marks	100	Internal: - 50 External: - 50	Course Type	Program Core(PC)
Pre-requisites	Introduction to Computer Science and Engineering, Programming Fundamentals		Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Define the core principle on which Internet and WWW operates. 2. Understand the concept of Web Development to create static Web pages using HTML, DHTML and CSS. 3. Demonstrate the need of interactive Web content using JavaScript using sessions and cookies. 4. Examine the server-side scripting using technologies like XML. 5. Ability to develop Web Pages using PHP and MySQL for server-side scripting. 6. Apply this knowledge for developing good sites.			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
INTERNET AND WORLD WIDE WEB: Introduction, Internet addressing, ISP, types of Internet connections, introduction to WWW, web browsers, web servers, URL, HTTP, DNS, web applications, tools for web site creation	4
HTML: Introduction to HTML, lists, adding graphics to HTML page, creating tables, linking documents, frames, DHTML and cascading style sheets.	7
Java Script: Introduction, programming constructs: variables, operators and expressions, conditional checking, functions and dialog boxes, JavaScript DOM, creating forms, objects like Window, Navigator, History, Location, introduction to cookies,	11
SECTION-B	
XML: Why XML, XML syntax rules, XML elements, XML attributes, XML DTD displaying XML with CSS.	6
PHP: Introduction, syntax, variables, statements, operators, decision making, loops, arrays, strings, forms, get and post methods, functions, cookies, sessions.	11
PHP and MySQL: Introduction to MySQL, connecting to MySQL database, creation, insertion, deletion and retrieval of MySQL data using PHP, PHP and XML, XML parsers, XML DOM	6

Suggested Books

S. No.	Title	Authors	Publisher	Edition/ Year
1.	XML How to Program,	Deitel, Deitel, Nieto, and Sandhu	Pearson Education	Latest Edition
2.	Java 2: The Complete Reference	Herbert Schieldt	TMH	Fifth Edition
3.	Web Enabled Development Application	Ivan Bayross : Commercial	BPB	Latest Edition
4.	HTML,CSS, JavaScript,Perl, Python and PHP	Schafer Textbooks.	Wiley India	Latest Edition

Mapping of Course Outcomes with POs and PSOs	COs	POs												PSOs	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
	CO1	1	2	-	2	-	-	-	-	-	1	2	3	2	2
	CO2	2	2	1	1	2	-	1	-	-	1	2	3	2	3
	CO3	1	2	2	2	2	-	2	-	-	1	2	3	2	1
	CO4	1	2	2	2	2	-	2	-	-	1	2	3	2	2
	CO5	1	2	2	2	2	-	2	-	-	1	2	3	2	2
	CO6	2	2	2	2	2	-	1	-	-	1	2	3	2	2

Title	WEB TECHNOLOGIES (Practical)		Credits	1
Code	CS 354	Semester: 3	L T P	0 0 3
Max. Marks	50	External: Nil Internal: - 50	Course Type	Program Core(PC)
Pre-requisites			Contact Hours	3

Course Outcomes

On completion of this course, a student will be able to

1. Understand the concept of Web Development and various technologies associated with the Web and Internet.
2. Create Web Pages using HTML, DHTML and CSS implementing client-side scripting concept
3. Create interactive and dynamic web pages using JavaScript and its related topics including, cookies, pop ups etc.
4. Creation of dynamic and interactive web pages with PHP (Server-Side Scripting) and highlight the concepts like Sessions, Cookies etc.
5. Create powerful Web applications using PHP as frontend and MySQL as backend and integrating both.
6. Ability to use this knowledge for developing good sites.

Note for Examiner

Teacher is supposed to do continuous evaluation of the student throughout the semester. The evaluation will be based on the experiments conducted in the lab by the student.
The teacher may schedule multiple practical tests and multiple viva voce examinations to evaluate the students continuously. Students are supposed to maintain laboratory files for the experiments conducted.

SYLLABUS

Practical should be covered based on the following directions:

1. Creation of Web pages using: HTML, DHTML
2. Creation of Web pages using JavaScript
3. Implementing basic concepts of Java
4. Creation of Web pages using AJAX
5. Database and AJAX
6. XML
7. PHP

Mapping of Course Outcomes with POs and PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	3	3	1	-	-	-	-	2	2	3	2	2	2
CO2	3	3	2	3	-	1	1	-	1	2	3	2	2	3
CO3	3	3	3	3	-	2	1	-	1	2	3	2	1	1
CO4	3	3	3	3	-	2	1	-	1	2	3	2	2	2
CO5	3	3	3	3	-	1	1	-	-	2	3	2	2	2
CO6	3	3	3	3	-	2	1	-	1	2	3	2	2	2

Title	SOFTWARE ENGINEERING		Credits	3
Code	CS 305	Semester: 3	L T P	3 0 0
Max. Marks	100	Internal: - 50 External: - 50	Course Type	Program Core(PC)
Pre-requisites	Introduction to Computer Science and Engineering (CS102), Programming Fundamentals (CS101/201)		Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Understand and analyze the various software engineering process models for a given software problem. 2. Learn the different phases of SDLC and apply them for software development. 3. Elicit the functionalities of SRS, design, coding, testing, and maintenance by means of taking different case studies. 4. Implement the use of various tools and techniques of function oriented and object-oriented analysis and design. 5. Understanding the various software testing techniques, and CASE tools to document models of a system. 6. Implement constructs of UML to document the artifacts of the software system.			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
Introduction: Introduction to Software Engineering, System Engineering Vs Software Engineering, Software Evolution, Software Characteristics, Cost of Software Production, Software Components, Crisis – Problem and Causes, Challenges in Software Engineering.	4
Software Process Models: SDLC, Waterfall Model, Incremental Model, Prototyping Model, Evolutionary Model, Spiral Model, Rapid Application Development Model, Rational Unified Process Model, Agile Methods, Xtreme programming, SEI Capability Maturity Model.	8
Software Requirements Analysis and Specification Concepts: Requirement Engineering, Requirement Elicitation Techniques, Requirements Documentation, Characteristics and Organization of SRS,	4
Software Analysis and Design: Design Principles, Design issues and Approaches, Abstraction, modularity, Coupling, Cohesion, Structured Analysis and Design, DFD, Object oriented Design, Data Design, Architectural design, Interface Design, Component Level Design, Object Oriented Design Concepts, Structured vs. Object Oriented Analysis.	8
SECTION-B	
Project Management Concepts: Management Activities, Project Planning, Project Scheduling, Size Estimation – LOC, FP; Cost Estimation Models –COCOMO, COCOMO-II.	6
Coding & Testing: Coding, Coding Standards, Coding Conventions, Programming Style, Verification and Validation, Testing Process, Design of Test Cases, Software Testing Strategies, Unit Testing, Integration Testing, Top Down and Bottom-Up Integration Testing, Alpha & Beta Testing, System Testing and Debugging.	5
Technical Metrics for Software: Software Measurements: What and Why, A Framework for Technical Software Metrics, Metrics	4

for the Analysis Model, Metrics for Design Model, Metrics for Source Code, Metrics for Testing, Metrics for Software Quality, Metrics for Maintenance.	
CASE (Computer Aided Software Engineering) and Introduction to UML: CASE and its Scope, building blocks of CASE, CASE Tools, CASE Environment, UML Concepts, Use Case Diagrams, Sequence Diagrams, Collaboration Diagrams, Class Diagrams, State Transition Diagrams, Component and Deployment Diagrams.	6

Suggested Books

S. No.	Title	Authors	Publisher	Edition/ Year
1.	Software Engineering	Ian Sommerville	Pearson Education	Seventh Edition

Recommended Books

S. No.	Title	Authors	Publisher	Edition/ Year
1	Software Engineering: A Practitioner's Approach	R.S. Pressman	McGraw Hill.	Sixth Edition
2	Software Engineering: Theory andPractice	Pfleeger, J.M. Atlee	Pearson Education	Second Edition
3	Software Engineering for Students.	Douglas Bell	Pearson Education	Fourth Edition
4	An Integrated Approach toSoftware Engineering,	Pankaj Jalote	Narosa	Second Edition
5	Software Engineering	K.K.Aggarwal,Yogesh Singh	New Age International.	Second Edition

Mapping of Course Outcomes with POs and PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	2	-	1	-	-	-	1	2	2	-	2	2
CO2	2	2	2	1	1	-	-	-	-	-	2	-	2	2
CO3	-	3	3	2	1	-	-	-	1	1	2	2	2	1
CO4	2	2	2	2	2	-	-	-	1	-	2	2	2	1
CO5	2	2	2	2	2	-	-	-	1	-	2	2	2	1
CO6	-	-	-	3	3	3	-	1	1	-	2	2	3	2

Title	**Latest Trends and Technologies in Computer Science**		**Credits**	2
Code	**VAC 101**	**Semester:** 3	**L T P**	2 0 0
Max. Marks	**100**	**Internal: - 50** **External: - 50**	**Course Type**	Program Core(PC)
Pre-requisites	Introduction to Computer Science and Engineering, Programming Fundamentals.		**Contact Hours**	2
5. Course Outcomes	On completion of this course, a student will be able to 1. Understanding about the latest technologies like telecom networks, IoT and AR/VR. 2. Recognize the applicability of technologies and evaluate their impact on individuals, organizations, and global society. 3. Demonstrate knowledge and skills of these technologies independently. 4. Learn the fundamental of cloud computing, data science and security, their applicability, benefits, as well as current and future challenges 5. Identify variety of programming models and develop working experience. 6. Exhibit familiarity about these technologies to apply on real life problems.			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
Telecommunication Networks: Evolution, Architecture, components and applications Mobile Networks: 1G, 2G, 3G, 4G, 5G and 6G, basic network performance metrics.	3
Internet of Things (IoT): Understanding IoT fundamentals, IoT Architecture and protocols, Various Platforms for IoT, Real-time Examples of IoT, Overview of IoT components and IoT Communication Technologies, sensors & Actuators, Challenges in IoT, electronics platforms /devices like Arduino, Raspberry Pi..	6
Augmented reality (AR) and Virtual Reality (VR): Introduction to the AR functionality, taking the next steps with ARCore, bringing ARCore to life, VR- hardware and history, applications, the psychology of VR: The three illusions, challenges in VR.	5
SECTION-B	
Cloud Computing: Introduction to Cloud Computing, NIST Definition of Cloud Computing, Essential Characteristics, Applications, Issues and Challenges, Virtualization; Hypervisors; Service Models: IaaS, PaaS, SaaS; Deployment Models: Private, Community, Public, Hybrid; Cloud Computing Reference Architecture: Consumer, Provider, Auditor, Broker, Carrier; Basic Features of Amazon Web Services (AWS), Google Cloud Platform (GCP) and Microsoft Azure.	6
Artificial Intelligence, Machine Learning and Data Science: Introduction to Artificial Intelligence, Data Mining, Machine Learning, Deep Learning, Data Science and how they relate to each other; Benefits, challenges, application areas and use-cases; Basic machine learning process and familiarization with key steps; Tools for developing intelligent applications..	6
Cybersecurity and Blockchain: Introduction to Information Security, Cyber Crime, Computer	4

Ethics and Security Policies, Blockchain and its working, key features, attributes and applications

Suggested Books

S. No.	Title	Authors	Publisher	Year
1.	Data Communications and Networking,	Behrouz A. Forouzan:	McGraw Hill Education, Latest Edition	Latest Edition
2.	Mastering Cloud Computing	Rajkumar Buyya, Christian Vecchiola and S. Thamarai Selvi	McGraw Hill Education	Latest Edition
3.	Internet of Things	Raj Kamal	McGraw Hill Education	Latest Edition
4.	Data Science: Concepts and Practice	Kotu and Deshpande	Morgan Kaufmann	Latest Edition
5.	Mastering Blockchain: Distributed Ledger Technology, decentralization, and smart contracts explained	Imran Bashir	Packt Publishing Ltd	Latest Edition
6.	Cryptography and Network Security - Principles and Practice	William Stallings	Pearson	Latest Edition
7.	Cloud Computing Bible	Barrie Sosinsky	Wiley Publishing	Latest Edition
8.	Computer Networks	Andrew S. Tanenbaum, David J. Wetherall	Pearson	Latest Edition
9.	Data Science and Machine Learning in R	Reema Thareja	McGraw Hill Education	Latest Edition

Online Resources

1	https://onlinecourses.swayam2.ac.in/nou19_cs08/preview
2	https://elearn.nptel.ac.in/shop/iit-workshops/completed/foundation-course-on-virtual-reality-and-augmented-reality/
3	https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01255779688268595211_shared/overview
4	https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013094404871520256156 6_shared/overview
5	https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01287485700796416090_shared/overview
6	https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012811207443464192620 6_shared/overview

Mapping of Course Outcomes with POs and PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	1	1	1	1	1	-	-	1	1	-	2	1	2
CO2	1	3	2	2	2	3	1	-	1	1	-	1	1	2

CO3	2	2	3	3	3	1	-	1	2	2	1	3	2	3
CO4	1	1	1	1	1	3	-	-	1	1	-	2	1	3
CO5	2	3	2	2	2	1	1	-	1	1	-	1	3	3
CO6	3	2	3	3	3	1	1	1	2	2	1	3	2	3

Title	ANALYSIS AND DESIGN OF ALGORITHMS		Credits	4
Code	CS 401	Semester: 4	L T P	3 1 0
Max. Marks	100	Internal: - 50 External: - 50	Course Type	Program Core(PC)
Pre-requisites	Introduction to Computer Science and Engineering, Data Structures		Contact Hours	4
Course Outcomes	On completion of this course, a student will be able to 1. Describe different measures for time and space complexities used in the analysis of algorithms. 2. Explain the usage of different algorithm design approaches including Divide and Conquer, Greedy, Dynamic Programming, and Backtracking. 3. Apply algorithm design paradigms to solve conventional computational problems including constraint satisfaction and optimization problems. 4. Differentiate between the scenarios in which a particular algorithm design paradigm can be suitably applied. 5. Describe the complexity classes P, NP, NP-hard and NP-complexity and examine to which complexity class a particular algorithmic solution belongs. 6. Synthesize efficient algorithms for common engineering problems.			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
Introduction: Revisiting space/time complexity and asymptotic notations; Recurrences: writing recurrences, solving recurrences: iterative substitution, recursion-tree method, Master's theorem, substitution method, randomized algorithms, elementary data structures: priority queues, sets and disjoint set union, graphs.	8
Divide and Conquer:- General method, Analysis of divide and conquer based solutions to: Binary Search, Merge sort, Quick sort, Selection sort, finding maximum and minimum, Strassen's matrix multiplication, Convex Hull problem	7
Greedy Algorithms: -Elements of Greedy strategy, Activity Selection Problem, Knapsack problem, Single source Shortest paths problem, Minimum Spanning tree problem and analysis of these problems.	8
SECTION-B	
Dynamic Programming: - Elements of dynamic programming, Traveling Salesperson Problem, Matrix-chain multiplication, Multistage Graph, All Pairs Shortest paths, Longest common subsequences, 0/1 Knapsack.	12
Backtracking: - - General method, N-Queen's problem, Graph coloring problem, Sum of subsets Problem, Hamiltonian Cycles.	6
Introduction to NP-Completeness and Approximation Algorithms:-Polynomial Time, polynomial-time verification, NP-completeness and reducibility, NP-complete problems, introduction to approximation algorithms	4

Suggested Books				
S. No.	**Title**	**Authors**	**Publisher**	**Edition/ Year**
1	Introduction to Algorithms	Thomas H. Cormen, Charles E. Leiserson,Ronald L. Rivest	Prentice Hall of India	Latest Edition
Recommended Books				
S. No.	**Title**	**Authors**	**Publisher**	**Edition/ Year**
1	Fundamentals of Computer Algorithms	Ellis Horowitz, Sartaj Sahni	Galgotia	Latest Edition
2	The Design and Analysisof Computer Algorithms	Aho A.V., Hopcroft J.E., Ullman J.D.	Pearson Education	Latest Edition
3	Introduction to the Design and Analysis of Algorithms	Goodman S.E. & Hedetniemi	McGraw-Hill	Latest Edition

Mapping of Course Outcomes with POs and PSOs

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	3	2	3	-	-	-	1	1	2	1	1	1
CO2	3	3	3	2	2	-	-	-	2	1	1	1	1	1
CO3	3	2	3	3	3	-	-	-	1	1	2	2	2	2
CO4	3	2	2	3	3	1	-	-	2	1	2	2	-	1
CO5	3	3	3	3	3	-	-	-	1	1	2	2	-	1
CO6	3	2	3	3	3	1	-	-	1	2	2	2	-	1

Title	ANALYSIS AND DESIGN OF ALGORITHMS (Practical)		Credits	1
Code	CS 451	Semester: 4	L T P	0 0 3
Max. Marks	50	External: Nil Internal: - 50	Course Type	Program Core(PC)
Pre-requisites			Contact Hours	3

Course Outcomes

On completion of this course, a student will be able to

1. Develop programs to find solutions to various engineering problems.
2. Analyze the time complexity and space complexity of the algorithm used for solving an engineering problem.
3. Determine practically the time and space taken by a particular solution.
4. Compare and contrast theoretical time and space estimates with practical time and space readings.
5. Identify and Assess scope of improvement in particular solution and create an improvised solution.
6. Recommend best solution for a particular engineering problem.

Note for Examiner

Teacher is supposed to do continuous evaluation of the student throughout the semester. The evaluation will be based on the experiments conducted in the lab by the student.
The teacher may schedule multiple practical tests and multiple viva voce examinations to evaluate the students continuously. Students are supposed to maintain laboratory files for the experiments conducted.

SYLLABUS

Practical should be covered based on the following directions:

1. Divide & Conquer
2. Greedy Method
3. Dynamic Programming
4. Backtracking

Mapping of Course Outcomes with POs and PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	3	2	2	-	-	-	2	2	2	1	2	2
CO2	3	3	3	3	3	1	-	-	2	2	3	1	2	3
CO3	3	3	3	3	2	1	-	-	2	1	1	1	2	1
CO4	3	3	3	3	3	1	-	-	2	2	2	2	2	2
CO5	2	2	3	3	3	2	-	-	2	2	2	2	2	2
CO6	3	3	2	3	3	2	–	-	2	2	2	2	2	2

Title	LINEAR ALGEBRA AND PROBABILITY THEORY		Credits	3
Code	CS 402	Semester: 4	L T P	3 0 0
Max. Marks	100	Internal: - 50 External: - 50	Course Type	Basic Sciences (BS)
Pre-requisites			Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Understand the use of linear algebra and linear transformations. 2. Design solutions using matrices and Eigen vectors 3. Apply probability theory in different engineering problems. 4. Understand the use of random variables in different applications. 5. Correlate applications of matrices in data science and other engineering fields.			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
Systems of Linear equations: Introduction, Linear equations, solutions, Linear equations in two unknowns, Systems of linear equations, equivalent systems, Elementary operations, Systems in Triangular and echelon form, Reduction Algorithm, Matrices, Row equivalence and elementary row operations, Systems of Linear equations and matrices, Homogeneous systems of Linear equations. (Scope as in Chapter 1, Sections 1.1-1.10 of Reference 1).	5
Vector Spaces: Introduction, Vector spaces, examples of vector spaces, subspaces, Linear combinations, Linear spans, Linear dependence and Independence, Basis and Dimension, Linear equations and vector spaces. (Scope as in Chapter 5, Sections 5.1-5.8 of Reference 1).	5
Eigenvalues and Eigenvectors, Diagonalization: Introduction, Polynomials in matrices, Characteristic polynomial, Cayley-Hamilton theorem, Eigen- values and Eigen-vectors, computing Eigen-values and Eigen-vectors, Diagonalizing matrices. (Scope as in Chapter 8, Sections 8.1-8.5 of Reference 1).	4
Linear Transformations: Introduction, Mappings, Linear mappings, Kernel and image of a linear mapping, Rank-Nullity theorem (without proof), singular and non-singular linear mappings, isomorphism. (Scope as in Chapter 9, Sections 9.1-9.5 of Reference 1).	5
Matrices and Linear transformations: Introduction, Matrix representation of a linear operator, Change of basis and Linear operators. (Scope as in Chapter 10, Sections 10.1-10.3 of Reference 1).	5
SECTION-B	
Probability Sample Space and Events, the Axioms of probability, some elementary theorems, Conditional probability, Baye's Theorem, Random Variables-Discrete and Continuous, Independent random variables, Expectation, Variance and Covariance, Means and variances of linear combinations of random variables, Chebyshev's inequality	7
Probability Distributions Joint Probability distributions, Marginal and Conditional distributions, Binomial, Poisson,	7

Uniform and Normal distributions, Normal and Poisson approximations to Binomial, Moments, Moment generating function.	
Two Dimensional Random Variables Joint distributions – Marginal and conditional distributions – Covariance – Correlation and Regression – function of a random Variable-Transformation of random variables - Central limit theorem.	7

Suggested Books

S. No.	Title	Authors	Publisher	Edition/ Year
1	Shaum's Outline of Theory andProblems of Linear Algebra	Seymour Lipschutz	McGraw-Hill, 1991.	2nd edition
2	Linear Algebra	Vivek Sahai, Vikas Bist	Narosa Publishing House, 2002	Latest Edition
3	Introduction to Probability andStatistics	J. S. Milton and J.C. Arnold	McGrawHill, 2007	4th edition
4	Probability and Statistics forEngineers	R.A. Johnson and C.B. Gupta	PearsonEducation, 2007	7th edition
5	Fundamentals of MathematicalStatistics	S. C. Gupta and V.K. Kapoor	Sultan Chand and Sons	Latest Edition

Mapping of Course Outcomes with POs and PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	-	2	1	-	-	-	-	1	1	-	2	3
CO2	3	3	-	2	1	-	-	-	-	1	1	-	2	3
CO3	3	3	-	2	1	-	-	-	-	1	1	-	1	3
CO4	3	3	-	2	1	-	-	-	-	1	1	-	2	3
CO5	3	3	-	2	1	-	-	-	-	1	1	-	2	3

Title	OPERATING SYSTEM		Credits	4
Code	CS 403	Semester: 4	L T P	3 1 0
Max. Marks	100	Internal: - 50 External: - 50	Course Type	Program Core(PC)
Pre-requisites	Introduction to Computer Science and Engineering, Programming Fundamentals, Data Structures		Contact Hours	4
Course Outcomes	On completion of this course, a student will be able to 1. Define and illustrate the functions of various types of operating systems. 2. Understand the concept of processes, Process Synchronization, Critical Sections, Semaphores and Monitors and evaluate the performance of CPU Scheduling Algorithms. 3. Explain deadlocks Detection, Recovery, Avoidance and Prevention. 4. Describe different approaches to memory management, Virtual Memory management and secondary memory management including scheduling algorithms. 5. Articulate file and directory Systems and various protection mechanisms. 6. Compare current operating systems using case Studies.			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
Introduction: What is an O.S., O.S. Functions; Different types of O.S.: batch, multiprogrammed, time sharing, real time, distributed, parallel; General structure of operating system, O/S services, system calls.	5
Process Management: Introduction to processes - Concept of processes, process scheduling, operations on processes; Interprocess Communication, Critical Sections, Mutual Exclusion with Busy Waiting, Sleep and Wakeup, Semaphores, Message passing; CPU scheduling- scheduling criteria, pre- emptive & non-pre-emptive scheduling, Scheduling Algorithms: FCFS, SJF, RR and priority, Threads.	10
Deadlocks: Introduction to deadlocks, Conditions for deadlock, Resource allocation graphs, Deadlock Detection and Recovery, Deadlock Avoidance, Deadlock Prevention	6
SECTION-B	
Memory Management: background, logical vs. physical address space, memory management without swapping; swapping; contiguous memory allocation, paging, segmentation, segmentation with paging; Virtual Memory, demand paging, performance, page replacement, page replacement algorithms (FIFO, Optimal, LRU); Thrashing.	6
File Systems: Files - file concept, file structure, file types, access methods, File attributes, file operations; directory structure, allocation methods (contiguous, linked, indexed), free-space management (bit vector, linked list, grouping), Protection mechanisms.	6
Secondary Storage: Disk Structure, Disk Scheduling (FCFS, SSTF, SCAN, C-SCAN, LOOK), Disk Management (Disk Formatting, Boot Blocks, Bad Blocks), Swap Space Management (Swap Space use, Swap Space Location, Swap Space Management)	6
Case Studies: Brief introduction of MS-DOS, Windows, UNIX and LINUX.	6

Suggested Books				
S. No.	**Title**	**Authors**	**Publisher**	**Year**
1.	Operating System Concepts	Silberschatz and Galvin	Addison WesleyInc.	Latest Edition
2	Operating System Design & Implementation	Tanenbaum A.S	Pearson Education.	Latest Edition
3	An introduction to Operating Systems Concepts and Practice,	Bhatt and Chandra	Prentice Hall ofIndia Publication	Latest Edition

Mapping of Course Outcomes with POs and PSOs

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	1		-	1	-	2	1	-	1	1	1	3	1	1
CO2	1	2	**2**		2	2	1	-	2	2	2	2	2	2
CO3	1	1	1	2	1	2	1	2	-	-	1	2	2	2
CO4	2	2	2	-	2	2	1	-	2	-	2	2	3	1
CO5	1	1	1	2	2	2	-	3	1	-	2	3	3	2
CO6	3	2	2	3	3	2	3	-	3	3	3	3	2	2

Title	OPERATING SYSTEM (Practical)		Credits	1
Code	CS 453	Semester: 4	L T P	0 0 3
Max. Marks	50	External: Nil Internal: - 50	Course Type	Program Core(PC)
Pre-requisites			Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Explain the fundamentals of LINUX/Ubuntu platform. 2. Compile different Ubuntu commands and use them in shell programming. 3. Articulate file and directory Systems and various protection mechanisms. 4. Develop shell programs, creating a script, making a script executable, shell syntax (variables, conditions, control structures, functions, commands) and C/C++ program in VI editor. 5. Deploy Process scheduling and Deadlock Handling 6. Demonstrate different approaches to Memory management, Virtual Memory management and Secondary storage scheduling algorithms.			
Note for Examiner	Teacher is supposed to do continuous evaluation of the student throughout the semester. The evaluation will be based on the experiments conducted in the lab by the student. The teacher may schedule multiple practical tests and multiple viva voce examinations to evaluate the students continuously. Students are supposed to maintain laboratory files for the experiments conducted.			

SYLLABUS

Practical should be covered based on the following directions:

1. Linux Introduction and Installation, Introduction to various types of shell: Bourne, Tc,Korn, Bash
2. Deploy commands: cat,man,echo,touch,ls,mkdir,cd,cp, pwd,tty,who,wc,mv, rmdir, whatis, whereis, find,type,bc,expr
3. Execute commands: diff,cmp,comm,sort,tee,cut,,tr, grep,head,tail,free,df,du,ulimit, cal,ncal
4. Implement commands:umask,chmod, adduser,su, deluser,gzip/gunzip,tar, split,sleep,shutdown
5. Execute processes:ps,nohup,kill,nice,batch,at, crontab,wall,write
6. Introduction to Shell Scripting and Editors: Vi, Vim etc, Modes of Working: Test, Command, Execute, Basic Script writing
7. Write shell scripts for various problems using Control structures
8. Deploy various CPU Scheduling algorithms for process management:FCFS,SJF,Priority, Round robin
9. Demonstrate Process Synchronisation for universal problems like producer-consumer, reader-writer, dining philosopher etc.
10. Demonstrate Deadlock handling using Banker's algorithm
11. Deploy memory management techniques: MFT, MVT(FF, BF,WF)
12. Execute various page replacement techniques like FIFO, OPR, LRU, LFU, MFU for virtual memory management
13. Demonstrate various Disk scheduling algorithms: FCFS,SSTF,SCAN, C-SCAN,LOOK, C-LOOK

Mapping of Course Outcomes with POs and PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	-	-	-	3	-	-	-	-	1	-	3	1	1
CO2	2	2	2	1	2	-	-	-	-	-	-	2	2	2
CO3	2	1	1	3	1	1	-	2	2	1	2	2	2	2

CO4	3	3	3	1	2	1	1	-	-	-	-	2	3	2	
CO5	2	2	2	1	1	1	-	-	2	3	2	2	2	2	
CO6	2	2	2	1	1	-	-	-	2	-	2	2	2	2	

Title	COMPUTER NETWORKS		Credits	4
Code	CS 404	Semester: 4	L T P	3 1 0
Max. Marks	100	Internal: - 50 External: - 50	Course Type	Program Core(PC)
Pre-requisites	Data Structures (CS 301)		Contact Hours	4
Course Outcomes	On completion of this course, a student will be able to 1. Apply the fundamental concepts of computer networks to solve different networking problems 2. Identify the concepts of layering structure of OSI and TCP/IP protocol suites and their differences 3. Articulate the terminology, services, protocols and issues of physical layer and data link layer 4. Design networks using principles of network layer and transport layer protocols 5. Investigate the features and operations of various application layer protocols such as HTTP, DNS, SMTP, etc 6. Able to understand telecommunication networks design techniques and practical implementation issues			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
Introduction: Data Communication: Components, Data Flow, Representation of data, Network Categories: LAN, MAN, WAN (Wireless / Wired), Various Connection Topology. Network Software: Concept of layers, protocols, interfaces and services, Reference Model: OSI, TCP/IP and their comparison. LAN Technology and Network Devices: LAN Architecture, Bus LANs, Ring LANs, Star LANs, Virtual LAN, Ethernet (IEEE 802.3 standard), Fast Ethernet, Gigabit Ethernet, Introduction to Wireless LANs (IEEE 802.11 standard), Introduction to Repeaters, Bridges, Switches and Routers.	8
Physical Layer: Analog and Digital signal, Bit rate, Bit length, Data Encoding, Spread Spectrum, Asynchronous and Synchronous Transmission. Transmission Impairments: Attenuation, Distortion, Noise; Data rate limits: Nyquist formula, Shannon Formula, Multiplexing: Frequency-Division, Time Division, Wavelength Division, Synchronous Time-Division Multiplexing, Statistical Time-Division Multiplexing. Transmission media: Guided Transmission Media, Wireless Transmission Media, Communication Satellites Switching: Switched Networks, Circuit-Switching Networks, Switching Concepts, Routing in Circuit-Switched Networks, Control Signaling, Packet-Switching Principles	8
Data link layer: Error detection and correction Techniques: Parity check, Checksum, Cyclic Redundancy Check (CRC) error detection, hamming error correction, Flow and Error Control. Sliding window protocols: Stop and Wait ARQ, Go back n ARQ, Selective repeat ARQ Random Access protocols: ALOHA, CSMA, CSMA/CD and CSMA/CA Channel partitioning protocols: TDM-FDM-Code Division Multiple Access(CDMA).	8

SECTION-B	
Network Layer: Logical Addressing: IPv4 and IPv6, Frame Formats and their comparison: IPv4 and IPv6 Address mapping: ARP, RARP, BOOTP and DHCP–Delivery, NAT Routing algorithms: Shortest Path, Distance vector, Link State Routing, Flooding Congestion Control: Principles of Congestion Control, Congestion prevention policies, Leaky bucket & Token bucket algorithms	8
Transport Layer: Process to Process Communication, Addressing, flow control & buffering, multiplexing & de-multiplexing. Example transport protocols: TCP, UDP and SCTP, Quality of Service.	5
Application Layer: FTP, DNS, HTTP, EMAIL, SMTP, SIP	3
Telecommunication networks: Introduction to architecture of 1G, 2G, 3G, 4G and 5G Networks	5

Suggested Books

S. No.	Title	Authors	Publisher	Year
1	Computer Networks	Andrew S. Tanenbaum, Nick Feamster and David J. Wetherall	Pearson Education,2021	6th edition
2	Data Communications and Networking	Behrouz A. Forouzan	2017, McGraw Hill Education	5th edition
3	Computer Networking	James F. Kurose and Keith W. Ross	Pearson Education 2017	7th edition
4	Data and Computer Communication	William Stalling	Pearson Education, 2018	10th edition
5	Computer Networks and Internets	Douglas E Comer	Pearson Education, 2018	6th edition

Mapping of Course Outcomes with POs and PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	1	-	1	-	-	1	1	-	1	1	2	2
CO2	3	2	1	-	1	-	-	1	1	-	1	1	2	1
CO3	3	2	1	-	1	-	-	1	1	-	1	1	2	1
CO4	3	2	1	-	1	-	-	1	1	-	1	1	2	2
CO5	3	2	1	-	1	-	-	1	1	-	1	1	2	1
CO6	3	2	1	-	1	-	-	1	1	-	1	1	2	2

Title	COMPUTER NETWORKS (Practical)		Credits	1
Code	CS 454	Semester: 4	L T P	0 0 3
Max. Marks	50	External: Nil Internal: - 50	Course Type	Program Core(PC)
Pre-requisites	Data Structures (CS 301)		Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Understand the concepts of data communication, network topologies and transmission media. 2. Analyze and configure different networking devices. 3. Illustrate the concept of data link layer by implementing error detection and correction and sliding window protocols. 4. Illustrate the concept of network layer by configuring IP addresses, VLANs, etc 5. Apply different networking commands for maintenance of computer networks. 6. Design and Analyze network and its performance using open-source network simulators			
Note for Examiner	Teacher is supposed to do continuous evaluation of the student throughout the semester. The evaluation will be based on the experiments conducted in the lab by the student. The teacher may schedule multiple practical tests and multiple viva voce examinations to evaluate the students continuously. Students are supposed to maintain laboratory files for the experiments conducted.			

SYLLABUS

1. To familiarize with the various basic tools (crimping, krone etc.) used in establishing a LAN.
2. To study various topologies for establishing computer networks.
3. To familiarize with switch, hub, connecters, cables (cabling standards), bridges, switches, routers, access points and their configuration used in networks
4. To understand working of Wireshark, simulate networks and analyze the performance.
5. To use some basic commands like ping, trace-root, ipconfig for trouble shooting network related problems.
6. To use various utilities for logging in to remote computer and to transfer files from/to remote computer.
7. To develop a program to compute the Hamming Distance between any two code words.
8. To develop a program to compute checksum for an 'm' bit frame using a generator polynomial.
9. To develop a program for implementing / simulating the sliding window protocol
10. To develop a program for implementing / simulating a routing algorithm
11. To study various IEEE standards (802.3, 802.11, 802.16)

Mapping of Course Outcomes with POs and PSOs

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1	_	1	_	_	1	1	_	1	1	2	3	1
CO2	3	2	1	_	1	_	_	1	1	_	1	1	2	3	1
CO3	3	2	1	_	1	_	_	1	1	_	1	1	2	3	1
CO4	3	2	1	_	1	_	_	1	1	_	1	1	2	3	1
CO5	3	2	1	_	1	_	_	1	1	_	1	1	2	3	1
CO6	3	2	1	_	1	_	_	1	1	_	1	1	2	3	1

Title	COMPUTER ARCHITECTURE & ORGANIZATION		Credits	3
Code	CS 405	Semester: 4	L T P	3 0 0
Max. Marks	100	Internal: - 50 External: - 50	Course Type	Program Core(PC)
Pre-requisites	Introduction to Computer Science and Engineering		Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Identify the basic element and functions of microprocessor, and Understand basic organization of any computing system 2. Explain instruction set architecture and develop their micro architectures 3. Understand and Illustrate various digital arithmetic algorithms 4. Illustrate and compare ALU and Control unit designs 5. Understand and explain the concepts of caching, memory system architectures and I/O organization 6. Understand pipelining and parallel processing concepts			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
Introduction to microprocessor: Microprocessor architecture, 8085 MPU	2
Basic organization of computers, Block level description of the functional units as related to the execution of a program; Fetch, decode and execute cycle.	4
Machine instructions, Instruction set architectures, Assembly language programming (8085), addressing modes, instruction cycles, registers and storage; discussions about RISC versus CISC architectures; Inside a CPU	10
Information representation, Floating point representation (IEEE 754), computer arithmetic and their implementation; Fixed-Point Arithmetic: Addition, Subtraction, Multiplication and Division, Arithmetic Logic Units control and data path, data path components, design of ALU and data path, controller design; Hardwired and Micro Programmed Control.	10
SECTION-B	
Memory Technology, Cache memory and Memory Hierarchy, Address Mapping, Cache updation schemes.	5
I/O subsystems: Interfacing with IO devices, keyboard and display interfaces; Basic concepts Bus Control, Read Write operations, Programmed IO, Concept of handshaking, Polled and Interrupt-driven I/O, DMA data transfer.	7
Pipeline Processing, Instruction and Arithmetic Pipeline, Pipeline hazards and their resolution, Parallel Processing.	7

Suggested Books				
S. No.	**Title**	**Authors**	**Publisher**	**Year**
1.	Microprocessor Programming and Architecture, Applications with the 8085	Ramesh S. Gaonkar	Pearson	Third edition
2.	Computer Organization	V. Carl Hamacher, Safwat G. Zaky and Zvonko G. Vranesic	Tata McGraw-Hill series (2002)	Latest Edition
3.	Computer Organization and Design	David Patterson and John Hennessey	Elsevier (2008)	Latest Edition
4.	Computer System Architecture	M. Morris Mano	Pearson	Third Edition
5.	Computer Architecture and Organization	J.P. Hayes	Tata McGraw-Hill	Third Edition
6.	Computer Organization and Architecture	William Stallings	Pearson	Seventh Edition

Mapping of Course Outcomes with POs and PSOs

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	2	1	1	1	-	1	-	-	-	1	-	1	1	-
CO2	2	2	2	2	2	1	-	-	1	2	-	2	1	-
CO3	2	2	2	2	1	1	-	-	1	2	-	2	1	-
CO4	2	1	1	1	1	1	-	-	1	1	-	1	1	-
CO5	2	2	2	2	1	1	-	-	2	2	-	2	1	-
CO6	2	2	2	2	2	1	-	-	1	2	-	2	1	-

Title	NATURAL LANGUAGE PROCESSING		Credits	3
Code	CS 501	Semester: 5	L T P	3 0 0
Max. Marks	100	Internal: - 50 External: - 50	Course Type	Program Core(PC)
Pre-requisites	Programming for Problem Solving (ESC X01), Data Structures (CS 301)		Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. To understand the linguistic phenomena relevant to each NLP task. 2. To analyze the concepts of words form using morphology analysis. 3. To apply NLP resources for different tasks of linguistic processing. 4. To interpret the knowledge of syntax and semantics related to natural languages. 5. To apply the knowledge of machine learning techniques used in NLP. 6. To design and develop various NLP algorithms.			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
Introduction to NLP: Introduction and Survey of applications, Levels of linguistic processing: morphology, syntax, semantics, Tokenization, Stemming, N-grams Modeling, smoothing techniques	5
Words and Word Forms: Bag of words, skip-gram, Continuous Bag-Of-Words, Embedding representations for words, Vector Semantics	5
Resources for NLP: Introduction to lexicons and knowledge bases, Lexical Knowledge Networks, WorldNet Theory	5
Computational morphology lemmatization, Part-of-Speech Tagging, Finite-State Analysis, noun phrase chunking.	5
SECTION-B	
Syntactic Processing: Basic parsing: Top Down and Bottom Up parsing, Chart parsing, Deterministic parsing, Statistical parsing, Grammars with features, Unification Grammars, The Lexicon	5
Semantic Interpretation: Lexical semantics, Semantics and logical form, Resolving ambiguities: Word Sense Disambiguation, Linking syntax and semantics, Linking syntax and semantics in restricted domains, distributional semantics	5
Context and World Knowledge: Discourse: linguistic context, Ellipsis; Word knowledge, Discourse structure Conversation and co-operation, Implementing "co-operative responses", Information Retrieval and Information Extraction, Cross-Lingual Information Retrieval	5
NLP concepts: named entity recognition, coreference resolution, question answering, text classification, document clustering, text summarization, machine translation, Sentiment Analysis, Basics of Machine Learning	5

Suggested Books				
S. No.	**Title**	**Authors**	**Publisher**	**Edition/ Year**
1	Natural language understanding	Allen, J	Redwood City, CA: 1994. Benjamin/Cummings	2nd Edition
2	Natural Language Processing for Prolog. Programmers	Covington, M.A	Prentice Hall, 1994	Latest Edition
3	Speech and Language Processing	Jurafsky,D. and Martin H.J	Prentice Hall, 2009	Latest Edition
4	Natural Language Processing in Prolog: An Introduction to Computational Linguistics	Gazdar, G. &Mellish, C.	Addison Wesley, 1989	Latest Edition
5	Foundations of Statistical Natural Language Processing	Manning D. C. and Schütze H	MIT Press (1999) 1sted.	Latest Edition

Mapping of Course Outcomes with POs and PSOs

COs	**Pos**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	2	1	2	1	-	1	1	1	1	1	3	1
CO2	3	2	2	1	2	1	-	1	1	1	1	1	3	1
CO3	3	2	2	1	2	1	-	1	1	1	1	1	3	1
CO4	3	2	2	1	2	1	-	1	1	1	1	1	3	1
CO5	3	2	2	1	2	1	-	1	1	1	1	1	3	1
CO6	3	2	2	1	2	1	-	1	1	1	1	1	3	1

Title	NATURAL LANGUAGE PROCESSING (Practical)		Credits	1
Code	CS 551	Semester: 5	L T P	0 0 3
Max. Marks	50	External: Nil Internal: - 50	Course Type	Program Core(PC)
Pre-requisites	Programming for Problem Solving (ESC X01), Data Structures (CS 301)		Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. To implement linguistic phenomena relevant to each NLP task. 2. To implement the concepts of words form using morphology analysis. 3. To practice NLP resources for different tasks of linguistic processing. 4. Apply the knowledge of syntax and semantics related to natural languages. 5. To implement various machine learning techniques used in NLP. 6. To design and implement various NLP algorithms.			
Note for Examiner	Teacher is supposed to do continuous evaluation of the student throughout the semester. The evaluation will be based on the experiments conducted in the lab by the student. The teacher may schedule multiple practical tests and multiple viva voce examinations to evaluate the students continuously. Students are supposed to maintain laboratory files for the experiments conducted.			

SYLLABUS

1. To implement basic text processing operations like: Tokenization, Normalization, Stemming, Lemmatization, Stop words removal, Sentence segmentation etc. on text document.
2. To Implement N□gram Language model.
3. Write a program to extract features (TF, TF-IDF etc.) from text.
4. To Implement word embedding using Word2Vec/Glove/fastText/ Bert.
5. To Implementation text classification using Naïve Bayes and SVM.
6. To Implementation of K-means Clustering algorithm on text.
7. To Implement PoS Tagging on text.
8. To Implement text processing with neural network.
9. To Implement text processing with LSTM.
10. To Develop any one NLP application.

Mapping of Course Outcomes with POs and PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	1	1	2	1	-	1	1	1	1	1	3	1
CO2	3	2	1	1	2	1	-	1	1	1	1	1	3	1
CO3	3	2	1	1	2	1	-	1	1	1	1	1	3	1
CO4	3	2	1	1	2	1	-	1	1	1	1	1	3	1
CO5	3	2	1	1	2	1	-	1	1	1	1	1	3	1
CO6	3	2	1	1	2	1	-	1	1	1	1	1	3	1

Title	COMPUTER GRAPHICS		Credits	3
Code	CS 502	Semester: 5	L T P	3 0 0
Max. Marks	100	Internal: - 50 External: - 50	Course Type	Program Core(PC)
Pre-requisites			Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Understand the core concepts and mathematics foundations of computer graphics. 2. Apply various algorithms for scan conversion and filling of basic objects. 3. Apply geometric transformations on the graphical objects in singular and composite form. 4. Understand three-dimensional graphical concepts and viewing pipeline. 5. Apply projections and visible surface detection algorithms for display of 3-D scene on to a 2-D screen. 6. Analyze the use of various shading techniques to render realistic scenes.			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
Graphics Hardware: Application areas of Computer Graphics, Overview of graphics systems, Video-display devices, Raster scan systems, Random scan systems, Graphics Input and Output devices.	4
Output Primitives: Points and Lines, Line Drawing Algorithms: DDA Algorithm, Bresenham's Line Algorithm, Circle Generating Algorithm: Midpoint circle algorithm, Ellipse Generating Algorithms: midpoint ellipse algorithm, Pixel Addressing and Object Geometry, Boundary Fill Algorithms, Flood Fill Algorithms, Character Generation, Line, Area-Fill and Character Attributes.	9
Two Dimensional Geometric Transformations and Viewing: Basic Transformations: Translation, Rotation and Scaling, Matrix Representations, Composite Transformations, Viewing Pipeline, Window to Viewport Coordinate Transformation, Clipping Operations: Line, Polygon, Curve and Text Clipping.	9
SECTION-B	
Three Dimensional Concepts, Transformations and Viewing: Three-Dimensional Display Methods, Three Dimensional Transformations; Three Dimensional Viewing Pipeline; Viewing Coordinates; Specifying the View Plane, Projections: Parallel Projections, Perspective Projections.	6
Splines and Curves: Curved Lines and Surfaces, Spline Representations, Cubic Splines, Bezier Curves and their properties, B-Spline Curves.	5
Visible Surface Detection Methods: Classification of Visible Surface Detection Methods, Back Face Detection, Depth Buffer, A-Buffer, Scan Line and Depth-Sorting Methods, Wireframe Methods, Concepts of Computer Animation, Design of Animation Sequences.	7
Illumination Models and Shading: Light sources, Basic Illumination models, Shading models: Flat and Smooth Shading.	5

Suggested Books				
S. No.	**Title**	**Authors**	**Publisher**	**Edition/ Year**
1.	Computer Graphics C Version	Donald Hearn, M.P. Baker	PearsonEducation.	Second Edition
Recommended Books				
S. No.	**Title**	**Authors**	**Publisher**	**Edition/ Year**
1	Computer Graphics: principles andpractice,	J. D. Foley, A. van Dam,S.K. Feiner, J.F. Hughes	PearsonEducation	Second Edition
2	Computer Graphics	Z. Xiang, R.A. Plastock	Schaum's Outlines, TataMcGraw-Hill.	Second Edition
3	Introduction to Computer Graphics	N. Krishnamurthy	Tata McGraw-Hill.	Latest Edition
4	Mathematical Elements for Computer Graphics,	David F. Rogers, James Alan Adams	Tata McGraw-Hill.	Latest Edition
5	Computer Graphics: A Programming Approach	S. Harrington	Tata McGraw-Hill.	Latest Edition

Mapping of Course Outcomes with POs and PSOs

COs	**Pos**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	2	3	3	2	2	-	-	-	-	-	-	-	2	2
CO2	3	2	2	2	2	-	-	-	-	-	-	-	2	2
CO3	3	2	2	2	2	-	-	-	-	-	-	-	2	2
CO4	3	2	2	2	2	-	-	-	-	-	-	-	2	2
CO5	3	2	3	2	2	-	-	-	-	-	-	-	2	2
CO6	3	2	3	2	2	-	-	-	-	-	-	-	2	2

Title	COMPUTER GRAPHICS (Practical)		Credits	1
Code	CS 552	Semester: 5	L T P	0 0 3
Max. Marks	50	External: Nil Internal: - 50	Course Type	Program Core(PC)
Pre-requisites			Contact Hours	3

Course Outcomes

On completion of this course, a student will be able to

1. Understand the core concepts and mathematics foundations of computer graphics.
2. Apply various algorithms for scan conversion and filling of basic objects.
3. Apply geometric transformations on the graphical objects in singular and composite form.
4. Understand three-dimensional graphical concepts and viewing pipeline.
5. Apply projections and visible surface detection algorithms for display of 3-D scene on to a 2-D screen.
6. Analyze the use of various shading techniques to render realistic scenes.

Note for Examiner

Teacher is supposed to do continuous evaluation of the student throughout the semester. The evaluation will be based on the experiments conducted in the lab by the student. The teacher may schedule multiple practical tests and multiple viva voce examinations to evaluate the students continuously. Students are supposed to maintain laboratory files for the experiments conducted.

SYLLABUS

Practical should be covered based on the following directions:

1. Introduction to Borland Graphics Interface (BGI) and graphics libraries such as OPENGL,Cairo.
2. Implement DDA, Bresenham and midpoint line drawing algorithms.
3. Implement midpoint circle drawing algorithm.
4. Implement ellipse drawing algorithm.
5. Performing transformations in 2D space.
6. Performing 3D transformations

Mapping of Course Outcomes with POs and PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	1	-	2	-	-	-	-	2	1	-	1	1
CO2	1	2	-	-	1	-	-	-	-	-	1	-	1	2
CO3	1	2	1	-	2	-	-	-	-	1	-	-	1	1
CO4	1	2	1	1	2	-	-	-	-	2	1	-	1	2
CO5	2	2	1	1	3	-	-	-	-	1	1	-	1	1
CO6	1	2	1	-	3	-	-	-	-	2	2	-	1	1

Title	ARTIFICIAL INTELLIGENCE		Credits	4
Code	CS 503	Semester: 5	L T P	3 1 0
Max. Marks	100	Internal: - 50 External: - 50	Course Type	Program Core(PC)
Pre-requisites	Discrete Structures (CS 303), Analysis and Design of Algorithms (CS 401)		Contact Hours	4
Course Outcomes	On completion of this course, a student will be able to 1. Understand fundamental AI concepts and identify a range of symbolic and non- symbolic AI techniques. 2. Demonstrate an understanding of various searching algorithms. 3. Identify different knowledge representation techniques used in AI Applications. 4. Demonstrate an understanding of agent-based AI architectures. 5. Demonstrate an understanding of Planning and logic-based agents. 6. Understand different Expert Systems architectures and their applications in AI			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
Introduction: Artificial Intelligence and its applications, Artificial Intelligence Techniques, criteria of success.	4
Problem solving techniques: Solving Problems by searching: State space search, control strategies, heuristic search, problem characteristics, production system characteristics., Heuristic Search Techniques: Generate and test, Hill climbing, best first search, A* search, AO* search, Constraint satisfaction problem, Game Playing: Min-Max Search, Alpha-Beta Pruning, Iterative Deepening, State of the Art Game playing programs.	9
Knowledge representation: Foundations of knowledge representation and reasoning. Mapping between facts and representations, Approaches to knowledge representation, procedural vs declarative knowledge, Propositional Logic, First Order Logic: Syntax and Semantics, Inference: skolemization, clausal form conversion, unification, resolution, Forward vs. Backward reasoning, representation and reasoning in Prolog	8
SECTION-B	
Non-Monotonic and Statistical Reasoning Non monotonic Logic, Default Logic, Circumscription, Bayes Theorem, Bayesian Network, Dempster Shafer Theory, Fuzzy sets, Fuzzy Logic, Defuzzification, fuzzy logic based control systems	8
Learning and Planning: Intelligent Agents, Nature and structure of Agents, Learning Agents, Introduction to different Forms of Learning, The Planning problem, planning with state space search, partial order planning, planning graphs, planning with propositional logic, Analysis of planning approaches, Hierarchical planning, conditional planning, Continuous and Multi Agent planning	9
Introduction to Expert system: Expert systems, Expert system examples, Expert System Architectures, Rule based Expert systems, Non Monotonic Expert Systems, Decision tree based Expert Systems.	7

Suggested Books				
S. No.	**Title**	**Authors**	**Publisher**	**Edition/ Year**
1.	AI: A Modern Approach	Stuart J. Russel, Peter Norvig	Pearson Education Latest Edition, 2012	Latest Edition
2	Artificial Intelligence	Elaine Rich, Knight	McGraw Hill Third Edition 2010	Latest Edition
3	Artificial Intelligence,	Saroj Kaushik	Cengage Learning,First Edition 2011	Latest Edition
4	Artificial Intelligence,	Partick Henry Winston	Addison Wesley Latest Edition 2012	Latest Edition
5	Artificial Intelligence	George Luger	Pearson Education Latest Edition 2010	Latest Edition
6	Introduction to AI and ExpertSystems	DAN, W. Patterson	PHI Latest Edition 2011	Latest Edition
7	Principles of AI,	A.J. Nillson	Narosa publications Latest Edition, 2010	Latest Edition

Mapping of Course Outcomes with POs and PSOs

COs	**Pos**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	2	2	-	1	2	-	-	-	-	2	1	-	2	1
CO2	2	3	2	2	2	-	-	-	-	2	1	-	3	2
CO3	2	3	-	-	2	-	-	-	-	2	1	-	3	-
CO4	2	2	1	1	3	-	-	-	-	2	1	-	2	1
CO5	1	2	-	2	2	1	-	-	-	1	2	-	2	2
CO6	1	2	-	-	3	-	-	-	-	1	1	-	2	-

Title	ARTIFICIAL INTELLIGENCE (Practical)		Credits	1
Code	CS 553	Semester: 5	L T P	0 0 3
Max. Marks	50	External: Nil Internal: - 50	Course Type	Program Core(PC)
Pre-requisites			Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Implement various State Space Searching Algorithms using different data structures 2. Implement Game Playing algorithms on common board games. 3. Demonstrate the use of recursive and back tracking techniques to solve different problems. 4. Implement logic-based solution using Fuzzy logic. 5. Demonstrate an understanding of Planning and logic-based agents. 6. Develop suitable architecture for use of a sample AI applications			
Note for Examiner	Teacher is supposed to do continuous evaluation of the student throughout the semester. The evaluation will be based on the experiments conducted in the lab by the student. The teacher may schedule multiple practical tests and multiple viva voce examinations to evaluate the students continuously. Students are supposed to maintain laboratory files for the experiments conducted.			

SYLLABUS

1. Program Related to Problem Solving techniques of AI
   - Breadth First Search
   - Depth First Search
   - Heuristic Search
   - Best Search
   - Min-Max Search with alpha-beta pruning
   - Tic-Tac-Toe problem
   - N-Queens and N-Knight problem
   - Unification Algorithm
2. Introduction to AI Languages such as LISP, PROLOG
3. Representing Knowledge using RuleML
4. Using semantic Web
5. Knowledge of using Neural Networks, Fuzzy logic, genetic algorithms
6. Other new AI Techniques

Mapping of Course Outcomes with POs and PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	1	2	3	-	-	-	-	2	2	-	2	1
CO2	2	2	2	-	2	2	-	-	-	2	2	-	3	2
CO3	2	2	1	2	3	-	-	-	-	2	2	-	3	-
CO4	2	2	1	-	2	-	-	-	-	2	2	-	2	1
CO5	2	2	1	2	3	-	-	-	-	2	2	-	2	2
CO6	2	2	1	-	2	-	-	-	-	2	2	-	2	-

Title	THEORY OF COMPUTATION		Credits	4
Code	CS 504	Semester: 5	L T P	3 1 0
Max. Marks	100	Internal: - 50 External: - 50	Course Type	Program Core(PC)
Pre-requisites			Contact Hours	4
Course Outcomes	On completion of this course, a student will be able to 1. Define the concept of formal grammar, formal language, regular expression and automata machine. 2. Design finite automata and push down automata (PDA) machines for given formal languages or computational real-world problem statements. 3. Understand the capability of Turing machine and design Turing Machine for context-sensitive languages or computational real-world problem statements. 4. Design appropriate automata for modeling the solution for various computational engineering problems. 5. Understand the concepts of undecidability, untraceable & intractable problems and P and NP completeness. 6. Students will be able to apply mathematical and formal techniques for solving problems in computer science			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
Finite Automata: Introduction: Basic mathematical notation and techniques, Finite Automata (FA), Deterministic Finite Automata (DFA), Non-deterministic Finite Automata (NFA), Finite Automata with Epsilon transitions.	7
Regular Expression and Languages: Regular Expression, Finite Automata and Regular Expressions, Regular and Non-regular languages, Closure properties of regular languages, Equivalence of Finite Automaton and regular expressions, Minimization of Automata, Pumping lemma for regular sets.	7
Grammars and Languages: Introduction, types of grammar, Context-free grammar, derivation and languages, ambiguity, Simplification of context-free grammars: Elimination of useless symbols, unit productions and Null productions, Normal Forms: Greibach normal form (GNF) and Chomsky normal form (CNF).	7
SECTION-B	
Pushdown Automaton: Pushdown Automaton: definition, moves, instantaneous descriptions, Deterministic Pushdown automaton, Equivalence of Pushdown automaton and Context free languages (CFL), Pumping lemma for CFL.	8
Turing Machines: Definitions of Turing Machines, models, computable languages and functions, Techniques for Turing machine construction, Multi-head and Multi-tape Turing machines, The halting problem.	8
Undecidability: Unsolvable problems and computational functions, Recursive and recursively enumerable	8

languages, Tractable and Intractable problems, P and NP completeness, Polynomial time reductions.

Suggested Books				
S. No.	**Title**	**Authors**	**Publisher**	**Edition/ Year**
1	Introduction to Automata Theory,languages and computations	J.E. Hopcroft, R. Motwani, J. D. Ullman	Pearson Education 2nd Edition,2008	2nd Edition
2	Introduction to languages and theory of computation	J. C. Martin	Tata McGraw Hill Publishing Company2007	Latest Edition
3	Theory of Computer Science-Automata, Languages and Computation	K L P Mishra, N Chandrasekaran	Prentice Hall India 3rd Edtion2004	3rd Edtion

Mapping of Course Outcomes with POs and PSOs

COs	Pos												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	1	2	1	2	3	-	-	-	-	1	2	-	2	2
CO2	1	2	1	2	3	2	2	-	-	1	2	-	2	2
CO3	1	2	1	2	3	2	2	-	-	1	2	-	2	2
CO4	1	2	2	2	3	2	-	-	-	1	2	-	2	2
CO5	1	2	-	2	2	1	-	-	-	1	2	-	2	2
CO6	3	2	1	3	3	2	1	1	1	3	3	3	2	2

Title	ECONOMICS		Credits	3
Code	AS 201	Semester:	L T P	3 0 0
Max. Marks	100	Internal: - 50 External: - 50	Course Type	Humanities and Social Sciences(HS)
Pre-requisites			Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Apply engineering knowledge to maximize profit, satisfaction and welfare. 2. Identify the forces that affect the economy. 3. Apply concepts of economy to software development.			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
Introduction to Economics Nature of Economics, Economic Thoughts, Economic Activities, Relationship of Economics with other Social Sciences and Engineering	5
Theory of Consumer Behaviour Demand: Types, Law of Demand, Determinants of Demand and Change in Demand Elasticity of Demand: Nature, Degrees, Types, Measurement and Factors Affecting Elasticity of Demand and its Application Laws of Consumption: Concept and Applicability of Law of Diminishing Marginal Utility and Law of Equi-Marginal Utility	10
Theory of Production and Cost Cost: Types of Costs, Production: Law of Variable Proportion, Returns to Factor and Returns to Scale, Economies and Diseconomies of Scale	9
SECTION-B	
Theory of Market Nature and Relevance of Perfect Competition, Monopoly and Monopolistic Competition	8
Basic Concepts of Macroeconomics National Income: Concept and Measurement, Determination of Equilibrium of Income Inflation: Concept, Causes and Effect of Inflation, Measures to Control Inflation	8
Economics of Software: -Why should software be valued? Principles of valuation. Cost versus value. Market value of software companies. Examples of estimation of the value of software. Sales expectations and discounting. Alternate business models. Risks when outsourcing and offshoring development.	5

Suggested Books				
S. No.	**Title**	**Authors**	**Publisher**	**Edition/ Year**
1.	Modern Economics	Ahuja H. L	S. Chand & Co. Ltd	Latest Edition
2	Economics For Engineers	Gupta M. L. & Gupta S. P	ESS PEE Publications	Latest Edition
3.	Valuing Intellectual Capital, Multinationals and Taxhavens	Gio Wiederhold	Springer Verlag, August 2013	Latest Edition
4.	Business Economics	Ahuja H. L	S. Chand & Co. Ltd	Latest Edition
5.	Macroeconomic Theory	Jhingan M.L	KonarkPublisherPvt. Ltd.	Latest Edition
6.	Principles of Microeconomics	Stiglitz J. & Walsh Carl E	W.W. Norton & Company	Latest Edition
7.	Principles of Macroeconomics	Stiglitz J. & Walsh Carl E	W.W. Norton & Company	Latest Edition
8.	Principles of Economics	Mankiw N Gregory	Cengage Learning	Latest Edition
9.	Course in Microeconomics Theory	Kreps A	Prentice Hall	Latest Edition
10.	Economics	Samuelson Paul A. & Nordhaus William D	Tata McGraw Hill	Latest Edition
11.	Microeconomics	Gravelle H. & Reiss R	Pearson Education	Latest Edition
12.	Macro Economics: Theory andPractice	Ahuja H. L.,	S. Chand & Co. Ltd.	Latest Edition

Mapping of Course Outcomes with POs and PSOs

COs	**Pos**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	-	-	-	-	-	-	2	2	-	-	2	-	2	-
CO2	-	-	-	-	-	-	2	2	-	-	2	-	2	-
CO3	-	-	-	-	-	-	2	2	-	-	2	-	2	-

Title	Industrial Training (After 4th Semester) (Practical)		Credits	2
Code	CS 555	Semester: 5	L T P	
Max. Marks		External: Internal: -	Course Type	Internships/ Seminars(IS)
Pre-requisites			Contact Hours	
Course Outcomes	On completion of this course, a student will be able to 1. To Identify appropriate learning platform to enhance their employability skills along with real corporate exposure. 2. To recognize and enhance their knowledge in current technology. 3. To discover and use their leadership ability and responsibility to execute the given task. 4. To identify and develop professional and ethical responsibilities of an engineer. 5. To analyze and increase their self-confidence in finding their own proficiency. 6. To develop a product along with exposure to real-life job situations.			
Note for Examiner	On the basis of defined rubrics and to evaluate through end Semester presentations, working projects, project reports and viva voce			

SYLLABUS

It involves an internship work in a company/research organization where the work is relevant to computer science.
The slot for completing the internship is the summer break after first year .
The minimum duration of the internship should be 4 weeks.
For the internship to be credited, the department requires that the work assigned during the internship has sufficient components related to computer science subjects in it. A rule of thumb is whether your internship work uses the skill set that you developed through the course of your degree courses.
The students need to submit the internship certificate and details to the course coordinator in order to get the internship credited.

Mapping of Course Outcomes with POs and PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	2	2	2	1	-	1	2	1	-	1	2	1
CO2	2	2	2	2	2	1	1	1	2	1	-	1	2	1
CO3	2	2	2	2	2	1	-	1	3	1	2	1	-	-
CO4	1	1	1	1	1	2	2	3	2	1	-	1	-	-
CO5	1	1	1	1	1	2	-	1	2	1	-	1	-	-
CO6	2	2	2	2	2	2	1	1	2	1	2	1	2	2

Title	DATA MINING AND MACHINE LEARNING		Credits	4
Code	CS 601	Semester: 6	L T P	3 1 0
Max. Marks	100	Internal: - 50 External: - 50	Course Type	Program Core(PC)
Pre-requisites	Database Systems (CS 302), Analysis and Design of Algorithms (CS 401), Linear Algebra and Probability Theory (CS 402), Artificial Intelligence (CS 503)		Contact Hours	4
Course Outcomes	On completion of this course, a student will be able to 1. Understand data mining and machine learning processes and tasks involved in them. 2. Apply data preprocessing and transformation techniques on given data. 3. Illustrate the use of Apriori algorithm for mining frequent item sets and association rules on given data. 4. Perform classification and regression using geometric, probabilistic and logical models for making predictions. 5. Perform clustering using hierarchical and density-based methods for identifying patterns in the data. 6. Apply ensemble methods to improve the performance of machine learning systems.			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
Introduction to data mining Data Mining as the Evolution of Information Technology, Data Mining Process - Steps, Kinds of data: Databases data, Data Warehouses data, Transactional data, Spatial data, Multimedia data, Web data, Data Streams; Data mining functionalities, technologies used, Data Mining Applications, Issues in Data Mining	6
Types of attributes and basic statistical descriptions Attribute types: Nominal, Binary, Ordinal, Numeric; Discrete versus Continuous Attributes; Measuresof Central Tendency: Mean, Median, and Mode; Measures of Dispersion of Data: Range, Quartiles, Variance, Standard Deviation, and Interquartile Range; Data Visualization, Measuring Data Similarity and Dissimilarity.	5
Data preprocessing Major Tasks in Data Preprocessing, Dealing with Missing values, Handling noisy data, Data Integration: Entity Identification Problem, Redundancy and Correlation Analysis; Data Reduction: Data Reduction Strategies; Data Transformation: Data Transformation Strategies	6
Mining frequent patterns, associations, and correlations Market Basket Analysis; Frequent Itemsets, Closed Itemsets, Association Rules;Apriori Algorithm: Finding Frequent Itemsets by Confined Candidate Generation; Generating Association Rules from Frequent Itemsets; Pattern Evaluation Measures.	5
SECTION-B	
Machine learning concepts and terminology The ingredients of machine learning: Tasks - the problems that can be solved with machine learning; Learning vs Designing; Models: Geometric Models, Probabilistic Models, Logical Models; Features; Machine Learning Process; Understanding supervised learning, unsupervised learning, Training dataset, Test dataset, Cross-validation, Overfitting,	6

Underfitting, Regularization, Variance, Bias.	
Classification and regression Classification: Basic Concepts, Binary Classification vs Multi-class classification, Assessing classification performance, confusion matrix, performance indicators, Decision Tree Learning, Naive Bayesian Classification, Lazy Learners: k-Nearest-Neighbor Classifiers, Support Vector Machines and Kernel Functions.	8
Custering and its evaluation Cluster Analysis: Partitioning Methods: k-Means; Hierarchical Methods: Agglomerative versus Divisive Hierarchical Clustering; Density-Based Methods: DBSCAN, Evaluation of Clustering: Assessing Clustering Tendency, Determining the number of clusters, Measuring Clustering Quality.	5
Trends in machine learning Ensemble Methods, Boosting and AdaBoost, Reinforcement Learning, Transfer Learning, Multi-task learning, Meta-learning	4

Suggested Books

S. No.	Title	Authors	Publisher	Edition/ Year
1	Data Mining: Concepts and Techniques	Jiawei Han, Jian Pei, Hanghang Tong	The Morgan Kaufmann Series in Data Management Systems,	Third Edition
2	Machine Learning: The Art and Science of Algorithms that Make Sense of Data	Peter Flach	Cambridge University Press,	Latest Edition

Recommended Books

S. No.	Title	Authors	Publisher	Edition/ Year
1	Introduction to Machine Learning	Ethem Alpaydin	The MIT Press, Latest Edition	Latest Edition
2	An Introduction to Statistical LearningWith Applications in R	GarethJames, Daniela Witten,Trevor Hastie, Robert Tibshirani	Springer, Latest Edition	Latest Edition
3	Reinforcement and Systematic Machine Learning for Decision Making	Parag Kulkarni	Wiley-IEEE Press, 2012	Latest Edition
4	Data Mining: Introductory And Advanced Topics	Margaret H Dunham	Pearson Education, Latest Edition	Latest Edition
5	Pattern Recognition and Machine Learning	Christopher M. Bishop	Springer, Latest Edition	

Mapping of Course Outcomes with POs and PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	1	2	-	-	-	-	-	-	-	1	1	3
CO2	2	2	2	2	1	-	-	-	-	-	-	1	2	3
CO3	3	3	3	3	1	-	-	-	-	-	-	1	2	3
CO4	3	3	3	3	1	-	-	-	-	-	-	1	2	3
CO5	3	3	3	3	1	-	-	-	-	-	-	1	2	3
CO6	3	3	3	3	1	-	-	-	-	-	-	1	2	3

Title	DATA MINING AND MACHINE LEARNING (Practical)		Credits	1
Code	CS 651	Semester: 6	L T P	0 0 3
Max. Marks	50	External: Nil Internal: - 50	Course Type	Program Core(PC)
Pre-requisites			Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Apply data preprocessing, transformation and visualization techniques on given data. 2. Use Apriori algorithm for mining frequent item sets and association rules using market basket data. 3. Apply classification techniques for making predictions. 4. Apply regression techniques for making predictions. 5. Apply clustering methods for identifying patterns in the data. 6. Apply ensemble methods to improve the performance of machine learning systems.			
Note for Examiner	Teacher is supposed to do continuous evaluation of the student throughout the semester. The evaluation will be based on the experiments conducted in the lab by the student. The teacher may schedule multiple practical tests and multiple viva voce examinations to evaluate the students continuously. Students are supposed to maintain laboratory files for the experiments conducted.			

SYLLABUS

Practical based on data mining and machine learning syllabus.

1. Read and represent data from different sources in different formats.
2. Preprocess data to clean, transform and integrate in different formats.
3. Plot data for visualization and better understanding.
4. Implement frequent pattern analysis on market basket data.
5. Apply feature selection techniques on available datasets.
6. Apply classification algorithms on available datasets for making predictions.
7. Apply regression algorithms on available datasets for making predictions.
8. Apply clustering algorithms on available datasets for identifying patterns.
9. Apply techniques to identify anomalies or outliers in a dataset.
10. Apply ensemble learning methods on available datasets to improve performance.

Mapping of Course Outcomes with POs and PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	1	1	1	1	-	-	1	-	-	-	1	2	3
CO2	2	2	3	2	1	-	-	1	-	-	-	1	2	3
CO3	2	2	3	2	1	-	-	1	-	-	-	1	2	3
CO4	2	2	3	2	1	-	-	1	-	-	-	1	2	3
CO5	2	2	3	2	1	-	-	1	-	-	-	1	2	3
CO6	3	3	3	3	1	-	-	1	-	-	-	1	2	3

Title	CRYPTOGRAPHY AND NETWORK SECURITY		Credits	3
Code	CS 602	Semester: 6	L T P	3 0 0
Max. Marks	100	Internal: - 50 External: - 50	Course Type	Program Core(PC)
Pre-requisites	Data Communication and Networks		Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Identify network security threats, appropriate cryptography scheme(s) and security mechanisms for different computing environments and information systems and determine action to counter them. 2. Familiarize with basic data encryption and decryption algorithms and techniques 3. Understand security concepts to write code for substitution ciphers, transposition ciphers, symmetric and asymmetric cryptographic algorithms, hash functions, digital signature generation. 4. Analyze the working of different key management protocols. 5. Utilize knowledge to determine security and selection of security service as per the need of the respective network for sending and receiving electronic payment, data, inside and outside of network, etc. 6. Apply critical thinking and problem-solving skills to detect current and future attacks on computer systems and networks.			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
Basic Encryption and Decryption: Attackers and Types of threats, challenges for information security, Encryption Techniques, Classical Cryptographic **Algorithms:** Monoalphabetic Substitutions such as the Caesar Cipher, Cryptanalysis of Monoalphabetic ciphers, Polyalphabetic Ciphers such as Vigenere, Vernam Cipher.	6
Stream, Block, Symmetric Key and Asymmetric Key Ciphers: Rotor based system and shift register based systems. Block cipher: principles, modes of operations. The Data encryption Standard (DES), Analyzing and Strengthening of DES,	7
Number theory and Basic Algebra: Modular Arithmetic, Euclidean algorithm, Extended Euclidean Algorithm, Random number generation, Fermat's Little Theorem, Euler totient function and theorem	5
Key Management Protocols: Solving Key Distribution Problem, Diffie-Hellman Algorithm, Key Exchange with Public Key Cryptography.	6
SECTION-B	
Message Authentication and Hash Functions Authentication Requirements, Authentication Functions, Message Authentication codes, Hash Functions, Hash Algorithms (MD-5 and SHA-1)	5
Network Security: Kerberos, IP security: Architecture, Authentication Header, Encapsulating Security Payload, Digital Signature Algorithms and authentication protocols, The Digital	5

Signature Standard (DSA).	
Web Security: Web security consideration, secure socket Layer protocol, Transport Layer Security Secure Electronic Transaction Protocol.	6
Firewalls: Firewall Design principles, Characteristics, Types of Firewall, trusted systems, Virtual Private Networks.	5

Suggested Books

S. No.	Title	Authors	Publisher	Edition/ Year
1	Network Security Essentials, Applications and Standards	William Stallings	Pearson Education	Latest Edition
2	Cryptography & Network Security	Behrouz A. Forouzan	McGraw-Hill	Latest Edition

Recommended Books

S. No.	Title	Authors	Publisher	Edition/ Year
1	Cryptography and Network Security Principles and practice	William Stallings	Pearson Education.	Latest Edition
2	Introduction to Computer Security. Addison-Wesley	Bishop, Matt	Pearson Education, Inc./ ISBN: 0-321-24744-2, 2005	Latest Edition
3	Principles of Information Security	Michael. E. Whitman and Herbert J. Mattord		Latest Edition
4	Cryptography & Network Security, TMH,	Atul Kahate	2nd Edition	2nd Edition

Mapping of Course Outcomes with POs and PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	3	2	3	2	2	-	-	-	-	-	-	2	-
CO2	2	2	2	2	2	1	-	-	-	-	-	-	1	-
CO3	2	3	3	3	2	1	-	-	-	-	-	-	3	-
CO4	2	3	2	3	3	1	-	-	-	-	-	-	2	1
CO5	2	3	3	3	3	2	-	-	-	1	-	1	2	2
CO6	2	3	3	3	3	3	-	1	-	1	-	1	2	3

Title	DIGITAL IMAGE PROCESSING		Credits	4
Code	CS 603	Semester: 6	L T P	3 1 0
Max. Marks	100	Internal: - 50 External: - 50	Course Type	Program Core(PC)
Pre-requisites	Computer Graphics (CS 502)		Contact Hours	4
Course Outcomes	On completion of this course, a student will be able to 1. Understand Basics of Image formation, transformation, restoration compression and image segmentation 2. Develop various image enhancement filters both in spatial and frequency domain, restoration techniques. 3. Apply morphological operations and image restoration principles 4. Perform and apply compression and coding techniques used for image data 5. Understand image segmentation and representation operations. 6. Design various image processing concepts that can be used in computer vision and related areas.			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
Fundamentals: Digital Image representation, Image Sampling & Quantization, Fundamental Steps in image Processing, Image acquisition, Gray scale and Color image representation	6
Image Transformation & Filtering: Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering– Smoothing and Sharpening Spatial Filtering, Frequency Domain: Introduction to Fourier Transform– Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters, Homomorphic filtering, Color image enhancement, Basics of Wavelet Transforms.	12
Image Restoration: Image degradation and restoration process, Noise Models, Noise Filters, degradation function, Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering, Homomorphism Filtering	7
SECTION-B	
Image Compression: Need for data compression, Coding redundancy, Interpixel redundancy, Psychovisual redundancy, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, JPEG standard, MPEG. Boundary representation, Boundary description, Fourier Descriptor, Regional Descriptors – Topological feature, Texture - Patterns and Pattern classes - Recognition based on matching., Huffman Coding, Arithmetic coding, Lossy compression techniques, JPEG Compression.	8
Image Segmentation & Representation: Point, Line and Edge Detection Edge detection, Edge linking via Hough transform – Thresholding - Region based segmentation – Region growing – Region splitting and merging – Morphological processing- erosion and dilation, Boundary linking Segmentation by morphological watersheds – basic concepts, Boundary Descriptors, Regional Descriptors,	12

Watershed segmentation	

Suggested Books

S. No.	Title	Authors	Publisher	Edition/ Year
1	Digital Image Processing	Gonzalez and Woods	Pearson @2018,	4th Edition
2	Computer Vision	Boyle and Thomas	Blackwell Science	2nd edition
3	Digital Image Processing and Pattern Recogination	Pakhira Malay K	PHI	Latest Edition

Mapping of Course Outcomes with POs and PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	1	-	-	-	-	-	-	2	-	1	-	-	-
CO2	1	2	3	2	2	1	1	2	2	-	-	1	2	1
CO3	3	2	2	2	1	-	-	-	1	-	-	1	1	1
CO4	3	2	2	2	1	-	-	-	1	-	-	1	1	1
CO5	2	1	-	-	-	-	-	-	2	-	-	-	-	-
CO6	1	2	3	2	2	1	1	2	2	-	-	1	2	1

Title	DIGITAL IMAGE PROCESSING (Practical)		Credits	1
Code	CS 653	Semester:	L T P	0 0 3
Max. Marks	50	External: Nil Internal: - 50	Course Type	Program Core(PC)
Pre-requisites	Computer Graphics (CS 502)		Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Implement various Image formation, transformation, restoration compression and image segmentation operations. 2. Develop the use of various image enhancement filters both in spatial and frequency domain, restoration techniques. 3. Apply morphological operations and image restoration principles in a language of choice. 4. Develop and apply compression and coding techniques used for image data 5. Implement basic image segmentation and representation operations. 6. Develop some application based on image processing concepts that can be used in computer vision and related areas.			
Note for Examiner	Teacher is supposed to do continuous evaluation of the student throughout the semester. The evaluation will be based on the experiments conducted in the lab by the student. The teacher may schedule multiple practical tests and multiple viva voce examinations to evaluate the students continuously. Students are supposed to maintain laboratory files for the experiments conducted.			

SYLLABUS

Experiment

1. Representation of images in RGB and color models
2. Image Printing Program Based on Halftoning.
3. Reducing the Number of Intensity Levels in an Image.
4. Zooming and Shrinking Images by Pixel Replication.
5. Zooming and Shrinking Images by Bilinear Interpolation
6. Arithmetic Operations.
7. Image Enhancement Using Intensity Transformations.
8. Histogram Equalization
9. Spatial Filtering
10. Enhancement Using the Laplacian
11. Unsharp masking

Mapping of Course Outcomes with POs and PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	1	-	-	-	-	-	-	2	-	1	-	-	-
CO2	1	2	3	2	2	1	1	2	2	-	-	1	2	1
CO3	3	2	2	2	1	-	-	-	1	-	-	1	1	1
CO4	3	2	2	2	1	-	-	-	1	-	-	1	1	1
CO5	2	1	-	-	-	-	-	-	2	-	-	-	-	-
CO6	1	2	3	2	2	1	1	2	2	-	-	1	2	1

Title	COMPILER DESIGN		Credits	4
Code	CS 604	Semester: 6	L T P	3 1 0
Max. Marks	100	Internal: - 50 External: - 50	Course Type	Program Core(PC)
Pre-requisites	Theory of Computation (CS 505)		Contact Hours	4
Course Outcomes	On completion of this course, a student will be able to 1. Understand the functioning of different phases of a compiler. 2. Implement lexical analyzer from specifications of lexical rules 3. Construct top down and bottom-up parsing tables for a given grammar 4. Develop Syntax Directed Translation Schemes for various compiler related tasks 5. Understand algorithms for generating code for target machine 6. Apply simple intermediate code optimizations techniques			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
Introduction: Compilers and Translators; The phases of the compiler – Lexical Analysis, Syntax Analysis, Intermediate Code Generation, Optimization, Code generation, Bookkeeping, Error handling.	5
Lexical Analysis: The role of the lexical analyzer, Tokens, Patterns, Lexemes, Input buffering, Specifications of a token, Recognition of a tokens, design of a lexical analyzer generator.	5
Syntax Analysis: The role of a parser, Context free grammars, writing a grammar, Top-down Parsing: Recursive decent parser, Predictive parser, Bottom up Parsing: Handles, Viable prefixes, Operator precedence parsing, LR parsers: SLR, LALR, CLR. Parser generator (YACC). Error Recovery techniques for different parsers	12
SECTION-B	
Syntax directed translation: Syntax directed definitions, Synthesized and inherited attributes, Construction of syntax trees.	4
Run time environments: Source language issues (Activation trees, Control stack, scope of declaration, binding of names), Storage organization (Subdivision of run-time memory, Activation records), Storage allocation strategies, Symbol tables: storage, data structures used	6
Intermediate code generation: Intermediate languages, Graphical representation, Three-address code, Implementation of three address statements (Quadruples, Triples, Indirect triples)	3
Code optimization and code generation: Introduction, Basic blocks & flow graphs, DAG, principle sources of optimization: loop optimization, eliminating induction variable, eliminating common sub-expression, loop unrolling, loop jamming etc. Peephole optimization, Issues in the design of code generator, a simple code generator, Register allocation & assignment.	10

Suggested Books				
S. No.	**Title**	**Authors**	**Publisher**	**Edition/ Year**
1	Compilers: Principles, techniquesand tools	A. V. Aho, J D. Ullman, M. S. Lam, R. Sethi	Pearson Education, 2014.	2nd edition
2	Compiler Construction: Principle and Practice	K C Louden	CengageLearning	1st edition
3	Compiler Design in C	Holub	PHI	Latest edition

Mapping of Course Outcomes with POs and PSOs

COs	**Pos**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	1	1	1	-	-	-	2	-	1	1	3	1
CO2	3	3	3	2	3	-	-	-	3	1	1	-	3	1
CO3	3	2	2	2	2	-	-	-	3	1	1	-	2	-
CO4	3	3	2	2	2	-	-	-	3	1	1	-	2	1
CO5	3	3	1	2	3	-	-	-	2	1	1	-	2	-
CO6	3	3	3	2	3	-	-	-	3	1	1	2	1	1

Title	SOFTWARE TESTING AND QUALITY ASSURANCE		Credits	3
Code	CS 605A	Semester: 6	L T P	3 0 0
Max. Marks	100	Internal: - 50 External: - 50	Course Type	Program Elective(PE)
Pre-requisites	Software Engineering (CS 404)		Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Understand the concept of Software Testing and Quality Assurance to develop effective software system. 2. Apply quality assurance concepts and standards for the development of software. 3. Develop RMMM plan to mitigate risk and manage the artifacts of software system. 4. Understand test strategies and metrics for conventional and object-oriented software. 5. Apply white-box and black-box testing techniques for conventional and object-oriented software. 6. Develop test plans for specialized software.			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
Introduction: Overview of Software Engineering, Software Process, Characteristics of a Software Process, Process Models, Project Management Process and its Phases, Software Measurements, Metrics, Scheduling, Estimation	7
Software Quality Assurance Concepts and Standards: Quality Concepts, Quality Control, Quality Assurance, SQA Activities, Software Reviews, Formal Technical Reviews, Review Guidelines, Software Reliability, Software Safety, Quality Assurance Standards, ISO 9000, ISO 9001:2000, ISO 9126 Quality Factors, CMM, TQM, Six Sigma, SPICE, Software Quality Assurance Metrics.	8
Risk Management and Change Management: Software Risks, Risk Identification, Risk Projection, Risk Refinement, The RMMM Plan, Software Configuration Management, Baselines, Software Configuration Items, SCM Process: Version Control, Change Control, Configuration Audit, Configuration Management for Web Engineering.	7
SECTION-B	
Software Testing: Testing, Verification and Validation, Test Strategies for Conventional and Object-Oriented Software, Unit Testing, Integration Testing, Validation Testing, Alpha and Beta Testing, System Testing, Recovery Testing, Security Testing, Stress Testing, Performance Testing, Metrics for Source Code, Metrics for Testing, Debugging Process, Debugging Strategies.	7
Testing Techniques: Software Testing Fundamentals, Black Box and White Box Testing, Basis Path Testing, Flow Graph Notation, Independent Program Paths, Graph Matrices, Control Structure Testing, Condition Testing, Data Flow Testing, Loop Testing, Graph Based Testing Methods, Equivalence Partitioning, Boundary Value Analysis, Object Oriented Testing	8

Methods: Applicability of Conventional Test Case Design Methods, Fault-Based Testing, Scenario-Based Testing, Random Testing and Partition Testing for Classes, Interclass Test Case Design.	
Testing Process and Specialized Systems Testing: Test Plan Development, Requirement Phase, Design Phase and Program Phase Testing, Testing Client/Server Systems, Testing Web based Systems, Testing Off-the-Shelf Software, testing in Multiplatform Environment, Testing for Real Time Systems, Testing Security	8

Suggested Books

S. No.	Title	Authors	Publisher	Edition/ Year
1	Software Engineering	Ian Somerville	PearsonEducation.	7th edition
2	Software Engineering: A Practitioner's Approach	Pressman	TataMcGraw- Hill.	6th edition
3	Effective Methods for Software Testing	William E. Perry	JohnWiley	2nd edition

Recommended Books

S. No.	Title	Authors	Publisher	Edition/ Year
1	Software Engineering: Theory andPractice	Pfleeger	PearsonEducation	2nd edition
2	Software Engineering	K..Aggarwal, Yogesh Singh.	New. Age International	2nd edition
3	An Integrated Approach to Software Engineering	Pankaj Jalote	2nd edition, Narosa	
4	Software Quality Assurance – Principles and Practice,	.Nina S Godbole :Narosa.	Narosa	2nd edition

Mapping of Course Outcomes with POs and PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	1	1	1	-	-	-	-	-	-	-	1	2	-
CO2	2	2	2	2	1	1	-	1	-	-	-	1	3	-
CO3	2	2	3	2	2	1	-	1	-	1	1	1	3	-
CO4	1	1	1	1	-	-	-	-	-	-	-	1	2	-
CO5	2	2	2	2	3	1	-	1	-	-	-	1	3	-
CO6	3	3	3	3	3	1	-	1	-	1	1	1	3	-

Title	SOFTWARE TESTING AND QUALITY ASSURANCE (Practical)		Credits	1
Code	CS 655A	Semester: 6	L T P	0 0 3
Max. Marks	50	External: Nil Internal: - 50	Course Type	Program Elective(PE)
Pre-requisites			Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Understand the features expected from a quality assurance and testing tool to develop quality software. 2. Apply black box testing techniques to test programs. 3. Apply white box testing techniques to test programs. 4. Apply object-oriented testing techniques to test programs. 5. Use of quality assurance and software testing tools. 6. Develop a quality assurance or software testing tool.			
Note for Examiner	Teacher is supposed to do continuous evaluation of the student throughout the semester. The evaluation will be based on the experiments conducted in the lab by the student. The teacher may schedule multiple practical tests and multiple viva voce examinations to evaluate the students continuously. Students are supposed to maintain laboratory files for the experiments conducted.			

SYLLABUS

Practical should be covered based on the following directions:

1. Study of different quality assurance and software testing tools.
2. Apply black box testing techniques to test programs.
3. Apply white box testing techniques to test programs.
4. Apply object oriented testing techniques to test programs.
5. Use of a software testing tool.
6. Use of a quality assurance tool.
7. Testing web based systems.
8. Design and implementation of a quality assurance / software testing tool.

Mapping of Course Outcomes with POs and PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	1	1	1	-	-	-	-	-	-	1	1	2	-
CO2	2	2	2	3	1	1	-	1	-	1	-	1	3	-
CO3	2	2	2	3	1	1	-	1	-	1	-	1	3	-
CO4	2	2	2	3	1	1	-	1	-	1	-	1	3	-
CO5	1	1	1	1	3	1	-	1	-	-	1	1	2	-
CO6	3	3	3	3	2	1	-	1	-	2	2	1	3	-

Title	MODELLING AND SIMULATION		Credits	3
Code	CS 605B	Semester: 6	L T P	3 0 0
Max. Marks	100	Internal: - 50 External: - 50	Course Type	Program Elective(PE)
Pre-requisites			Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Define modeling and simulation and Illustrate its application areas. 2. Understand continuous and discrete event simulation techniques and apply them suitably to real time problems where experimentation on actual system is risky. 3. Illustrate the Concept of different queuing systems and evaluate their performance parameters. 4. Analyze different methods to generate random numbers and apply them for implementation of different simulation systems. 5. Interpret the fundamentals of different simulation languages like MATLAB and GPSS and apply them to simulate different systems. 6. Develop the programs for generation of random variates following discrete and continuous distributions to simulate the different systems.			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
Introduction: What is modeling and simulation, application areas, definition and types of system, model and simulation ,introduction to discrete-event and continuous simulation.	5
Simulation Methods: Discrete-event Simulation, Time advance Mechanisms, Components and organization of Discrete-event simulation, Flow chart of next- event time advance approach, Continuous Simulation, Monte Carlo Simulation.	10
Queuing Models: Single server queuing system, introduction to arrival and departure time, flowcharts for arrivalanddeparture routine. Eventgraphs of queuing model. Determining the events and variables, Eventgraphsforinventorymodel.	10
SECTION-B	
Random Numbers: Introduction to Random Numbers, Importance of Random Numbers in Simulation, Mid-Square randomnumbergenerator,Residuemethod,ArithmeticCongruentialgenerator, Testing Numbers for Randomness, Chi-Square Test.	5
Distribution Functions: Stochasticactivities,Discreteprobabilityfunctions,Cumulativedistributionfunction, Continuous probability functions. Generation of random numbers following binomial distribution, Poisson distribution, continuous distribution, normal distribution, Exponential distribution, uniform distribution.	10
Simulation Languages: Basic Introduction to Special Simulation Languages: -GPSS/MATLAB/Network Simulators.	5

Suggested Books				
S. No.	**Title**	**Authors**	**Publisher**	**Edition/ Year**
1	Simulation Modeling And Analysis	AverillM.Law	TataMcgrawHill, 2007.	4th edition
2	System Simulation	Geoffery Gordon	Prentice-Hallof India,2001	2nd edition
3	System Simulation	D.S.Hira	S. Chand Publication,2001	1st edition
4	MATLAB Programming forEngineers	StephenJ.Chapman	ThomsonLearning, 2005	3rd edition
5	Discrete-Event System Simulation	JerryBanks,JohnS. Carson,BarryL.Nelsonand David M.Nicol	Prentice-Hallof India,2009	5th edition
6	Getting Started with MATLAB:A Quick Introduction for Scientists and Engineers	RudraPratap	Oxford UniversityPress,2009	8th edition

Mapping of Course Outcomes with POs and PSOs

COs	**Pos**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	2	2	3	1	–	–	2	1	2	1	2	2
CO2	3	3	2	2	3	1	–	–	2	1	2	1	2	2
CO3	3	3	2	2	3	1	–	–	2	1	2	1	2	2
CO4	3	3	2	2	3	1	–	–	2	1	2	1	2	2
CO5	3	3	2	2	3	1	–	–	2	1	2	1	2	2
CO6	3	3	2	2	3	1	–	–	2	1	2	1	2	2

Title	MODELING AND SIMULATION (Practical)		Credits	1
Code	CS 655B	Semester: 6	L T P	0 0 3
Max. Marks	50	External: Nil Internal: - 50	Course Type	Program Elective(PE)
Pre-requisites			Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Interpret the fundamental MATLAB syntax and semantics 2. Simulate different queuing systems in MATLAB by applying discrete event simulation techniques 3. Develop different random number generation programs and use them for simulation of actual systems 4. Simulate different real systems using MATLAB and GPSS. 5. Analyze the concept of network simulator and use it to simulate different network problems 6. Develop programs for generation of random variates following discrete and Continuous distributions to simulate different systems			
Note for Examiner	Teacher is supposed to do continuous evaluation of the student throughout the semester. The evaluation will be based on the experiments conducted in the lab by the student. The teacher may schedule multiple practical tests and multiple viva voce examinations to evaluate the students continuously. Students are supposed to maintain laboratory files for the experiments conducted.			

SYLLABUS

Practical should be covered based on the following directions:

1. Programming in MATLAB: Introduction, Branching statements, loops, functions, additional datatypes, plots, arrays, inputs/outputs etc.
2. Introduction regarding usage of any Network Simulator.
3. Practical Implementation of Queuing Models using C/C++.

Mapping of Course Outcomes with POs and PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	2	2	3	1	–	–	2	1	2	1	2	2
CO2	3	2	2	2	3	1	–	–	2	1	2	1	2	2
CO3	3	2	2	2	3	1	–	–	2	1	2	1	2	2
CO4	3	2	2	2	3	1	–	–	2	1	2	1	2	2
CO5	3	2	2	2	3	1	–	–	2	1	2	1	2	2
CO6	3	2	2	2	3	1	–	–	2	1	2	1	2	2

Title	MOBILE APPLICATION DEVELOPMENT		Credits	3
Code	CS 605C	Semester: 6	L T P	3 0 0
Max. Marks	100	Internal: - 50 External: - 50	Course Type	Program Elective(PE)
Pre-requisites	Programming Fundamentals (CS 101), Object-Oriented Programming (CS 202)		Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Understand Android Platform, its features and programming environment for developing applications using Java. 2. Describe various concepts of mobile programming and use an emulator for developing mobile applications. 3. Develop App interfaces by making use of UI elements, layouts and employ interaction among activities. 4. Illustrate the use of threads, notifications, files and animation in context to mobile Apps. 5. Connect Mobile Apps with databases such as SQLite or similar for data access. 6. Test, debug Mobile Apps and publish final applications in mobile marketplace.			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
Introduction to Java and Android Basic programming introduction to Java, Java Foundation Classes, Developing applications in Java, Overview of Android platform	9
Getting started with Mobility Mobility landscape, Mobile platforms, Mobile apps development, setting up the mobile app development environment along with an emulator, a case study on Mobile app development	6
Building blocks of mobile apps App user interface designing – mobile UI resources (Layout, UI elements, Drawable, Menu), Activity-states and lifecycle, interaction amongst activities.	6
SECTION-B	
Sprucing up mobile apps App functionality beyond user interface - Threads, Async task, Services – states and life cycle, Notifications, Broadcast receivers, Telephony and SMS APIs Native data handling –on-device file I/O, shared preferences, mobile databases such as SQLite, and Enterprise data access (via Internet/Intranet) Graphics and animation – custom views, canvas, animation APIs, multimedia – audio/video playback and record, location awareness, and native hardware access (sensors such as accelerometer and gyroscope)	16
Testing mobile apps Debugging mobile apps, White box testing, Black box testing, and test automation of mobile apps, JUnit for Android, Robotium, Monkey Talk	5
Deployment of apps Versioning, signing and packaging mobileapps, distributing apps on mobile marketplace	3

Suggested Books				
S. No.	**Title**	**Authors**	**Publisher**	**Edition/ Year**
1	Android Application Development Allin one for Dummies	Barry Burd	1st edition	1st edition
2	Android Application Development	Rick Rogers, John Lombardo, Meike Blake	O'Reilly,2010	1st edition
3	Professional Android 2 Application Development	Reto Meier	Wrox,2010	1st edition
4	Teach Yourself Android Application Development In 24 Hours	Carmen Delessio Lauren Darcey, Shane Conder	SAMS	1st edition

Mapping of Course Outcomes with POs and PSOs

COs	**Pos**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	1	1	1	1	3	-	-	-	-	-	-	-	1	-
CO2	1	2	2	2	3	-	-	-	-	-	-	-	2	1
CO3	2	2	3	2	3	-	-	-	-	-	-	-	3	1
CO4	2	2	3	2	3	-	-	-	-	-	-	-	3	1
CO5	2	2	3	2	3	-	-	-	-	-	-	-	3	1
CO6	2	2	3	2	3	-	-	-	-	-	-	-	3	1

Title	MOBILE APPLICATION DEVELOPMENT (Practical)		Credits	1
Code	CS 655C	Semester: 6	L T P	0 0 3
Max. Marks	50	External: Nil Internal: - 50	Course Type	Program Elective(PE)
Pre-requisites			Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Understand Android Platform and its features for developing mobile applications. 2. Develop application interfaces by making use of UI elements, layouts and employ interaction among activities. 3. Design applications that require the use of threads and notifications. 4. Create applications that require handling files and creating animations. 5. Connect mobile applications with databases such as SQLite or similar for data access. 6. Test and debug mobile applications and publish them in mobile marketplace.			
Note for Examiner	Teacher is supposed to do continuous evaluation of the student throughout the semester. The evaluation will be based on the experiments conducted in the lab by the student. The teacher may schedule multiple practical tests and multiple viva voce examinations to evaluate the students continuously. Students are supposed to maintain laboratory files for the experiments conducted.			

SYLLABUS

Practical should be covered based on the following directions:

1. Introduction to Android and it's components. Creating an android application. Creating the activity, Design user interface with Views, Working with intents, fragments, services and different types of layouts components. Displaying picture and menus using views.
2. Basic Controls and UI Components Text view, Radio button, Checkbox, Image Button, Edit Text, Slider and other controls.
3. Persistence data using the file system (external, internal, SD card), working with shared preferences, Working with content providers, CRUD operation using SQLite database connection.
4. Drawing graphics in android, creating animations with androids graphics API, Playing audio & video.
5. Create an application to design a Visiting Card.
6. Develop an Android application using controls like Button, TextView, EditText for designing a calculator having basic functionality.
7. Develop an application to set an image as wallpaper. On click of a button, the wallpaper image should start to change randomly every 30 seconds.
8. Write a program to create an activity with two buttons START and STOP. On pressing of the START button, the activity must start the counter by displaying the numbers from One and the counter must keep on counting until the STOP button is pressed. Display the counter value in a TextView control.
9. Write a program to enter Medicine Name, Date and Time of the Day as input from the user and store it in the SQLite database. Input for Time of the Day should be either Morning or Afternoon or Evening or Night. Trigger an alarm based on the Date and Time of the Day and display the Medicine Name.
10. Develop an application to demonstrate the use of Asynchronous tasks in android. The asynchronous task should implement the functionality of a simple moving banner. On

pressing the Start Task button, the banner message should scroll from right to left. On pressing the Stop Task button, the banner message should stop. Let the banner message be "Demonstration of Asynchronous Task".

Mapping of Course Outcomes with POs and PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	1	1	1	3	-	-	-	-	-	-	-	1	-
CO2	2	2	3	2	3	-	2	-	2	2	2	2	3	1
CO3	2	2	3	2	3	-	2	-	2	2	2	2	3	1
CO4	2	2	3	2	3	-	2	-	2	2	2	2	3	1
CO5	2	2	3	2	3	-	-	-	-	-	-	-	3	1
CO6	2	2	3	2	3	-	3	-	3	3	3	3	3	1

Title	DATA ACQUISITION AND INTERFACING		Credits	3
Code	CS 605D	Semester: 6	L T P	3 0 0
Max. Marks	100	Internal: - 50 External: - 50	Course Type	Program Elective(PE)
Pre-requisites	Basics of Electrical and electronics, Computer Architecture and Organization (CS 405)		Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Understand the principles of operation and limitations of the data acquisition system (single and Multiple channels). 2. Apply LabVIEW for analyzing and generating reports of various acquired signals. 3. Distinguish different interface mechanisms of devices for communication. 4. Demonstrate the real time data acquisition using DAQ devices. 5. Design data acquisition & control systems. 6. Create projects using the functions available in LabVIEW.			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
Signal conditioning and data acquisition: Analog-to-digital and digital-to-analog converters; sampling rate, multiplexing, resolution, range, and code width; grounding, isolation and noise; single-ended and differential measurements; attenuation, amplification, and filtering; excitation and linearization; impedance mismatch and loading; digital signal conditioning; signal transmission (voltage vs. currentloop); and hardware architecture of a modern multi-function data acquisition card.Various DAS Configurations, Single Channel DAS, Multi-Channel DAS, ICBased DAS, Data Acquisition, Data Acquisition in PLC	9
Fundamentals of programming logic: LabVIEW: Virtual instruments; indicators and controls; front panel and block diagram; data types and data flow programming; case and sequence structures; arrays, loops, and clusters; graphs and charts; subVIs; and fileI/O.	12
SECTION-B	
Instrument control: Components of an instrument control system (GPIB and RS-232); detecting and configuring instruments; and instrument drivers.	6
Instrumentation system design: Design specifications; functional block representation; design, debugging, and testing; interpretation and presentation of data; userinterface; temperature control system design; motorspeed control system design; and instrumentation project incorporating multiple sensors, signal interfacing electronics, data-acquisition hardware, instrument control.	6
Buses – Industry standard architecture (ISA), peripheral component Interconnect (PCI) – Instrumentation Buses: Serial (RS232C, USB) and Parallel (GPIB) Accelerated Graphics port (AGP) – plug-and-playdevices– SCSIconcepts– USB architecture.	4
Project Work: Using Labview: Generation of signal (different function generators)on PC and acquiring the signal from sensor at PC again with different sampling rate and quantization level. Representations of different characteristics of acquired signals and their analysis and reporting.	8

Suggested Books				
S. No.	**Title**	**Authors**	**Publisher**	**Edition/ Year**
1	Instrumentation Devices And Systems	Rangan C. S., Sarma G. R.and Mani V. S. V.	TataMcGraw-Hill	Latest Edition
2	Modern Electronic Instrumentation and Measurement Techniques	Helfrick AlbertD.and CooperW. D.	Prentice Hall India	Latest Edition
3	Digital Instrumentation	A.J. Bouvens	McGraw-Hill	Latest Edition
4	Process Control Instrumentation Technology	Johnson Curtis D.	Prentice Hall	Latest Edition
5	A Course In Electrical And Electronics Measurements And Instrumentation	Shawhney A.K.	Dhanpat Rai &Sons	Latest Edition
6	Data acquisition technique using personal computers	Howard Austurlitz		Latest Edition

Mapping of Course Outcomes with POs and PSOs

COs	**Pos**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	2	2	2	3	2	1	1	-	-	-	1	2	2	3
CO2	1	1	2	2	2	1	-	1	-	1	2	1	1	2
CO3	-	-	1	1	1	1	2	2	1	-	1	2	2	2
CO4	1	2	1	2	2	1	1	-	1	-	1	2	2	2
CO5	1	1	1	2	1	1	1	1	-	1	2	2	1	1
CO6	-	-	-	1	2	1	1	1	-	2	2	2	2	2

Title	DATA ACQUISITION AND INTERFACING (Practical)		Credits	1
Code	CS 655D	Semester: 6	L T P	0 0 3
Max. Marks	50	External: Nil Internal: - 50	Course Type	Program Elective(PE)
Pre-requisites			Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Understand the basics of virtual instrumentation concept and dataflow programming. 2. Apply various functions available in LabVIEW for engineering applications. 3. Design projects using the functions available in LabVIEW. 4. Identify the interfacing of DAQ devices and customized user designed hardware with LabVIEW. 5. Develop control systems using local data acquisition. 6. Demonstrate team□based laboratory activities with fellow students to interact effectively on a social and interpersonal level.			
Note for Examiner	Teacher is supposed to do continuous evaluation of the student throughout the semester. The evaluation will be based on the experiments conducted in the lab by the student. The teacher may schedule multiple practical tests and multiple viva voce examinations to evaluate the students continuously. Students are supposed to maintain laboratory files for the experiments conducted.			

SYLLABUS

Practical should be covered based on the following directions:

1. Embedded Programming.
2. RF Experiments.
3. Experiments in interfacing with UbiSense.
4. Experiments in interfacing with Ubi-DAQ.
5. WSN Applications

Mapping of Course Outcomes with POs and PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	-	1	2	-	-	-	1	1	2	2	2	3
CO2	3	2	-	1	2	-	-	-	1	1	2	2	1	2
CO3	3	3	1	1	2	-	-	-	1	1	2	2	2	1
CO4	2	2	3	1	1	-	1	-	1	1	2	2	1	2
CO5	2	2	1	2	2	1	1	2	2	1	2	2	2	1
CO6	1	1	1	2	2	1	1	2	3	1	3	2	1	3

Title	MULTIMEDIA COMPUTING		Credits	3
Code	CS 605E	Semester: 6	L T P	3 0 0
Max. Marks	100	Internal: - 50 External: - 50	Course Type	Program Elective(PE)
Pre-requisites			Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Understand basic concepts of multimedia systems, their characteristics, challenges, applications and trends. 2. Describe multimedia hardware devices, software development tools, standards and storage media. 3. Examine various audio formats and compression methods for digital audio. 4. Identify various coding techniques and color models used in commonly used image file formats. 5. Evaluate video signals and employ compression and decoding of videos using software. 6. Building communication network and distributed multimedia systems.			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
Introduction: Multimedia and its types, Introduction to Hypermedia, HyperText, Multimedia Systems and their Characteristics, Challenges, Desirable Features, Components and Applications, Trends in Multimedia	4
Multimedia Technology: Multimedia Systems Technology, Multimedia Hardware devices, Multimedia software development tools, Multimedia Authoring Tools, Multimedia Standards for Document Architecture, SGML, ODA, Multimedia Standards for Document interchange, MHEG, Multimedia Software for different media.	6
Storage Media: Magnetic and Optical Media, RAID and its levels, Compact Disc and its standards, DVD and its standards, Multimedia Servers	4
Audio: Basics of Digital Audio, Application of Digital Audio, Digitization of Sound, Sample Rates and Bit Size, Nyquist's Sampling Theorem Typical Audio Formats Delivering Audio over a Network, Introduction to MIDI (Musical Instrument Digital Interface), Components of a MIDI System, Hardware Aspects of MIDI, MIDI Messages. Audio Compression, Simple Audio Compression Methods, Psychoacoustics, MPEG Audio Compression	8
SECTION-B	
Basics of Compression: Classifying Compression Algorithms, Lossless Compression Algorithms, Entropy Encoding, Run-length Encoding, Pattern Substitution, Basics of Information theory, Huffman Coding, Adaptive Huffman Coding, Arithmetic Coding, Lempel-Ziv-Welch (LZW) Algorithm, Source Coding Techniques:Transform Coding, Frequency Domain Methods, Differential Encoding.	6
Image and Graphics Compression:	6

Color in Images, Types of Color Models, Graphic/Image File Formats: TIFF, RIFF, BMP, PNG, PDF, Graphic/Image Data, and JPEG Compression, GIF Compression.	
Video Compression: Basics of Video, Video Signals, Analog Video, Digital Video, TV standards, H. 261 Compression, IntraFrame Coding, Inter-frame (P-frame) Coding, MPEG Compression, MPEG Video, The MPEG Video Bitstream, Decoding MPEG Video in Software.	6
Multimedia Communication: Building Communication network, Application Subsystem, Transport Subsystem, QOS, Resource Management, and Distributed Multimedia Systems.	5

Suggested Books

S. No.	Title	Authors	Publisher	Edition/ Year
1	Multimedia Computing Communications and Applications	Ralf Steinmetz and Klara Nahrstedt	Pearson Educations	Latest Edition
2	Multimedia Systems	Parag Havaldar, Gerard Medioni	Cengage Learning publication	Latest Edition
3	Multimedia System Design	Prabhat K. Andleigh, Kran Thakkar	Latest edition, PHI	Latest Edition
4	Multimedia Communications	Fred Halsall	Pearson Education	Latest Edition

Mapping of Course Outcomes with POs and PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	1	1	1	1	-	-	-	-	-	-	-	1	-
CO2	1	2	2	2	2	-	-	-	-	-	-	-	1	-
CO3	2	2	2	2	2	-	-	-	-	-	-	-	2	-
CO4	2	2	2	2	2	-	-	-	-	-	-	-	2	-
CO5	2	2	2	2	2	-	-	-	-	-	-	-	3	-
CO6	3	2	3	3	2	-	-	-	-	--	-	-	3	-

Title	MULTIMEDIA COMPUTING (Practical)		Credits	1
Code	CS 655E	Semester: 6	L T P	0 0 3
Max. Marks	50	External: Nil Internal: - 50	Course Type	Program Elective(PE)
Pre-requisites			Contact Hours	3

Course Outcomes	1. Identify multimedia hardware devices, software development tools, standards and storage media. 2. Analyse various audio formats and compression methods for digital audio. 3. Implement different text encoding and compression techniques. 4. Apply coding techniques and color models used in commonly used image file formats. 5. Evaluate video signals and employ compression of videos. 6. Compare and analyse multimedia communication protocols and systems.
Note for Examiner	Teacher is supposed to do continuous evaluation of the student throughout the semester. The evaluation will be based on the experiments conducted in the lab by the student. The teacher may schedule multiple practical tests and multiple viva voce examinations to evaluate the students continuously. Students are supposed to maintain laboratory files for the experiments conducted.

SYLLABUS

Practical should be covered based on the following directions:

1. WAP to determine the amount of data compression that is acceptable in different genres of digital audio music recordings.
2. WAP to determine the number of bits required to store the text using the Huffman Code.
3. WAP to determine the number of bits required to store the text using the Lempel-Ziv coding.
4. WAP to determine the types of images that compress "better" and the types of images that compress "worse" using JPEG image compression.
5. WAP to perform uniform quantization on a sound signal. Run the program on a speech file recorded at 8 bits/sample. Compare the distortion in waveform as well as sound quality obtained with different choices of the number of quantization levels.
6. WAP to perform uniform quantization on a sound signal. Run the program on a music file at 16 bits/sample. Compare the distortion in waveform as well as sound quality obtained with different choices of the number of quantization levels.
7. WAP to perform video encoding using H. 261Compression technique.
8. Compare and Analyse the multimedia over IP protocols: RSVP (Resource ReSerVation Protocol), RTP (Real-time Transport Protocol) and RTSP (Real-Time Streaming Protocol)

Mapping of Course Outcomes with POs and PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	1	1	1	2	-	-	-	-	-	-	-	1	-
CO2	1	1	1	1	2	-	-	-	-	-	-	-	1	-
CO3	2	2	2	-	3	-	2	-	2	2	2-	2	2	-
CO4	2	2	2	-	3	-	-2	-	2-	2	2	2	2	-
CO5	2	3	3	3	2	-	-	-	-	-	-	-	3	-
CO6	2	3	3	3	3	-	2-	-	2-	2-	-2	-2	3	-

Title	CLOUD COMPUTING		Credits	3
Code	CS 605F	Semester: 6	L T P	3 0 0
Max. Marks	100	Internal: - 50 External: - 50	Course Type	Program Elective(PE)
Pre-requisites	Data Communication and Networks(CS 501), Web Technologies(CS 402), Database Systems (CS 302)		Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Understand the characteristics, applications and architecture of cloud systems. 2. Analyze virtualization technologies for enabling cloud services. 3. Design cloud storage systems. 4. Correlate social media, mobility, analytics and virtualization technologies to build cloud systems. 5. Identify security risks and their handling mechanisms in cloud environments. 6. Use existing cloud platforms to configure and host cloud services			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
Cloud Computing Basics Cloud Computing Overview; Characteristics; Applications; Internet and Cloud; Benefits; Limitations; Challenges; Cloud Computing Reference Architecture; Architectural Components; Cloud Computing Services and Deployment Models.	7
Abstraction and Virtualization Virtualization, Types of virtualization; Hardware Virtualization - full, partial, paravirtualization; Software Virtualization; Memory Virtualization; Storage Virtualization; Data Virtualization; Network Virtualization; Nested Virtualization; Hypervisor- Type-1, Type-2; Hyperjacking.	7
Cloud Storage Cloud Storage – managed, unmanaged; Storage as a Service; Cloud Storage issues and challenges; Creating cloud storage system; Virtual storage containers; SAN, NAS, SAN vs. NAS	7
SECTION-B	
SMAC-SMAC-Social Media, Mobility, Analytics and Cloud; Big Data, Introduction to Hadoop, MapReduce; MapReduce steps.	7
Cloud Security Cloud security issues and challenges; cloud security controls, dimensions of cloud security, Security and privacy, identity management, physical security, confidentiality, access controllability, integrity, Migration to cloud-issues, approaches	5
Mobile Cloud Computing Overview of Mobile Cloud Computing, Advantages, Challenges, Using Smartphones with the Cloud, Offloading techniques - their pros and cons, Mobile Cloud Security	5
Cloud Computing Platforms Introduction to cloud platforms: Google Cloud Platform – Google Compute Engine, Google App Engine, BigTable, BigQuery, Amazon Web Services, Microsoft Azure, IBM Bluemix, features of important cloud platforms.	7

Suggested Books				
S. No.	**Title**	**Authors**	**Publisher**	**Edition/ Year**
1	Cloud Computing: A PracticalApproach	Anthony T. Velte, Toby J.Velte, and Robert Elsenpeter	McGraw Hill, 2010	Latest Edition
2	Cloud Computing: Principles and Paradigms	RajkumarBuyys, JamesBroberg, Andrzej Goscinski (Editors)	Wiley, 2011	Latest Edition
3	Cloud Computing Bible,	Barrie Sosinsky	Wiley, 2011	Latest Edition
4	Cloud Computing for Dummies	Judith Hurwitz, Robin Bloor,Marcia Kaufman,Fern Halper	Wiley, 2010	Latest Edition
5	Handbook of Cloud Computing	BorkoFurht, Armando Escalante (Editors)	Springer, 2010	Latest Edition

Mapping of Course Outcomes with POs and PSOs

COs	**Pos**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	1	2	-	-	-	-	-	-	-	1	2	-
CO2	3	3	2	3	2	-	-	-	-	-	-	1	2	-
CO3	3	3	3	2	2	-	-	-	-	-	-	1	3	-
CO4	3	2	1	2	-	1	-	-	-	-	-	1	2	-
CO5	3	3	2	3	2	1	-	1	-	-	-	1	2	-
CO6	3	3	3	3	3	-	-	-	-	-	-	1	3	-

Title	CLOUD COMPUTING (Practical)		Credits	1
Code	CS 655F	Semester: 6	L T P	0 0 3
Max. Marks	50	External: Nil Internal: - 50	Course Type	Program Elective(PE)
Pre-requisites			Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Understand the key features of cloud computing services provided by cloud service providers 2. Create, configure and utilize compute and cloud storage services 3. Employ cloud database services for relational and NoSQL databases 4. Use cloud file system and services to create and configure shared file systems 5. Setup virtual private cloud and configure security and access control policies 6. Use cloud services to deploy machine learning models			
Note for Examiner	Teacher is supposed to do continuous evaluation of the student throughout the semester. The evaluation will be based on the experiments conducted in the lab by the student. The teacher may schedule multiple practical tests and multiple viva voce examinations to evaluate the students continuously. Students are supposed to maintain laboratory files for the experiments conducted.			

SYLLABUS

For practicals, Amazon Web Services (AWS) or other similar services providers offering similar services may be used.

1. Understand the key features of AWS and creation of AWS account
2. Create and launch Amazon Elastic Compute Cloud (Amazon EC2) instances
3. Create and configure Amazon Simple Storage Service (Amazon S3)
4. Use and configure Amazon Relational Database Service (Amazon RDS)
5. Employ Amazon DynamoDB
6. Utilize Amazon Elastic File System (EFS) to create and configure shared file systems
7. Use Amazon EBS (Elastic Block Store) service
8. Set up a virtual private cloud using Amazon VPC
9. Configure security and access control policies
10. Deploy machine learning models using Amazon SageMaker

Mapping of Course Outcomes with POs and PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	1	2	1	-	-	-	-	-	-	-	1	2	-
CO2	2	2	3	2	3	-	-	-	-	-	-	1	3	-
CO3	2	2	3	2	3	-	-	-	-	-	-	1	3	2
CO4	2	2	3	2	3	-	-	-	-	-	-	1	3	-
CO5	2	2	3	2	3	1	-	1	-	-	-	1	3	-
CO6	2	2	3	2	3	-	-	-	-	-	-	1	3	2

Title	NEURAL NETWORKS AND DEEP LEARNING		Credits	4
Code	CS 701	Semester: 7	L T P	3 1 0
Max. Marks	100	Internal: - 50 External: - 50	Course Type	Program Core(PC)
Pre-requisites	Introduction to Artificial Intelligence, Data Pre-Processing		Contact Hours	4
Course Outcomes	On completion of this course, a student will be able to 1. Understand and explain functioning of various neural network's architectures along with their learning mechanisms. 2. Analyze and explain feedforward Neural Networks, and Deep neural networks. 3. Evaluate and argue the efficacy of DNNs in relation to the specific problems. 4. Analyze and explain Convolution neural networks (CNNs), and Recurrent neural networks (RNNs). 5. Evaluate and argue the efficacy of CNNs, RNNs in relation to the specific problems. 6. Apply and demonstrate the applications of DNNs, CNNs and RNNs in solving problems related to vision, speech and NLP.			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
Basics of artificial neural networks (ANN): Artificial neurons, Computational models of neurons, Structure of neural networks, Functional units of ANN for pattern recognition tasks.	4
Feed forward neural networks: Pattern classification using perceptron, Multilayer feedforward neural networks (MLFFNNs), Backpropagation learning, Empirical risk minimization, Regularization, Autoencoders	6
Deep neural networks (DNNs): Difficulty of training DNNs, Greedy layer wise training, Optimization for training DNNs, Newer optimization methods for neural networks (AdaGrad, RMSProp, Adam), Second order methods for training, Regularization methods (dropout, drop connect, batch normalization)	12
SECTION-B	
Convolution neural networks (CNNs): Introduction to CNNs – convolution, pooling, Deep CNNs, Different deep CNN architectures – LeNet, AlexNet, VGG, PlacesNet, Training a CNNs: weights initialization, batch normalization, hyperparameter optimization, Understanding and visualizing CNNs.	12
Recurrent neural networks (RNNs): Sequence modeling using RNNs, Back propagation through time, Long Short-Term Memory (LSTM), Bidirectional LSTMs, Bidirectional RNNs, Gated RNN Architecture	8
Applications: Applications in vision, speech and natural language processing	3

Suggested Books				
S. No.	**Title**	**Authors**	**Publisher**	**Edition/ Year**
1.	Deep Learning	Ian Goodfellow, Yoshua Bengio and Aaron Courville	MIT Press, Available online: http://www.deeplearningbook.org , 2016	Latest Edition
2.	Neural Networks and Learning Machines	S. Haykin	Prentice Hall of India, 2010	Latest Edition
3.	Pattern Recognition and Machine Learning	C.M. Bishop	Springer, 2006	Latest Edition
4.	Neural Networks – A Classroom Approach	Satish Kumar	Tata Mcgraw, 2013	Latest Edition

Mapping of Course Outcomes with POs and PSOs

COs	**Pos**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	3	1	2	-	-	-		-	-	1	2	2
CO2	3	2	3	2	2	2	-	-	-	-	-	1	2	2
CO3	3	2	3	2	2	3	-	-	-	-	-	1	2	3
CO4	3	2	3	2	2	2	-	-	-	-	-	1	2	2
CO5	3	2	3	2	2	3	-	-	-	-	-	1	2	3
CO6	3	3	3	3	3	2	-	-	2	-	-	1	3	3

Title	NEURAL NETWORKS AND DEEP LEARNING (Practical)		Credits	1
Code	CS 751	Semester: 7	L T P	0 0 3
Max. Marks	50	External: Nil Internal: - 50	Course Type	Program Core(PC)
Pre-requisites			Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Build simple neural networks in a programming language of choice. 2. Demonstrate the working of feed forward neural networks in a language of choice 3. Demonstrate the working of deep neural networks in a language of choice 4. Implement CNN networks and its various pre-trained models 5. Analyze the performance of DNN, CNN and RNN with respect to suitable applications. 6. Apply and Demonstrate the applications of Recurrent Neural Networks (RNN)			
Note for Examiner	Teacher is supposed to do continuous evaluation of the student throughout the semester. The evaluation will be based on the experiments conducted in the lab by the student. The teacher may schedule multiple practical tests and multiple viva voce examinations to evaluate the students continuously. Students are supposed to maintain laboratory files for the experiments conducted.			

SYLLABUS

Practical based on Neural Networks syllabus.

1. Implement basic neural networks without using any library in a language of choice.
2. Implement various learning mechanisms for neural networks
3. Build single layer and multi-layer perceptron networks for classification for single class and
4. multiclass problems.
5. Implement deep neural networks (DNNs).
6. Implement convolution neural networks (CNNs)
7. Implement recurrent neural networks (RNNs)

Mapping of Course Outcomes with POs and PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	1	2	1	2	-	-	-	-	-	-	1	1	2
CO2	3	2	3	2	2	1	-	-	-	-	-	1	2	3
CO3	3	2	3	2	2	1	-	-	-	-	-	1	2	3
CO4	3	2	3	2	2	1	-	-	-	-	-	1	1	3
CO5	3	2	3	2	2	1	-	-	-	-	-	1	1	3
CO6	2	1	2	1	2	-	-	-	-	-	-	1	2	2

Title	CYBER LAWS AND IPR		Credits	3
Code	CS 702	Semester: 7	L T P	3 0 0
Max. Marks	100	Internal: - 50 External: - 50	Course Type	Humanities and Social Sciences(HS)
Pre-requisites			Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Understand the various cyber laws those govern the cyber space. 2. Understand the legal aspects of e-commerce. 3. Understand the Intellectual Property Rights and the different components of the IT Act. 4. Understanding the Intellectual Property Rights and the different components of the IT Act. 5. Providing general understanding of email and domain system. 6. Providing basic knowledge about the Emerging Cyber Concepts.			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
Basics of Computer & Internet Technology Internet, ISP & domain name; Network Security; Encryption Techniques and Algorithms; Digital Signatures.	8
Introduction to Cyber World Introduction to Cyberspace and Cyber Law; Different Components of cyber Laws; Cyber Law and Netizens.	2
E-Commerce Introduction to E-Commerce; Different E-Commerce Models; E-Commerce Trends and Prospects; E-Commerce and Taxation; Legal Aspects of E-Commerce.	7
SECTION-B	
Intellectual Property Rights IPR Regime in the Digital Society; Copyright and Patents; International Treaties and Conventions; Business Software Patents; Domain Name Disputes and Resolution.	12
IT Act, 2000 Aims and Objectives; Overview of the Act; Jurisdiction; Role of Certifying Authority; Regulators under IT Act; Cyber Crimes-Offences and Contraventions; Grey Areas of IT Act.	12
Project Work Candidates will be required to work on a project. At the end of the course students will make a presentation and submit the project report.	4

Suggested Books				
S. No.	**Title**	**Authors**	**Publisher**	**Edition/ Year**
1	A Guide to Cyber Laws & IT Act 2000 with Rules & Notification	NandanKamath	Galgotia Publications	Latest Edition
2	Cyber Cops, Cyber Criminals& Internet	Keith Merill& Deepti Chopra	(IK Inter.)	Latest Edition
3	Information Technology Laws	Diane RowLand	TATA McGrawHill	Latest Edition
4	Handbook of CyberLaw	Vakul Sharma	(McMillian)	Latest Edition

Mapping of Course Outcomes with POs and PSOs

COs	**Pos**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	1	1	2	-	1	2	1	3	2	1	1	3	2	2
CO2	1	1	1	-	1	-	2	1	2	1	2	2	2	2
CO3	1	1	1	1	1	2	1	3	2	1	1	3	1	3
CO4	1	2	1	1	1	3	1	1	2	1	2	1	2	1
CO5	1	2	2	2	2	2	2	2	1	1	1	2	3	2
CO6	2	2	1	2	1	1	2	1	2	1	2	1	2	3

Title	SOFTWARE PROJECT MANAGEMENT		Credits	3
Code	CS 703A	Semester: 7	L T P	3 0 0
Max. Marks	100	Internal: - 50 External: - 50	Course Type	Program Elective(PE)
Pre-requisites	Software Engineering (CS 404), Software Testing and Quality Assurance (CS 605A)		Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Identify the various types of project management activities such as planning, estimation and scheduling. 2. Understand, analyse, and apply the various techniques and tools of software project management. 3. Analyze various artifacts of software applications and plan them to track the changes approved by CCB. 4. Elicit an appropriate project management strategy via evaluation of business context and project scope. 5. Implement RMMM plan to mitigate risk association for software application development. Evaluate various engineering techniques and principles to improve the quality of system. 6. Practice the role of professional ethics for software development.			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
Project Management Concepts The management spectrum, the people, the product, the process, the project, stakeholders, W^5HH Principle, critical practices, the SPM plan, project planning steps.	4
Process and Project Metrics Metrics in the Process and Project Domains, Software Measurement, Size-Oriented Metrics, Function- Oriented Metrics, Reconciling LOC and FP Metrics, Object-Oriented Metrics, Use Case-Oriented Metrics, WebApp Project Metrics, Metrics for Software Quality, Integrating Metrics within the Software Process, Establishing a Software Metrics Program.	6
Estimation for Software Projects The Project Planning Process, Selection of an appropriate project approach, Software Project Estimation, Decomposition Techniques, Software Sizing, Problem-Based Estimation, An Example of LOC-Based Estimation, An Example of FP-Based Estimation, Process-Based Estimation, Estimation with Use Cases, Reconciling Estimates, Empirical Estimation Models, Estimation for Object-Oriented Projects, Specialized Estimation Techniques, The Make/Buy Decision.	7
Project Scheduling Basic Concepts of Project Scheduling, The Relationship between People and Effort, Effort Distribution, defining a Task Set for the Software Project, Refinement of Major Tasks, Time-Line Charts, Tracking the Schedule, Tracking Progress for an OO Project, Scheduling for WebApp and Mobile Projects, Earned Value Analysis, Project Monitoring and Control.	6
SECTION-B	
Quality Planning Quality Concepts, Quality control, Quality assurance, Formal Technical Reviews, Team Management, The SQA Plan, ISO and CMM standards	7

Risk Management Reactive versus Proactive Risk Strategies, Software Risks, Risk Identification, Assessing Overall Project Risk, Risk Projection, Assessing Risk Impact, Risk Refinement, Risk Mitigation, Monitoring, and Management, The RMMM Plan.	4
Configuration Management Elements of a Configuration Management System, Baselines, Software Configuration Items, Management of Dependencies and Changes, The SCM Repository, The SCM Process, Version Control, Change Control, Configuration Audit, Status Reporting, Configuration Management for Web and MobileApps.	4
Maintenance and Reengineering Software Maintenance, Software Supportability, Reengineering, Business Process Reengineering, Software Reengineering Process Model, Reverse Engineering, Restructuring, Forward Engineering, The Economics of Reengineering.	7

Suggested Books

S. No.	Title	Authors	Publisher	Edition/ Year
1	Software Project Management	Bob Hughes and Mike Cotterell	McGraw Hill	Latest edition
2	Software Engineering	Roger S. Pressman, Bruce R. Maxim	McGrawHill	8th edition
3	Software Project Management in Practice	Pankaj Jalote	Addison Wesley	Latest edition
4	Software Project Management	Walker Royce	Latest edition, Addison Wesley	Latest edition
5	Software Project Management: A Concise Study	S A Kelkar	Latest edition, PHI	Latest edition
6	Software Project Management: A Real-World Guide To Success	Joel Henry	Latest edition, Pearson	Latest edition

Mapping of Course Outcomes with POs and PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	1	1	1	-	-	1	1	1	1	2	2	2
CO2	2	2	2	2	3	-	-	-	2	2	2	2	1	2
CO3	1	2	2	2	2	-	1	1	2	2	2	1	2	2
CO4	-	1	2	2	2	-	-	-	2	2	2	1	1	2
CO5	-	-	3	2	2	1	-	-	2	2	2	2	1	2
CO6	-	-	3	3	2	-	-	3	2	2	2	2	1	1

Title	SOFTWARE PROJECT MANAGEMENT (Practical)		Credits	1
Code	CS 753A	Semester: 7	L T P	0 0 3
Max. Marks	50	External: Nil Internal: - 50	Course Type	Program Elective(PE)
Pre-requisites			Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Develop efficient project plans while considering the various constraints and objectives. 2. Analyze risk management activities to minimize various known and unknown risk with minimum impact that threaten the viability of project. 3. Evaluate various test cases that have the highest capability of mitigating the impact on projects at various levels. 4. Analyze various SCM activities to maintain software. 5. Practice on deploying the key phases of project management. 6. Acquire the knowledge of managing, economics for conventional, modern and future software projects.			
Note for Examiner	Teacher is supposed to do continuous evaluation of the student throughout the semester. The evaluation will be based on the experiments conducted in the lab by the student. The teacher may schedule multiple practical tests and multiple viva voce examinations to evaluate the students continuously. Students are supposed to maintain laboratory files for the experiments conducted.			

SYLLABUS

1. Illustrate the project planning and scheduling activities by drawing GANTT and PERT chart.
2. Analyze the various project attributes such as cost/effort, schedule, productivity, and staff for an organic and embedded type of software project based on COCOMO model.
3. Write the procedure to implement function point analysis.
4. For a given software, specify the techniques to manage various types of risk associations.
5. Discuss the SCM activities for different types of software.

Mapping of Course Outcomes with POs and PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	-	2	1	2	-	1	1	1	1	1	1	2	2
CO2	1	-	2	1	2	-	-	-	1	1	1	1	2	2
CO3	-	1	2	1	2	-	-	-	2	1	1	1	2	2
CO4	-	2	2	1	1	2	-	-	1	2	2	1	1	1
CO5	-	2	2	1	1	2	-	2	1	2	2	1	2	2
CO6	2	1	2	1	2	2	1	2	2	1	1	-	1	1

Title	INTERNET OF THINGS		Credits	3
Code	CS 703B	Semester: 7	L T P	3 0 0
Max. Marks	100	Internal: - 50 External: - 50	Course Type	Program Elective(PE)
Pre-requisites	Data Communication and Networks (CS 501)		Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Understand the concepts, network design and applications of IoT 2. Analyze the design issues of IoT 3. Learn architecture and deployment features of IoT 4. Implement IoT platform for different Use Cases 5. Knowledge of different IoT platforms 6. Evaluate performance measurements of IoT scenarios and understanding of different kinds and types of sensor for deployment			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
Introduction Fundamentals of Wireless Communication Technology – The Electromagnetic Spectrum, Radio propagation Mechanisms, Characteristics of the Wireless Channel, Wireless Sensor Networks (WSNs):concepts and architectures. Applications of Sensor networks. Design Challenges in Sensor Networks. **Internet of Things:** Basic Introduction and communication mechanism, various applications in different fields, Case Study	8
Overview of Wireless Sensor Networks and its Architecture Challenges for Wireless Sensor Networks, Enabling Technologies For Wireless Sensor Networks. Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes , Operating Systems and Execution Environments, Network Architecture - Sensor Network Scenarios, Optimization Goals and Figures of Merit, Gateway Concepts	9
Networking Sensors Physical Layer and Transceiver Design Considerations, MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts - S-MAC, The Mediation Device Protocol, Wakeup Radio Concepts, Address and Name Management, Assignment of MAC Addresses	9
SECTION-B	
WSN Routing, Localization and QOS Issues in WSN routing – OLSR- Localization – Indoor and Sensor Network Localization-absolute and relative localization, triangulation, Topology Control , Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control, QOS in WSN-Energy Efficient Design-Synchronization-Transport Layer issues.	10
Sensor Network Platforms and Tools Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms, Node-level Simulators, State-centric programming.	9
IEEE 1451 Standard and Frequency Sensors: Brief introduction to IEEE 1451 standard and its extension for any sensors and transducers from frequency-time signal domain. Direct Sensor-to-Microcontroller Interface for resistive, capacitance, inductance, resistive bridges	13

sensing elements. Integration of all components of sensor system into a single system-on-chip (SoC) with advanced processing and conversion methods.

Suggested Books

S. No.	Title	Authors	Publisher	Edition/ Year
1	AdHoc Wireless Networks: architectures and Protocols	C. Siva Ram Murthy, and B. S. Manoj	Prentice Hall Professional Technical Reference, 2008	6th edition
2	Protocols and Architectures for Wireless Sensor Networks	Holger Karl and Andreas Willig	Wiley, 2005	Latest edition
3	Ad Hoc & Sensor Networks: Theory and Applications	Carlos De MoraisCordeiro, Dharma Prakash Agrawal	World Scientific Publishing Company, 2006	Latest edition
4	Wireless Sensor Networks: - An Information Processing Approach	Feng Zhao and LeonidesGuibas	Elsevier Publication, 2007	Latest edition
5	Wireless Sensor Networks- Technology, Protocols, and Applications	KazemSohraby, Daniel Minoli, &TaiebZnati	John Wiley, 2007	Latest edition
6	Wireless Sensor Network Designs	Anna Hac	John Wiley, 2003	Latest edition

Mapping of Course Outcomes with POs and PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	3	1	1	1	1	1	1	-	-	-	-	1	-
CO2	1	3	1	1	1	1	1	1	-	-	-	-	1	-
CO3	3	1	3	2	1	1	2	-	-	-	-	-	2	-
CO4	2	1	3	3	2	1	2	-	-	-	-	-	3	-
CO5	1	2	3	1	2	1	3	-	-	-	-	-	1	-
CO6	1	-	2	-	2	1	3	1	-	-	-	-	1	-

Title	INTERNET OF THINGS (Practical)		Credits	1
Code	CS 753B	Semester: 7	L T P	0 0 3
Max. Marks	50	External: Nil Internal: - 50	Course Type	Program Elective(PE)
Pre-requisites			Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to			
Note for Examiner	Teacher is supposed to do continuous evaluation of the student throughout the semester. The evaluation will be based on the experiments conducted in the lab by the student. The teacher may schedule multiple practical tests and multiple viva voce examinations to evaluate the students continuously. Students are supposed to maintain laboratory files for the experiments conducted.			

SYLLABUS

Practical based on INTERNET OF THINGS syllabus.

1. Comparative study of various standards of IoT
2. Understanding IoT Use Case implementation in oneM2M standard
3. Familiarization with the concept of IOT, Arduino / Raspberry Pi and perform necessary software installation.
4. Using simulation tool for IoT Use case scenario
5. Turn your smart-phone into an IoT device using the cloud-hosted service.
6. Develop a system to sense temperature, moisture etc of the room and send the collated information to mobile device

Mapping of Course Outcomes with POs and PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	3	1	1	1	1	1	1	-	-	-	-	1	-
CO2	1	3	1	1	1	1	1	1	-	-	-	-	1	-
CO3	3	1	3	2	1	1	2	-	-	-	-	-	2	-
CO4	2	1	3	3	2	1	2	-	-	-	-	-	3	-
CO5	1	2	3	1	2	1	3	-	-	-	-	-	1	-
CO6	1	-	2	-	2	1	3	1	-	-	-	-	1	-

Title	BUSINESS INTELLIGENCE		Credits	3
Code	CS 703C	Semester: 7	L T P	3 0 0
Max. Marks	100	Internal: - 50 External: - 50	Course Type	Program Elective(PE)
Pre-requisites	Database Systems (CS 302)		Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Understand fundamental Business processes, their requirements, evaluation using key roles and responsibilities. 2. Demonstrate an understanding of BI framework and its implementation using open source tools. 3. Demonstrate an understanding of various concepts related to data warehousing and OLAP. 4. Compare and analyse various BI Tools for usage in a particular domain using performance indicators. 5. Understanding enterprise reporting and Dashboards. 6. Use different data analysis and representation techniques used in different business domains			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
Introduction to Business Intelligence: Introduction to OLTP and OLAP, BI Definitions &Concepts, Business Applications of BI, BI Framework,Role of Data Warehousing in BI, BI Infrastructure Components–BI Process, BI Technology,BI Roles &Responsibilities	8
Basics of Data Integration (Extraction Transformation Loading) Concepts of data integration need and advantages of using data integration, introduction to common data integration approaches, introduction to ETL, Introduction to data quality, data profiling concepts and applications.	8
Introduction to Multi-Dimensional Data Modeling, Introduction to data and dimension modeling, multidimensional data model, ER Modeling vs. multi-dimensional modeling, concepts of dimensions, facts, cubes, attribute, hierarchies, star and snowflake schema, introduction to business metrics and KPIs, creating cubes using SSA	8
SECTION-B	
Basics of Enterprise Reporting Introduction to enterprise reporting, concepts of dashboards, balanced scorecards, and overall architecture	6
Data Analysis: Dimensionality Analysis, SVD, Low Rank Matrix Factorization, Principle Component Analysis, Gaussian Mixture Models, EM Algorithm, Density Based Analysis, Error Analysis of Classification Algorithms, Ensemble Models using Bagging, Boosting, Stacking. Random Forest, Adaptive Boosting, Gradient Boosting	15

Suggested Books				
S. No.	**Title**	**Authors**	**Publisher**	**Edition/ Year**
1	Fundamentals of Business Analytics	RN Prasad, Seema Acharya	WileyIndia,2011	1st edition
2	Data Mining: Concepts and Techniques	Hanand M.Kamber	Morgan Kaufman publishers, HarcourtIndiapvt.Ltd,2010	Latest edition
3	Business Intelligence: The Savvy Manager's Guide.	David Loshin	KnowledgeEnterprise,2011	Latest edition
4	Business Intelligence roadmap	Larissa Terpeluk Moss,Shaku Atre	AddisonWesley,2012	Latest edition
5	Successful Business Intelligence: Secrets to making Killer BI Applications	Cindi Howson	TataMcGrawHill,2012	Latest edition
6	Business intelligence for the enterprise	Mike Biere	AddisonWesley,2010	Latest edition

Mapping of Course Outcomes with POs and PSOs

COs	**Pos**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	2	1	2	3	1	1	2	1	1	1	2	3	2	2
CO2	1	2	2	1	1	2	1	2	1	1	2	2	2	2
CO3	2	1	1	2	2	1	1	2	1	2	2	2	1	1
CO4	1	1	2	2	3	1	1	1	2	1	3	3	2	1
CO5	3	2	1	2	2	1	1	1	1	1	2	2	1	2
CO6	2	1	3	1	1	1	2	2	1	2	2	1	2	2

Title	BUSINESS INTELLIGENCE (Practical)		Credits	1
Code	CS 753C	Semester: 7	L T P	0 0 3
Max. Marks	50	External: Nil Internal: - 50	Course Type	Program Elective(PE)
Pre-requisites			Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Understand installation and configuration of Business intelligence tools. 2. Demonstrate an understanding of BI framework and its implementation using open source tools. 3. Design of Business Use Case using various concepts related to data warehousing and OLAP. 4. Enable to do Techno-commercial analysis of usage of Business intelligence tools in a domain. 5. Evaluation of BI usage for performance tuning 6. Implementation of BI Framework for a particular Domain and implementation of reporting and dashboards.			
Note for Examiner	Teacher is supposed to do continuous evaluation of the student throughout the semester. The evaluation will be based on the experiments conducted in the lab by the student. The teacher may schedule multiple practical tests and multiple viva voce examinations to evaluate the students continuously. Students are supposed to maintain laboratory files for the experiments conducted.			

SYLLABUS

Practical should be covered on following aspects

1. To represent two dimensional data into three or more dimensions.
2. To integrate to schema using a key attribute
3. To integrate multiple schema without any key attributes.
4. To implement various OLAP operations on numeric datasets.
5. To transform data into one format to another without losing any information.
6. To pre-process the data and clean the data by removing or replacing key values.
7. To generate SQL based Reports using aggregate operations.
8. To develop a web based dashboard by displaying Key performance indicators.
9. To implement Association rule analysis algorithm on market basket data and analyse it for different support and confidence values.
10. To implement KNN algorithm on a numeric data
11. To implement K-means and EM algorithm on multi variate Gaussian data
12. To perform dimensionality analysis on large data

Mapping of Course Outcomes with POs and PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	1	2	3	1	1	2	1	1	1	2	3	2	2
CO2	1	2	2	1	1	2	1	2	1	1	2	2	2	2
CO3	2	1	1	2	2	1	1	2	1	2	2	2	1	1
CO4	1	1	2	2	3	1	1	1	2	1	3	3	2	1
CO5	3	2	1	2	2	1	1	1	1	1	2	2	1	2
CO6	2	1	3	1	1	1	2	2	1	2	2	1	2	2

Title	WIRELESS SENSOR NETWORKS		Credits	3
Code	CS 703D	Semester: 7	L T P	3 0 0
Max. Marks	100	Internal: - 50 External: - 50	Course Type	Program Elective(PE)
Pre-requisites			Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Understand the concepts, network architectures and applications of Adhoc and Wireless Sensor Networks 2. Analyze the protocol design issues of Sensor networks 3. Implement routing protocols for Wireless Sensor Networks with respect to some protocol design issues 4. Evaluate the QoS related performance measurements of Sensor networks 5. Understanding of different kinds and types of sensors for deployment 6. Create real-time applications using sensors on hardware kits			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
Introduction-Fundamentals of Wireless Communication Technology – The Electromagnetic Spectrum, Radio propagation Mechanisms, Characteristics of the Wireless Channel, Mobile Adhoc Networks (MANETs) and Wireless Sensor Networks (WSNs): concepts and architectures. Applications of AdHoc and Sensor networks. Design Challenges in Adhoc and Sensor Networks.	8
Overview of Wireless Sensor Networks and its Architecture-Challenges for Wireless Sensor Networks, Enabling Technologies for Wireless Sensor Networks. Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes, Operating Systems and Execution Environments, Network Architecture -Sensor Network Scenarios, Optimization Goals and Figures of Merit, Gateway Concepts	9
Networking Sensors-Physical Layer and Transceiver Design Considerations, MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols and Wakeup Concepts - S-MAC, The Mediation Device Protocol, Wakeup Radio Concepts, Address and Name Management, Assignment of MAC Addresses	9
SECTION-B	
WSN Routing, Localization and QOS-Issues in WSN routing – OLSR- Localization – Indoor and Sensor Network Localization-absolute and relative localization, triangulation, Topology Control, Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control, QOS in WSN-Energy Efficient Design- Synchronization-Transport Layer issues.	10
Sensor Network Platforms and Tools-Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms, Node-level Simulators, State-centric programming.	9

Suggested Books				
S. No.	**Title**	**Authors**	**Publisher**	**Edition/ Year**
1	AdHoc Wireless Networks: architectures and Protocols	C. Siva Ram Murthy, and B. S. Manoj	PrenticeHall Professional Technical Reference, 2008	6th edition
2	Protocols and Architectures for Wireless Sensor Networks	Holger Karl and AndreasWillig	Wiley, 2005	Latest edition
1	AdHoc & Sensor Networks: Theory andApplications	CarlosDe Morais Cordeiro,Dharma Prakash Agrawal	World Scientific Publishing Company, 2006	Latest edition
2	Wireless Sensor Networks: - An Information Processing Approach	Feng Zhao and LeonidesGuibas	Elsevier Publication, 2007	Latest edition
3	Wireless Sensor Networks-Technology, Protocols, and Applications	KazemSohraby, DanielMinoli, &TaiebZnati	John Wiley, 2007	Latest edition
4	Wireless Sensor Network Designs	Anna Hac	John Wiley, 2003	Latest edition

Mapping of Course Outcomes with POs and PSOs

COs	**Pos**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	1	2	3	2	2	-	-	-	1	1	-	3	1	1
CO2	1	2	3	2	2	-	-	-	1	1	-	3	1	1
CO3	1	2	3	2	2	-	-	-	1	1	-	3	1	1
CO4	1	2	3	2	2	-	-	-	1	1	-	3	1	1
CO5	2	2	3	2	3	3	1	2	2	2	-	3	1	3
CO6	2	2	3	2	3	3	1	2	2	2	1	3	1	3

Title	WIRELESS SENSOR NETWORKS (Practical)		Credits	1
Code	CS 753D	Semester: 7	L T P	0 0 3
Max. Marks	50	External: Nil Internal: - 50	Course Type	Program Elective(PE)
Pre-requisites			Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Understand the use of sensor related technology 2. Differentiate and examine different Simulation environments for Wireless Sensor Networks. 3. Analyse and Implement the MAC layer, TCP and UDP protocols for Wireless Sensor Networks. 4. Evaluate and implement protocols for energy efficiency for Wireless Sensor Networks. 5. Create real-time applications using sensor technology			
Note for Examiner	Teacher is supposed to do continuous evaluation of the student throughout the semester. The evaluation will be based on the experiments conducted in the lab by the student. The teacher may schedule multiple practical tests and multiple viva voce examinations to evaluate the students continuously. Students are supposed to maintain laboratory files for the experiments conducted.			

SYLLABUS

Practical based on Wireless Sensor Networks syllabus

1. Study different standards of Wireless Sensor Networks
2. Install and configure tool to simulate wireless sensor network
3. Create two scenarios for simulation of building automation and manufacturing control
4. Simulate a scenario to control building automation using the tool
5. Simulate a scenario to control manufacturing plant using the tool
6. Create a hardware configuration for controlling the electrical appliances using sensors through mobile phone application.

Mapping of Course Outcomes with POs and PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	2	3	2	2	-	-	-	1	1	-	3	1	1
CO2	1	2	3	2	2	-	-	-	1	1	-	3	1	1
CO3	1	2	3	2	2	-	-	-	1	1	-	3	1	1
CO4	1	2	3	2	2	-	-	-	1	1	-	3	1	1
CO5	2	2	3	2	3	3	1	2	2	2	-	3	1	3
CO6														

Title	SENSOR SYSTEMS AND APPLICATIONS		Credits	3
Code	CS 703E	Semester: 7	L T P	3 0 0
Max. Marks	100	Internal: - 50 External: - 50	Course Type	Program Elective(PE)
Pre-requisites			Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Understand sensor classification and architecture. 2. Illustrate the various types of mobile phone sensors. 3. Identify and explain various application sensors. 4. Demonstrate Application sensors demo with examples. 5. Evaluate data acquisition methods for sensor systems. 6. Capture data from multiple sensors and analyze it.			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
Basics Sensors: Examples and Definitions, Introduction to Sensor Electronics and terminology (Fraden Ch. 2) Sensors classifications from output point of view and quasi-digital sensors classification; Sensors architectures for integrated and smart sensors; Informative parameters (unified and frequency-time domain parameters of signal); Advantages of frequency as informative parameter including high noise immunity, high power of signal, wide dynamic range, high reference accuracy, simple interfacing, simple Integration and coding.	12
Mobile Phone Sensors Capacitive sensors: Fundamentals, Applications and Examples (Fraden Ch. 3.2, 6.3, 7.3, 10.6), Accelerometers (Fraden Ch. 8) Piezoelectric Sensors (Fraden Ch. 3.6, 5.2.4, 8.4) Pressure sensors: Principles and Examples (Fraden Ch. 10) Inductive and Magnetic Sensors (Fraden Ch. 3.3, 3.4, 7.4)	9
SECTION-B	
Application Sensors Strain Gauges: Basics and Examples (FradenCh 3.5, 5.1, 5.2, 5.7, 9), Thermometers: Measurement Techniques and Examples, Flow Sensors (Fraden Ch. 16),Radiation Sensors: Overview of Types, Examples of Applications (Fraden Ch. 14)IR Sensors and Demo: IR Motion Active sounding: Methods for measurement, Examples Chemical Sensors, Biosensors, RF sensors	12
Data Acquisition Methods for Sensor Systems: Data acquisition (DAQ) systems, data-loggers, DAQ boards. Frequency-to-digital converter (FDC) - to - microcontroller interface. Different DAQ architectures and main errors of DAQ.	12

Suggested Books

S. No.	Title	Authors	Publisher	Edition/ Year
1	Handbook of Modern Sensors: Physics, Designs, andApplications.	Fraden, J.	Springer,India, 2010	4th edition
2	Understanding the Smart Sensors	Frank. R,	ArtechHouse, 2010	2nd edition

3	Smart Sensor Systems by 2008	Meijer.M. C.G	John Willey & Sons Ltd,2008	Latest edition

Mapping of Course Outcomes with POs and PSOs

COs	Pos												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	2	1	1	1	1	1	1	-		1	-	1	1	-
CO2	2	2	2	2	2	1	1	-		2	-	2	1	-
CO3	2	2	2	2	2	1	1	-		2	-	2	1	-
CO4	2	2	2	2	2	1	1	-	3	3	-	3	2	-
CO5	2	1	1	1	1	-	-	-		1	-	1	1	1
CO6	2	2	2	2	2	1	1	-		2	-	2	2	1

Title	SENSOR SYSTEMS AND APPLICATIONS (Practical)		Credits	1
Code	CS 753E	Semester: 7	L T P	0 0 3
Max. Marks	50	External: Nil Internal: - 50	Course Type	Program Elective(PE)
Pre-requisites			Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Understand tools for designing various sensor systems. 2. Design a simple application based on single sensor. 3. Simulate mobile phone sensor based sample applications. 4. Build application sensor based application. 5. Evaluate and demonstrate data acquisition systems. 6. Design and test different DAQ architectures for mai errors of DAQ.			
Note for Examiner	Teacher is supposed to do continuous evaluation of the student throughout the semester. The evaluation will be based on the experiments conducted in the lab by the student. The teacher may schedule multiple practical tests and multiple viva voce examinations to evaluate the students continuously. Students are supposed to maintain laboratory files for the experiments conducted.			

SYLLABUS

1. Select a Physical Sensor, Identify the INPUT signal for the sensor, Briefly describe how the sensor works, Identify the OUTPUT signal for the sensor, Identify AT LEAST ONE application for that sensor and explain how it is used.
2. Design a simple application based on any sensor.
3. Determine which sensors are available on a device. Determine an individual sensor's capabilities, such as its maximum range, manufacturer, power requirements, and resolution. Acquire raw sensor data and define the minimum rate at which you acquire sensor data.
4. Build Blood pressure monitoring (self) application based on signals generated by sensors in medical equipment.
5. Build a LabVIEW Thermocouple sensor Data Acquisition Program (Voltage measurement) that acquires voltage generated by the thermocouple sensor and displays it.
6. Create a VI for acquiring and continuously displaying a thermocouple sensor signal using labVIEW and PC plug-in Data Acquisition (DAQ) board.
7. Build a VI to measure temperature and display it on the waveform chart. This VI will measure the temperature using the Thermometer VI you will built.
8. Modify the Temperature Monitor VI you created to detect when a temperature is out of range. If the temperature exceeds the set limit, a front panel LED will turn on and a beep will sound.

Mapping of Course Outcomes with POs and PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	2	2	3	1	-	-	3	3	-	3	1	1
CO2	2	2	3	3	3	1	1	2	3	3	-	3	2	1
CO3	2	2	3	3	3	1	1	-	3	3	-	3	2	1
CO4	2	2	3	3	3	1	1	2	3	3	-	3	2	1
CO5	2	2	3	3	3	1	-	1	3	3	-	3	2	2
CO6	2	2	3	3	3	1	-	2	3	3	-	3	2	2

Title	SOFT COMPUTING		Credits	3
Code	CS 703F	Semester: 7	L T P	3 0 0
Max. Marks	100	Internal: - 50 External: - 50	Course Type	Program Elective(PE)
Pre-requisites	Artificial Intelligence (CS 503)		Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Understand the concept of soft computing and hard computing. 2. Illustrate use of fuzzy logic in solving a real-life computational problem. 3. Illustrate the use of genetic algorithms in solving a real life computational problem. 4. Illustrate use of supervised learning paradigm based neural networks in solving a real life computational problem. 5. Illustrate use of unsupervised learning paradigm based neural networks in solving a real life computational problem. 6. Develop solution for problem in hand by selecting suitable soft computing tool.			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
Introduction to Soft Computing-Concept of computing systems, "Soft" computing versus "Hard" computing, Characteristics of Soft computing, Some applications of Soft computing techniques, soft computing and artificial intelligence.	3
Probabilistic Reasoning and Fuzzy logic-Knowledge representation under uncertainty, Bayesian theorem, Bayesian Networks, Introduction to Fuzzy logic, Fuzzy sets and membership functions, Operations on Fuzzy sets, Fuzzy relations, rules, propositions, implications and inferences, Defuzzification techniques, Fuzzy logic controller design, Some applications of Fuzzy logic.	9
Genetic Algorithms-Concept of "Genetics" and "Evolution" and its application to probabilistic search techniques, Basic GA framework and different GA architectures, GA operators: Encoding, Crossover, Selection, Mutation, etc., Solving single-objective optimization problems using GAs, Concept of multi-objective optimization problems (MOOPs) and issues of solving them**.**	9
SECTION-B	
Introduction to Artificial Neural Networks (ANNs)-Biological neurons and ANNs, threshold value, activation functions, learning rules, bias, network topologies, synchronous and asynchronous activation, learning curve and error measurement.	6
Supervised learning network paradigms-Perceptron, back-propagation, Radial basis functions networks, Hopfield networks, learning vector quantization networks.	10
Unsupervised learning network paradigms-Self-organizing feature maps: structure, learning and applications, Adaptive resonance theory networks: structure, learning and applications.	7

Suggested Books				
S. No.	**Title**	**Authors**	**Publisher**	**Edition/ Year**
1	AI: A Modern Approach	Stuart J.Russel, Norvig	Pearson Publication	Latest edition
2	Artificial Intelligence: A Guide to Intelligent Systems	Michael Negnevitsky	Addison Wesley, 2005	2nd edition
3	Neural Networks - Algorithms, Applications & Programming Techniques	James Freeman A. and David Skapura M	Addison Wesley, 1992	Latest edition
4	Artificial Neural Networks	Yegnanarayana B	Prentice Hall of India Private Ltd, 1999	Latest edition
5	Genetic algorithms in search, optimization and machine learning	Goldberg, David E	Addison Wesley	Latest edition

Mapping of Course Outcomes with POs and PSOs

COs	**Pos**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	2	1	-	1	3	-	-	1	-	-	1	1	1	2
CO2	1	1	2	1	-	-	1	-	-	-	-	1	1	1
CO3	1	1	2	1	1	-	1	-	-	-	-	1	2	2
CO4	1	1	2	1	1	-	-	1	-	-	-	1	1	1
CO5	1	1	2	1	1	-	-	1	-	-	-	1	2	2
CO6	2	2	1	2	3	1	-	1	-	-	1	1	1	2

Title	SOFT COMPUTING (Practical)		Credits	1
Code	CS 753F	Semester: 7	L T P	0 0 3
Max. Marks	50	External: Nil Internal: - 50	Course Type	Program Elective(PE)
Pre-requisites			Contact Hours	3

Course Outcomes

On completion of this course, a student will be able to

1. Understand the basic soft computing techniques available and to apply these concepts as applicable to different problems in real life.
2. Describe, argue for and critique Soft Computing discipline. Students will be able to use at least two of the Soft Computing techniques.
3. Illustrate the use of genetic algorithms in solving a real life computational problem.
4. Illustrate use of supervised learning paradigm based neural networks in solving a real life computational problem.
5. Illustrate use of unsupervised learning paradigm based neural networks in solving a real life computational problem.
6. Analyze and select suitable soft computing tool for solving the the problem in hand.

Note for Examiner

Teacher is supposed to do continuous evaluation of the student throughout the semester. The evaluation will be based on the experiments conducted in the lab by the student. The teacher may schedule multiple practical tests and multiple viva voce examinations to evaluate the students continuously. Students are supposed to maintain laboratory files for the experiments conducted.

SYLLABUS

Practical should be covered based on the following directions:

1. Write programs for implementation of solutions using Fuzzy Inference Systems.
2. Write programs for implementation of problem solution using Genetic Algorithms.
3. Write programs for implementation of solution using supervised learning paradigm based neural networks
4. Write programs for implementation of solution using unsupervised learning paradigm based neural networks.

Mapping of Course Outcomes with POs and PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	3	2	1	2	3	2	1	3	2	1	2	3
CO2	2	3	2	3	2	1	1	1	2	3	1	3	2	1
CO3	1	2	2	2	2	2	1	2	2	2	2	2	3	2
CO4	1	2	1	1	2	1	2	1	2	1	2	1	2	2
CO5	2	2	1	2	2	1	2	1	2	1	1	1	2	2
CO6	1	2	2	1	2	3	2	1	2	1	2	2	1	2

Title	AGILE SOFTWARE DEVELOPMENT		Credits	3
Code	CS 704A	Semester: 7	L T P	3 0 0
Max. Marks	100	Internal: - 50 External: - 50	Course Type	Program Elective(PE)
Pre-requisites	Software Engineering (CS 404), Software Testing and Quality Assurance (CS 605A)		Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Understand the principles and practices of agile software development. 2. Describe different agile approaches for software development. 3. Apply agile design principles. 4. Employ agile testing techniques. 5. Differentiate and apply agile project management tasks like scheduling, estimation, monitoring and quality assurance activities. 6. Create appropriate adaptations to existing processes after analysis of typical problems.			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
Basics of Agile Software Development-The Genesis of Agile, Introduction and background, Agile Manifesto and Principles, Differences between Agile and traditional plans, Stakeholders, Challenges	6
Agile Approaches-Extreme Programming, Agile Process Models: Scrum, Project Phases, Dynamic Systems Development Method, Agile Modeling, Agile Unified Process. A Tool Set for the Agile Process, Feature Driven development, Lean Software Development, Agile Project management, Test Driven Development, Continuous Integration, Refactoring, Pair Programming.	8
Agile Design practices, The Single-Responsibility Principle, The Open-Closed Principle, The Liskov-Substitution Principle, The Dependency-Inversion Principle, The Interface-Segregation Principle	9
SECTION-B	
Agile Testing-Planning and Managing Testing Cycle, Agile Lifecycle and its impact on testing, Principles of Agile Testing, Agile Testing Techniques, xUnit Framework, Test-Driven Development, User Acceptance Tests, Test Automation	8
Agile Project Management-Scheduling in an agile project, scheduling challenges, estimating costs, monitoring project progress, burning down the product backlog, reporting, controlling the project	7
Incorporating ISO 9001 into the Agile Transition-Quality Assurance in Agile World, Managing Scrum Teams, Agile Metrics, Incorporating ISO 9001 into the Agile Transition, Creating Policy and Process Documentation, Development processes, Focusing on customers, Resource management, Formal reviews.	7

Suggested Books				
S. No.	**Title**	**Authors**	**Publisher**	**Edition/ Year**
1	Agile Software Development, Principles, Patterns, and Practices	Robert C. Martin	Pearson	Latest edition
2	Enterprise-Scale Agile Software Development	James Schiel	Latest edition, CRCPress	Latest edition
3	Software Engineering	Roger S. Pressman, Bruce R. Maxim	McGrawHill	8th edition
4	Agile software development Methods Review and analysis	PekkaAbrahamsson, OutiSalo, JussiRonkainen &JuhaniWarsta	VTT Publications	Latest edition
5	Agile Testing	Lisa Crispin, Janet Gregory	Addison-Wesley	Latest edition,
6	Succeeding with Agile: SoftwareDevelopment Using Scrum	Mike Cohn	Addison-Wesley	Latest edition,

Mapping of Course Outcomes with POs and PSOs

COs	**Pos**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	-	2	-	-	-	-	-	-	-	1	-	3	3	1
CO2	-	2	-	2	-	-	-	-	-	1	-	3	3	1
CO3	2	-	2	2	1	-	-	2	1	2	-	3	3	1
CO4	2	-	2	2	1	-	-	2	1	2	-	3	3	1
CO5	2	-	2	2	2	-	-	2	1	2	-	3	3	1
CO6	-	-	-	-	-	-	-	2	1	2	-	3	-	-

Title	AGILE SOFTWARE DEVELOPMENT (Practical)		Credits	1
Code	CS 754A	Semester: 7	L T P	0 0 3
Max. Marks	50	External: Nil Internal: - 50	Course Type	Program Elective(PE)
Pre-requisites			Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Evaluate the use of agile approaches for software development. 2. Identify the roles and responsibilities in agile projects and their difference from traditional method projects. 3. Apply agile design principles to develop software. 4. Employ agile testing techniques to develop software. 5. Implement agile project management tasks like scheduling, estimation, monitoring and quality assurance activities. 6. Develop software by applying agile design principles and approaches.			
Note for Examiner	Teacher is supposed to do continuous evaluation of the student throughout the semester. The evaluation will be based on the experiments conducted in the lab by the student. The teacher may schedule multiple practical tests and multiple viva voce examinations to evaluate the students continuously. Students are supposed to maintain laboratory files for the experiments conducted.			

SYLLABUS

List of Practicals:

1. Practice the use of automated build tool.
2. Practice the use of version control tool.
3. Practice the use of Continuous Integration tool.
4. Practice the use of Refactoring to achieve agility.
5. Perform Testing within an agile project.
6. Build out a backlog and user stories.
7. Design an E-Commerce website with various functionalities that allows the user/customer to engage in the activity of online grocery shopping using SCRUM.
8. Develop a Game from scratch using Extreme Programming (XP).

Mapping of Course Outcomes with POs and PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	-	2	-	2	-	1	2	-	2	-	3	3	1
CO2	2	-	2	-	2	-	1	2	-	2	-	3	3	1
CO3	2	-	2	-	2	-	1	3	3	3	1	3	3	1
CO4	2	-	2	-	2	-	1	3	3	3	1	3	3	1
CO5	2	-	2	-	2	-	1	3	3	3	1	3	3	1
CO6	-	-	-	-	-	-	1	3	3	3	1	3	-	-

Title	WIRELESS AND MOBILE NETWORKS		Credits	3
Code	CS 704B	Semester: 7	L T P	3 0 0
Max. Marks	100	Internal: - 50 External: - 50	Course Type	Program Elective(PE)
Pre-requisites	Data Communication and Networks (CS 501)		Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Knowledge of wireless communication and current telecommunication technologies 2. To understand advanced element of learning in the field of wireless communication, wireless devices and mobile networks. 3. Understanding of the characteristics and limitations of mobile hardware devices including their user-interface modalities 4. Understand the use of transaction and e-commerce principles over such mobile networks 5. Understanding of Mobile network architecture and its implementation 6. Ability to develop applications that are mobile-device specific and demonstrate current practice in mobile network context			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
Mobile Devices and Systems -Cellular Networks and Frequency Resuse, Mobile Smartphones, Smart Mobiles and Systems, Handheld Devices, Smart Systems, Limitations of Mobile Devices and Automative Systems	6
GSM and Other Architectures -Modulation, Multiplexing, Controlling the Medium Access, GSM, Radio Interfaces, Protocols, Localization, Call Handling, Handover, Security, GPRS, Spread Spectrum, FHSS, CDMA, WCDMA, CDMA 2000, OFDM, HSPA, WiMAX, Broadband Wirless access, 4G/5G Networks	8
Mobile IP Network Layer -Mobile Network Layer Mobile IP Goals, Assumptions and Requirements, Entities, IP packet Delivery Agent Advertisement and Discovery, Registration. Tunneling and Encapsulation, Optimization Reverse Tunneling, IPv6, DHCP.	7
SECTION-B	
Mobile Transport Layer -Mobile Transport Layer & Wireless Application Protocol Traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP, Transmission / Timeout Freezing Selective Retransmission, Transaction oriented TCP. Architecture, Datagram Protocol, Transport Layer Security, Transaction Protocol, Session Protocol, Application Environment , Wireless Telephony.	8
Databases and Mobile Computing -Data Organization, Database Transaction Models, Query processing, Recovery process, Data Caching, Context Aware Mobile Computing	5
Mobile Ad-Hoc and Wireless Sensor Networks -MANET-architecture, properties, Spectrum, Applications, Routing Algorithms- DSR, AODV, TORA, OLSR	5
Wireless and Mobile Standards -2G to 6G: Evolution of Standards, Recent Trends into convergence of broadband technologies	7

Suggested Books				
S. No.	**Title**	**Authors**	**Publisher**	**Edition/ Year**
1	Mobile Computing	Raj Kamal	Oxford, 2012	2nd edition
2	Mobile Communication	J Schiller	Addison Wesley, 2006	2nd edition
3	Mobile Communication Design Fundamentals	William C . Y Lee	John Wiley, 1993	2nd edition
4	Wireless Communication and Networks,	William Stallings	Pearson Education, 2009	2nd edition
5	WAP-Wireless Application Protocol	Sandeep Singhla, Thomas Bridgman, LalithaSuryanarayana	Pearson Education, 2006	2nd edition

Mapping of Course Outcomes with POs and PSOs

COs	**Pos**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	1	3	1	1	1	1	1	1	-	-	-	-	1	-
CO2	1	3	1	1	1	1	1	1	-	-	-	-	1	-
CO3	3	1	3	2	1	1	2	-	-	-	-	-	2	-
CO4	2	1	3	3	2	1	2	-	-	-	-	-	3	-
CO5	1	2	3	1	2	1	3	-	-	-	-	-	1	-
CO6	1	-	2	-	2	1	3	1	-	-	-	-	1	-

Title	WIRELESS AND MOBILE NETWORKS (Practical)		Credits	1
Code	CS 754B	Semester: 7	L T P	0 0 3
Max. Marks	50	External: Nil Internal: - 50	Course Type	Program Elective(PE)
Pre-requisites			Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to			
Note for Examiner	Teacher is supposed to do continuous evaluation of the student throughout the semester. The evaluation will be based on the experiments conducted in the lab by the student. The teacher may schedule multiple practical tests and multiple viva voce examinations to evaluate the students continuously. Students are supposed to maintain laboratory files for the experiments conducted.			

SYLLABUS

Practical based on **WIRELESS AND MOBILE NETWORKS** syllabus.

1. Understanding the role of standards in wireless networks
2. Preparing the comparative statement of specifications of any four 4G based smart mobile phones
3. Measuring the signal strength of the GSM network
4. Configuring an adhoc network with certain nodes
5. Configuring a Wifi Router with different settings
6. Visit to the GSM Switch for understanding the back-office operations

Mapping of Course Outcomes with POs and PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	3	1	1	1	1	1	1	-	-	-	-	1	-
CO2	1	3	1	1	1	1	1	1	-	-	-	-	1	-
CO3	3	1	3	2	1	1	2	-	-	-	-	-	2	-
CO4	2	1	3	3	2	1	2	-	-	-	-	-	3	-
CO5	1	2	3	1	2	1	3	-	-	-	-	-	1	-
CO6	1	-	2	-	2	1	3	1	-	-	-	-	1	-

Title	INFORMATION RETRIEVAL AND MANAGEMENT		Credits	3
Code	CS 704C	Semester: 7	L T P	3 0 0
Max. Marks	100	Internal: - 50 External: - 50	Course Type	Program Elective(PE)
Pre-requisites	Soft Computing (CS 605B), Data Mining and Analysis (CS 605C)		Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Understand fundamental of components Information Retrieval systems 2. Applying the indexing mechanism and their application in text based retrieval systems. 3. Design the scoring/ ranking system for retrieved information 4. Analyzing the web search engine basics and different methods of design. 5. Compare and contrast various web search engines using different types of queries. 6. Classifying the information retrieved into different domains			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
Introduction Introduction to Information Retrieval, Inverted indices and boolean queries, Query optimization, Unstructured and semi-structured information	5
Term vocabulary and postings lists Text encoding: tokenization, stemming, lemmatization, stop words, phrases. Optimizing indices with skip lists. Proximity and phrase queries. Positional indices.	5
Dictionaries and tolerant retrieval Dictionary data structures. Wild-card queries, permuterm indices, n-gram indices. Spelling correction and synonyms: edit distance, soundex, language detection.	6
Index construction Postings size estimation, sort-based indexing, dynamic indexing, positional indexes, n-gram indexes, distributed indexing, real-world issues.	5
SECTION-B	
Scoring Term weighting and the vector space model. Parametric or fielded search, Document zones, Vector space retrieval model, weighting, Cosine measure.Scoring documents.	6
Computing scores in a complete search system Components of an IR system, Efficient vector space scoring, Nearest neighbor techniques, reduced dimensionality approximations, random projection.	6
Classification Naive Bayes models. Spam filtering, K Nearest Neighbors, Decision Trees, Support vector machine classifiers.	6
Web Crawling What makes the web different? Web search overview, web structure, the user, paid placement, search engine optimization. Web size measurement, Crawling and web indexes. Near-duplicate detection, Link analysis, Learning to rank, focused web crawler and its different architectures.	6

Suggested Books				
S. No.	**Title**	**Authors**	**Publisher**	**Edition/ Year**
1	Introduction to Information Retrieval	C. Manning, P. Raghavan, and H. Schütze	Cambridge University Press, 2008	Latest Edition
2	Modern Information Retrieval	R. Baeza-Yates, B. Ribeiro-Neto	Addison-Wesley, 1999	Latest Edition

Mapping of Course Outcomes with POs and PSOs

COs	**Pos**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	1	1	2	1	1	-	1	-	-	1	-	3	2	2
CO2	1	-	-	2	2	-	1	-	-	1	-	-	1	2
CO3	2	2	2	3	2	2	1	2	-	1	1	2	1	1
CO4	1	2	2	2	1	1	1	2	-	1	1	2	1	2
CO5	3	2	1	2	2	1	2	1	3	2	2	2	2	3
CO6	3	3	2	1	2	1	2	2	2	3	1	1	2	3

Title	INFORMATION RETRIEVAL AND MANAGEMENT(Practical)		Credits	1
Code	CS 754C	Semester: 7	L T P	0 0 3
Max. Marks	50	External: Nil Internal: - 50	Course Type	Program Elective(PE)
Pre-requisites			Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Understand fundamental of components Information Retrieval systems 2. Applying the indexing mechanism and their application in text based retrieval systems. 3. Design the scoring/ ranking system for retrieved information 4. Analyzing the web search engine basics and different methods of design. 5. Compare and contrast various web search engines using different types of queries. 6. Classifying the information retrieved into different domains			
Note for Examiner	Teacher is supposed to do continuous evaluation of the student throughout the semester. The evaluation will be based on the experiments conducted in the lab by the student. The teacher may schedule multiple practical tests and multiple viva voce examinations to evaluate the students continuously. Students are supposed to maintain laboratory files for the experiments conducted.			

SYLLABUS

1. Compare one search string results on atleast 5 different web search engines
2. Write a program to search a string in an indexed data
3. Write a program to read a text file and generate dictionary
4. Write a program to calculate jacquard coefficient between two different strings
5. Write a program to calculate Cosine similarity between two documents
6. Download any open source Crawler and configure it to crawl the local websites.
7. Retrieve information from any of the social media platform and then classify it into various domains using any algorithm

Mapping of Course Outcomes with POs and PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	1	2	1	1	-	1	-	-	1	-	3	2	2
CO2	1	-	-	2	2	-	1	-	-	1	-	-	1	2
CO3	2	2	2	3	2	2	1	2	-	1	1	2	1	1
CO4	1	2	2	2	1	1	1	2	-	1	1	2	1	2
CO5	3	2	1	2	2	1	2	1	3	2	2	2	2	3
CO6	3	3	2	1	2	1	2	2	2	3	1	1	2	3

Title	MOBILE COMPUTING		Credits	3
Code	CS 704D	Semester: 7	L T P	3 0 0
Max. Marks	100	Internal: - 50 External: - 50	Course Type	Program Elective(PE)
Pre-requisites	Data Communication and Networks (CS 501)		Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Understand wireless communication and current telecommunication technologies. 2. Identify the characteristics and limitations of mobile hardware devices including their user-interface modalities. 3. Implement MANETs routing algorithms. 4. Develop applications that are mobile-device specific and demonstrate current practice in mobile computing contexts. 5. Demonstrate the Adhoc networks concept and its routing protocols. 6. Analyse different mobile platforms and application development.			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
Mobile Devices and Systems Cellular Networks and Frequency Reuse, Mobile Smartphones, Smart Mobiles and Systems, Handheld Devices, Smart Systems, Limitations of Mobile Devices and Automative Systems	6
GSM and Other Architectures Localization, Call Handling, Handover, Security, GPRS, Spread Spectrum, FHSS, CDMA, WCDMA, CDMA 2000, OFDM, HSPA, WiMAX, Broadband Wirless access, 4G Networks	7
Mobile IP Network Layer Mobile Network Layer Mobile IP Goals, Assumptions and Requirements, Entities, IP packet Delivery Agent Advertisement and Discovery, Registration, Tunneling and Encapsulation, Optimization Reverse Tunneling, IPv6, DHCP.	7
SECTION-B	
Mobile Transport Layer Mobile Transport Layer & Wireless Application Protocol Traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP, Transmission / Timeout Freezing Selective Retransmission, Transaction oriented TCP. Architecture, Datagram Protocol, Transport Layer Security, Transaction Protocol, Session Protocol, Application Environment, Wireless Telephony.	8
Databases and Mobile Computing Data Organization, Database Transaction Models, Query processing, Recovery process, Data Caching, Context Aware Mobile Computing	5
Mobile Ad-Hoc and Wireless Sensor Networks MANET-architecture, properties, Spectrum, Applications, Routing Algorithms- DSR, AODV, TORA, OLSR	5
Mobile Application Languages and Mobile Application Development Platforms Mobile Application Development, XML, JAVA, Java 2 Micro Edition, OS, Windows Phone, Android.	7

Suggested Books				
S. No.	**Title**	**Authors**	**Publisher**	**Edition/ Year**
1	Mobile Computing	Raj Kamal	Oxford,2012	2nd edition
2	Mobile Communication	J Schiller	AddisonWesley, 2006	2nd edition
1	Mobile Communication Design Fundamentals	William C. Y Lee	JohnWiley, 1993	2nd edition
2	Wireless Communication and Networks	William Stallings	PearsonEducation, 2009	2nd edition
3	WAP-Wireless Application Protocol	Sandeep Singhla, Thomas Bridgman, Lalitha Suryanarayana	PearsonEducation, 2006	2nd edition

Mapping of Course Outcomes with POs and PSOs

COs	**Pos**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	2	1	-	-	1	-	-	2	-	3	2	2
CO2	3	1	-	2	2	2	1	-	-	2	-	3	2	1
CO3	2	2	2	2	2	-	-	2	2	3	1	3	1	1
CO4	3	3	2	1	2	-	-	2	2	3	1	3	2	3
CO5	2	2	2	-	-	-	1	2	2	3	1	3	1	1
CO6	3	3	2	1	2	-	-	-	1	2	-	3	2	3

Title	MOBILE COMPUTING (Practical)		Credits	1
Code	CS 754D	Semester: 7	L T P	0 0 3
Max. Marks	50	External: Nil Internal: - 50	Course Type	Program Elective(PE)
Pre-requisites			Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Understand mobile and pervasive computing applications. 2. Demonstrate the use of contemporary development environment and languages (e.g., C#, Java) to develop mobile applications. 3. Develop programs with typical functionalities of modern smartphones (e.g., light sensor, gyro, accelerometer, cameras, microphones, GPS, barometer). 4. Craft a mobile application using android/blackberry/ios/Windows SDK. 5. Realize a project based on Android, ios. 6. Demonstrate team-based laboratory activities with fellow students to interact effectively on a social and interpersonal level to complete a large programming project.			
Note for Examiner	Teacher is supposed to do continuous evaluation of the student throughout the semester. The evaluation will be based on the experiments conducted in the lab by the student. The teacher may schedule multiple practical tests and multiple viva voce examinations to evaluate the students continuously. Students are supposed to maintain laboratory files for the experiments conducted.			

SYLLABUS

List of Practicals:

1. Write a program to simulate Fixed Time Division Multiplexing. Take 12 stations. Every station has time slice of 417 microseconds. Delay should be 10 ms. Every time the station gets turn, it shows message.
2. Write a program that identifies the Bluetooth devices in the wireless range.
3. Write a program that prints the signal strength of WiFi connection of the given computer.
4. Prepare a wireless ad hoc network and show its working.
5. Write a program to find hamming distance. For example Hamming distance d(v1,v2) = 3 if v1 = 011011, v2 = 110001.
6. Write a program to perform infrared communication.
7. Write a program to perform Bluetooth file transfer.
8. Develop an android app which displays “Hello, welcome to Android Lab” message.
9. Develop an android app which displays a form to get information from user (Username; Password; Email Address; Phone Number; Country; State; Gender; Interests; Birth Date). Form should be followed by a Button with label “Submit”. When user clicks the button, a message should be displayed to user describing the information entered. Utilize suitable UI controls (i.e. widgets).
10. Using Android, Create a login Activity. It asks “username” and “password” from user. If username and password are valid, it displays Welcome message using new activity.

Develop calculator Android Application

Mapping of Course Outcomes with POs and PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	2	1	2	-	-	-	-	2	-	3	2	1
CO2	3	2	2	2	2	1	-	-	-	2	-	3	2	1

	CO3	3	2	2	2	2	1	2	2	2	3	3	3	1	1	
	CO4	3	2	2	2	2	1	2	2	2	3	3	3	2	1	
	CO5	3	2	2	2	2	1	2	2	2	3	3	3	1	1	
	CO6	1	2	1	3	2	1	2	2	3	3	3	1	2	-	

Title	SMART SYSTEM DESIGN		Credits	3
Code	CS 704E	Semester: 7	L T P	3 0 0
Max. Marks	100	Internal: - 50 External: - 50	Course Type	Program Elective(PE)
Pre-requisites			Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Understand sensors classification and architecture for building smart systems 2. Examine characteristics of digital sensors for designing smart systems 3. Interface digital sensors for smart sensor system design 4. Understand IEEE 1451 standard and its associated concepts for building effective and quality systems 5. Interfacing and integrating components for building smart systems 6. Design IoT solutions for various applications			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
Introduction: Main definitions for smart sensors and their properties, quasi-digital sensors, MTS, MEMS and system-on-chip (SoC); Sensors classifications from output point of view and quasi-digital sensors classification; Sensors architectures for integrated and smart sensors; Informative parameters (unified and frequency-time domain parameters of signal); Advantages of frequency as informative parameter including high noise immunity, high power of signal, wide dynamic range, high reference accuracy, simple interfacing, simple Integration and coding.	11
Digital Sensors and Smart Sensors System Design: Practical realizations of different smart sensors systems and digital sensors: optical sensors systems with color-to-digital and light-to-digital converters; a DAQ system for temperature sensors; accelerometers based systems; rotation speed digital sensors and systems; digital humidity sensors and data loggers; temperature and humidity multisensors system; pressure sensors systems and digital gauges; digital magnetic sensors and systems; multiparameters sensors systems.	12
SECTION-B	
IEEE 1451 Standard and Frequency Sensors: Brief introduction to IEEE 1451 standard and its extension for any sensors and transducers from frequency-time signal domain. Direct Sensor-to- Microcontroller Interface for resistive, capacitance, inductance, resistive bridges sensing elements. Future Trends - The future development of main systems' components as the Universal Frequency-to-Digital Converter (UFDC-2) and Universal Sensors and Transducers Interface (USTI). Integration of all components of sensor system into a single system-on-chip (SoC) with advanced processing and conversion methods.	12
Internet of Things: Basic Introduction and communication mechanism, various applications in different fields, Case Studies.	10

Suggested Books				
S. No.	**Title**	**Authors**	**Publisher**	**Edition/ Year**
1	Handbook of Modern Sensors: Physics, Designs, and Applications.	Fraden, J.	Springer, India, 2010	4th edition
2	Understanding Smart Sensors	Frank, R.	Artech house, 2010	2nd edition
3	Smart Sensor Systems	Meijer, G.	John Willey & Sons	Latest edition
4	Introduction to Instrumentation,Sensors and Process Control	Dunn, C.W.	Artech House	Latest edition

Mapping of Course Outcomes with POs and PSOs

COs	**Pos**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	1	1	1	1	-	-	-	-	-	-	-	-	1	-
CO2	2	2	2	1	-	-	-	-	-	-	-	-	2	1
CO3	3	3	3	1	-	-	-	-	-	-	-	-	1	-
CO4	2	1	1	1	-	-	-	-	-	-	-	-	1	-
CO5	3	3	3	1	-	-	-	-	-	-	-	-	1	-
CO6	3	3	3	1	1	-	-	-	-	-	-	-	2	2

Title	SMART SYSTEM DESIGN (Practical)		Credits	1
Code	CS 754E	Semester: 7	L T P	0 0 3
Max. Marks	50	External: Nil Internal: - 50	Course Type	Program Elective(PE)
Pre-requisites			Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Understand Arduino board and Arduino IDE to write and upload programs 2. Interfacing sensors with Arduino board for building basic sensor systems 3. Implementing a control system using Arduino for making decisions 4. Understand Raspberry Pi, its basic setup and configuration 5. Interfacing common sensors using Raspberry Pi for building basic IoT systems 6. Using Raspberry Pi for sending and plotting data			
Note for Examiner	Teacher is supposed to do continuous evaluation of the student throughout the semester. The evaluation will be based on the experiments conducted in the lab by the student. The teacher may schedule multiple practical tests and multiple viva voce examinations to evaluate the students continuously. Students are supposed to maintain laboratory files for the experiments conducted.			

SYLLABUS

1. Understanding Arduino and using Arduino and the normal Breadboard to switch on and off a LED.
2. Interfacing a humidity and temperature sensor (DHT) with Arduino board.
3. Integration of a motor based actuator with Arduino board.
4. Implementing a basic traffic control system using Arduino.
5. Introduction to Raspberry Pi, its basic setup and configuration.
6. Using Raspberry Pi and the normal Breadboard to blink a LED.
7. Integration of a Pi camera with the Raspberry Pi for taking images.
8. Using Raspberry Pi to capture data from sensors and make decision.
9. Using Raspberry Pi with DHT sensor to sense temperature and send data to a server.
10. Using Raspberry Pi to plot the sensed data at Server.

Mapping of Course Outcomes with POs and PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	1	1	1	2	-	-	-	-	-	-	-	2	-
CO2	2	2	2	1	2	-	-	-	-	-	-	-	2	-
CO3	3	3	3	1	2	-	-	-	-	-	-	-	2	-
CO4	1	1	1	1	2	-	-	-	-	-	-	-	2	-
CO5	2	2	2	1	2	-	-	-	-	-	-	-	2	-
CO6	3	3	3	1	2	-	-	-	-	-	-	-	2	2

Title	Project-I		Credits	3
Code	CS 756	Semester: 7	L T P	0 0 6
Max. Marks	100	External: Nil Internal: - 100	Course Type	Project(PW)
Pre-requisites			Contact Hours	6
Course Outcomes	On completion of this course, a student will be able to 1. Apply the knowledge from previous semesters to undertake and solve a real-life problem 2. Illustrate the solution after identifying various objectives of the problem undertaken 3. Devise an organised action plan along with all the team members 4. Develop a solution using approrpriate methodology and tools available 5. Communicate and demonstrate the work through structured report and oral presentation			
Note for Examiner	Project Mentor is supposed to do continuous evaluation of the student throughout the semester. The evaluation will be based on the progress of the project undertaken in the lab by the student. The mentor may schedule multiple presentations to evaluate the students continuously. Students are supposed to have regular meetings and feedback from their mentors. The evaluation of the student will be On the basis of defined rubrics and will be evaluated through Semester presentations, working projects, project reports and viva voce			

SYLLABUS

The students will be required to submit working project demonstrating the acquired computer science and engineering skills.

Mapping of Course Outcomes with POs and PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	3	3	2	2	1	-	2	1	1	2	2	2
CO2	3	2	2	2	2	2	1	-	2	1	1	2	2	2
CO3	3	3	3	2	2	2	1	-	3	1	2	2	2	2
CO4	3	3	3	2	3	2	1	2	2	1	2	2	2	2
CO5	1	1	2	1	1	-	-	2	2	3	1	2	2	2

Title	Industrial Training after 6th Sem		Credits	2
Code	CS 755	Semester: 7	L T P	
Max. Marks	100	External: Nil Internal: - 100	Course Type	Internships/ Seminars(IS)
Pre-requisites			Contact Hours	
Course Outcomes	On completion of this course, a student will be able to 1. To demonstrate professional competency with updated knowledge and changes in technological world. 2. To apply knowledge gained with capability and enthusiasm for continuous professional development 3. Ability to identify, formulate and model problems and find engineering solution with state of art technology 4. To demonstrate abilities of true professional using ethical practice and fulfilling social responsibilities			
Note for Examiner	On the basis of defined rubrics and will be evaluated through end Semester presentations, working projects, project reports and viva voce			

SYLLABUS

It involves an internship work in a company/research organization where the work is relevant to computer science.
The slot for completing the internship is the summer break after 3rd year.
The minimum duration of the internship should be 4/6 weeks.
For the internship to be credited, the department requires that the work assigned during the internship has sufficient components related to computer science subjects in it. A rule of thumb is whether your internship work uses the skillset that you developed through the course of your degree courses.
The students need to submit the internship certificate and details to the course coordinator in order to get the internship credited.
The students are also required to submit working project demonstrating the acquired skills.

Mapping of Course Outcomes with POs and PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	3	-	1	-	2	2	-	-	-	-	1	-	2
CO2	3	3	3	2	2	-	-	-	1	2	1	1	3	3
CO3	3	3	3	2	2	-	-	-	1	2	1	1	3	3
CO4	3	3	3	2	2	-	-	-	1	2	1	1	3	3

Title	PRINCIPLES OF MANAGEMENT		Credits	3
Code	HSM 401	Semester: 8	L T P	2 0 0
Max. Marks	100	Internal: - 50 External: - 50	Course Type	Humanities and Social Sciences(HS)
Pre-requisites			Contact Hours	2
Course Outcomes	On completion of this course, a student will be able to 5. Understand the management process and principles of management. 6. Examine the roles and responsibilities of managers. 7. Appraise the significance of management principles. 8. Analyze organization structure 9. Apply management concepts and principles in work life and manage things efficiently and effectively. 10. Develop new methods of managing organizations by using management knowledge and functions.			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
Introduction to Management Nature of Management: Art or Science, Principles and Functions of Management	3
Evolution of Management Thought Classical Theories: Bureaucratic, Scientific and Administrative Approach Neo-Classical Theories: Human Relations and Human Behaviour Approach Modern Theories of Management Relevance of Management Thought in present scenario – Management Cases	6
Planning Nature of Planning, Planning Process, Application of Planning Process in a Hypothetical Situation, Types of Planning, Types of Plans, Management by Objective (MBO)	4
Organizing Concept of Organization, Departmentation, Forms of Organization Structure Analysis of Organization Structure – Case Studies Hypothetical Formation of an Organization New Methods of Managing Organizations	4
SECTION-B	
Staffing Human Resource Planning: HRP Process, Job Analysis: Job Description, Job Specifications and Used of Job Analysis Recruitment: Sources and Methods Selection: Selection Process, Role Playing and Case Study on Selection Tests and Interviews Training and Development: Techniques, Performance Appraisal: Methods Case Study on Staffing Practices	6
Directing Concept, Leadership: Importance and Styles, Motivation: Theories and their relevance in present scenario, Communication: Process, Types and Barriers of Communication Management Game on Leadership, Motivation and Communication	6
Controlling Nature and Process of Controlling, Requirements for Effective Controlling	2

Suggested Books				
S. No.	**Title**	**Authors**	**Publisher**	**Edition/ Year**
1	Principles and Practices of Management	Rao V.S.P. and NarayanaP.S.	KonarkPublishers, 1987	Latest Edition
2	Principles & Practice of Management	Prasad L.M.	Sultan Chand & Sons, 2012	8th Edition
3	Essentials of Management: International and Leadership Perspective	Weihrich H.and Koontz H.	McGrawHill, 2012	Latest Edition
4	The New Era of Management	Daft R.L	Cengage Learning, 2014	11th Edition,
5	Management: Text and Cases	Rao V.S.P. and KrishnaV.H	Excel Books, 2008	Latest Edition
6	Fundamentals of Management: Essential Concepts and Applications	Robbins S.P, DeCenzo D.A., Bhattacharya S. andAgarwal M.N	PearsonIndia, 2009	6th Edition,

Mapping of Course Outcomes with POs and PSOs

COs	**Pos**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	-	-	-	-	-	1	1	1	1	1	1	1	-	-
CO2	-	-	-	-	-	1	1	1	1	1	1	1	-	-
CO3	-	-	-	-	-	1	1	1	1	1	1	1	-	-
CO4	-	-	-	-	-	3	3	3	3	3	3	3	3	3
CO5	-	-	-	-	-	3	3	3	3	3	3	3	3	3
CO6	-	-	-	-	-	3	3	3	3	3	3	3	3	3

Title	BUSINESS ENVIRONMENT AND BUSINESS LAWS		Credits	3
Code	HSM 402	Semester: 8	L T P	2 0 0
Max. Marks	100	Internal: - 50 External: - 50	Course Type	Humanities and Social Sciences(HS)
Pre-requisites			Contact Hours	2
Course Outcomes	On completion of this course, a student will be able to 1. Analyze the impact of environment on business and formulate appropriate business strategies to compete in the competitive world. 2. Solve problems easily with evaluation criteria, to justify the evaluation based on arguments. 3. Learning the rings what challenges globalization brings in for organizations. 4. Learn how companies' social responsibility practices along with fulfilling economic objectives. 5. Understanding about how the organizations need to be governed for effectiveness. 6. Implementation of various business laws in practice and gain knowledge about application.			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
Introduction to Business Scope and Characteristics of Business, Classification of Business Activities Forms of Ownership of Business: Sole Proprietorship, Partnership and Company	5
Internal Environment: Concept and Elements (Value System, Vision Mission Objectives, Management Structure, Human Resources, Company Image etc.) SWOT Analysis: Concept and Case Study External Environment: Micro Environment (Suppliers, Customers, Competitors, Market Intermediaries etc.) and Macro Environment – PESTEL Analysis (Political, Economic, Social, Technological, Ecological and Legal), Case Study on Impact of Environment on Business	7
Globalization Concept, Pros and Cons of Globalization, Impact of Global Environment on Business Globalization of Company – Case Study	4
SECTION-B	
Corporate Social Responsibility Concept, Social Responsibility towards different stakeholders, Rationale for CSR CSR – Case Studies	2
Corporate Governance Concept, Elements and Essentials of Good Governance	3
Contract Law Concept, Types and Essentials Elements of Contract	3
Partnership Law Nature of Partnership, Provisions of Partnership Act, Issues Related to Partnership Firm, Hypothetical Formation of a Partnership Firm	2

Company Law Nature of Company, Provisions of Company Act, Issues Related to Incorporation of Company, Hypothetical Formation of a Company	2

Suggested Books

S. No.	Title	Authors	Publisher	Edition/ Year
1	Business Environment: Text andCases	Cherunilam F	Himalaya Publications, 2013	22nd Edition,
2	Legal Aspects of Business	Pathak A	McGrawHill Education, 2013	5th Edition,
3	Essential of Business Environment: Text, Cases and Exercises	Aswathappa K.	Himalaya Publication, 2011	11th Edition,
4	Business Law Including CompanyLaw	Gulshan S.S. and KapoorG.K	New Age International (p) Ltd, 2011	15th Edition,
5	Business Law and Corporate Laws	Tulsian P.C	Sultan Chand Publishing, 2011	1st Edition,
6	Fundamentals of Business Organization & Management	Bhushan Y.K	Sultan Chand & Sons, 2013	19th Edition,
7	Corporate Governance: Principles,Policies and Practices	Fernando A.C	PearsonIndia, 2011	2nd Edition,

Mapping of Course Outcomes with POs and PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	-	-	-	1	-	-	2	1	2	2	2	2	1	1
CO2	-	-	1	-	1	1	2	1	-	-	2	1	1	-
CO3	-	1	2	1	2	1	1	-	1	-	1	1	1	-
CO4	-	-	-	-	-	-	-	1	-	-	-	-	1	1
CO5	-	-	-	-	-	-	-	-	1	-	-	-	2	2
CO6	-	-	-	-	-	-	-	1	-	-	-	-	2	1

Title	ENTREPRENEURSHIP AND PROJECT MANAGEMENT		Credits	3
Code	HSM 403	Semester: 8	L T P	2 0 0
Max. Marks	100	Internal: - 50 External: - 50	Course Type	Humanities and Social Sciences(HS)
Pre-requisites			Contact Hours	2
Course Outcomes	On completion of this course, a student will be able to 1. Understanding about entrepreneurial development and how business plans are made practically (with dummy plans in practice). Also, they will learn about the financial and marketing aspects of organizations. 2. Learning about the environment for women entrepreneurs and what challenges they face along with the government schemes promoting women entrepreneurs. 3. Understanding about the cycle and timelines that are required to start up their own enterprise. 4. Analyze how to check the viability of the enterprise with respect to technical, political, social, economic and financial feasibility. 5. Presenting their business ideas in form of business / project report effectively. 6. Understanding of how to prepare marketing and financial plans with the strategies that will provide maximum benefit for the organization.			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
Introduction to Entrepreneurship Concept of Entrepreneurship, Characteristics and Functions of Entrepreneur Forms of Ownership of Business, Factors Affecting Entrepreneurship Case Studies of Entrepreneurs	6
Women Entrepreneurship Nature of Women Entrepreneurship, Problems of Women Entrepreneurs, Institutional Initiatives for Promotion of Women Entrepreneurs	2
Micro, Small and Medium Enterprises (MSMEs) Concept of MSMEs, Schemes of MSMEs Functions of Entrepreneurial Development Programmes (EDPs)	2
Project Identification Idea Generation, Project Life Cycle, Concept of SWOT Analysis SWOT Analysis of Selected Project	2
SECTION-B	
Project Planning and Formulation Elements of Project Formulation: Product, Technical (Location, Scale, Technology, Production Process, Layout, Manpower, Resources), Market, Finance and Economic Aspects Feasibility Analysis: Financial Viability and Profitability, and Socio-Economic Desirability	7
Project Report Formulation of Business Plan and Project Report, Hypothetical Example of a Real-Life	2

Project	
Finance and Marketing Function Concept of Finance, Finance Related Terminologies, Sources of Finance, Cost Estimations Marketing Mix: Product, Place, Price, Promotion, People, Process and Physical Evidence Marketing Segmentation Targeting and Positioning	5
Discussions on Additional Reading (any one of the following in the semester) - The New Age Entrepreneurs - The $100 Startup: Fire your Boss, Do what you Love and Work Better to Live More - A Guide to Entrepreneurship - Dhandha: How Gujaratis Do Business - Rokda: How Baniyas Do Business - Take Me Home - Business Families of Ludhiana	2

Suggested Books

S. No.	Title	Authors	Publisher	Edition/ Year
1	Dynamics of Entrepreneurial Development & Management	Desai V.	Himalaya Publishing House.	5th Edition,
2	Projects: Planning, Analysis,Selection, Financing, Implementation and Review	Chandra P	McGraw-Hill Education (India), 2014	8th Edition,
3	Entrepreneur's Toolkit	Harvard Business School	Harvard University Press, 2004	Latest Edition
4	Entrepreneurship	Hisrich R.D., Peters M.P. and Shepherd D.A	McGraw Hill Education, 2006	Latest Edition
5	Essentials of Project Management	Ramakrishna K	PHI Learning	
6	Entrepreneurship	Roy R	Oxford University Press,2011	2nd Edition,
7	Entrepreneurship Development inIndia	Gupta C.B. and SrinivasanN.P.	Sultan Chand and Sons, 2013	Latest Edition

Mapping of Course Outcomes with POs and PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	2	2	2	1	-	1	1	2	3	2	2	1	1
CO2	2	1	1	2	2	1	2	2	1	2	2	3	1	-
CO3	2	2	1	3	2	-	2	2	1	1	2	2	1	-
CO4	-	-	-	-	-	1	1	-	-	-	1	-	1	1
CO5	-	-	-	-	-	-	1	-	-	-	-	-	2	2
CO6	-	-	-	-	-	-	-	-	-	-	-	1	2	1

Title	FINANCIAL MANAGEMENT		Credits	3
Code	HSM 404	Semester: 8	L T P	2 0 0
Max. Marks	100	Internal: - 50 External: - 50	Course Type	Humanities and Social Sciences(HS)
Pre-requisites			Contact Hours	2
Course Outcomes	On completion of this course, a student will be able to 1. Understand the functioning of the financial system (financial markets, financial institutions, financial services and financial instruments) of the country. 2. Explain different financial decisions i.e. investing, financing and dividend, required to be taken by a company. 3. Examine techniques/methods with numerical applications for short-term and long-term investment. 4. Apply best combination of financial decisions by considering risk and return trade-off. 5. Identify how business can gain maximum through the financial system. 6. Determine how to manage funds effectively so as to maximize returns.			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
Introduction to Financial Management Concept of Finance, Terminology Related to Finance, Financial Decisions, Factors Affecting Financial Decisions, Risk-Return Trade-Off	4
Financial System Concept and Role of Financial System in Indian Economy	2
Financial Markets and Instruments Concept and Relevance of Money Market and Capital Market Money Market Instruments: Call Money, Treasury Bills, Commercial Papers, Certificate of Deposits Capital Market Instruments: Equity Shares, Preference Shares and Debentures Hypothetical Trading in Financial Markets	6
Financial Services Nature and Functions of Financial Services: Merchant Banking, Mutual Funds, Factoring, Forfaiting, Credit Rating Case Study on Financial Services	6
SECTION-B	
Financial Institutions Nature and Functions of Financial Institutions: Reserve Bank of India (RBI), Securities and Exchange Board of India (SEBI), Discount and Finance House of India (DFHI)	3
Long Term Investment Decisions Capital Budgeting: Concept, Importance, Factors Techniques/Methods with Numerical Applications (Pay Back Period, Accounting Rate of Return, Net Present Value, Internal Rate of Return and Profitability Index), Case Study	3
Short Term Investment Decisions Working Capital: Nature, Type and Factors Affecting the Requirement of Working Capital, Case Study	3
Financing Decisions Capital Structure: Essentials and Approaches of Capital Structure	3

Sources of Finance (long-term and short-term), Financial Leverage: Concept and Numerical Application, Case Study	
Dividend Decisions Types of Dividend, Dividend Policy: Nature and Factors Affecting Dividend Policy, Case Study	3

Suggested Books

S. No.	Title	Authors	Publisher	Edition/ Year
1	Financial Management	Shah P.	Dreamtech Press,2009	2nd Edition,
2	Financial Markets and Services	Gordon E. and NatarajanK.	Himalaya PublishingHouse, 2006	3rd Edition,
3	Financial Management: Theory and Practice	Chandra P.	McGraw Hill Education(India), 2012	8th Edition,
4	Financial Management	Pandey I.M.	VikasPublishing House Pvt. Ltd., Noida,2010	10th Edition,
5	Cases in Financial Management	Pandey I.M. and Bhat R.	McGrawHill Education (India), 2012	3rd Edition,
6	Financial Institutions and Markets: Structure, Growth and Innovations	Bhole L.M. and MahakudJ.	McGraw Hill Education(India), 2009	5th Edition,
7	The Indian Financial System: Markets, Institutions and Services	Pathak B.V.	PearsonIndia, 2010	3rd Edition,
8	Financial Management and Policy	Horne J.C.V. and DhamijaS.	PearsonIndia, 2011	12th Edition,

Mapping of Course Outcomes with POs and PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	-	-	-	-	-	1	1	1	1	1	1	1	-	-
CO2	-	-	-	-	-	1	1	1	1	1	1	1	-	-
CO3	-	-	-	-	-	1	1	1	1	1	1	1	-	-
CO4	-	-	-	-	-	3	3	3	3	3	3	3	3	3
CO5	-	-	-	-	-	3	3	3	3	3	3	3	3	3
CO6	-	-	-	-	-	3	3	3	3	3	3	3	3	3

Title	MARKETING MANAGEMENT		Credits	3
Code	HSM 405	Semester: 8	L T P	2 0 0
Max. Marks	100	Internal: - 50 External: - 50	Course Type	Humanities and Social Sciences(HS)
Pre-requisites			Contact Hours	2
Course Outcomes	On completion of this course, a student will be able to 1. Understanding about how to market goods and services effectively to different segments so as to deliver value to customers. 2. Enhance your knowledge about marketing principle and theories and how they will be applied in real time events and situations. 3. Analyze the marketing activities of the firm. 4. Ability to formulate marketing mix and marketing strategies for different products and different sets of customers. 5. Learning of how to relate marketing to other business functions effectively and for maximization of profits. 6. Conducting the marketing research.			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
Introduction to Marketing Concepts, Role, Scope and Types of Marketing, Case Study on Marketing Management	3
Marketing Research Scope and Process of Marketing Research, Hypothetical Marketing Research Analysis	3
Consumer and Business Markets Types of Markets, Building Customer Value Consumer and Business Buying Behaviour: Factors Influencing Behaviour and Buying Decision Process	4
Selection of Markets Segmentation: Factors and Bases, Targeting and Positioning Preparation of STP of Selected Product	3
Marketing Mix 7 P's of Marketing Mix: Product, Price, Physical Distribution, Promotion, People, Process and Physical Evidence Formulation of Marketing Mix of Selected Product	3
SECTION-B	
Product Decisions Product (Good or Service) Characteristics, Product Life-Cycle, Packaging and Branding, Product Development and Management	3
Pricing Decisions Pricing Policies and Strategies, Factors Influencing Pricing	3
Physical Distribution Decisions Marketing Channels, Channel Players, Physical Distribution, Managing Distribution, Analysis of Supply Chain Management – Case Studies	3
Promotion Decisions Nature of Promotion Decisions, Managing Mass Communication and Personal	3

Communication Analysis of Promotional Strategies – Case Studies	

Suggested Books

S. No.	Title	Authors	Publisher	Edition/ Year
1	Marketing Management: Concepts, Cases, Challenges andTrends	Govindarajan M	PHILearning, 2009	2nd Edition
2	Marketing Management	Kotler P., Keller K.L.,Koshy A. and Jha M.	PearsonIndia, 2012	14th Edition
3	Marketing Concepts and Strategies	Dibb S., Simkin L., Pride W.M. and Ferrell O.C.	Cengage Learning, 2012	
4	Marketing Management	Kumar A. and MeenakshiN	VikasPublishing HousePvt. Ltd., Noida, 2011	2nd Edition
5	Marketing Management	Saxena R.	McGraw Hill Education(India),2013	4th Edition
6	Marketing: Managerial Introduction	Gandhi J.C.	McGrawHill Education, 1987	1st Edition
7	Marketing	Etzel M.J., Walker B.J., Stanton W.J. and Pandit A.	McGraw Hill Education (India), 2010	14th Edition
8	Super Marketwala: Secrets toWinning Consumer India	Mall D.	RandomHouse India, 2014	1st Edition

Mapping of Course Outcomes with POs and PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	-	-	-	-	-	-	-	-	-	1	1	1	1	1
CO2	-	-	-	1	-	-	-	-	1	2	1	1	1	-
CO3	2	1	-	1	1	-	1	-	-	-	1	2	1	-
CO4	3	2	1	2	1	-	1	1	2	1	2	2	1	1
CO5	3	2	1	2	1	-	1	1	2	1	2	2	2	2
CO6	2	2	2	2	1	-	1	1	2	1	2	2	2	1

Title	HUMAN RESOURCE MANAGEMENT		Credits	3
Code	HSM 406	Semester: 8	L T P	2 0 0
Max. Marks	100	Internal: - 50 External: - 50	Course Type	Humanities and Social Sciences(HS)
Pre-requisites			Contact Hours	2
Course Outcomes	On completion of this course, a student will be able to 1. Understand concepts and practices within the field of HRM. 2. Identify the strategic role of HRM in managing an organization. 3. Develop the ability to solve problems in area of HRM in organizations. 4. Identify and appreciate the significance of the ethical issues in HR 5. Determine the issues related to health and safety, workplace health hazards 6. Develop awareness of latest developments in HRM practices which are essential for effective management in organization.			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
Introduction to Human Resource Management-HRM: Nature, Scope, Functions, HRM Practices and Problems in India with Case Studies	4
Human Resource Planning (HRP)-Concept and Process of HRP, Factors Affecting HRP	3
Job Analysis and Designing-Uses and Process of Job Analysis, Job Description and Job Specification: Features and Hypothetical Formulation, Job Designing: Job Enrichment, Job Enlargement	3
Recruitment and Selection-Recruitment: Sources and Methods-Selection: Selection Process, Selection Tests, Types and Nature of Interviews Role Playing and Case Study on Selection Process, Tests and Interview	4
SECTION-B	
Induction and Internal Mobility-Induction Programme, Need and Scope of Internal Mobility: Transfer, Promotion, Demotion	3
Training and Development-Training: Need and Methods, Management Development: Need, Methods and Management Development Programme HRM Games for Development of Employees	5
Performance Appraisal and Compensation-Nature and Methods of Performance Appraisal, Hypothetical Performance Appraisal Compensation: Financial and Non-Financial Benefits	3
Employee Health and Safety-Concept, Issues related to Health and Safety, Workplace Health Hazards	3

Suggested Books				
S. No.	**Title**	**Authors**	**Publisher**	**Edition/ Year**
1	Human Resource Management: Text and Cases	Rao V.S.P.	Excel Books, 2002	Latest Edition
2	Human Resource Management	Dessler G. and Varkkey B.	PearsonIndia, 2011	12th Edition
3	Human Resource Management: Text and Cases	Aswathappa K.	McGraw Hill Education (India), 2013	7th Edition
4	Human Resource Management: Text and Cases	Gupta C.B.	Sultan Chand and Sons, 2012	14th Edition
5	Human Resource Management: Text and Cases	Bedi S.P.S. and Ghai R.K	Bharti Publications,2012	Latest Edition
6	Human Resource Management Applications: Cases, Exercises, Incidents and Skill Builders	Fottler M.D., McAfee R.B.and Nkomo S.M.	CengageLearning, 2013	7th Edition,

Mapping of Course Outcomes with POs and PSOs

COs	Pos												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	-	-	-	-	-	1	1	1	1	1	1	1	-	-
CO2	-	-	-	-	-	1	1	1	1	1	1	1	-	-
CO3	-	-	-	-	-	1	1	1	1	1	1	1	-	-
CO4	-	-	-	-	-	3	3	3	3	3	3	3	3	3
CO5	-	-	-	-	-	3	3	3	3	3	3	3	3	3
CO6	-	-	-	-	-	3	3	3	3	3	3	3	3	3

Title	BUILDING ENTERPRISE APPLICATIONS		Credit	3
Code	CS 802A	Semester: 8	L T P	3 0 0
Max. Marks	100	Internal: - 50 External: - 50	Course Type	Program Elective(PE)
Pre-requisites	Database Systems (CS 302)		Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Understand fundamental of Enterprise applications and key determinants to measure the success. 2. Familiarize with concept of Business Process Modeling. 3. Illustrate the Enterprise architecture, views and viewpoints, logical architecture, technical architecture. 4. Demonstrate different techniques used to design Enterprise applications. 5. Construct applications by understanding the design. 6. Test and roll out the enterprise applications in real environment.			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
Introduction to Enterprise application Introduction to enterprise applications and their types, software engineering methodologies, life cycle of raising an enterprise application, introduction to skills required to build an enterprise application, key determinants of successful enterprise applications, and measuring the success of enterprise applications.	8
Incepting enterprise application and business process modelling Inception of enterprise applications, enterprise analysis, business modelling, requirements elicitation, use case modelling, prototyping, non-functional requirements, requirements validation, planning and estimation.	7
Enterprise Architecture and designing enterprise application Concept of architecture, views and viewpoints, enterprise architecture, logical architecture, technical architecture - design, different technical layers, best practices, data architecture and design – relational, XML, and other structured data representations, Infrastructure architecture and design elements - Networking, Internetworking, and Communication Protocols, IT Hardware and Software, Middleware, Policies for Infrastructure Management, Deployment Strategy, Documentation of application architecture and design.	8
SECTION-B	
Constructing enterprise application Construction readiness of enterprise applications - defining a construction plan, defining a package structure, setting up a configuration management plan, setting up a development environment, introduction to the concept of Software Construction Maps, construction of technical solutions layers, methodologies of code review, static code analysis, build and testing, dynamic code analysis – code profiling and code coverage.	12
Testing and rolling out enterprise application Types and methods of testing an enterprise application, testing levels and approaches, testing environments, integration testing, performance testing, penetration testing, usability testing, globalization testing and interface testing, user acceptance testing, rolling out an	10

enterprise application.

Suggested Books

S. No.	Title	Authors	Publisher	Edition/ Year
1	Raising Enterprise Applications	Anubhav Pradhan, Satheesha B. Nanjappa, Senthil K. Nallasamy, VeerakumarEsakimuthu	WileyIndia, 2012	1st edition
2	Building Java EnterpriseApplications,	Brett McLaughlin	O' Reily Media, 2010	Latest edition
3	Software Requirements: Styles & Techniques.	Soren Lauesen	AddisonWesley,2012	Latest edition
4	Software Systems Requirements Engineering: In Practice	Brian Berenbach, Daniel J.Paulish, Juergen Kazmeier, Arnold Rudorfer	McGraw-Hill/Osborne Media,2009	Latest edition
5	Managing Software Requirements:A Use Case Approach,	Dean Leffingwell, Don Widrig	Pearson,2003	1st edition
6	Software Architecture: A CaseBased Approach	VasudevVerma	Pearson,2009	1st edition
7	SOFTWARE TESTING Principles and Practices,	Srinivasan Desikan, Gopalaswamy Ramesh	Pearson,2006	1st edition,

Mapping of Course Outcomes with POs and PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	2	1	1	-	-	-	2	-	1	1	2	3
CO2	3	2	2	1	1	-	-	-	2	-	1	1	2	3
CO3	3	2	2	1	1	-	-	-	2	-	1	1	2	3
CO4	3	2	2	1	1	-	-	-	2	-	1	1	2	3
CO5	3	2	2	1	1	-	-	-	2	-	1	1	2	3
CO6	3	2	2	1	1	-	-	-	2	-	1	1	2	3

Title	BUILDING ENTERPRISE APPLICATIONS (Practical)		Credits	1
Code	CS 852A	Semester: 8	L T P	0 0 3
Max. Marks	50	External: Nil Internal: - 50	Course Type	Program Elective(PE)
Pre-requisites			Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Design and Develop Key fundamental concepts of Enterprise applications. 2. Familiarize with concept of Business Process Modeling and its implementation. 3. Design and document the application architecture, application framework and other application components. 4. Construct and develop different solution layers by understanding the design. 5. Perform Code review, Code analysis, build process to design Enterprise applications. 6.Test and roll out the enterprise applications in real environment.			
Note for Examiner	Teacher is supposed to do continuous evaluation of the student throughout the semester. The evaluation will be based on the experiments conducted in the lab by the student. The teacher may schedule multiple practical tests and multiple viva voce examinations to evaluate the students continuously. Students are supposed to maintain laboratory files for the experiments conducted.			

SYLLABUS

Mapping of Course Outcomes with POs and PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	2	1	1	-	-	-	2	-	1	1	2	3
CO2	3	2	2	1	1	-	-	-	2	-	1	1	2	3
CO3	3	2	2	1	1	-	-	-	2	-	1	1	2	3
CO4	3	2	2	1	1	-	-	-	2	-	1	1	2	3
CO5	3	2	2	1	1	-	-	-	2	-	1	1	2	3
CO6	3	2	2	1	1	-	-	-	2	-	1	1	2	3

Title	BLOCK CHAIN TECHNOLOGIES		Credit	3
Code	CS 802B	Semester: 8	L T P	3 0 0
Max. Marks	100	Internal: - 50 External: - 50	Course Type	Program Elective(PE)
Pre-requisites			Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Explain the fundamental characteristics of blockchain. 2. Demonstrate the application of hashing and public key cryptography in protecting the blockchain 3. Explain the elements of trust in a Blockchain: validation, verification, and consensus. 4. Perform a transaction on different test nets. 5. Develop smart contracts in Ethereum framework. 6. Exploit applications of Blockchain in real world sceneries.			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
Blockchain Overview: Introduction, Basic Concepts, Evolution, Possibilities, Challenges and Future prospects.	8
Blockchain in Depth: Building Blocks of Blockchain technology, Cryptography in Blockchain, Distributed Consensus, Forking in Blockchain, Smart Contracts, Crypto Assets and Wallets	12
Blockchain for Enterprises: Introduction to Enterprise Blockchain, Enterprise Blockchain Architecture, Enterprise Blockchain Platform	8
SECTION-B	
Introduction to Ethereum Blockchain: Ethereum Basics, Solidity Smart Contract Programming for Ethereum Blockchain, Creating a Dapp on Ethereum Blockchain	12
Emerging Applications of Blockchain in industry Central Bank Digital Currency (CBDC), Regulatory Discussions, Emerging Risks, Metaverse, etc.	5

Suggested Books

S. No.	Title	Authors	Publisher	Edition/ Year
1	Blockchain Revolution	Don and Alex Tapscott	Pearson,	Latest Edition
2	Infosys Springboard	https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01255779688268595211_shared/overview		

Mapping of Course Outcomes with POs and

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2

PSOs	**CO1**	2	2	2	2	2	-	-	1	2	1	-	2	1	1
	CO2	2	2	2	2	2	-	-	1	2	1	1	2	1	1
	CO3	1	2	2	1	2	-	-	1	2	1	1	2	1	1
	CO4	1	2	2	2	2	-	-	1	2	1	2	2	2	2
	CO5	1	2	2	2	2	-	-	1	2	1	1	2	1	1
	CO6	1	2	2	2	2	-	-	1	2	1	1	2	1	1

Title	BLOCK CHAIN TECHNOLOGIES (PRACTICAL)		Credits	1
Code	CS 852B	Semester: 8	L T P	0 0 3
Max. Marks	50	External: Nil Internal: - 50	Course Type	Program Elective(PE)
Pre-requisites	Basics of Cybersecurity and cryptography		Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Explain the fundamental characteristics of blockchain. 2. Demonstrate the application of hashing and public key cryptography in protecting the blockchain 3. Explain the elements of trust in a Blockchain: validation, verification, and consensus. 4. Perform a transaction on different test nets. 5. Develop smart contracts in Ethereum framework 6. Exploit applications of Blockchain in real world sceneries			
Note for Examiner	Teacher is supposed to do continuous evaluation of the student throughout the semester. The evaluation will be based on the experiments conducted in the lab by the student. The teacher may schedule multiple practical tests and multiple viva voce examinations to evaluate the students continuously. Students are supposed to maintain laboratory files for the experiments conducted.			

SYLLABUS

Practicals based on use, design of block chain technologies**.**

Mapping of Course Outcomes with POs and PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	2	2	2	-	-	1	2	1	-	2	1	1
CO2	2	2	2	2	2	-	-	1	2	1	1	2	1	1
CO3	1	2	2	1	2	-	-	1	2	1	1	2	1	1
CO4	1	2	2	2	2	-	-	1	2	1	2	2	2	2
CO5	1	2	2	2	2	-	-	1	2	1	1	2	1	1
CO6	1	2	2	2	2	-	-	1	2	1	1	2	1	1

Title	HUMAN COMPUTER INTERACTION		Credit	3
Code	CS 802C	Semester: 8	L T P	3 0 0
Max. Marks	100	Internal: - 50 External: - 50	Course Type	Program Elective(PE)
Pre-requisites			Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Learn the basics of human and computational abilities and limitations. 2. Understand the working of the interface between the human and systems. 3. Analyze basic theories, tools and techniques in HCI. 4. Designing and evaluating the fundamental aspects of interfaces. 5. Implement a variety of simple methods for evaluating the quality of a user interface. 6. Apply appropriate HCI techniques to design systems that are usable by people.			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
Introduction to Human-Computer Interaction. Psychology of everyday things: psychopathology of everyday things, examples, concepts for designing everyday things	3
User-centred design and prototyping: assumptions, participatory design, methods for involving the user prototyping, low fidelity prototypes, medium fidelity prototypes, wizard of Oz examples	5
Task-centered system design: task-centered process, development of task examples, evaluation of designs through a task-centered walk-through	5
Methods for evaluation of interfaces with users: goals of evaluation, approaches, ethics, introspection, extracting the conceptual model, direct observation, constructive interaction, interviews and questionnaires, continuous evaluation via user feedback and field studies, choosing an evaluation method.	10
SECTION-B	
Beyond screen design: characteristics of good representations, information visualization, Tufte's guidelines, visual variables, metaphors, direct manipulation. Graphical screen design: graphical design concepts, components of visible language, graphical design by grids	10
Design principles and usability heuristics: design principles, principles to support usability, golden rules and heuristics, HCI patterns. HCI design standards: process-oriented standards, product-oriented standards, strengths and limitations of HCI Standards	10
Past and future of HCI: the past, present and future, perceptual interfaces, context-awareness and perception	2

Suggested Books				
S. No.	**Title**	**Authors**	**Publisher**	**Edition/ Year**
1	Human-Computer Interaction	Dix A. et al.	Harlow,England: Prentice Hall, 2004.	Latest Edition
2	Interaction Design: Beyond Human Computer Interaction	Yvonne Rogers, HelenSharp, Jenny Preece	Wiley,2011	3rd Edition

Mapping of Course Outcomes with POs and PSOs

COs	**Pos**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	2	2	2	2	2	1	1	1	2	2	2	2	3	1
CO2	2	2	3	2	2	1	1	1	2	2	2	2	3	1
CO3	2	2	3	2	2	1	1	1	2	2	2	2	3	1
CO4	2	2	2	2	2	1	1	1	2	2	2	2	3	1
CO5	1	2	2	2	2	1	1	1	2	2	2	2	3	1
CO6	1	2	2	2	2	1	1	1	2	2	2	2	3	1

Title	HUMAN COMPUTER INTERACTION(PRACTICAL)		Credits	1
Code	CS 852C	Semester: 8	L T P	0 0 3
Max. Marks	50	External: Nil Internal: - 50	Course Type	Program Elective(PE)
Pre-requisites			Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Understand the basics of human and computational abilities and limitations. Analyze basic theories, tools and techniques in HCI. Designing and evaluating interfaces. Practice a variety of simple methods for evaluating the quality of a user intApply appropriate HCI techniques to design systems that are usable by people. Apply course content in coping with real life situations.			
Note for Examiner	Teacher is supposed to do continuous evaluation of the student throughout the semester. The evaluation will be based on the experiments conducted in the lab by the student. The teacher may schedule multiple practical tests and multiple viva voce examinations to evaluate the students continuously. Students are supposed to maintain laboratory files for the experiments conducted.			

SYLLABUS

Practical based on Human Computer Interaction

Mapping of Course Outcomes with POs and PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	1	1	2	1	1	-	-	-	-	1	1	1
CO2	2	2	3	1	2	1	-	-	-	-	1	-	1	2
CO3	2	1	3	2	2	-	1	2	2	1	1	-	1	2
CO4	-	1	1	1	2	1	1	1	1	-	-	1	2	2
CO5	1	2	2	2	2	2	1	1	-	1	2	3	3	1
CO6	1	2	2	3	2	2	1	1	1	2	3	2	3	1

Title	DISTRIBUTED COMPUTING		Credits	3
Code	CS 802D	Semester: 8	L T P	3 0 0
Max. Marks	100	Internal: - 50 External: - 50	Course Type	Program Elective(PE)
Pre-requisites	Operating Systems (CS 403), Data Communication and Networks (CS 501)		Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Differentiate between a distributed and a network system and understand how communication takes place in a distributed environment. 2. Understand the design principles in distributed systems and the architectures for distributed systems 3. Apply various distributed algorithms related to clock synchronization, concurrency control, deadlock detection, load balancing, voting. 4. Analyze the design and functioning of existing distributed systems and file systems. 5. Compare fault tolerance and recovery in distributed systems and algorithms for the same. 6. Formulation of distributed algorithms solving a specific problem in Distributed Computing Systems			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
Introduction to Distributed Systems-Definition of distributed systems, their objectives, types, architecture, self-management in distributed systems, introduction to XML, SOAP, service oriented architecture.	6
Communication-Interprocess communication, Remote Procedure Call (RPC), Remote Method Invocation (RMI), Remote Object Invocation, Message Oriented Communication.	6
Processes-Introduction to threads, threads in distributed and non-distributed systems, virtualization, networked user interfaces, client side software, design issues for servers, code migration.	6
Naming-General issues with respect to naming, flat naming, distributed hash tables, hierarchical approaches, structured naming, name spaces, name resolution, implementation of a name space, domain name system, X.500 name space, attribute based naming.	5
SECTION-B	
Security-Security threats, policies, and mechanisms, design issues, cryptography, secure channels, authentication using public key cryptography, message integrity and confidentiality, digital signatures, session keys, Kerberos, general issues in access control, firewalls.	6
Distributed Object-based Systems-Distributed objects, general architecture of an EJB server, global distributed shared objects, processes, object servers, communication, static vs. dynamic RMI, Java RMI, naming, CORBA object references.	6
Distributed File Systems-Architecture: client-server, cluster-based distributed file systems, symmetric architectures, communication, RPC in NFS, naming, Naming in NFS, synchronization, consistency and replication.	5
Distributed Web-based Systems-Architecture, traditional web-based systems, web services, processes, general organization of the Apache web server, web server clusters,	5

communication, hypertext transfer protocol, simple object access protocol, naming, replication for web hosting systems.	

Suggested Books				
S. No.	**Title**	**Authors**	**Publisher**	**Edition/ Year**
1	Distributed Systems- Principlesand Paradigms	Andrew S. Tanenbaum	PearsonEducation	2nd edition
2	Distributed Systems – Conceptsand Design	George Coulouris, JeanDollimore, Tim Kindberg	Pearson Education	4th edition
3	Distributed Systems and Networks	William Buchanan	McGraw-Hill	Latest Edition

Mapping of Course Outcomes with POs and PSOs

COs	**Pos**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	-	2	-	2	-	2	-	-	2	-	-	-	1	1
CO2	-	2	1	-	-	-	2	-	-	2	-	-	-	-
CO3	3	-	2	-	2	1	-	1	1	2	2	-	2	-
CO4	-	-	-	2	-	2	-	2	2	2	2	2	-	-
CO5	2	-	2	-	3	-	3	-	2	-	-	-	-	-
CO6	-	-	2	-	-	2	-	-	2	-	2	-	2	2

Title	DISTRIBUTED COMPUTING (Practical)		Credits	1
Code	CS 852D	Semester: 8	L T P	0 0 3
Max. Marks	50	External: Nil Internal: - 50	Course Type	Program Elective(PE)
Pre-requisites			Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Illustrate principles and importance of distributed operating system. 2. Formulate and evaluate a hypothesis by proposing, implementing and testing a project. 3. Understand the fundamental questions in parallel and distributed computing and analyze different solutions to these questions. 4. Compile different distributed algorithms over current distributed platforms 5. Apply various distributed algorithms related to clock synchronization, concurrency control, deadlock detection, load balancing, voting 6. Apply distributed computing techniques to solve real world problems and for decisions making.			
Note for Examiner	Teacher is supposed to do continuous evaluation of the student throughout the semester. The evaluation will be based on the experiments conducted in the lab by the student. The teacher may schedule multiple practical tests and multiple viva voce examinations to evaluate the students continuously. Students are supposed to maintain laboratory files for the experiments conducted.			

SYLLABUS

Practical based on Distributed Computing syllabus.

Mapping of Course Outcomes with POs and PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	-	3	2	2	-	2	-	2	-	2	-	-	-	-
CO2	2	2	1	2	-	2	-	-	1	-	-	-	2	2
CO3	-	2	-	2	-	-	1	2	-	2	2	-	2	-
CO4	-	-	2	-	-	1	-	-	2	-	2	-	2	-
CO5	2	-	3	-	2	1	-	1	-	1	-	-	-	-
CO6	2	1	1	2	1	2	1	2	3	2	2	3	1	1

Title	PATTERN RECOGNITION		Credits	3
Code	CS 802E	Semester: 8	L T P	3 0 0
Max. Marks	100	Internal: - 50 External: - 50	Course Type	Program Elective(PE)
Pre-requisites			Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Define the various techniques involved in pattern recognition. 2. Understand the various statistical principles and concepts which can be further applied for pattern Recognition. 3. Solve the problems that can be solved with the application of principles of Pattern Recognition 4. Apply the fundamental theory of different pattern recognition techniques 5. Design pattern recognition techniques to solve real world problems and for decisions making. 6. Visualizing and taking other considerations to decide on appropriate action.			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
INTRODUCTION - Basic concepts, Applications, Fundamental problems in pattern Recognition system design, Design concepts and methodologies, Examples of Automatic Pattern recognition systems, Simple pattern recognition model	4
DECISION AND DISTANCE FUNCTIONS - Linear and generalized decision functions, Pattern space and weight space, Geometrical properties, implementations of decision functions, Minimum-distance pattern classifications.	5
STATISTICAL DECISION MAKING - Introduction, Baye's theorem, Multiple features, Conditionally independent features, Decision boundaries, Unequal cost of error, estimation of error rates, the leaving-one-out-techniques, characteristic curves, estimating the composition of populations. Baye's classifier for normal patterns.	7
NON PARAMETRIC DECISION MAKING - Introduction, histogram, kernel and window estimation, nearest neighbour classification techniques. Adaptive decision boundaries, adaptive discriminate functions, Minimum squared error discriminate functions, choosing a decision making techniques.	6
SECTION-B	
CLUSTERING AND PARTITIONING - Hierarchical Clustering: Introduction, agglomerative clustering algorithm, the single-linkage, complete-linkage and average-linkage algorithm. Ward's method Partition clustering-Forg's algorithm, K-means's algorithm, Isodata algorithm.	6
PATTERN PREPROCESSING AND FEATURE SELECTION- Introduction, distance measures, clustering transformation and feature ordering, clustering in feature selection through entropy minimization, features selection through orthogonal expansion, binary feature selection.	7
SYNTACTIC PATTERN RECOGNITION - Introduction, concepts from formal language theory, formulation of syntactic pattern recognition problem, syntactic pattern description, recognition grammars, automata as pattern recognizers	7
APPLICATION OF PATTERN RECOGNITION - Application of pattern recognition	3

techniques in bio-metric, facial recognition, IRIS scan, Finger prints recognition, etc.

Suggested Books

S. No.	Title	Authors	Publisher	Edition/ Year
1	Pattern Recognition and Image Analysis	Earl Gose, Richard johnsonbaugh, Steve Jost	Prentice Hall of India,.Pvt Ltd, New Delhi, 1996	Latest Edition
2	Pattern Classification	Duda R.O., P.E.Hart& D.G Stork	J.WileyInc, 2001	2nd edition
3	Pattern Recognition: St	Robert Schalkoff	John wiley& sons , Inc, 1992	Latest Edition
4	Neural Networks for Pattern Recognition	Bishop C.M	Oxford University Press, 1995	Latest Edition

Mapping of Course Outcomes with POs and PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	-	2	1	1	2	2	1	3	1	2	2	3	1	1
CO2	1	1	2	2	1	3	2	2	-	2	1	2	1	2
CO3	2	1	2	2	1	2	1	-	1	2	1	2	2	2
CO4	-	-	2	1	-	-	-	1	1	2	1	2	1	2
CO5	2	1	2	-	-	2	2	-	2	2	2	2	2	1
CO6	1	2	1	1	2	1	1	1	2	1	1	2	1	2

Title	PATTERN RECOGNITION (Practical)		Credits	1
Code	CS 852E	Semester: 8	L T P	0 0 3
Max. Marks	50	External: Nil Internal: - 50	Course Type	Program Elective(PE)
Pre-requisites			Contact Hours	3

Course Outcomes

On completion of this course, a student will be able to

1. To Convert images or sounds or other inputs into signal data.
2. To study the various sensed objects and isolate them from the background.
3. To study the concepts related to Measuring objects properties that are useful for classification.
4. To examine and assign the sensed object to a category.
5. To develop and give human recognition intelligence to machines that are required in image processing technology.
6. To understand and take other considerations to decide on appropriate action

Note for Examiner

Teacher is supposed to do continuous evaluation of the student throughout the semester. The evaluation will be based on the experiments conducted in the lab by the student. The teacher may schedule multiple practical tests and multiple viva voce examinations to evaluate the students continuously. Students are supposed to maintain laboratory files for the experiments conducted.

SYLLABUS

Practical based on Pattern Recognition syllabus.

Mapping of Course Outcomes with POs and PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	3	2	3	1	2	1	2	1	2	2	2	1	2
CO2	1	2	1	2	3	1	1	1	2	1	2	-	2	2
CO3	2	1	2	3	1	2	2	2	2	1	1	2	1	1
CO4	2	1	3	1	2	3	1	2	2	1	2	1	1	2
CO5	1	2	3	2	1	1	1	1	2	2	1	2	2	2
CO6	1	2	2	1	2	2	1	1	1	1	2	1	1	2

Title	NETWORK SCIENCE: STRUCTURAL ANALYSIS AND VISUALIZATION		Credits	3
Code	CS 803A	Semester: 8	L T P	3 0 0
Max. Marks	100	Internal: - 50 External: - 50	Course Type	Program Elective(PE)
Pre-requisites	Data Structures (CS 301), Analysis and Design of Algorithms (CS 401)		Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Recognise Fundamentals necessary for Network Science 2. Illustrate Network Science with respect to Link Analysis and Prediction 3. Employ Network Science in modeling social phenomena 4. Simulate diffusion on networks under various epidemiological models. 5. Introduce diffusion of innovation and influence maximization. 6. Constructing applications by understanding the network design			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
Introduction to graph theory and network science: Review of Graph theory and Notations, Introduction to the complex network theory, Network properties and metrics; Power laws: Power law distribution, Scale-free networks, Pareto distribution, normalization, moments. Zipf law, Rank-frequency plot.	5
Random graphs: Erdos-Reni random graph model. Poisson and Bernoulli distributions, Distribution of node degrees, Phase transition, gigantic connected component. Diameter and cluster coefficient. Configuration model.	5
Centrality measures: Node centrality metrics, degree centrality, closeness centrality, betweenness centrality, eigenvector centrality. Katz status index and Bonacich centrality, alpha centrality Spearman rho and Kendall-Tau ranking distance.	5
Link analysis and Prediction: Directed graphs. PageRank, Perron-Frobenius theorem and algorithm convergence. Power iterations. Hubs and Authorities. HITS algorithm. Link prediction problem, Proximity measures, scoring algorithms, Prediction by supervised learning, Performance evaluation	10
SECTION-B	
Diffusion on networks: Random walks on graph, Stationary distribution, Physical diffusion, Diffusion equation, Diffusion on networks, Discrete Laplace operator, Laplace matrix, Solution of the diffusion equation, Normalized Laplacian.	5
Epidemics: Epidemic models: SI, SIS, SIR, limiting cases, Basic reproduction number, Branching Galton-Watson process, Probability of epidemics**.** Spread of epidemics on network, SI, SIS, SIR models, Epidemic threshold, Simulations of infection propagation.	10
Social contagion and spread of information: Information diffusion. Rumor spreading models. Homogenous and mean field models.Examples.Cascades and information propagation trees.	3
Diffusion of innovation and influence maximization: Diffusion of innovation, Independent cascade model, Linear threshold model, Influence maximization, Sub-modular functions. Finding most influential nodes in networks.	2

Suggested Books				
S. No.	**Title**	**Authors**	**Publisher**	**Edition/ Year**
1	Networks: An Introduction	Mark Newman	Oxford University Press, 2010	Latest Edition
2	Social and Economic Networks	Matthew O. Jackson	Princeton University Press, 2010	Latest Edition
3	Networks, Crowds, and Markets:Reasoning About a Highly Connected World.	David Easley and John Kleinberg	Cambridge University Press, 2010	Latest Edition
4	Social Network Analysis. Methodsand Applications.	Stanley Wasserman and Katherine Faust	Cambridge University Press,2010	Latest Edition
5	The Structure and Dynamics of Networks	Eds.M. Newman, A.-L. Barabasi, D. Watts	Princeton University Press, 2006	Latest Edition
6	Network Analysis	Eds. UlrikBrandes, Thomas Erlebach	Lecture Notes in Computer Science, Springer, 2005	Latest Edition
7	Social Network Data Analysis	Ed. Charu C. Aggarwal	Springer, 2011	Latest Edition

Mapping of Course Outcomes with POs and PSOs

COs	**Pos**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	-	1	-	1	-	-	-	-	-	-	-	-	1	1
CO2	-	1	-	1	-	-	-	-	-	-	-	-	1	1
CO3	2	-	2	-	2	-	-	-	-	-	-	-	1	1
CO4	2	-	2	-	2	-	-	-	-	-	-	-	1	1
CO5	-	1	-	1	-	-	-	-	-	-	-	-	1	1
CO6	-	1	1	2	1	1	2	1	-	-	1	-	2	2

Title	NETWORK SCIENCE: STRUCTURAL ANALYSIS AND VISUALIZATION(Practical)		Credits	1
Code	CS 853A	Semester:8	L T P	0 0 3
Max. Marks	50	External: Nil Internal: - 50	Course Type	Program Elective(PE)
Pre-requisites			Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Evaluate various Network related measures and analysis. 2. Apply Epidemic models in relation to large networks. 3. Demonstrate Contagion spread over the social networks. 4. Implement Link Analysis and Prediction, 5. Execute diffusion on networks using various epidemiological models. 6. To construct applications by understanding the network design.			
Note for Examiner	Teacher is supposed to do continuous evaluation of the student throughout the semester. The evaluation will be based on the experiments conducted in the lab by the student. The teacher may schedule multiple practical tests and multiple viva voce examinations to evaluate the students continuously. Students are supposed to maintain laboratory files for the experiments conducted.			

SYLLABUS

Practical based on Network Science: Structural Analysis and Visualization syllabus.

Mapping of Course Outcomes with POs and PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	-	1	-	1	-	-	-	-	-	-	-	-	1	1
CO2	2	-	2	-	2	-	-	-	-	-	-	-	1	1
CO3	-	1	-	1	-	-	-	-	-	-	-	-	1	1
CO4	2	-	2	-	2	-	-	-	-	-	-	-	1	1
CO5	2	1	2	1	2	-	-	-	-	-	-	-	1	1
CO6	1	2	1	1	1	-	1	-	1	-	1	-	1	1

Title	ADVANCE DATABASE SYSTEMS		Credits	3
Code	CS 803B	Semester: 8	L T P	3 0 0
Max. Marks	100	Internal: - 50 External: - 50	Course Type	Program Elective(PE)
Pre-requisites	Database Systems (CS 302)		Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Recall various Database concepts with discovery of advanced strategies for Transaction processing, Concurrency control, Recovery management and Query Processing. 2. Understand Object Oriented and Distributed databases. 3. Analyze significance of Data warehousing, Data mining, OLAP and OLTP. 4. Examine various Case studies like Oracle, Sql server, DB2, MySql etc. 5. Visualize role of Data mining, OLAP, OLTP in databases and their implementation strategies. 6. Familiarizing with Object oriented databases and their significance.			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
Introduction to Database Systems: Database System Concepts and Architecture, Data Models, Data Independence, SQL: DDL, DML, DCL, Normalization: 1NF, 2NF, 3NF, BCNF, 4NF, 5NF.	6
Query Processing and Optimization: Query Processing, Syntax Analyzer, Query Decomposition, Query Optimization, Heuristic Query Optimization, Cost Estimation, Cost Functions for Select, Join, Query Evaluation Plans.	6
Transaction Processing and Concurrency Control: Transaction Processing Concepts, Concurrency Control Techniques: Two-phase Locking, Timestamp Ordering, Multiversion, Validation, Multiple Granularity Locking.	5
Object Oriented and Object Relational Databases: Object Oriented Concepts, Object Oriented Data Model, Object Definition Language, Object Query Language, Object Relational Systems, SQL3, ORDBMS Design.	5
SECTION-B	
Distributed Databases: Distributed Database Concepts, Advantages and Disadvantages, Types of Distributed Database Systems, Data Fragmentation, Replication and Allocation Techniques for Distributed Database Design, Five Level Schema Architecture, Query Processing, Concurrency Control and Recovery in Distributed Databases.	6
Backup and Recovery: Types of Database Failures, Types of Database Recovery, Recovery Techniques: Deferred Update, Immediate Update, Shadow Paging, Checkpoints, Buffer Management.	5
Introduction to Data Warehousing and Data Mining: Introduction to OLAP, OLTP, Data Warehouse, Data Marts, Data Mining, Data Mining Process.	5
Commercial Databases: Commercial Database Products, Familiarity with IBM DB2 Universal Database, Oracle,	7

Microsoft SQL Server, MySql, their features.

Suggested Books

S. No.	Title	Authors	Publisher	Edition/ Year
1	Fundamentals of Database Systems	RamezElmasri, ShamkantNavathe	PearsonEducation, 2007	5th edition
2	Database Management Systems,	Raghu Ramakrishnan, Johannes Gehrke	Tata McGraw-Hill	Latest Edition
3	An Introduction to DatabaseSystems	C.J. Date	PearsonEducation	8th edition
4	Database Management Systems	Alexis Leon,Mathews Leon	Leon Press	Latest Edition
5	Database System Concepts	Abraham Silberschatz, Henry F. Korth,S. Sudarshan	Tata McGraw-Hill	Latest Edition
6	Database Systems Concepts,Design and Applications	S. K. Singh	Pearson Education	Latest Edition

Mapping of Course Outcomes with POs and PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	2	1	2	3	1	-	-	1	-	2	2	2	2
CO2	2	2	2	1	2	-	1	1	1	2	2	1	2	2
CO3	1	2	1	2	3	1	-	1	1	-	2	2	1	2
CO4	2	2	2	3	2	-	1	1	1	1	2	3	3	1
CO5	1	2	3	2	1	3	1	2	1	2	1	1	2	1
CO6	3	2	3	1	2	3	1	2	1	3	1	3	2	2

Title	ADVANCE DATABASE SYSTEMS(PRACTICAL)		Credits	1
Code	CS 853B	Semester: 8	L T P	0 0 3
Max. Marks	50	External: Nil Internal: - 50	Course Type	Program Elective(PE)
Pre-requisites	Database Systems (CS 302)		Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Learn to install various relational database systems 2. Analyze all types of SQL commands and create own workspace for implementation of commands 3. Develop programs and apply SQL/MySQL commands 4. Understand object oriented and advanced XML queries on database 5. Design/Manipulate data using MongoDB commands 6. Learn data mining tools like WEKA and perform data manipulation using WEKA			
Note for Examiner	Teacher is supposed to do continuous evaluation of the student throughout the semester. The evaluation will be based on the experiments conducted in the lab by the student. The teacher may schedule multiple practical tests and multiple viva voce examinations to evaluate the students continuously. Students are supposed to maintain laboratory files for the experiments conducted.			

SYLLABUS

List of Practical

1. Install and configure database system (SQL, MYSQL, MongoDB or any other relational database system)
2. Data Definition Language Commands
3. Data Manipulation Language Commands
4. Data Control Language, Transfer Control Language Commands
5. Nested Queries And Join Queries
6. Set of SQL Server
7. Views
8. Procedure and Function
9. Trigger
10. Implementation of locking protocols
11. Create database using XML attributes and elements
12. Design and develop MongoDB queries using basic operations
13. Implement aggregate queries using MongoDB
14. Install and configure any data mining tool like WEKA
15. Make use of installed data mining tool like WEKA

Mapping of Course Outcomes with POs and PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	1	1	1	1	1	1	1	1	1	3	3	1
CO2	1	3	2	1	1	1	2	2	1	1	1	1	3	2
CO3	1	1	3	1	1	3	1	3	2	1	1	1	2	1
CO4	2	2	1	1	2	1	3	1	2	1	1	1	2	1
CO5	1	1	3	1	2	2	1	1	2	1	1	1	3	2
CO6	3	2	1	1	3	1	1	1	1	1	1	1	3	1

Title	User Interface Technologies		Credits	3
Code	CS 803C	Semester: 8	L T P	3 0 0
Max. Marks	100	Internal: - 50 External: - 50	Course Type	Program Elective(PE)
Pre-requisites	Computer Basics, Procedural Programming Languages, HTML		Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Understand the core concepts and features of HTML5. 2. Analyse the qualities of a user interface design and relate it to fundamental interaction design theory. 3. Design static web pages using HTML5 and CSS3. 4. Apply the concept of client-side validation and develop dynamic web pages using JavaScript. 5. Apply Complete Bootstrap Implementation into any website. 6. Build real-world Angular applications on your own.			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
HTML5: Basics HTML Elements, Table elements, Form elements, Embedded elements, Security, Best Practices, Capstone Project.	6
CSS3: Introduction, Selectors, Cascading Order, Typography, Box Model, Transformation, Transitions, Animations, Responsive Web design, Security, Best Practces.	6
JavaScript: Getting started, Identifiers, Data types, Operators, Statements and expressions, Loops, Functions, Classes, Event handling, Objects, Iterables, Asynchronous Programming, Modular Programming, Capstone project.	7
SECTION-B	
Bootstrap: Introduction, Page layouts, UI components, forms, Responsive web design.	6
Typescript: Basics, Function, Interface, Class, Modules, and Namespace, Generics	8
Angular: Components and Modules, Templates, Directives, Data Binding, Pipes, Nested Components, Forms, Services, Routing, Capstone projects	12

Suggested Books

S. No.	Title	Authors	Publisher	Edition/ Year
1	Infosys Springboard	https://infyspringboard.onwingspan.com/web /en/app/toc/lex_auth_01255779688268595211_shared/overview		

Mapping of Course Outcomes with POs and PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	2	2	3	1	-	1	2	1	-	2	2	1
CO2	3	3	3	3	3	1	-	1	2	1	2	3	3	1

	CO3	3	3	3	3	3	1	-	1	3	2	2	2	3	1
	CO4	3	3	3	3	3	1	-	1	3	1	2	2	3	1
	CO5	3	3	3	3	3	1	-	1	2	1	2	2	3	1
	CO6	3	2	3	3	3	1	-	1	2	2	2	2	3	1

Title	USER INTERFACE TECHNOLOGIES(PRACTICAL)		Credits	1
Code	CS 853C	Semester: 7	L T P	0 0 3
Max. Marks	50	External: Nil Internal: - 50	Course Type	Program Elective(PE)
Pre-requisites	Computer Basics, Procedural Programming Languages, HTML		Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Understand the core concepts and features of HTML5. 2. Analyse the qualities of a user interface design and relate it to fundamental interaction design theory. 3. Design static web pages using HTML5 and CSS3. 4. Apply the concept of client-side validation and develop dynamic web pages using JavaScript. 5. Apply Complete Bootstrap Implementation into any website. 6. Build real-world Angular applications on your own.			
Note for Examiner	Teacher is supposed to do continuous evaluation of the student throughout the semester. The evaluation will be based on the experiments conducted in the lab by the student. The teacher may schedule multiple practical tests and multiple viva voce examinations to evaluate the students continuously. Students are supposed to maintain laboratory files for the experiments conducted.			

SYLLABUS

Practical based on User Interface Technologies syllabus

Mapping of Course Outcomes with POs and PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	2	2	3	1	-	1	2	1	-	2	2	1
CO2	3	3	3	3	3	1	-	1	2	1	2	3	3	1
CO3	3	3	3	3	3	1	-	1	3	2	2	2	3	1
CO4	3	3	3	3	3	1	-	1	3	1	2	2	3	1
CO5	3	3	3	3	3	1	-	1	2	1	2	2	3	1
CO6	3	2	3	3	3	1	-	1	2	2	2	2	3	1

Title	EXPERT SYSTEMS		Credits	3
Code	CS 803D	Semester: 8	L T P	3 0 0
Max. Marks	100	Internal: - 50 External: - 50	Course Type	Program Elective(PE)
Pre-requisites	Artificial Intelligence (CS 503); Soft Computing (CS 605B)		Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Understand current trends and advances in the discipline to the forefront so that they may be considered for possible use as solutions to appropriate problems. 2. Learn basics of expert systems and decision support systems. 3. Analyze the concepts central to the creation of knowledge bases and expert systems... 4. Articulate ES and DSS design, implementation approaches and tools 5. Design and develop their relationship to different applications in different businesses 6. Design small expert systems while building a base for advanced study.			
Note for Examiner	Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 marks each and is compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.			

SECTION-A	Hrs
Concepts and challenges; Various paradigms in expert systems; Rule-based systems; Bayesian networks	6
Knowledge representation and methods of inference	8
Probability in AI; Probability and conditional probability; Independence; Bayesian rules; Bayesian views (in comparison with frequentism and propensity interpretation); Utility theories and decision making	13
SECTION-B	
Bayesian Networks Inference in Bayesian Networks; Junction Tree Algorithms; Learning in Bayesian Networks	8
Decision Networks Knowledge Engineering with Bayesian Network; Applications of Bayesian Networks; Other formalisms of uncertainty reasoning: Default logic; Certainty factor; Dempster-Shafer theory; Fuzzy set	10

Suggested Books				
S. No.	**Title**	**Authors**	**Publisher**	**Edition/ Year**
1	Bayesian Artificial Intelligence	Kevin B. Korb and Ann E. Nicholson, Chapman and Hall	CRC Press, 2004	Latest Edition
2	Expert Systems: Principles andProgramming	Joseph C. Giarratano, Gary D. Riley	Thomson Course Technology	4th edition,
3	Artificial Intelligence: A ModernApproach	Stuart Russell, PeterNorvig	PrenticeHall	3rd edition
4	Bayesian Networks and DecisionGraphs	Finn B. Jensen, Thomas Graven-Nielsen	Springer	2nd edition

Mapping of Course Outcomes with POs and PSOs

COs	**Pos**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	-	-	-	-	-	-	1	-	1	1	1	1	2	1
CO2	1	2	1	2	1	1	1	-	-	1	1	2	3	2
CO3	1	2	1	1	1	-	1	-	-	-	-	1	1	2
CO4	-	-	1	1	2	1	2	1	2	1	-	-	3	1
CO5	1	2	3	1	3	2	1	-	2	1	3	2	3	1
CO6	1	2	1	1	2	1	2	1	-	2	1	-	3	1

Title	EXPERT SYSTEMS (Practical)		Credits	1
Code	CS 853D	Semester: 8	L T P	0 0 3
Max. Marks	50	External: Nil Internal: - 50	Course Type	Program Elective(PE)
Pre-requisites			Contact Hours	3
Course Outcomes	On completion of this course, a student will be able to 1. Implement an expert system. 2. Determine Inference mechanism for a given problem. 3. Determine knowledge representation for a given problem. 4. Analyze the construction phases of the database. 5. Compare the design patterns and explain which should be used for implementation.			
Note for Examiner	Teacher is supposed to do continuous evaluation of the student throughout the semester. The evaluation will be based on the experiments conducted in the lab by the student. The teacher may schedule multiple practical tests and multiple viva voce examinations to evaluate the students continuously. Students are supposed to maintain laboratory files for the experiments conducted.			

SYLLABUS

Practical based on Expert Systems syllabus.

Mapping of Course Outcomes with POs and PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	3	3	2	2	1	1	2	2	2	1	2	3	2
CO2	2	3	2	2	2	1	1	2	2	2	1	2	3	2
CO3	2	3	2	2	2	1	1	2	2	2	1	2	3	2
CO4	2	3	2	2	2	1	1	2	2	2	1	2	3	2
CO5	2	3	2	2	3	1	1	2	2	2	1	2	3	2
CO6	2	3	2	2	2	1	1	2	2	2	1	2	3	2

Title	Project-II		Credits	3
Code	CS 854	Semester: 8	L T P	0 0 6
Max. Marks	100	External: Nil Internal: - 100	Course Type	Project(PW)
Pre-requisites			Contact Hours	6
Course Outcomes	On completion of this course, a student will be able to 1. Apply the knowledge from previous semesters to undertake and solve a real-life problem 2. Illustrate the solution after identifying various objectives of the problem undertaken 3. Devise an organised action plan along with all the team members 4. Develop a solution using approrpriate methodology and tools available 5. Communicate and demonstrate the work through structured report and oral presentation			
Note for Examiner	Project Mentor is supposed to do continuous evaluation of the student throughout the semester. The evaluation will be based on the progress of the project undertaken in the lab by the student. The mentor may schedule multiple presentations to evaluate the students continuously. Students are supposed to have regular meetings and feedback from their mentors. The evaluation of the student will be On the basis of defined rubrics and will be evaluated through Semester presentations, working projects, project reports and viva voce			

SYLLABUS

The students will be required to submit working project demonstrating the acquired computer science and engineering skills.

Mapping of Course Outcomes with POs and PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	3	3	2	2	1	-	2	1	1	2	2	2
CO2	3	2	2	2	2	2	1	-	2	1	1	2	2	2
CO3	3	3	3	2	2	2	1	-	3	1	2	2	2	2
CO4	3	3	3	2	3	2	1	2	2	1	2	2	2	2
CO5	1	1	2	1	1	-	-	2	2	3	1	2	2	2

Title	Industrial Training		Credits	14
Code	CS 855	Semester: 8	L T P	
Max. Marks	500	External: 250 Internal: - 250	Course Type	Internships/ Seminars(IS)
Pre-requisites			Contact Hours	
Course Outcomes	On completion of this course, a student will be able to 1. Improve the knowledge and skills relevant to areas of Software Engineering, Computer Network & Data Science. 2. Relate, apply and adapt relevant knowledge, concepts and theories within an industrial organization, practice and ethics. 3. Acquire knowledge and skills to compete in the job market with this experience and exposure. 4. Write technical/training reports and give oral presentation related to the work completed			
Note for Examiner	On the basis of defined rubrics and to be evaluated through end mid and Semester presentations, working projects, project reports and viva voce			

SYLLABUS

It involves an internship work in a company/ research organization where the work is relevant to computer science.
The slot for completing the internship is after 7th semester.
The minimum duration of the internship should be 4-6 months.
For the internship to be credited, the department requires that the work assigned during the internship has sufficient components related to computer science subjects in it.
A rule of thumb is whether your internship work uses the skill-set that you developed through the course of your degree courses.
The students need to submit the internship certificate and details to the course coordinator in order to get the internship credited.
The students are also required to submit working project demonstrating the acquired skills.

Mapping of Course Outcomes with POs and PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	-	2	2	2	-	-	-	-	-	3	-	3	3
CO2	3	-	3	3	2	2	-	3	-	-	2	-	2	1
CO3	-	2	2	-	-	-	-	-	-	-	-	-	2	-
CO4	-	-	-	3	-	-	-	-	-	3	-	-	-	1