GNSU Handbook

of

B.Tech (Computer Science Engineering)

AY-2023-24

August-2023

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1.1	**1.1 Vision of the Faculty of Information Technology**
	To emerge as a leading destination in the field of Computer Science and Engineering education and research, by providing quality technical education to the aspiring students.
1.2	**Mission of the Faculty of Information Technology**
	1. To educate the students with state-of-the-art technologies to meet the current needs of the industry and society. 2. To inculcate ethical values, team spirit and leadership qualities among the students. 3. To create an environment that will encourage higher study and research.
2.1	**Program Educational Objectives (PEOs):** After 3-4 years of graduation, the students of the program will be able to:
	PEO1: Apply the knowledge acquired in the field of Computer Science and Engineering to provide solutions for various multidisciplinary engineering and societal challenges
	PEO2: Involve in life-long learning for sustainable development in the evolving technological domains.
	PEO3: Emerge as successful computer engineers, administrators, academicians and entrepreneurs through teamwork while maintaining ethical values. Program Outcomes and the Program Specific Outcomes are listed below-
2.2	**Program Outcomes (POs) -** Engineering Graduates will be able to:
	PO-1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
	PO-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.
	PO-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
	PO-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
	PO-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.
	PO-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.

	PO-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.
	PO-8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
	PO-9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
	PO-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.
	PO-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.
	PO-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.
2.3	**List of Program Specific Outcomes (PSOs):** After the completion of **B.Tech course in Computer Science and Engineering,** the students will be able to:
	PSO1: Attain the ability to design efficient algorithms for developing hardware and software based systems.
	PSO2: Apply standard software engineering approach and be able to use modern tools for solving real life problems.
	PSO3: Apply the acquired proficiency to become successful technocrats and entrepreneurs as well as engage in research work in emerging fields of Computer Science and Engineering.
3.1	**Teaching and Learning Process:** The whole process/system for Teaching and Learning Quality Improvement is shown in **Fig.1.1.** The Academic Calendar of the Faculty of Information Technology is based on Syllabus prescribed by the University. The calendar of events of the academic calendar incorporates various industrial visits, guest lectures, technical competitions and short-term courses. The calendar of events is incorporated in framing the Timetable.
3.2	**Teaching Learning Process- Flowchart**

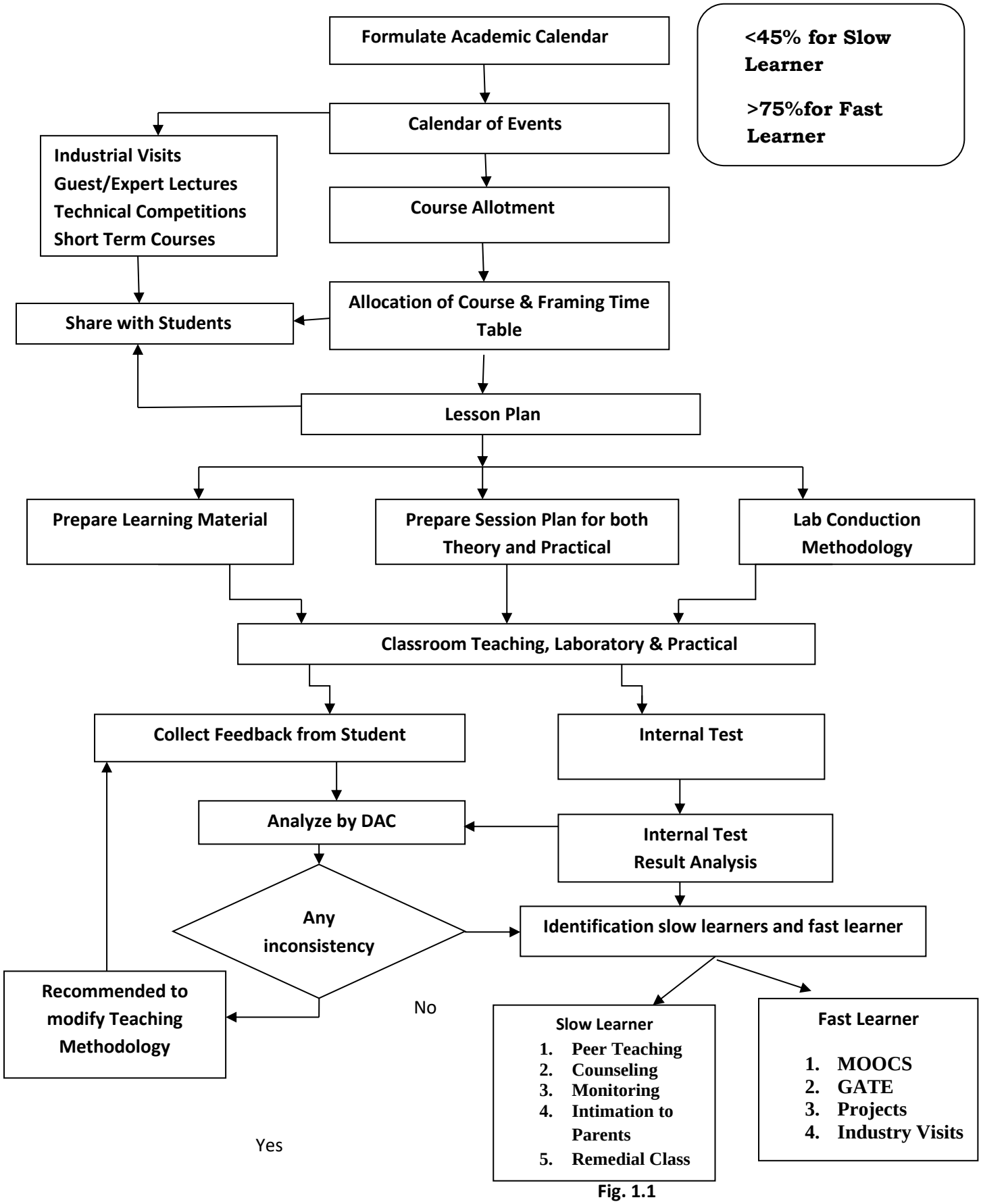
Formulate Academic Calendar
<45% for Slow Learner
>75%for Fast Learner
Calendar of Events
Industrial Visits
Guest/Expert Lectures
Technical Competitions
Short Term Courses
Course Allotment
Share with Students
Allocation of Course & Framing Time Table
Lesson Plan
Prepare Learning Material
Prepare Session Plan for both Theory and Practical
Lab Conduction Methodology
Classroom Teaching, Laboratory & Practical
Collect Feedback from Student
Internal Test
Analyze by DAC
Internal Test Result Analysis
Any inconsistency
Identification slow learners and fast learner
Recommended to modify Teaching Methodology
No
Yes
Slow Learner
1. Peer Teaching
2. Counseling
3. Monitoring
4. Intimation to Parents
5. Remedial Class
Fast Learner
1. MOOCS
2. GATE
3. Projects
4. Industry Visits

Fig. 1.1

The academic calendar events and time table are shared with the students. The faculty prepares the lesson plan for the allotted subject. For better delivery of teaching learning process, the faculty prepares the course plan and learning methodology for the allotted subject.

The faculty conducts the classes as per the lecture and course plan. Online feedback from the students are collected and analysed by the **Departmental Academic committee** (**DAC**). If any inconsistencies are found by DAC in the teaching learning process, the concerned faculty are advised to modify the teaching methodology and also attend Faculty development programmes.

Two internal assessments are conducted for a particular subject per semester. The attainment of COs are analysed for taking remedial actions. **Remedial actions** include identification of **slow, and fast learners.**

For the **slow learners (≤45% marks in class test)** the following methods of improvement are adopted- Peer teaching, Counselling, mentoring, intimation to parents and conducting extra classes.

Fast learners (>75% marks in class test) are motivated to continue the achieve excellency and they are encouraged to participate in co-curricular and extra-curricular activities.

4. **Gopal Narayan Singh University B.Tech Admission Rule regulation:** Gopal Narayan Singh University (GNSU) offers Bachelor of Technology (B.Tech) programme at the UG level with a few specializations. The program is offered in full time regular mode for 4 years. The Faculty of Information Technology accepts a lateral entry in the 2nd year.

Duration	**4 years – B.Tech, 3 Years – B.Tech Lateral**
Type	**Full time/Regular**
No. of specializations	**1**
Basic Eligibility Criteria	**10+2**
Medium of Instruction	**English**

Specializations

- Computer Science and Engineering

Eligibility Criteria-

B.Tech (CSE)- 4 Years

Passed 10+2 examination with Physics & Mathematics-For remaining single course select any courses out of 12 # Chemistry/ Computer Science/ Electronics/ Information Technology/ Biology/ Informatics Practices/Biotechnology/ Technical Vocational subject/ Agriculture/Engineering Graphics/ Business Studies/ Entrepreneurship.

Obtained at least 45% marks (40% marks in case of candidates belonging to reserved category) in the abovesubjects taken together.

OR

Passed D.Voc. Stream in the same or allied sector.

(The Universities will offer suitable bridge courses such as Mathematics, Physics, Engineering drawing, etc., for

the students coming from diverse backgrounds to prepare Level playing field and desired learning outcomes of the programme)

B.Tech (CSE)-3years
(Lateral Entry toSecond year)

Passed Minimum THREE years / TWO years (Lateral Entry) Diploma examination with at least 45% marks (40% marks in case of candidates belonging to reserved category) in ANY branch of Engineering and Technology.

OR

Passed B.Sc. Degree from a recognized University as defined by UGC, with at least 45% marks (40% marksin case of candidates belonging to reserved category) and passed 10+2 examination with Mathematics as asubject.

OR

Passed B.Voc/3-year D.Voc. Stream in the same or allied sector.

(Suitable bridge courses such as Mathematics, Physics, Engineering drawing, etc., for the students coming from diverse backgrounds to achieve desired learning outcomes of the programme will be offered by the University)

Selection Criteria

Admission to all courses will be made in the Autumn Semester of each session, at the First Year level, through the JEE (Mains) conducted by National Test Agency (NTA) or as approved by MoE (Shiksha Mantralaya), Govt. of India or GET(GNSU Entrance Test) or BCECE for admission to B. Tech. Candidate not below the age of 17 year and more than 25 years on 31st July of the admission year. 5 % relaxation in the minimum marks will be provided to the candidate belongs to the SC/ST/OBC and disable candidates.

Admission of NRI and their Reservations

Reservations and admissions to **NRI / Foreign Students / Persons of Indian Origin (PIO) / Children of Indian Workers in the Gulf Countries and Management / InstitutePreference** Quota shall as per the policy laid down by Central government / State government of Bihar. The reservations for SC / ST / OBC (excluding creamy layer) /Minority communities shall be as per the policy laid down by Central government / State government of Bihar.

Intake

Specialization	Intake
Computer Science and Engineering	120

Documents Required

- Scanned copies of academic details.
- Scanned passport size photograph of the candidate in JPG/JPEG format
- Scanned clear signature of the candidate in JPG/JPEG format
- A valid e-mail ID.
- Scanned copies of Category certificate, PwD certificate, if applicable.
- Migration certificate
- Transfer certificate
- Character certificate

**Other documents if any

Academic Calendar - Each academic session is divided into two semesters of approximately an Odd semester (July- December) and Even semester (January-May).

B.Tech (CSE) and B.Tech (CSE with Hons.) guidelines:

5.	Bachelor of Technology (CSE) programme has **160 credits** in the entire programme of **B.Tech 4 years**, and **additional 20 credits** will be required to be achieved through **Massive Open Online Courses (MOOCs)** from different platform for the degree of **B. Tech (CSE) with Honours**. These additional 20 credits will have to be acquired with online courses (MOOCs) as per AICTE. **Students of B Tech (CSE) program will have to complete additional 20 credits through MOOCs within 4 years of time**. 16 credit points is applicable for 3 year UG programs. This creates an excellent opportunity for students to acquire the necessary additional skill set for employability through massive open online courses where the rare expertise of world famous experts from academics and industry are available. **Gopal Narayan Singh University, Jamuhar, Bihar** has thus decided to introduce AICTE model curriculum for its B.Tech Programmes and allow students to choose courses from any established online platform as per following revised guidelines from **academic year 2023-24.** MOOCs for **B.Tech Honours Degree**: For B.Tech Honours Degree, a **B.Tech student will have to earn 20 credits from MOOCs** from any established MOOCs platform **addition to 160 credits for B.Tech degree.** The total of **20 credits** that is required to attain **eligibility for B.Tech Honours degree** is distributed over four years in the following way: **1st year: 4-8 credits** **2nd year: 4-8 credits** **3rd year: 4-8 credits** **4th year: 4 credits** **A student of first year has to cover courses from at least three skills:** **1. Computer Programing with Python /R** **2. Soft-Skill** **3. Ethics** Students of B.Tech streams are to be equipped with Programming skill in the language that is in high demand worldwide in the first year itself so that they can apply this skill in the subsequent semesters in their different areas including their core area of study. Soft skill is very essential for grooming of the student and student must be exposed to it in the very beginning of the 4 year long program. Ethics is something that one should practice. Students are to be made aware of the ethics right in the beginning of the 4 year long program so that they can practice at least some of the ethical norms as applicable to Institutional environment and society, and be prepared to practice ethics in their working life. During choosing courses in the online platform students would essentially avoid the courses taught/offered through the curriculum in the offline / class room mode. **For NPTEL/Swayam platform:** Credit points as specified in the platform to be considered.
6.	**Industry Ready courses in curriculum- IT Workshop and Skilling**
	The courses which make the students Industry ready has been incorporated in regular BTECH CSE curriculum. **IT Workshop & Skilling -1,2 has been incorporated in 4th and 6th Semester Engineering curriculum.** These courses will be conducted during **Summer breaks.** Skilled instructors from Industry will be conducting these courses to make the students Industry Ready. After the completion of the courses the students may be motivated to appear for different **certification programs by Oracle, Microsoft etc** which will ultimately lead to **better placements.** **Tentative Skills that may be required by the Industry** – IT Java Script, Java, Rust, ReactJS, NumPy and Pandas, Kotlin, Django, Angular JS Front End Skills, Java Full Stack, Python, Snowflake, Cybersecurity,

Cloud Native development such as Kubernetes, Microservices, Blockchain development, Docker and Containerisation, Azure ML, RPA, Edge Computing, Data Architect, Data Scientist and Analytics skills. The skills which are required by the industry need to be updated as per requirements.

7. General Course Structure and Theme-

Definition of Credit:

1 Hr. Lecture (L) per week	1 Credit
1 Hr. Tutorial (T) per week	1 Credit
1 Hr. Practical (P) per week	0.5 Credit
2 Hours Practical (P) per week	1 Credit

7.2. Range of Credits: **Gopal Narayan Singh University** Graduatedegree program in Engineering has about 160 credits, the total number of credits proposed for the four-year B. Tech in Computer Science and Engineering & Technology is kept as **160**.

B.Tech Hons. in Computer Science and Engineering & Technology Degree will be granted if **180** credits are acquired as discussed in section 5

7.3.Structure of UG Program in CSE: The structure of UG program in Computer Science and Engineering have the following categories of courses with the breakup of credits as given:

S.No.	Category	Credit Breakup for CSE students
1	Humanities and Social Sciences including Management courses	19
2	Basic Science courses	22
3	Engineering Science courses including workshop, drawing, basicsof electrical/mechanical/computer etc.	24
4	Professional core courses	56
5	Professional Elective courses relevant to chosen specialization/branch	14
6	Open subjects – Electives from other technical and /or emerging subjects	9
7	Project work, seminar and internship in industry or elsewhere	16
8	Mandatory Courses [Environmental Sciences, Induction Program, Indian Constitution, Essence of Indian Knowledge Tradition]	(non-credit)
	Total	**160**

7.4. Course Code and Definition:

Course code	Definitions
L	Lecture
T	Tutorial
P	Practical
C	Credits
BSC	Basic Science Courses

ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences including Management courses
PCC-CS	Professional core courses
PEC -CS	Professional Elective courses
OEC-CS	Open Elective courses
LC	Laboratory course
MC	Mandatory courses

7.5. **Mandatory Induction Program:** The Essence and Details of Induction program can also be understood from the 'Detailed Guide on Student Induction program', as available on AICTE Portal, (Link: https://www.aicteindia.org/sites/default/files/Detailed%20Guide%20on%20Student%20Induction%20program.pdf).

Induction program (mandatory)	**Three-week duration**
Induction program for students to be offered right at the start ofthe first year.	• Physical activity • Creative Arts • Universal Human Values • Literary • Proficiency Modules • Lectures by Eminent People • Visits to local Areas • Familiarization to Dept./Branch & Innovations

8. **B.Tech CSE Professional Core, Professional Electives and Open Elective**

- **Course level coding scheme:** Three-digit number (odd numbers are for the odd semester courses and even numbers are for even semester courses) used as suffix withthe Course Code for identifying the level of the course. Digit at hundred's place signifiesthe year in which course is offered.

  e.g. 101, 102 … etc. for first year. 201, 202 …. Etc. for second year.301, 302 … for third year.

  Sessional (Project, Seminar, etc) e.g. PCC-CS-681..i.e 6-Sixth Sem,8-Sessional, 1- sequence.

  Laboratory- PCC-CS-691.. ..i.e 6-Sixth Sem,9-Laboratory, 1- sequence

Total credit for BTECH-CSE to be awarded- 160

- **Category-wise Courses**

HUMANITIES & SOCIAL SCIENCES COURSES including MANAGEMENT COURSES[HS]						
	Code	**Name**	**L**	**T**	**P**	**Credits**
1	HSMC-201	English	2	0	0	2
2	HSMC-291	**English Language Laboratory-I**	0	0	4	2
3	HSMC-301	Economics for Engineers	3	0	0	3
4	HSMC-391	**English Language Laboratory-II**	0	0	4	2
5	HSMC-401	Introduction to Innovation, IP & Entrepreneurship	2	0	0	2
6	HSMC-701	Financial & Cost Accounting	2	0	0	2
7	HSMC-702	Human Resource Management	2	0	0	2
8	HSMC-791	**English Language Laboratory-III**	0	0	4	2
9	HSMC-801	Industrial Management	2	0	0	2
Total Credits in HSMC						**19**
BASIC SCIENCE COURSE [BSC]						
1	BSC-101	Physics/Chemistry-I Gr.A or Gr.B	3	1	0	4
2	BSC-102	Mathematics-I	3	1	0	4
3	BSC-191	Physics/ Chemistry Gr.A or Gr.B	0	0	2	1
4	BSC-201	Physics/Chemistry-I Gr.A or Gr.B	3	1	0	4
5	BSC-202	Mathematics-II	3	1	0	4
6	BSC-291	Physics/ Chemistry Gr.A or Gr.B	0	0	2	1
7	BSC-301	Computational Statistics	3	1	0	4
Total Credits in Basic Science						**22**
ENGINEERING SCIENCE COURSE [ESC]						
1	ESC-101	Basic Electrical Engineering	3	1	0	4
2	ESC-191	Basic Electrical Engineering Lab	0	0	2	1
3	ESC-192	Engineering Graphics & Design/ Workshop Practice-Gr.A or Gr.B	0	1	4	3
4	ESC-201	Programming in C	3	1	0	4
5	ESC-291	**Programming in C Laboratory**	0	0	4	2
6	ESC-292	Engineering Graphics & Design/ Workshop Practice Gr.A or Gr.B	0	1	4	3
7	ESC-301	Digital Electronics	3	0	0	3
8	ESC-391	**Digital Electronics laboratory**	0	0	2	1
9	ESC-501	Software Engineering	3	0	0	3
Total Credits in Engineering Sciences						**24**
Professional Core						
1	PCC-CS-301	**Data Structure & Algorithms using C**	3	0	0	3
2	PCC-CS-302	Discrete Mathematics	3	1	0	4
3	PCC-CS-391	**Data Structure & Algorithms using C Lab**	0	0	4	2

4	PCC-CS-401	Formal Language & Automata Theory	2	1	0	3
5	PCC-CS-402	**OOPs using C++**	2	1	0	3
6	PCC-CS-403	Computer Architecture & Organization	3	0	0	3
7	PCC-CS-404	Operating Systems	3	0	0	3
8	PCC-CS-491	**IT Workshop & Skilling -1**	0	0	12	6
9	PCC-CS-492	**OOPs using C++ Laboratory**	0	0	4	2
10	PCC-CS-494	Operating Systems Laboratory	0	0	2	1
11	PCC-CS-501	Computer Networks	3	0	0	3
12	PCC-CS-502	Data Base Management Systems	3	0	0	3
13	PCC-CS-503	**Machine Learning**	3	0	0	3
14	PCC-CS-591	**Computer Networks Laboratory**	0	0	2	1
15	PCC-CS-592	**DBMS Laboratory**	0	0	4	2
16	PCC-CS-593	**Machine Learning using Python Laboratory**	0	0	4	2
17	PCC-CS-601	Design & Analysis ofAlgorithms	3	0	0	3
18	PCC-CS-602	**Web Technology**	2	1	0	3
19	PCC-CS-691	Design Analysis & Algorithm Laboratory	0	0	2	1
20	PCC-CS-692	**Web Technology Laboratory**	0	0	2	1
21	PCC-CS-693	**IT Workshop & Skilling -2/Minor Project**	0	0	12	6
Total Credits in Professional Core						**58**
Professional Elective						
1	PEC-CS-501	**Computer Graphics/ AI/E-commerce & ERP**	3	1	0	4
2	PEC-CS-601	Compiler Design/Pattern Recognition/ Image Processing/ Software Design with UML	3	0	0	3
3	PEC-CS-602	Big Data Analytics/Cloud Computing/ Data Mining and Analytics	3	0	0	3
4	PEC-CS-701	Introduction to IoT / Introduction to Cognitive Science / Web and Social Media Analytics	3	1	0	4
Total Credits in Professional Elective						**14**
Open Electives						
1	OE-CS-601	Cyber Law and Ethics /Mobile Computing/ Bioinformatics	3	0	0	3
2	OE-CS-801	Cryptography and Network Security / Quantum Computing / Numerical Methods	3	0	0	3
3	OE-CS-802	Robotics and Embedded Systems / Financial Management /Applied Behavioral Economics	3	0	0	3
Total Credits in Open Elective						**9**

PROJECT WORK, SEMINAR AND INTERNSHIP IN INDUSTRY OR ELSEWHERE						
1	PCC-CS-781	**Project Evaluation I**	0	0	8	4
2	PCC-CS-881	Research Methodology	3	0	0	3
3	HSMC-881	**Seminar and Group Discussion**	0	0	2	1
4	PCC-CS-882	**Project Evaluation II**	0	0	12	6
		Total Credits				**14**
Mandatory Course-Non Credit						
1	MC-CS-401	Environmental Sciences	2	0	0	Non-Credit
2	MC-CS-501	Constitution of India/ Essence of Indian Knowledge & Tradition	1	0	0	Non-Credit

8. Semester-wise subject structure of B.Tech (CSE)							Sem-wise Credit
8.1-- 1st Semester-Theory							
1	BSC-101	Physics/Chemistry-I Gr.A or Gr.B	3	1	0	4	**17**
2	BSC-102	Mathematics-I	3	1	0	4	
3	ESC-101	Basic Electrical Engineering	3	1	0	4	
1st Semester-Laboratory							
4	BSC-191	Physics/ Chemistry Gr.A or Gr.B	0	0	2	1	
5	ESC-191	Basic Electrical Engineering Lab	0	0	2	1	
6	ESC-192	Engineering Graphics & Design/ Workshop Practice-Gr.A or Gr.B	0	1	4	3	
8.2-- 2nd Semester-Theory							**22**
1	ESC-201	Programming in C	3	1	0	4	
2	BSC-201	Physics/Chemistry-I Gr.A or Gr.B	3	1	0	4	
3	BSC-202	Mathematics-II	3	1	0	4	
4	HSMC-201	English	2	0	0	2	
2nd Semester-Laboratory							
5	HSMC-291	**English Language Laboratory-I**	0	0	4	2	
6	BSC-291	Physics/ Chemistry Gr.A or Gr.B	0	0	2	1	
7	ESC-291	**Programming in C laboratory**	0	0	4	2	
8	ESC-292	Engineering Graphics & Design/ Workshop Practice Gr.A or Gr.B	0	1	4	3	
8.3-- 3rd Semester Theory							
1	HSMC-301	Economics for Engineers	3	0	0	3	**22**
2	ESC-301	Digital Electronics	3	0	0	3	
3	BSC-301	Computational Statistics	3	1	0	4	
4	PCC-CS-301	**Data Structure & Algorithms using C**	3	0	0	3	
5	PCC-CS-302	Discrete Mathematics	3	1	0	4	
	3rd Semester Laboratory						
6	HSMC-391	**English Language Laboratory-II**	0	0	4	2	
7	PCC-CS-391	**Data Structure & Algorithms using C Lab**	0	0	4	2	

8	ESC-391	**Digital Electronics laboratory**	0	0	2	1	
8.4--4th Semester Theory							
1	HSMC-401	Introduction to Innovation, IP & Entrepreneurship	2	0	0	2	**23**
2	PCC-CS-401	Formal Language & Automata Theory	2	1	0	3	
3	PCC-CS-402	**OOPs using C++**	2	1	0	3	
4	PCC-CS-403	Computer Architecture & Organization	3	0	0	3	
5	PCC-CS-404	Operating Systems	3	0	0	3	
4th Semester Laboratory							
6	PCC-CS-491	**IT Workshop & Skilling -1**	0	0	12	6	
7	PCC-CS-492	**OOPs using C++ Laboratory**	0	0	4	2	
8	PCC-CS-494	Operating Systems Laboratory	0	0	2	1	
8.5-- 5th Semester Theory							
1	ESC-501	Software Engineering	3	0	0	3	**21**
2	PCC-CS-501	Computer Networks	3	0	0	3	
3	PCC-CS-502	Data Base Management Systems	3	0	0	3	
4	PCC-CS-503	**Machine Learning**	3	0	0	3	
5	PEC-CS-501	**Computer Graphics/ AI/ E-commerce & ERP**	3	1	0	4	
5th Semester Laboratory							
6	PCC-CS-591	**Computer Networks Laboratory**	0	0	2	1	
7	PCC-CS-592	**DBMS Laboratory**	0	0	4	2	
8	PCC-CS-593	**Machine Learning using Python Laboratory**	0	0	4	2	
8.6-- 6th Semester Theory							
1	PCC-CS-601	Design & Analysis ofAlgorithms	3	0	0	3	**23**
2	PCC-CS-602	**Web Technology**	3	0	0	3	
3	PEC-CS-601	Compiler Design/Pattern Recognition/ Image Processing/ Software Design with UML	3	0	0	3	
4	PEC-CS-602	Big Data Analytics/ Cloud Computing/ Data Mining and Analytics	3	0	0	3	
5	OE-CS-601	Cyber Law Ethics/ Mobile Computing/ Bioinformatics	3	0	0	3	

6th Semester Laboratory							
6	PCC-CS-691	Design Analysis & Algorithm Laboratory	0	0	2	1	
7	PCC-CS-692	**Web Technology Laboratory**	0	0	2	1	
8	PCC-CS-693	**IT Workshop & Skilling -2/Minor Project**	0	0	12	6	
8.7-- 7th Semester Theory							
1	HSMC-701	Financial & Cost Accounting	2	0	0	2	**14**
2	HSMC-702	Human Resource Management	2	0	0	2	
3	PEC-CS-701	Introduction to IoT / Introduction to Cognitive Science / Web and Social Media Analytics	3	1	0	4	
7th Semester Laboratory							
4	HSMC-791	**English Language Laboratory-III**	0	0	4	2	
5	PCC-CS-781	**Project Evaluation I**	0	0	8	4	
8.8-- 8th Semester Theory							
1	HSMC-801	Industrial Management	2	0	0	2	**18**
2	OE-CS-801	Cryptography and Network Security/ Quantum Computing / Numerical Methods	3	0	0	3	
3	OE-CS-802	Robotics and Embedded Systems / Financial Management /Applied Behavioral Economics	3	0	0	3	
8th Semester Laboratory							
4	HSMC-881	**Seminar and Group Discussion**	0	0	2	1	
5	PCC-CS-881	Research Methodology	3	0	0	3	
6	PCC-CS-882	**Project Evaluation II**	0	0	12	6	
Total credit for BTECH-CSE to be awarded							**160**
Mandatory Course-Non Credit							
1	MC-CS-401	Environmental Sciences	2	0	0	Non-Credit	
2	MC-CS-501	Constitution of India/ Essence of Indian Knowledge & Tradition	1	0	0	Non-Credit	

9. Evaluation Scheme:

It is advised to refer page numbers 48-51 of the document "Examination Reform Policy November 2018" published by AICTE to get some examples of assessment rubrics (https://www.aicte-india.org/sites/default/files/ExaminationReforms.pdf). There are several good examples of assessment rubrics available on the web when searching with the string "examples of assessment rubrics". There are many good videos available on YouTube on examples and strategies for preparing assessment rubrics.

Since assessment rubrics are not generic in nature and depend on courses, topics, assessment strategies of individual faculties etc., it is suggested that Faculty of Information Technology will follow the following rubrics for Theory, Laboratory and Sessional evaluation.

a. Rubrics for Theory Courses:

The internal assessment will be of 30 marks and end semester examinations will be of 70 marks.For passing the subject the students should obtain at least 40 marks out of 100 (Internal assessment and end semester assessment).

Suggestive rubrics for Internal Assessment: Calculation of Internal assessment number will be Average of Best of three CA plus 5 marks of Attendance.

Continuous Assessment	Activities
CA1	Quiz/ Assignment
CA2	Internal test (Pen and paper)
CA3	PPT presentation/ Group Discussion
CA4	Internal test(Pen and paper)

b. Rubrics for Practical Courses:

The internal assessment will be of 40 marks and end semester laboratory examinations will be of 60 marks. For passing the subject the students should obtain at least 50 marks out of 100 (Internal assessment and end semester assessment).

Sessional Exams- (Project, Seminar, Group Discussion, Internship, Training etc.) end semester examinations will be held for 100 marks. For passing the subject the students should obtain at least 50 marks out of 100 . Evaluation will be based on work done, quality of report, performance in viva-voice, presentation etc. for which rubrics may be designed based on course outcomes. The Project Viva and practical examinations will preferably have external examiners as per rules of the University.

c. Mapping of Marks to Grades

Each course (Theory/Practical)is to be assigned 100 marks, irrespective of the number of credits, and the mapping of marks to grades may be done as per the following table:

Classification	Letter Grade	Score on 100 percentage point	Points
Outstanding	O	100 to 90	10

Excellent	E	89 to 80	9
Very Good	A	79 to 70	8
Good	B	69 to 60	7
Fair	C	59 to 50	6
Below Average	D	49 to 40	5
Failed	F	Below 40	2
Incomplete	I	------	2

d. Promotional Policy: Candidates will be eligible for promotion to the next semester without clearing all end semester theory courses of earlier semesters if,

a. Candidate has minimum attendance percentage of 75% in the previous semester
b. Candidates must have appeared for all internal examinations and has secured marks in Continuous Assessments, Sessional Examinations, Practical Examinations
c. Candidates must have applied for appearing in the end semester examinations and have valid admit card in previous semester

Candidates failed to achieve the minimum benchmarks as mentioned in (a), (b), (c) for promotion will not be eligible for promotion to the next higher semester.

Candidates will appear in the end semester theory examinations as back log candidate in corresponding semester, of subsequent academic year. Marks scored in Continuous Assessments, Sessional Examinations, Practical Examinations during attending regular semester with minimum qualifying attendance would be carried all through. Backlog candidates would be allowed to appear in the end semester examinations only to achieve qualifying marks of the paper concerned. For 7th and 8thSemester backlog students, backlog examinations may be conducted after two months from the date of result publication.

If any candidate fails to secure minimum qualifying marks (pass marks) in sessional or practical examinations would suffer year lag and they have to continue the semester concerned afresh in the next academic year. In the internal examination of 30 marks -Cumulative Assessment 25 plus 5 marks for attendance.

The marks of a back log paper will be determined from the marks obtained in theory examination and marks of the continuous evaluation of the regular semester. No up-gradation of internal/continuous assessment marks would be allowed.

If any candidates fail to achieve any of the three conditions above (a, b & c) in any semester (say, 1st semester), they would not be allowed to continue their study in the next semester (i.e., 2nd semester) and they have to fulfill the academic regulations by enrolling them in the next academic year from the discontinued semester (i.e. 1st semester) and so on.

However, there would not be any limit of number of back papers to continue their study in subsequent semester as regular candidate.

e. Calculation of DGPA, CGPA for one, two, three and four year programmes.

- Result Status: X=Not eligible for Semester Promotion/Degree; XP=Eligible for Promotion with Backlogs; P=Passed and Promoted.
- The method of calculation of Grade Point Average is as follows
- **SGPA (Semester Grade Point Average)** = $\frac{Credit\ Index}{\sum \text{Credits}}$
- **YGPA (Yearly Grade Point Average)** = $\frac{\text{Credit Index Odd Semester + Credit Index Even Semester}}{\sum \text{Credits Odd Semester} + \sum \text{Credits Even Semester}}$
- For final **Degree Grade Point Average (DGPA)** the calculation is as under

DGPA = $\frac{\text{YGPA 1 + YGPA2 + 1.5} * \text{YGPA3 + 1.5} * \text{YGPA4}}{5}$

(For 4 Year Course)

DGPA = $\frac{\text{YGPA2 + 1.5} * \text{YGPA3 + 1.5} * \text{YGPA4}}{4}$

(For Lateral Entry Students)

DGPA = $\frac{\text{YGPA 1 + YGPA2 + YGPA3}}{3}$

(For 3 Year Course)

DGPA = $\frac{\text{YGPA 1 + YGPA2}}{2}$

(For 2 Year Course)

DGPA = YGPA1

(For 1 Year Course)

CUMULATIVE GRADE POINT AVARAGE (CGPA)

CGPA = $\frac{\sum_{K=1}^{K=n} Credit\ Index\ of\ k^{th}\ semester}{\sum_{k=1}^{k=n} Credit\ of\ k^{th}\ Semester}$

Where

n = 4 for 2 years programme

n=6 for 3 years programme

n = 8 for 4 years programme

n = 10 for 5 years programme

10.

Student Roll No..... Student Name: .....

GNSU

Academic year: 2023-24
Internal Examinations-I
B. Tech. (Branch), 2023 Batch
1st Semester

Subject Code: **Subject Name**

Time: 1 hours **Max. Marks: 25**

This template is recommended for courses with 4 COs and two In-Sem Tests. Can also be followed for courses with five COs. The COs can be altered in the template depending on the test being conducted.

(Assume any missing data suitably and design adequate hypothesis, if required)

	Part-A	**(3X 1M=3M)**
	Answer Any Three Questions	
	Q. No. 1, 2 from CO1 Preferred to be at lower BTL than the Max BTL of CO1	
	Q. No 3, 4 from CO2 Preferred to be at lower BTL than the Max BTL of CO2	
1.		
2.		
3.		
4.		
	Part-B	**(2 X 4M=8M)**
	Answer Any Two Questions	
	Q. No. 5, 6 from CO1 Preferred to be at lower BTL than the Max BTL of CO1	
	Q. No 7, 8 from CO2 Preferred to be at lower BTL than the Max BTL of CO2	
5.		
6.		
7.		
8.		
	Part-C	**(2 X 7M=14M)**
	Answer ALL Questions	
	Q. No. 9,10 from CO1 and have a internal choice between Q.No.9 and Q.No.10	
	Q. No. 11,12 from CO2 and have a internal choice between Q.No.11 and Q.No.12	
9.	Q. No. 9 from CO1 Preferred to be at lower BTL than the Max BTL of CO1, At least one sub question must be of Max. BTL of the CO1, max 2 sub questions.	
	(Or)	
10.	Q. No.10 from CO1 Preferred to be at lower BTL than the Max BTL of CO1, At least one sub question must be of Max. BTL of the CO1, max 2 sub questions.	
11.	Q. No.11 from CO2 Preferred to be at lower BTL than the Max BTL of CO2, At least one sub question must be of Max. BTL of the CO1, max 2 sub questions.	
	(Or)	
12.	Q. No.11 from CO2 Preferred to be at lower BTL than the Max BTL of CO2, At least one sub question must be of Max. BTL of the CO1, max 2 sub questions.	

Student Roll No.:..... Student Name:.....

Academic year: 2023-24
Internal Examinations-II
B. Tech. (Branch), 2023 Batch
1st Semester

Subject Code: **Subject Name**

Time: 1 hours **Max. Marks: 25**

This template is recommended for courses with 4 COs and two In-Sem Tests. Can also be followed for courses with five COs. The COs can be altered in the template depending on the test being conducted.

(Assume any missing data suitably and design adequate hypothesis, if required)

	Part-A	**(3X 1M=3M)**
	Answer Any Three Questions	
	Q. No. 1, 2 from CO3 Preferred to be at lower BTL than the Max BTL of CO3	
	Q. No 3, 4 from CO4 Preferred to be at lower BTL than the Max BTL of CO4	
1.		
2.		
3.		
4.		
	Part-B	**(2 X 4M=8M)**
	Answer Any Two Questions	
	Q. No. 5, 6 from CO3 Preferred to be at lower BTL than the Max BTL of CO3	
	Q. No 7, 8 from CO4 Preferred to be at lower BTL than the Max BTL of CO4	
5.		
6.		
7.		
8.		
	Part-C	**(2 X 7M=14M)**
	Answer ALL Questions	
	Q. No. 9,10 from CO3 and have a internal choice between Q.No.9 and Q.No.10	
	Q. No. 11,12 from CO4 and have a internal choice between Q.No.11 and Q.No.12	
9.	Q. No. 9 from CO3 Preferred to be at lower BTL than the Max BTL of CO3, At least one sub question must be of Max. BTL of the CO3, max 2 sub questions.	
	(Or)	
10.	Q. No.10 from CO3 Preferred to be at lower BTL than the Max BTL of CO3, At least one sub question must be of Max. BTL of the CO3, max 2 sub questions.	
11.	Q. No.11 from CO4 Preferred to be at lower BTL than the Max BTL of CO4, At least one sub question must be of Max. BTL of the CO4, max 2 sub questions.	
	(Or)	
12.	Q. No.11 from CO4 Preferred to be at lower BTL than the Max BTL of CO4, At least one sub question must be of Max. BTL of the CO4, max 2 sub questions.	

Student Roll No.:..... Student Name:.....

Academic year: 2023-24
Sem-End Examinations, Nov-Dec 2023
B. Tech. (Branch), 2023 Batch
1st Semester

Subject Code: **Name of the Course:**

Time: 3 hours **Max. Marks: 70**

(Assume any missing data suitably and design adequate hypothesis, if required)

	Part-A	**(8 X 4M=32M)**
	Answer ALL Questions	
	Q. No.1.a to 1.h Preferred to be at lower BTL than the Max BTL, No sub questions	
1 a.	Q. No. 1.a from CO1 with Lower BTL Level	
1 b.	Q. No. 1.b from CO1 with Lower BTL Level	
1 c.	Q. No. 1.c from CO2 with Lower BTL Level	
1 d.	Q. No. 1.d from CO2 with Lower BTL Level	
1 e.	Q. No. 1.e from CO3 with Lower BTL Level	
1 f.	Q. No. 1.f from CO3 with Lower BTL Level	
1 g.	Q. No. 1.g from CO4 with Lower BTL Level	
1 h.	Q. No. 1.h from CO4 with Lower BTL Level	
	Part-B	**(4 X 7M=28M)**
	Answer ALL Questions	
	Q. No. 2 to 4 Preferred to be at lower BTL than the Max BTL, No sub questions and have a internal choice	
2.a	Q. No. 2.a from CO1 with BTL Level	
	(OR)	
2.b	Q. No. 2.b from CO1 with BTL Level	
3.a	Q. No. 3.a from CO2 with BTL Level	
	(OR)	
3.b	Q. No. 3.b from CO2 with BTL Level	
4.a	Q. No. 4.a from CO3 with BTL Level	
	(OR)	
4.b	Q. No. 4.b from CO3 with BTL Level	
5.a	Q. No. 5.a from CO4 with BTL Level	
	(OR)	
5.b	Q. No. 5.b from CO4 with BTL Level	
	Part-C	**(1 X 10M=10M)**
	Answer ANY ONE Question	
	Q. No.6 and 7 preferably be Max BTL and maximum four sub questions with equal marks and may have a link between those questions. *(Question must be based on comprehensive knowledge of course and interconnection of courses)*	
6	Combination of all CO's	
7	Combination of all CO's	

11.	**Exit Policy:**
	Preamble NEP2020 suggests that a student should have multiple exits. This note suggests a possibility for B Tech CSE students. It should be emphasized that it is a choice which a student may wish to take due to his/her financial/family/other situation and needs, and that it should not be considered as a failure option. We suggest two exits, and flexible re-entry options.
	11.1 Certificate in Computer Science A student should be able to get a certificate if he/she completes: **1. 50% of the credits for B Tech** **2. 50% of CSE program core courses including IT Workshop-1 so that leaving student has decent skills.** **3. Minimum CGPA requirements-7.0**
	11.2 B.Sc in Computer Science A student should be able to get a BSc if he/she completes: **1. 75% of the credits for B Tech, and at least 3 years in the program** **2. 75% of CSE core program courses including IT Workshop-1 so that leaving student has decent skills. PCC-CS-693 Mini Project will be compulsory for B.Sc exit students.** **3. Minimum CGPA requirements-7.0** With BSc, the student is eligible for entry into programs which take BSc as eligibility criteria.
	Re-entry to complete the program A student exiting with a certificate or BSc should be entitled to re-enrol in the program. It is suggested that all credits will be transferred, if the student enrols back within a limited period (suggested: 3 years) of exiting. In case a student enrols after that, then the transfer of credits should be examined by looking at the change in the curriculum from what the student did.

Appendix-1

Course Code : BSC-101	**Category : BSC**
Course Title : Chemistry-I	**Semester** : **I/II**
L-T-P : 3-1-0	**Credit:4**
Pre-Requisites:	

Detailed contents

i) Atomic and molecular structure

Schrodinger equation. Particle in box solutions and their applications for simple sample. Molecular or bitalsof diatomic molecules (e.g.H_2). Energy level diagrams of diatomic. Pi-molecular or bitals of butadiene and benzene and aromatic city. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on bandstructures.

ii) Spectroscopic techniques and applications

Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging, surface characterization techniques. Diffraction and scattering.

iii) **Intermolecular *forces and potential energy surfaces***

Ionic, dipolar and van Der Waals interactions. Equations of state of real gases and critical phenomena.

iv) Use of free energy in chemical equilibria

First and second laws of thermodynamics and thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and Emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Water chemistry. Corrosion. Use of free energy considerations in metallurgy through Ellingham diagrams.

v) Periodic properties

Effective nuclear charge, penetration of or bitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and Electro negativity, polarizebility, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries

vi) **Stereochemistry**

Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds.

vii) Organic reactions and synthesis of a drug molecule

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule.

Course Outcomes

The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications. Quantum theory is more than 100 years old and to understand phenomena at nanometer levels, one has to base the description of all chemical processes at molecular levels. The course will enable the student to:

Analyses microscopic chemistry in terms of atomic and molecular or bitals and intermolecular forces. Rationalize bulk properties and processes using thermodynamic considerations. Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques. Rationalise periodic properties such as ionization potential, electronic activity, oxidation states and electronegativity. List major chemical reactions that are used in the synthesis of molecules.

Learning Resources:

1. Engineering Chemistry, Satyaprakash, Khanna Book Publishing, Delhi
2. University chemistry, by B. H. Mahan
3. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane
4. Fundamentals of Molecular Spectroscopy, by C. N. Ban well
5. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan
6. Physical Chemistry, by P. W. Atkins
7. Spectroscopy of Organic Compounds, by P.S.Kalsi, New Age International Pvt Ltd Publishers
8. Physical Chemistry, P. C. Rakshit, Sarat Book House
9. Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition
10. Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition

    http://bcs.whfreeman.com/vollhardtschore5e/default.asp

Course Code : BSC-102	**Category :** Basic Science Course
Course Title : Mathematics – I	**Semester** : First
L-T-P : **3-1-0**	**Credit: 4**
Pre-Requisites: High School Mathematics	

Module No.	Description of Topic
1	***Calculus (Integration):*** Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.
2	***Calculus (Differentiation):*** Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin's theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima.
3	***Matrices:*** Matrices, Vectors: addition and scalar multiplication, matrix multiplication; Linear systems of equations, linear Independence, rank of a matrix, determinants, Cramer's Rule, inverse of a matrix, Gauss elimination and Gauss-Jordan elimination.
4	***Vector Spaces:*** Vector Space, linear dependence of vectors, Basis, Dimension; Linear transformations (maps), Range and Kernel of a linear map, Rank and Nullity, Inverse of a linear transformation, Rank-Nullity theorem, composition of linear maps, Matrix associated with a linear map.
5	***Vector Spaces (Continued):*** Eigenvalues, Eigenvectors, Symmetric, Skew-symmetric, and Orthogonal Matrices, Eigenbases. Diagonalization; Inner product spaces, Gram-Schmidt orthogonalization.

Course Outcomes:

The students will be able to:

Apply the concept and techniques of differential and integral calculus to determine curvature and evaluation of different types of improper integrals.

Understand the domain of applications of mean value theorems to engineering problems.

Learn different types of matrices, concept of rank, methods of matrix inversion and their applications. Understand linear spaces, its basis and dimension with corresponding applications in the field of computer science.

Learn and apply the concept of eigen values, eigen vectors, diagonalisation of matrices and

orthogonalization in inner product spaces for understanding physical and engineering problems

Learning Resources:

1. Reena Garg, Engineering Mathematics-I, Khanna Publishers.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
3. Michael Greenberg, Advanced Engineering Mathematics, Pearson.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
5. Kanti B. Dutta, Mathematical Methods of Science and Engineering, Cenage Learning.
6. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi.
7. S.K. Mapa, Higher Algebra: Abstract and Linear, Sarat Book House Pvt.Ltd.
8. Hoffman and Kunze: Linear algebra, PHI.

Course Code : ESC-101	**Category :** Engineering Science Courses
Course Title : Basic Electrical Engineering	**Semester** : First
L-T-P : **3-1-0**	**Credit: 4**
Pre-Requisites:	

Detailed contents:

Module 1: DC Circuits

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

Module 2: AC Circuits

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three phase balanced circuits,voltage and current relations in star and delta connections.

Module 3: Transformers

Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

Module 4: Electrical Machines

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction
and working of synchronous generators.

Module 5: Power Converters

DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation.

Module 6: Electrical Installations

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

Course Outcomes

To understand and analyze basic electric and magnetic circuits

To study the working principles of electrical machines and power converters.

To introduce the components of low voltage electrical installations

Learning Recourses:

1. Ritu Sahdev, Basic Electrical Engineering, Khanna Book Publishing Co. (P) Ltd., Delhi.
2. D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill, 2010.
3. D. C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009.
4. L. S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press, 2011.
5. E. Hughes, “Electrical and Electronics Technology”, Pearson, 2010.
6. V. D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 1989.

Course Code : ESC-192	**Category :** Engineering Science Courses
Course Title : Engineering Graphics & Design	**Semester** : First/ Second
L-T-P : 0-**1-4**	**Credit: 3**
Pre-Requisites:	

Sl. No.	Content
1	**INTRODUCTION TO ENGINEERING DRAWING** Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Different types of lines and their use; Drawing standards and codes.
2	**LETTERING, DIMENSIONING, SCALES** Plain scale, Diagonal scale and Vernier Scales.
3	**GEOMETRICAL CONSTRUCTION AND CURVES** Construction of polygons, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid, Involute, Archemedian Spiral.
4	**PROJECTION OF POINTS, LINES, SURFACES** Principles of Orthographic Projections-Conventions - 1st and 3rd angle projection, Projections of Points and lines inclined to both planes; Projections of planes (Rectangle, pentagon, Hexagon etc.) inclined Planes - Auxiliary Planes.
5	**PROJECTION OF REGULAR SOLIDS** Regular solids inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale (Cube, Pyramid, Prism, Cylinder, Cone).
6	**COMBINATION OF REGULAR SOLIDS, FLOOR PLANS** Regular solids in mutual contact with each other like Spheres in contact with cones standing on their base. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.
7	**ISOMETRIC PROJECTIONS** Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions;

8	**SECTIONS AND SECTIONAL VIEWS OF RIGHT ANGULAR SOLIDS** Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)
9	**OVERVIEW OF COMPUTER GRAPHICS**, C**USTOMISATION& CAD DRAWING** listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CADsoftware [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcutmenus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids]; Set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate inputentry methods to draw straight lines, Applying various ways of drawing circles;
	ANNOTATIONS, LAYERING & OTHER FUNCTIONS Applying dimensions to objects, applying annotations to drawings;
10	Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer- aided design (CAD) software modeling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models. Part editing and two-dimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, multiview, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerancing techniques; dimensioning and scale multi views of dwelling;

11	**DEMONSTRATION OF A SIMPLE TEAM DESIGN PROJECT** Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; meshed topologies for engineering analysis and tool-path generation for component manufacture; geometric dimensioning and tolerancing; Use of solid- modeling software for creating associative models at the component and assembly levels; floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Applying colour coding according to building drawing practice; Drawing sectional elevation showing foundation to ceiling; Introduction to Building Information Modelling (BIM).

Course Outcomes

The student will learn:

- Introduction to engineering design and its place in society
- Exposure to the visual aspects of engineering design
- Exposure to engineering graphics standards
- Exposure to solid modeling

General Instructions

1. In every topic some problems are to be done in the class and some are to be given to students as home assignment.
2. The problems for class work are to be prepared on drawing sheet of A1 size in the class/ using AutoCAD software.
3. The problems for home assignments are to be prepared on drawing copy/ using AutoCAD software.
4. Print out of every assignment is to be taken for CAD Drawings on Drawing sheets (A4 Sheets).
5. A title block must be prepared in each sheet/ assignment.

Following is the list of drawing instruments that required for making engineering drawings on paper with perfection.

1. Drawing Board
2. Mini drafter/ Set-squares (45°–45° & 60°–90°), T-square
3. Protractor (180°, 360°)
4. Scales (Plain, Diagonal)

5. Compass (Small and Large)
6. Divider (Small and Large)
7. French Curves
8. Drawing paper (A1 Size)
9. Drawing pencil (H, HB, B)
10. Sharpener
11. Eraser
12. Drawing pins & clips
13. Duster or handkerchief etc.

Learning Resources:

1. Pradeep Jain, Ankita Maheswari, A.P. Gautam, Engineering Graphics & Design, Khanna Publishing House
2. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
3. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
4. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
5. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers
6. Corresponding set of CAD Software Theory and User Manuals

Course Code : BSC-191	**Category :** Basic Science Courses
Course Title : Chemistry-I Laboratory	**Semester** : First/ Second
L-T-P : 0-0-2	**Credit: 1**
Pre-Requisites:	

Choose 10 experiments from the following:

1. Conductometric titration for determination of the strength of a given HCl solution by titration against a standard NaOH solution.
2. pH- metric titration for determination of strength of a given HCl solution against a standard NaOH solution.
3. Determination of dissolved oxygen present in a given water sample.
4. To determine chloride ion in a given water sample by Argentometric method (using chromate indicator solution)
5. Determination of surface tension and viscosity
6. Thin layer chromatography
7. Ion exchange column for removal of hardness of water
8. Determination of the rate constant of a reaction

9. Determination of cell constant and conductance of solutions
10. Potentiometry - determination of redox potentials and emfs
11. Saponification/acid value of an oil
12. Chemical analysis of a salt
13. Determination of the partition coefficient of a substance between two immiscible liquids
14. Adsorption of acetic acid by charcoal
15. Use of the capillary viscosimeters to the demonstrate of the iso electric pointas
    the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of egg.

Course Code : ESC-191	**Category :** Engineering Science Courses
Course Title : Basic Electrical Engineering Laboratory	**Semester** : First
L-T-P : **0-0-2**	**Credit: 1**
Pre-Requisites:	

Choose 10 experiments from the following:

1. First activity: Introduction to basic safety precautions and mentioning of the do's and Don'ts. Noting down list of experiments to be performed, and instruction for writing the laboratory reports by the students. Group formation. Students are to be informed about the modalities of evaluation.
2. Introduction and uses of following instruments :
   (a) Voltmeter
   (b) Ammeter
   (c) Multimeter
   (d) Oscilloscope

   Demonstration of real life resistors, capacitors with color code , inductors and autotransformer.
3. Demonstration of cut-out sections of machines: DC machine, Induction machine,
   Synchronous machine and single phase induction machine.
4. Calibration of ammeter and Wattmeter.
5. Determination of steady state and transient response of R-L, R-C and R-L-C circuit to a step change in voltage.
6. Determination of steady state response of R-L and R-C and R-L-C circuit and calculation of impedance and power factor.
7. Determination of resonance frequency and quality factor of series and parallel R-L-C circuit.
8. (a) Open circuit and short circuit test of a single-phase transformer
   (b) Load test of the transformer and determination of efficiency and regulation
9. Demonstration of three phase transformer connections. Voltage and current relationship, phase shifts between the primary and secondary side.

10. Measurement of power in a three phase unbalanced circuit by two wattmeter method.
11. Determination of Torque –Speed characteristics of separately excited DC motor.
12. Determination of Torque speed characteristics and observation of direction reversal by change of phase sequence of connection of Induction motor.
13. Determination of operating characteristics of Synchronous generator.
14. Demonstration of operation of (a) DC-DC converter (b) DC-AC converter (c) DC-AC converter for speed control of an Induction motor
15. Demonstration of components of LT switchgear

Course Code: ESC-201	Category- Engineering Science Courses
Course Title: Programming in C	Semester: II
L-T-P : 3-1-0	Credit: 4

Detailed content

Unit 1: Introduction to Programming

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) - (1 lecture).

Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudo code with examples. (1 lecture)

From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code. (2 lectures)

Unit 2: Arithmetic expressions and precedence

Unit 3: Conditional Branching and Loops

Writing and evaluation of conditionals and consequent branching

Iteration and loops

Unit 4: Arrays

Arrays (1-D, 2-D), Character arrays and Strings.

Unit 5: Basic Algorithms

Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required).

Unit 6: Function

Functions (including using built in libraries), Parameter passing in functions, call by value, passing arrays to functions: idea of call by reference.

Unit 7: Recursion

Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

Unit 8: Structure

Structures, Defining structures and Array of Structures

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Unit 9: Pointers

Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation).

Unit 10: File handling (only if time is available, otherwise should be done as part of the lab).

Course Outcomes

The student will learn

To formulate simple algorithms for arithmetic and logical problems.

To translate the algorithms to programs (in C language).

To test and execute the programs and correct syntax and logical errors.

To implement conditional branching, iteration and recursion.

To decompose a problem into functions and synthesize a complete program using divide and conquer approach.

To use arrays, pointers and structures to formulate algorithms and programs.

To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.

To apply programming to solve simple numerical method problems, namely rot finding of function, differentiation of function and simple integration.

Learning Resources:

1. R. S. Salaria, Computer Concepts and Programming in C, Khanna Publishers
2. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
3. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill
4. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

Course Code : BSC-202	**Category :** Basic Science Course
Course Title : Mathematics – II	**Semester** : Second
L-T-P : **3-1-0**	**Credit: 4**
Pre-Requisites: High School Mathematics	

Module No.	Description of Topic
1	**Basic Probability:** Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the Multinomial distribution, Poisson approximation to the Binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality.
2	**Continuous Probability Distributions:** Continuous random variables and their properties, Distribution functions and densities, Normal, Exponential and Gamma densities.
3	**Bivariate Distributions:** Bivariate distributions and their properties, distribution of sums and quotients,Conditional densities, Bayes' rule.
4	**Basic Statistics:** Measures of Central tendency, Moments, Skewness and Kurtosis, Probability distributions: Binomial, Poisson and Normal and evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation.
5	**Applied Statistics:** Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.
6	**Small samples:** Test for single mean, difference of means and correlation coefficients, test for ratioof variances - Chi-square test for goodness of fit and independence of attributes.

Learning Resources:

1. Reena Garg, Chandrika Prasad, Advanced Engineering Mathematics, Khanna Publishers.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
3. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.

Course Code : BSC-201	**Category :** Basic Science Courses
Course Title : Physics-I	**Semester** : First/ Second
L-T-P : **3-1-0**	**Credit:4**
Pre-Requisites:	

Course objectives:

Basic concepts of mechanics, optics and its applications, electricity, magnetism and qualitative understanding of concepts of quantum physics and statistical mechanics.

1. Mechanics

Problems including constraints & friction. Basic ideas of vector calculus and partialdifferential equations. Potential energy function F = -grad V, equipotential surfaces and meaning of gradient. Conservative and non-conservative forces. Conservation laws of energy & momentum. Non-inertial frames of reference. Harmonic oscillator; Damped harmonic motion forced oscillations and resonance. Motion of a rigid body in a plane and in 3D. Angular velocity vector. Moment of inertia.

2. Optics

- Distinction between interference and diffraction, Fraunhofer and Fresnel diffraction, Fraunhofer diffraction at single slit, double slit, and multiple slits (only the expressions for max;min, & intensity and qualitative discussion of fringes); diffraction grating(resolution formulac only), characteristics of diffration grating and its applications.
- Polarisation : Introduction, polarisation by reflection, polarisation by double reflection, scattering of light, circular and elliptical polarisation, optical activity.
- Lasers : Principles and working of laser : population inversion, pumping, various modes, threshold population inversion with examples .

3. Electromagnetism and Dielectric Magnetic Properties of Materials

- Maxwell's equations. Polarisation, permeability and dielectric constant, polar and non-polar dielectrics, internal fields in a solid, Clausius- Mossotti equation(expression only), applications of dielectrics.
- Magnetisation , permeability and susceptibility, classification of magnetic materials, ferromagnetism, magnetic domains and hysteresis, applications.

4. Quantum Mechanics

- Introduction to quantum physics, black body radiation, explanation using the photon concept, Compton effect, de Broglie hypothesis, wave-particle duality, verification of matter waves, uncertainty principle, Schrodinger wave equation, particle in box, quantum harmonic oscillator, hydrogen atom.

5. Statistical Mechanics

- Macrostate, Microstate, Density of states, Qualitative treatment of Maxwell Boltzmann, Fermi-Dirac and Bose-Einstein statistics.

Course outcomes:

Students will be familiar with

- Basic concepts of mechanics
- Bragg's Law and introduction to the principles of lasers, types of lasers and applications.
- Various terms related to properties of materials such as, permeability, polarization,etc.
- Some of the basic laws related to quantum mechanics as well as magnetic and dielectric properties of materials.
- Simple quantum mechanics calculations.

Learning Resources:

1. Introduction to Electrodynamics, David J. Griffiths, Pearson Education India Learning Private Limited
2. Principles of Physics, 10ed, David Halliday, Robert Resnick Jearl Walker ,Wiley
3. Electricity, Magnetism, and Light, Wayne M. Saslow, Academic Press
4. Engineering Mechanics (In SI Units) (SIE), S. Timoshenko, D.H. Young, J.V. Rao, Sukumar Pati , McGraw Hill Education
5. Classical mechanics, Narayan Rana, Pramod Joag, McGraw Hill Education
6. Introduction to Classical Mechanics, R Takwale, P Puranik, McGraw Hill Education
7. Engineering Mechanics, M.K. Harbola , Cengage India
8. An Introduction to Mechanics (SIE), David Kleppner, Robert Kolenkow, McGraw Hill Education
9. Principles of mechanics, John L. Synge and Byron A. Griffith, New York, McGraw-Hill
10. Mechanics (Dover Books on Physics) , J. P. Den Hartog , Dover Publications Inc.
11. Engineering Mechanics: Dynamics, L.G. Kraige J.L. Meriam, Wiley
12. Quantum Physics of Atoms, Molecules, Solids, Nuclei and Particles, Robert Eisberg, Robert Resnick, Wiley
13. Introduction to Quantum Mechanics, J. Griffiths David , Pearson Education
14. Modern Quantum Mechanics, J. J. Sakurai, Cambridge University Press
15. Optics , Hecht, Pearson Education
16. Optics, Ghatak, McGraw Hill Education India Private Limited
17. Fundamentals of Statistical and Thermal Physics, Reif, Sarat Book Distributors
18. Statistical Mechanics , Pathria , Elsevier
19. Statistical Physics, L.D.Landau , E.M. Lifshitz, Butterworth-Heinemann

Course Code : HSMC-201	**Category :** Humanities and Social Sciences including Management courses
Course Title : English	**Semester** : Second
L-T-P : **2-0-0**	**Credit:2**
Pre-Requisites:	

Detailed contents

1. Vocabulary Building

1.1 The concept of Word Formation: Compounding, Backformation, Clipping, Blending.
1.2 Root words from foreign languages and their use in English
1.3 Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.
1.4 Synonyms, antonyms, and standard abbreviations: Acronyms

2. Basic Writing Skills

2.1 Sentence Structures & Types: Simple, Compound, Complex
2.2 Use of phrases and clauses in sentences: Transformation of sentences, active, passive, narration
2.3 Importance of proper punctuation
2.4 Creating coherence: Arranging paragraphs & Sentencesin logical order
2.5 Creating Cohesion: Organizing principles of paragraphs indocuments
2.6 Techniques for writing precisely

3. Identifying Common Errors in Writing

3.1 Subject-verb agreement
3.2 Noun-pronoun agreement
3.3 Misplaced modifiers
3.4 Articles
3.5 Prepositions
3.6 Redundancies
3.7 Clichés

4. Nature and Style of sensible Writing

4.1 Describing
4.2 Defining
4.3 Classifying
4.4 Providing examples or evidence
4.5 Writing introduction and conclusion

5. Writing Practices

5.1 Comprehension
5.2 Précis Writing
5.3 Essay Writing
5.4 Business Letter, Cover Letter & CV; E-mail

Learning Resources:

(i) Kulbushan Kumar, R S Salaria,Effective Communication Skills, Khanna Publishing House, Delhi.
(ii) Practical English Usage. Michael Swan. OUP. 1995.
(iii) Remedial English Grammar. F.T. Wood. Macmillan.2007
(iv) On Writing Well. William Zinsser. Harper Resource Book. 2001
(v) Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
(vi) Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.

(vii) Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press
(viii) Universal English Prof. Prasad Kataria Publications, 2019.
(ix) "Communication Skills for Professionals"-Nira Konar, Prentice Hall of India 2nd edition, New Delhi, 2011
(x) Gajendra Singh Chauhan, Smita Kashiramka and L. Thimmesha. Functional English. Cengage , 2019.

Course Outcomes

The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

Course Code : HSMC-291	**Category :** Humanities and Social Sciences including Management courses
Course Title : **English Language Laboratory-I**	**Semester** : Second
L-T-P : **0-0-4**	**Credit: 2**
Pre-Requisites:	

1) Honing 'Listening Skill' and its sub skills through Language Lab Audio device;
2) Honing 'Speaking Skill' and its sub skills
3) Helping them master Linguistic/Paralinguistic features (Pronunciation/Phonetics/ Voice modulation/ Stress/ Intonation/ Pitch &Accent) of connected speech
4) Honing 'Conversation Skill' using Language Lab Audio –Visual input; Conversational Practice Sessions (Face to Face / via Telephone, Mobile phone & Role Play Mode)
5) Introducing 'Group Discussion' through audio –Visual input and acquainting them with key strategies for success
6) G D Practice Sessions for helping them internalize basic Principles (turn- taking, creative intervention, by using correct body language, courtesies & other soft skills) of GD
7) Honing 'Reading Skills' and its sub skills using Visual / Graphics/ Diagrams /Chart Display/Technical/Non Technical Passages Learning Global / Contextual /Inferential Comprehension;
8) Honing 'Writing Skill' and its sub skills by using Language Lab Audio –Visual input; Practice Sessions

Course Outcomes

- The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

Course code: ESC-291	**Category: Engineering Science Courses**
Course Title: Programming in C laboratory	**Semester: II**
L-T-P : 0-0-4	**Credit: 02**

The laboratory should be preceded or followed by a tutorial to explain the approach or algorithm to be implemented for the problem given.

Experiment-I

To demonstrate the usage of operators and data types in C

a. Write a program to print the size of all the data types with its modifiers supported by C and itsrange.

b. Write a program to calculate simple interest.

Experiment-II

To demonstrate the usage of if, if-else, nested-if and switch

a. Write a program to find the largest, smallest and second largest of three numbers.

b. Write a program to accept marks of three subjects calculate the total percentage and output the result of the student.

c. Write a program to find the second largest of four numbers.

d. Write a program to calculate Julian date.

Experiment-III

To demonstrate the usage of while, do-while and for loops

a. Write a program to find the sum of numbers from 1 to N.

b. Write a program to reverse a number.

c. Write a program to generate the Fibonacci series.

Experiment-IV

To demonstrate the concept of arrays and strings

a. Write a program to check whether a string is a Palindrome without using array.

b. Write a program to insert a number at a given position in an array.

c. Write a program to arrange a list of numbers in ascendingorder.

d. Write a program to check whether a given matrix is symmetric or not.

e. Write a program to perform matrix multiplication.

Experiment-V

To demonstrate the usage of functions and recursion

a. Write a program to check whether a given number is prime or not.

b. Write a program to find the roots of a quadratic equation

c. Write a recursive program to find the factorial of a number.

d. Write a recursive program to find sum of natural number using recursion.

Experiment-VI

To demonstrate the concept of structures

a. Write a program to create a student record and display the same.

Experiment-VII

To demonstrate the concept of pointers

a. Write a program using function to swap two numbers using pointers

Experiment-VIII

To demonstrate the concept of File

a. Write a program to create a file and store some records in it. Display the contents of the same. And show the use of write, read and append mode.

***Note:** The above are only suggestive programs. Any other programs can be added as per requirements by the faculty.

Course Code : ESC-292	**Category :** Engineering Science Courses
Course Title : Workshop Practice	**Semester** : First/ Second
L-T-P : **0-1-4**	**Credit:3**
Pre-Requisites:	

(i) Lectures & videos:

Detailed contents:

1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods
2. CNC machining, Additive manufacturing
3. Fitting operations & power tools
4. Electrical &Electronics
5. Carpentry
6. Plastic moulding, glass cutting
7. Metal casting
8. Welding (arc welding & gas welding), brazing

(ii) Workshop Practice:

Machine shop

Typical jobs that may be made in this practice module:

To make a pin from a mild steel rod in a lathe.

To make rectangular and vee slot in a block of cast iron or mild steel in a shaping and / or milling machine.

Fitting shop

Typical jobs that may be made in this practice module:

To make a Gauge from MS plate.

Carpentry

Typical jobs that may be made in this practice module:

To make wooden joints and/or a pattern or like.

Welding shop

Typical jobs that may be made in this practice module:

ARC WELDING : To join two thick (approx 6mm) MS plates by manual metal arc welding.

GAS WELDING : To join two thin mild steel plates or sheets by gas welding.

Casting

Typical jobs that may be made in this practice module:

One/ two green sand moulds to prepare, and a casting be demonstrated.

Smithy

Typical jobs that may be made in this practice module:

A simple job of making a square rod from a round bar or like.

Plastic moulding & Glass cutting

Typical jobs that may be made in this practice module:

For plastic moulding, making at least one simple plastic component should be made.

For glass cutting, three rectangular glass pieces may be cut to make a kaleidoscope using a black colour diamond cutter, or similar other components may be made.

Electrical & Electronics

Familiarization with LT switchgear elements, making its sketches and noting down its specification. Kitkat fuse, Glass cartridge fuse, Plastic fuse holders (optional), Iron clad isolators, MCB style isolators, Single phase MCB, Single-phase wire, wiring cable.

Demonstration of domestic wiring involving two MCB, two piano key switches, one incandescent lamp, one LED lamp and plug point.

Simple wiring exercise to be executed to understand the basic electrical circuit.

Simple soldering exercises to be executed to understand the basic process of soldering.

Fabrication of a single-phase full wave rectifier with a step down transformer using four diodes and electrolytic capacitor and to find its volt-ampere characteristics to understand basic electronic circuit fabrication.

Examinations could involve the actual fabrication of simple components, utilizing one or more of the techniques covered above.

Laboratory Outcomes

Upon completion of this laboratory course, students will be able to fabricate components with their own hands.

They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.

By assembling different components, they will be able to produce small devices of their interest.

Learning Resources:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
2. Kalpakjian S. and Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition, Pearson Education India Edition, 2002.
3. Gowri P. Hariharan and A. Suresh Babu,"Manufacturing Technology – I" Pearson Education, 2008.
4. Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998.
5. Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGrawHill House, 2017.

Course Code : BSC-291	**Category :** Basic Science course
Course Title : Physics-I Laboratory	**Semester** : First/ Second
L-T-P : **0-0-2**	**Credit: 1**
Pre-Requisites:	

Choose 10 experiments including at least one from Optics, Electricity and Magnetism and Quantum Mechanics and at least a total of six from these three groups.

Experiments in Optics

1. Determination of dispersive power of the material of a prism
2. Determination of wavelength of a monochromatic light by Newton's ring
3. Determination of wavelength of a monochromatic light by Fresnel's bi-prism
4. Determination of wavelength of the given laser source by diffraction method

Electricity & Magnetism experiments

1. Determination of thermo electric power of a given thermocouple.
2. Determination of specific charge (e/m) of electron by J.J. Thompson's method.
3. Determination of dielectric constant of a given dielectric material.
4. Determination of Hall coefficient of a semiconductor by four probe method.
5. To study current voltage characteristics, load response, areal characteristic and spectral response of a photovoltaic solar cell.
6. Determination of resistance of ballistic galvanometer by half deflection method and study of variation of logarithmic decrement with series resistance.
7. Determination of unknown resistance using Carey Foster's bridge
8. Study of Transient Response in LR, RC and LCR circuits using expeyes
9. Generating sound from electrical energy using expeyes

Experiments in Quantum Physics

1. Determination of Stefan-Boltzmann constant.
2. Determination of Planck constant using photocell.
3. Determination of Lande-g factor using Electron spin resonance spectrometer.
4. Determination of Rydberg constant by studying Hydrogen spectrum.
5. Determination of Band gap of semiconductor.
6. To study current voltage characteristics, load response, areal characteristic and spectral response of a photovoltaic solar cell.

Miscellaneous experiments

1. Determination of Young's modulus of elasticity of the material of a bar by the method of flexure
2. Determination of bending moment and sheer force of a rectangular beam of uniform cross- section
3. Determination of modulus of rigidity of the material of a rod by static method

4. Determination of rigidity modulus of the material of a wire by dynamic method
5. To determine the moment of inertia of a body about an axis passing through its centre of gravity andto determine the modulus of rigidity of the material of the suspended wire
6. Determination of coefficient of viscosity by Poiseulle's capillary flow method

Name of the Course:	**Economics for Engineers (Humanities-II)**
Course Code: HSMC-301	Semester: III
Duration: 6 months	Maximum Marks: 100
	LTP:**3-0-0**
Credit Points:	3

Objective:

1	Understand the role and scope of Engineering Economics and the process of economic decision making
2	Understand the different concepts of cost and different cost estimation techniques
3	Familiarization with the concepts of cash flow, time value of money and different interest formulas
4	Appreciation of the role of uncertainty in future events and using different concepts from probability to deal with uncertainty
5	Understand the concepts of Depreciation and Replacement analysis along with their methods of calculation
6	Familiarization with the phenomenon of inflation and the use of price indices in engineering Economics
7	Introduction to basic concepts of Accounting and Financial Management

Pre-Requisite:

1	Mathematics

Unit	Content
1	**UNIT 1 INTRODUCTION** Introduction to Economics - Concept of Engineering Economics – Law of Demand & Law of Supply – Determinants of Demand & Supply – Elasticity of demand - Concept of Utility – Law of diminishing marginal utility – Equi- Marginal Utility – consumer's Surplus analysis – Indifference Curve Approach – Budget Line – Consumer's Equilibrium
2	**UNIT 2 PRODUCTION, COST ANALYSIS AND PRICING** Production function – returns to scale – production optimization – least cost input – Isoquants – Managerial uses of production function. Cost concepts – cost function – Determinants of cost – Short run and long run cost curves – Cost output decisions – Estimation of cost - Pricing under different market structures – price discrimination – pricing methods in practice.
3	**UNIT 3 MONEY, BANKING AND TRADE** Money- nature and functions – Inflation and Deflation – Kinds of Banking – commercial banks – Central banking – Credit instrument - Monetary Policy – International trade – Balance of trade and Balance of Payments – taxation – Direct and Indirect taxes – GST - Impact and Incidence of tax - Concept of National Income – Features with reference to developing countries.
4	**UNIT 4 PLAN AND POLICIES FOR ECONOMIC GROWTH IN INDIA** Brief overview of post-independence period – plans – Five years plans and it role on Economic growth - Role of Industry in economic development - Industrial Policies in India – New Economic Reforms - New industrial Policy – MSME - concept of unemployment - concept of poverty - concept of urbanization.
5	**UNIT 5 ESTIMATION** Estimation of Material – Labor and Overhead Cost – Allocation of Overheads – Estimation for different types of jobs - Use of relevant Indian Standard Specifications - Bar bending Schedules – Mass haul Diagrams

	– Estimating Earthwork and Foundations – Estimating Concrete and Masonry – Finishes –Interiors –MEP works – BIM and quantity take-offs.

COURSE OUTCOMES

On completion of the course the student will be able to

CO1: Have an idea of Economics in general, Economics of India particularly for public sector agencies and private sector businesses

CO2: Be able to perform and evaluate present worth, future worth and annual worth analyses on one of more economic alternatives.

CO3: Be able to carry out and evaluate benefit/cost, life cycle and breakeven analyses on one or more economic alternatives.

CO4: Be able to understand the technical specifications for various works to be performed for a project and how they impact the cost of a structure.

CO5: Be able to quantify the worth of a structure by evaluating quantities of constituents, derive their cost rates and build up the overall cost of the structure.

CO6: Be able to understand how competitive bidding works and how to submit a competitive bid proposal.

TEXT/REFERENCE BOOKS

1. V. Mote, S. Paul, G. Gupta (2004), Managerial Economics, Tata McGraw Hill
2. Misra, S.K. and Puri (2009), Indian Economy, Himalaya
3. Paul A Samuelson and William D Nardhaus, Economics, McGraw Hill International Edition
4. M Chakravarty, Estimating, Costing Specifications & Valuation Relevant Indian Standard Specifications.
5. Dutta, B.N., Estimating and Costing in Civil Engineering (Theory & Practice), UBS Publishers, 2016
6. Barthwal R R, Industrial Economics – An Introductory Text Book, New Age International Pvt Ltd, 2000.
7. Panneer Selvam, R, "Engineering Economics", Prentice Hall of India Ltd, New Delhi, 2001.
8. Zahid A khan: Engineering Economy, "Engineering Economy", Dorling Kindersley, 2012

Name of the Course:	**Digital Electronics**	
Course Code: ESC-301	Semester: III	
Duration: 6 months	Maximum Marks: 100	
Teaching Scheme		**LTP:3-0-0**
Credit Points:	3	
Objective:		
1	To acquire the basic knowledge of different analog components and their applications	
2	To acquire the basic knowledge of digital logic levels and application of knowledge to understand digital electronics circuits.	
3	To prepare students to perform the analysis and design of various digital electronic circuits	
Pre-Requisite:		
1	Bridge course in basic electronic ,Basic BJTs.	
2	P-N diodes, Schottky diodes	
3	Basic FETs and OPAMP as a basic circuit component. Concept of Feedback	

Module	
1	a) Data and number systems; Binary, Octal and Hexadecimal representation and their conversions; BCD, ASCII, EBDIC, Gray codes and their conversions; Signed binary number representation with 1's and 2's complement methods, Binary arithmetic. b) Venn diagram, Boolean algebra; Various Logic gates- their truth tables and circuits; Representation in SOP and POS forms; Minimization of logic expressions by algebraic method, K-map method
2	a) Combinational circuits- Adder and Subtractor circuits; Applications and circuits of Encoder, Decoder, Comparator, Multiplexer, De-Multiplexer and Parity Generator. [5] b) Memory Systems: RAM, ROM, EPROM, EEROM c) Design of combinational circuits-using ROM, Programming logic devices and gate arrays. (PLAs and PLDs)
3	Sequential Circuits- Basic memory element-S-R, J-K, D and T Flip Flops, various types of Registers and counters and their design, Irregular counter, State table and state transition diagram, sequential circuits design methodology.
4	a) Different types of A/D and D/A conversion techniques. b) Logic families-TTL, ECL, MOS and CMOS, their operation and specifications.

Name of the Course:	**COMPUTATIONAL STATISTICS**	
Course Code: **(BSC-301)**	Semester: III	
Duration: 6 months	Maximum Marks: 100	
LTP:3-1-0		
Credit Points:	4	

Multivariate Normal Distribution: Multivariate Normal Distribution Functions, Conditional Distribution and its relation to regression model, Estimation of parameters.

Multiple Linear Regression Model: Standard multiple regression models with emphasison detection of collinearity, outliers, non-normality and autocorrelation, Validation of model assumptions.

Multivariate Regression: Assumptions of Multivariate Regression Models, Parameterestimation, Multivariate Analysis of variance and covariance

Discriminant Analysis: Statistical background, linear discriminant function analysis,Estimating linear discriminant functions and their properties.

Principal Component Analysis: Principal components, Algorithm for conducting principal component analysis, deciding on how many principal components to retain, H-plot.

Factor Analysis: Factor analysis model, Extracting common factors, determining numberof factors, Transformation of factor analysis solutions, Factor scores.

Cluster Analysis: Introduction, Types of clustering, Correlations and distances, clustering by partitioning methods, hierarchical clustering, overlapping clustering, K-Means Clustering-Profiling and Interpreting Clusters.

Text Books:

1. An Introduction to Multivariate Statistical Analysis, T.W. Anderson.
2. Applied Multivariate Data Analysis, Vol I & II, J.D. Jobson.
3. Statistical Tests for Multivariate Analysis, H. Kris.
4. Programming Python, MarkLutz.
5. Python 3 for Absolute Beginners, Tim Hall and J-P Stacey.
6. BeginningPython: From Novice to Professional, Magnus Lie Hetland. Edition, 2005.
7. Beginner's Guide for Data Analysis using R Programming, Jeeva Jose, KhannaPublishing House.
8. Data Science and Analytics, V.K. Jain, Khanna Publishing House.

Reference Books:

1. Regression Diagnostics, Identifying Influential Data and Sources of Collinearety, D.A.Belsey, E. Kuh and R.E. Welsch
2. Applied Linear Regression Models, J. Neter, W. Wasserman and M.H. Kutner.
3. The Foundations of Factor Analysis, A.S. Mulaik.
4. Introduction to Linear Regression Analysis, D.C. Montgomery and E.A. Peck.
5. Cluster Analysis for Applications, M.R. Anderberg.
6. Multivariate Statistical Analysis, D.F. Morrison.
7. Python for Data Analysis, Wes Mc Kinney.

Course code: PCC-CS-301	**Category:**
Course Title: Data Structure & Algorithms using C	**Semester: III**
L-T-P : 3-0-0	**Credit: 3**

Detailed Contents

Basic Terminologies and Introduction to Algorithm & Data Organisation: Algorithm specification, Recursion, Performance analysis, Asymptotic Notation - The Big-O, Omega and Theta notation, Programming Style, Refinement of Coding - Time-Space Trade Off, Testing, Data Abstraction

Linear Data Structure: Array, Stack, Queue, Linked-list and its types, Various Representations, Operations & Applications of Linear Data Structures

Non-linear Data Structure: Trees (Binary Tree, Threaded Binary Tree, Binary Search Tree, B & B+ Tree, AVL Tree, Splay Tree) and Graphs (Directed, Undirected), Various Representations, Operations & Applications of Non-Linear Data Structures

Searching and Sorting on Various Data Structures: Sequential Search, Binary Search, Comparison Trees, Breadth First Search, Depth First Search Insertion Sort, Selection Sort, Shell Sort, Divide and Conquer Sort, Merge Sort, Quick Sort, Heap sort, Introduction to Hashing

File Organization (Sequential, Direct, Indexed Sequential, and Hashed) and various types of accessing schemes.

Graph: Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis.

Text Books:

1. Fundamentals of Data Structures, E. Horowitz, S. Sahni, S. A-Freed, Universities Press.
2. Data Structures, R.S. Salaria, Khanna Book Publishing, Delhi.
3. Data Structures and Algorithms, A. V. Aho, J. E. Hopperoft, J. D. Ullman, Pearson.
4. Expert Data Structures with C, R.P. Patel, Khanna Publishing House.

Reference Books:

1. The Art of Computer Programming: Volume 1: Fundamental Algorithms, Donald E. Knuth.
2. Design and Analysis of Algorithms, Gajendra Sharma, Khanna Book Publishing
3. Introduction to Algorithms, Thomas, H. Cormen, Charles E. Leiserson,

Ronald L.Rivest, Clifford Stein, The MIT Press.

4. Open Data Structures: An Introduction (Open Paths to Enriched Learning),(Thirty First Edition), Pat Morin, UBC Press.

Course title: Discrete Mathematics

Course code: PCC-CS-302

LTP: 3-1-0

Boolean algebra: Introduction of Boolean algebra, truth table, basic logic gate, basic postulates of Boolean algebra, principle of duality, canonical form, Karnaugh map.

Abstract algebra: Set, relation, group, ring, field.

Combinatorics: Basic counting, balls and bins problems, generating functions, recurrence relations. Proof techniques, principle of mathematical induction, pigeonhole principle.

Graph Theory: Graphs and digraphs, complement, isomorphism, connectedness and reachability, adjacency matrix, Eulerian paths and circuits in graphs and digraphs, Hamiltonian paths and circuits in graphs and tournaments, trees; Planar graphs, Euler's formula, dual of a planer graph, independence number and clique number, chromatic number, statement of Four-color theorem.

Logic: Propositional calculus - propositions and connectives, syntax; Semantics - truth assignments and truth tables, validity and satisfiability, tautology; Adequate set of connectives; Equivalence and normal forms; Compactness and resolution; Formal reducibility - natural deduction system and axiom system; Soundness and completeness.

Text Books: 1.

Text Books:

1. Topics in Algebra, I. N. Herstein, John Wiley and Sons.
2. Digital Logic & Computer Design, M. Morris Mano, Pearson.
3. Elements of Discrete Mathematics, (Second Edition) C. L. LiuMc Graw Hill, New Delhi.
4. Graph Theory with Applications, J. A. Bondy and U. S. R. Murty, Macmillan Press, London.
5. Mathematical Logic for Computer Science, L. Zhongwan, World Scientific, Singapore.
6. Discrete Structures, S.B. Singh, Khanna Publishing House

Reference Books:

1. Introduction to linear algebra. Gilbert Strang.
2. Introductory Combinatorics, R. A. Brualdi, North-Holland, New York.
3. Graph Theory with Applications to Engineering and Computer Science, N. Deo, Prentice Hall, Englewood Cliffs.
4. Introduction to Mathematical Logic, (Second Edition), E. Mendelsohn, Van-Nostrand, London.

Course code: PCC-CS-391	**Category:**
Course Title: Data Structure & Algorithms using C	**Semester: III**
L-T-P : 0-0-4	**Credit: 2**

The laboratory should be preceded or followed by a tutorial to explain the approach or algorithm to be implemented for the problem given.

List of Practical:

1. Implementation of searching and sorting techniques.
2. Implementation of linked list.
3. Implementation of push and pop operation on stack
4. Implementation of inqueue and dequeue operation.
5. Write a program to solve the problems using iteration/recursion
6. Write a program to implement Merge Sort
7. Write a program to implement Bubble Sort
8. Program for storing data as tree structure and implementation of various traversal techniques
9. Program for storing data as graph structure and implementation of various traversal techniques
10. Write a program to implement Linear Sort
11. Write a program to implement Binary Sort

**** Faculty may add or remove experiments as per syllabus requirements.**

Name of the Course:	**Digital Electronics Lab**
Course Code: ESC-391	Semester: III
Duration: 6 months	Maximum Marks: 100
L-T-P: 0-0-2	**Credit -1**
Pre-Requisite:	
	ESC-301

1	Realization of basic gates using Universal logic gates.
2	Code conversion circuits- BCD to Excess-3 and vice-versa.
3	Four-bit parity generator and comparator circuits.
4	Construction of simple Decoder and Multiplexer circuits using logic gates.
5	Design of combinational circuit for BCD to decimal conversion to drive 7-segment display using multiplexer.

6	Construction of simple arithmetic circuits-Adder, Subtractor.
7	Realization of RS-JK and D flip-flops using Universal logic gates.
8	Realization of Universal Register using JK flip-flops and logic gates.
9	Realization of Universal Register using multiplexer and flip-flops.
10	Construction of Adder circuit using Shift Register and full Adder.
11	Realization of Asynchronous Up/Down counter.
12	Realization of Synchronous Up/Down counter.
13	Design of Sequential Counter with irregular sequences.
14	Realization of Ring counter and Johnson's counter.
15	Construction of adder circuit using Shift Register and full Adder.

Course Tittle: English Language Laboratory-II

Course code: HSMC-391

LTP: 0-0-4

Course Objectives:

1. To facilitate computer-assisted multi-media instruction enabling individualized and independent language learning
2. To sensitize students to the nuances of English speech sounds, word accent, intonation and rhythm
3. To bring about a consistent accent and intelligibility in students' pronunciation of English by providing an opportunity for practice in speaking
4. To improve the fluency of students in spoken English and neutralize their mother tongue influence
5. To train students to use language appropriately for public speaking and interviews.

Learning Outcomes: Students will be able to attain

1. Better understanding of nuances of English language through audio-visual experience and group activities
2. Neutralization of accent for intelligibility
3. Speaking skills with clarity and confidence which in turn enhances their employability skills.

Syllabus

English Language and Communication Skills Lab (ELCS) shall have two parts:

a. **Computer Assisted Language Learning (CALL) Lab**
b. **Interactive Communication Skills (ICS) Lab**

Listening Skills

Objectives

1. To enable students develop their listening skills so that they may appreciate its role in the LSRW skills approach to language and improve their pronunciation
2. To equip students with necessary training in listening so that they can comprehend the speech of people of different backgrounds and regions

Students should be given practice in listening to the sounds of the language, to be able to recognize them and find the distinction between different sounds, to be able to mark stress and recognize and use the right intonation in sentences.

- Listening for general content
- Listening to fill up information
- Intensive listening

- Listening for specific information

Speaking Skills

Objectives

1. To involve students in speaking activities in various contexts
2. To enable students express themselves fluently and appropriately in social and professional contexts
   - Oral practice: Just A Minute (JAM) Sessions
   - Describing objects/situations/people
   - Role play – Individual/Group activities

As the syllabus is very limited, it is required to prepare teaching/learning materials by the teachers collectively in the form of handouts based on the needs of the students in their respective colleges for effective teaching/learning and timesaving in the Lab)

Exercise – I

CALL Lab:

Understand: Listening Skill- Its importance – Purpose- Process- Types- Barriers of Listening.
Practice: Introduction to Phonetics – Speech Sounds – Vowels and Consonants.

ICS Lab:

Understand: Communication at Work Place- Spoken vs. Written language.

Practice: Ice-Breaking Activity and JAM Session- Situational Dialogues–Greetings–Taking Leave – Introducing Oneself and Others.

Exercise – II

CALL Lab:

Understand: Structure of Syllables – Word Stress and Rhythm– Weak Forms and Strong Forms in Context.
Practice: Basic Rules of Word Accent - Stress Shift - Weak Forms and Strong Forms in Context.

ICS Lab:

Understand: Features of Good Conversation – Non-verbal Communication.
Practice: Situational Dialogues – Role-Play- Expressions in Various Situations –Making Requests and Seeking Permissions - Telephone Etiquette.

Exercise - III CALL Lab:

Understand: Intonation- Errors in Pronunciation- the Influence of Mother Tongue (MTI).
Practice: Common Indian Variants in Pronunciation – Differences in British and American Pronunciation.

ICS Lab:

Understand: How to make Formal Presentations.

Practice: Formal Presentations.

Exercise – IV CALL Lab:

Understand: Listening for General Details.

Practice: Listening Comprehension Tests. **ICS Lab**:

Understand: Public Speaking – Exposure to Structured Talks.

Practice: Making a Short Speech – Extempore.

Exercise – V CALL Lab:

Understand: Listening for Specific Details.

Practice: Listening Comprehension Tests. **ICS Lab**:

Understand: Interview Skills.

Practice: Mock Interviews.

Minimum Requirement of infrastructural facilities for Lab:

1. **Computer Assisted Language Learning (CALL) Lab:**

   The Computer Assisted Language Learning Lab has to accommodate 40 students with 40 systems, with one Master Console, LAN facility and English language learning software for self- study by students.

System Requirement (Hardware component):

Computer network with LAN facility (minimum 40 systems with multimedia) with the following specifications:

i) Computers with Suitable Configuration
ii) High Fidelity Headphones

2. **Interactive Communication Skills (ICS) Lab:**

The Interactive Communication Skills Lab: A Spacious room with movable chairs and audio-visual aids with a Public-Address System, a LCD and a projector etc.

Course Title: **Introduction to Innovation, IP Management & Entrepreneurship**
Course code**: HSMC-401 LTP: 2- 0-0**

Course Pre Requisite(s):

Good knowledge of Fundamentals of Management

Course Outcome(s):

The major emphasis of the course will be on creating a learning system through which management students can enhance their innovation and creative thinking skills, acquaint themselves with the specialchallenges of starting new ventures and use IPR as an effective tool to protect their innovations and intangible assets from exploitation.

As a part of this course, students will:

- Learn to be familiar with creative and innovative thinking styles
- Learn to investigate, understand and internalize the process of founding a startup
- Learn to manage various types of IPR to protect competitive advantage

Topics to Be Covered:

UNIT – I

Innovation: What and Why?

Innovation as a core business process, Sources of innovation, Knowledge push vs. need pull innovations.Class

Discussion- Is innovation manageable or just a random gambling activity?

UNIT – II

Building an Innovative Organization

Creating new products and services, Exploiting open innovation and collaboration, Use of innovation forstarting a new venture.

Class Discussion- Innovation: Co-operating across networks vs. 'go-it-alone' approach

UNIT – III

Entrepreneurship:

- Opportunity recognition and entry strategies
- Entrepreneurship as a Style ofManagement
- Maintaining Competitive Advantage- Use of IPR to protect Innovation

UNIT – IV

Entrepreneurship- Financial Planning:

- Financial Projections and Valuation
- Stages of financing
- Debt, Venture Capital and other forms of Financing

UNIT – V

Intellectual Property Rights (IPR)

- Introduction and the economics behind development of IPR: Business Perspective
- IPR in India – Genesis and Development
- International Context
- Concept of IP Management, Use in marketing

UNIT – VI

Types of Intellectual Property

- Patent- Procedure, Licensing and Assignment, Infringement and Penalty
- Trademark- Use in marketing, example of trademarks- Domain name
- Geographical Indications- What is GI, Why protect them?
- Copyright- What is copyright
- Industrial Designs- What is design? How to protect?

Class Discussion- Major Court battles regarding violation of patents between corporate companies

Home Assignment:

Case study materials book will be given to students. Students are required to meet in groups before coming to class and prepare on the case for the day. Instructor may ask the student groups to present their analysis and findings to the class.

Further, the topic for class discussion will be mentioned beforehand and students should be ready to discuss these topics (in groups) in class. Students are required to meet in groups before coming to class and prepare on the topic. Few topics are mentioned below as examples. Instructor can add or change any topic as per requirement.

Topic 1- Is innovation manageable or just a random gambling activity?

Topic 2- Innovation: Co-operating across networks vs. 'go-it-alone' approach

Topic 3- Major Court battles regarding violation of patents between corporate companies.

Text Books:

1. Joe Tidd, John Bessant. Managing Innovation: Integrating Technological, Market and Organizational Change
2. Case Study Materials: To be distributed for class discussion

Course Title**: FORMAL LANGUAGE & AUTOMATA THEORY**
Course code**: PCC -CS -401**
LTP: 2-1-0

Introduction: Alphabet, languages and grammars, productions and derivation, Chomsky hierarchy of languages.

Regular languages and finite automata: Regular expressions and languages, deterministic finite automata (DFA) and equivalence with regular expressions, nondeterministic finite automata (NFA) and equivalence with DFA, regular grammars and equivalence with finite automata, properties of regular languages, Kleene's theorem, pumping lemma for regular languages, Myhill-Nerode theorem and its uses, minimization of finite automata.

Context-free languages and pushdown automata: Context-free grammars (CFG) and languages (CFL), Chomsky and Greibach normal forms, nondeterministic pushdown automata (PDA) and equivalence with CFG, parse trees, ambiguity in CFG, pumping lemma for context-free languages, deterministic pushdown automata, closure properties of CFLs.

Context-sensitive languages: Context-sensitive grammars (CSG) and languages, linear bounded automata and equivalence with CSG.

Turing machines: The basic model for Turing machines (TM), Turing recognizable (recursively enumerable) and Turing-decidable (recursive) languages and their closure properties, variants of Turing machines, nondeterministic TMs and equivalence with deterministic TMs, unrestricted grammars and equivalence with Turing machines, TMs as enumerators.

Undecidability: Church-Turing thesis, universal Turing machine, the universal and diagonalization languages, reduction between languages and Rice s theorem, undecidable problems about languages.

Basic Introduction to Complexity: Introductory ideas on Time complexity of deterministic and nondeterministic Turing machines, P and NP, NP- completeness, Cook's Theorem, other NP - Complete problems.

Text Books:

1. Introduction to Automata Theory, Languages, and Computation John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman.

Reference Books:

1. Elements of the Theory of Computation, Harry R. Lewis and Christos H. Papadimitriou.
2. Automata and Computability, Dexter C. Kozen.
3. Introduction to the Theory of Computation, Michael Sipser.
4. Introduction to Languages and the Theory of Computation, John Martin.
5. Computers and Intractability: A Guide to the Theory of NP Completeness, M. R. Garey and D. S.Johnson.

Course code: PCC -CS -402	**Category:**
Course Title: OOPs using C++	**Semester: IV**
L-T-P : 2-1-0	**Credit:3**

Detailed content

Procedural programming, An Overview of C: Types Operator and Expressions, Scope and Lifetime, Constants, Pointers, Arrays, and References, Control Flow, Functions and Program Structure, Namespaces, error handling, Input and Output (C-way), Library Functions (string, math,stdlib), Command line arguments, Pre-processor directive

Some difference between C and C++: Single line comments, Local variable declaration within function scope, function declaration, function overloading, stronger type checking, Reference variable, parameter passing–value vs. reference, passing pointer by value or reference, #define constant vs const, Operator new and delete, the typecasting operator, Inline Functions in contrast to macro, default arguments

The Fundamentals of Object Oriented Programming: Necessity for OOP, Data Hiding, Data Abstraction, Encapsulation, Procedural Abstraction, Class and Object.

More extensions to C in C++ to provide OOP Facilities: Scope of Class and Scope Resolution Operator, Member Function of a Class, private, protected and public Access Specifier, this Keyword,Constructors and Destructors, friend class, error handling (exception)

Essentials of Object Oriented Programming: Operator overloading, Inheritance – Single and Multiple, Class Hierarchy, Pointers to Objects, Assignment of an Object to another Object, Polymorphism through dynamic binding, Virtual Functions, Overloading, overriding and hiding, Error Handling

Generic Programming: Template concept, class template, function template, template specialization

Input and Output: Streams, Files, Library functions, formatted output

Text Books:

1. The C++ Programming Language, Bjarne Stroustrup, Addison Wesley.
2. C++ and Object-Oriented Programming Paradigm, Debasish Jana, PHI Learning Pvt. Ltd.

Reference Books:

1. Programming – Principles and Practice Using C++, Bjarne Stroustrup, Addison Wesley.
2. The Design and Evolution of C++, Bjarne Stroustrup, Addison Wesley.

Course Title: **COMPUTER ORGANIZATION & ARCHITECHTURE**
Course code: **PCC-CS-403 LTP: 3-0-0**

Revision of basics in Boolean logic and Combinational/Sequential Circuits.

Functional blocks of a computer: CPU, memory, input-output subsystems, control unit.

Instruction set architecture of a CPU: Registers, instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set. Outlining instruction sets of some common CPUs.

Data representation: Signed number representation, fixed and floating point representations, character representation.

Computer arithmetic: Integer addition and subtraction, ripple carry adder, carry look-ahead adder, etc. multiplication – shift-and-add, Booth multiplier, carry save multiplier, etc.
Division restoring and non-restoring techniques, floating point arithmetic, IEEE 754 format.

Introduction to x86 architecture.

CPU control unit design: Hardwired and micro-programmed design approaches, design of a simple hypothetical CPU.

Memory system design: Semiconductor memory technologies, memory organization.

Peripheral devices and their characteristics: Input-output subsystems, I/O device interface, I/Otransfers–programcontrolled,interruptdrivenandDMA,privilegedand non-privileged instructions,softwareinterruptsandexceptions.Programsandprocesses
– role of interrupts in process state transitions, I/O device interfaces – SCII, USB

Pipelining: Basicconceptsofpipelining,throughputandspeedup,pipelinehazards. Parallel Processors: Introduction to parallel processors, Concurrent access to memory and cachecoherency.

Memory organization: Memory interleaving, concept of hierarchical memory organization, cachememory, cache size vs. block size, mapping functions, replacement algorithms, write policies.

Text Books:

1. Computer System Architecture M. M. Mano:, 3rd ed., Prentice Hall of India, New Delhi, 1993.
2. Computer Organization and Design: The Hardware/Software Interface, David A. Patterson andJohn L. Hennessy.
3. Computer Organization and Embedded Systems, Carl Hamacher.

Reference Books:

1. Computer Architecture and Organization, John P. Hayes.
2. Computer Organization and Architecture: Designing for Performance, William Stallings.
3. Computer System Design and Architecture, Vincent P. Heuring and Harry F. Jordan

Course code: PCC -CS -404	**Category:**
Course Title: Operating Systems	**Semester: IV**
L-T-P : 3-0-0	**Credit: 3**

Detailed Content

Unit I.

Overview of Operating Systems: OS and the Computer System, Efficiency, System Performance and User Convenience, Classes of Operating Systems, Batch Processing Systems, Multiprogramming Systems, Time Sharing Systems, Real Time Operating Systems, Distributed Operating Systems, Modern Operating Systems.

Unit II.

Processes and Threads: Processes and Programs, Programmer view of Processes, OS view of Processes, Threads, Case studies of Processes and Threads.

Scheduling: Preliminaries, Non-preemptive Scheduling Policies, Preemptive Scheduling Policies, Scheduling in Practice, Real Time Scheduling, Scheduling in Unix, Scheduling in Linux, Scheduling in Windows, Performance Analysis of Scheduling Policies.

Unit III.

Memory Management: Managing the Memory Hierarchy, Static and Dynamic Memory Allocation, Memory Allocation to a Process, Reuse of Memory, Contiguous Memory Allocation, Noncontiguous Memory Allocation, Paging, Segmentation, Segmentation with Paging, Kernel Memory Allocation, Virtual Memory: Virtual Memory Basics, Demand Paging, Page Replacement Policies, Memory Allocation to a Process, Shared Pages, Memory Mapped Files, Unix Virtual Memory, Linux Virtual Memory, Virtual Memory using Segmentation.

Unit IV.

Security and Protection: Overview of Security and Protection, Goals of Security and Protection, Security Attacks, Formal and Practical aspects of Security, Encryption, Authentication and Password Security, Access Descriptors and the Access Control Matrix, Protection Structures, Capabilities, Unix Security, Linux Security, Windows Security

TEXT BOOK:

1. A. Silberschatz et.al.-Operating System Concepts , 6th Edition, John Wiley Inc., 2003
2. H.M. Deitel -Operating Systems , 6th Edition, Pearson Education, 2006
3. A. Robbins- Linux Programming by Example- Pearson Education, New Delhi- 2005
4. Sumitabh Das : Your UNIX The Ultimate Guide; TMH

REFERENCE BOOKS:

1. D.M. Dhandhare - Operating Systems, 2nd Edition, Tata McGraw Hill, New Delhi, 2006
2. J.Goerzen- Linux Programming Bible, IDG Books, New Delhi- 2001
3. N.Mathew & R.Stones- Beginning Linux Programming Wiley Publishing India, 2004.
4. S.E. Mandnick & J.J. Donovan : Operating System; TMH

Course code: PCC -CS -492	**Category:**
Course Title: OOPs using C++ Laboratory	**Semester: IV**
L-T-P : 0-0-4	**Credit: 2**

Exercise 1

a) Write a C++ program to display "Hello, Welcome to C++ Programming"

b) Write a C++ program to print details name, roll number in a single and two lines.

c) Write a C++ program to print name by reading, assigning and initializing to a variable with an appropriate prompt.

d) Write a C++ program to print your personal details name, surname (single character),total marks, gender(M/F), result(P/F) by taking input from the user.

Exercise 2

a) Write a C++ program to convert centigrade into Fahrenheit. Formula: C=(F-32)/1.8

b) Write a C++ program that declares two integers, determines whether the first is a multiple of the second and print the result. (Hint: Use the remainder operator)

c) Write a C++ program that prompts the user to enter two integer values in int variables val1, val2 and find largest, sum, difference, product and ratio of these values.

d) Write a C++ program that prompts the user to enter three integer values, and then outputs the values in numerical sequence separated by commas. So, if the user enters the values 10 4 6, the output should be 4,6,10. If two values are the same, they should just be ordered together. So, the input 4 5 4 should give 4,4,5.

Exercise 3

a) Write a C++ program to read a sequence of double values into a vector. Think of each value as the distance between two cities along a given route. Compute and print the total distance. Find and print the smallest and greatest distance between two neighboring cities. Find and print the mean distance of the neighboring cities.

b) Write a C++ program to convert decimal to binary.

c) Write a C++ program to print the accepted number and its reverse number.

d) Write a C++ program to read marks in 6 subjects using vectors and find average marks

Exercise 4

a) Write a C++ program to read names using vector and display the names and their count.

b) Write a C++ program to read a number between 1 and 100 and the program asks questions to figure out what the number is (e.g. "Is the number you are thinking of less than 50?"). Your program should be able to identify the number after asking no more than seven questions. Hint: use the < and <= operators and the if-else statement.

c) Develop a simple calculator using if-else if and switch-case.

Exercise 5

a) Write a C++ program to find the sum of individual digits of a positive integer.

b) Make a vector holding the ten strings "zero", "one", … , "nine". Use that in a program that convertsa digits to its corresponding spelled out values; e.g. the input 5 gives the output five. Have thesame program, using the same input loop, convert spelled out numbers into their digit form; e.g., the input five gives the output 5.

c) Write a C++ program to find all the prime numbers between 1 and 100. Write a function to do this.

Exercise 6

a) Write a C++ program that uses functions.

a) To swap twointegers

b) To swap characters

c) To swap tworeals

b) Write a C++ program that reads a series of numbers and stores them in a vector<int>. After the user inputsall thenumbershewishesto, askhowmanyofthenumbersthe userwantstosum. Foran answer N, printthesumof thefirstNelementsofthevector. Forexample"Pleaseentersomenumbers(press'0' at prompt tostop):" 12 23 13 24 15 "Please enter how many of the numbers you wish to sum, starting from the first:" 3 "The sum of the first 3 numbers: 12 23 and 13 is 48"

c) Write a C++ program that writes out the Fibonacci series. Find the largest Fibonacci number that fits in an int.

Exercise 7

a) Define a class name_value that holds a string and a value. Give it a constructor (a bit like Token). Use vector<name_value> instead of two vectors.

b) Create a class employee that includes firstname(type String), lastname(type String) and a monthly salary. Create two employee objects and display each object's yearly salary. Give each employee a 10¿ raise and display each employee's yearly salary.

Exercise 8

a) Write a C++ program that reads digits and computes them into integers. For example 123 is read as the characters 1,2 and 3. The program should output "123 is 1 hundred and 2 tens and 3 ones". The number should be output as an int value. Handle numbers with one, two, three or four digits. Hint: to get the integer value 5 of the character '5' subtract '0' that is '5'-'0'==5.

b) Provide name constants that you really can't change the value of. Hint: you have to add a member to variable that distinguishes between constants and variables and check for it in set_value(). If you want to let the user define constants. You'll have to add a notation to let the user express that, for example, const pi=3.14.

Exercise 9

a) Write a function print() that prints a vector of ints to cout. Give it two arguments; a string for "labeling" the output and a vector.

b) Write two functions that reverse the order of elements in a vector<int>. The first reverse function should produce a new vector with the reversed sequence, leaving its original vector unchanged. The other reverse function should reverse the elements of its vector without using any other vectors.

Exercise 10

a) Write a function randint() that produces a pseudo-random number in the range [0:MAXINT].

b) Write a function that using randint() from the previous exercise. Computes a pseudorandom integer in the range(a:b). rand_in_range(int a, int b).

c) Write a function that finds the smallest and the largest element of a vector argument and also computes the mean and the median. Do not use global variables. Either return a struct containing the results or pass them back through reference arguments.

Exercise 11

a) Write a function that takes a vector<string> argument and returns a vector<int> containing the number of characters in each string. Also find the longest and the shortest string and the lexicographically first and last string.

b) Write a function that given two vector<double> price and weight computes a value (an "index") that is the sum of all price[i]*weight[i]. Note that we must have weight.size()<=price.size().

Exercise 12

a) Write a C++ program to display the contents of a text file.

b) Write a C++ program that counts the characters, lines and words in the text file.

c) Write a C++ program that produces the sum of all the numbers in a file of whitespace separated integers.

Exercise 13

a) Write a C++ program that creates a file of data in the form of the temperature. Fill the file with at least 50 temperature readings. Call this program store_temps.cpp and the file it creates raw_temps.txt.

b) Write a C++ program that accepts two file names and produces a new file that is the contents of the first file followed by the contents of the second; that is, the program concatenates the two files.

Exercise 14

a) Write a C++ program that given a file name and a word outputs each line that contains that word together with the line number. Hint:getline().

b) Write a C++ program that reads a text file and converts its input to all lower case, producing a new file.

Exercise 15

1. Write a C++ program that replaces punctuation with whitespace. For example, "don't use the as-if rule" becomes dont use the asif rule".
2. Write a C++ program to reverse the order of characters in a text file. For example, asdfghjkl becomes lkjhgfdsa.

Exercise 16

a) Write a C++ program that reads a text file and writes out how many characters of each character classification are in the file.

b) Write a C++ program draw a rectangle as a rectangle and as a polygon. Make the lines of the

polygon red and the lines of the rectangle blue.

c) Write a C++ program draw a 100-by-30 rectangle and place the text "PVPSIT" inside it.

Exercise 17

a) Write a C++ program to draw the Olympic five rings.

b) Write a C++ program to display an image like photo on the screen.

c) Write a C++ program to draw a part of an ellipse by defining a class arc. Hint: fl_arc().

Exercise 18

a) Write a C++ program to draw a box with rounded corners. Define a class box, consisting of four lines and four arcs.

b) Write a C++ program to draw a line with an arrowhead by defining a class arrow.

Exercise 19

a) Define a class poly that represents a polygon but checks that its points really do make a polygon in its constructor. Hint: you'll have to supply the points to the constructor.

b) Define a class star. One parameter should be the number of points. Write a C++ program to draw a few stars with differing numbers of points, differing line colors, and differing fill colors.

c) Define two classes smiley and frowny, which are both derived from class circle and have two eyes and a mouth. Next, derive classes from smiley and frowny, which add an appropriate hat to each.

Exercise 20

a) Write a C++ program to write a function void to_lower(char* s) that replaces all uppercase characters. Don't use any standard library functions.

b) Write a C++ program to write a function, char* findx(const char* s, const char* x), that finds the first occurrence of the string x in s.

Exercise 21

a) Write a C++ program that reads characters from cin into an array that you allocate on the free store. Read individual characters until an asterisk (*) is entered. Do not use a std::string.

b) Write a C++ program to write a function, char* strdup(const char*) that copies a string into memory it allocates on the free store. Use the dereference operator * instead.

Exercise 22

a) Write a C++ program to write a function char* findx(const char* s, const char* x) that find the first occurrence of the string x in s. Use dereference operator * instead.

Exercise 23

a) Write a C++ program to write a function template for finding the minimum value contained in any array.

b) Write a template function that takes a vector<T> vt and a vector<U> vu as arguments and returns the sum of all vt[i]*vt[i]s.

c) Define a class Int having a single member of class int. Define constructors, assignment, and operators +,-,*,/ for it.

d) Implement vector::operator=() using an allocator for memory management.

Exercise 24

a) Define a file handle class with a constructor that takes a string argument (filename), opens the file in the constructor, and closes it in the destructor.

b) Define an input and an output operator (>> and <<) for vector.

c) Given a list<int> as a (by-reference) parameter, make a vector<double> and copy the elements of the list into it. Verify that the copy was complete and correct. Then print the elements sorted in order of increasing value.

Exercise 25

a) Define a single-linked list, slist, and perform operations insertion, deletion and traverse.

b) Define a p vector to be like a vector of pointers except that it contains pointers to objects and its destructor deletes each object.

Course code: PCC -CS -494	**Category:**
Course Title: Operating Systems Laboratory	**Semester: IV**
L-T-P : 0-0-2	**Credit: 01**

The laboratory should be preceded or followed by a tutorial to explain the approach or algorithm to be implemented for the problem given.

1. Implement in C the following UNIX commands using System calls: cat and mv.
2. Write a program in C to determine the size of a file using the lseek command.
3. Write a program to calculate the number of blocks assigned for the file.
4. Write a C program that deletes a directory with all its subfolders. The name of the directory should be read from the command line.
5. Write a program that deletes every 5th byte from a file, but without using a temporary file or allocating a buffer in the memory.
6. Write a program in C to implement FCFS CPU scheduling Algorithm.
7. Write a program in C to implement SJF CPU scheduling Algorithm.
8. Write a program in C to implement Priority CPU scheduling Algorithm.
9. Write a program in C to implement Round Robin (RR) CPU scheduling Algorithm.
10. Write a program in c to read from the buffer & produce desired output.
11. Write a program in C to create Userid & Password.
12. Write a program in c to implement and find how many Users currently login in NetWork.
13. Write a program in c to create your own system call just like a copy.

14. Write a program in c to create your won system call just like a delete.

15. Write a program in c to find the Disk Space.

16. Write a program In C to find The number of pages in the process.

17. Write a program In C to find The number of frames allocated to the process.

18. Write a program in c to find the no. of blocks occupied by a file.

19. Write a program in c to create your won system call just like a delete.

20. Write a program in c to create your won system call just like a ls.

21. Write a program in c to find a PID no. of any Process.

Name of the Course:	**Software Engineering**
Course Code: **ESC-501**	Semester: V
	LTP: 3-0-0

Unit	**Conten t**
1	**Introduction:** Programming in the small vs. programming in the large; software project failures and importance of software quality and timely availability; of software engineering towards successful execution of large software projects; emergence of software engineering as a discipline, Software Engineering Historical Development from Jackson Structured Programming to Agile Development.
2	**Software Project Management:** Basic concepts of life cycle models – different models and milestones; software project planning –identification of activities and resources; concepts of feasibility study; techniques for estimation of schedule and effort; software cost estimation models and concepts of software engineering economics; techniques of software project control and reporting; introduction to measurement of software size; introduction to the concepts of risk and its mitigation; configuration management.
3	**Software Quality Management and Reliability:** Software quality; Garvin's quality dimensions McCall's quality factor, ISO 9126 quality factor; Software Quality Dilemma; Introduction to Capability Maturity Models (CMM and CMMI); Introduction to software reliability reliability models and estimation.
4	**Software Requirements Analysis, Design and Construction:** Introduction to Software Requirement Specifications (SRS) and requirement elicitation techniques; techniques for requirement modelling– decision tables, event tables, state transition tables Petrinets; requirements documentation through use cases; introduction to UML, introduction to software metrics and metrics-based control methods; measure of code and design quality.

5	**Object Oriented Analysis, Design and Construction:** Concepts -- the principles of abstraction, modularity, specification, encapsulation and information hiding; concepts of abstract data type; Class Responsibility Collaborator (CRC) model; quality of design; design measurements; concepts of design patterns; Refactoring; object-oriented construction principles; object oriented metrics.
6	**Software Testing:** Introduction to faults and failures; basic testing concepts; concepts of verification and validation; black box and white box tests; white box test coverage – code coverage, condition coverage, branch coverage; basic concepts of black-box tests – equivalence classes, boundary value tests, usage of state tables; testing use cases; transaction based testing; testing for non-functional requirements – volume performance and efficiency; concepts of inspection; Unit Testing, Integration Testing, System Testing and Acceptance Testing.
7	**Agile Software Engineering:** Concepts of Agile Methods, Extreme Programming; Agile Process Model - Scrum, Feature; Scenarios and Stories

Course code: PCC -CS -501	**Category:**
Course Title: Computer Networks	**Semester: V**
L-T-P : 3-0-0	**Credit:**
Objective:	

1	To develop an understanding of modern network architectures from a design andperformance perspective.
2	To introduce the student to the major concepts involved in wide-area networks(WANs), local area networks (LANs) and Wireless LANs (WLANs).
3	To provide an opportunity to do network programming
4	To provide a WLAN measurement ideas.

Detailed content

Unit 1:

Data communication Components: Representation of data and its flow Networks, Various Connection Topology, Protocols and Standards, OSI model, Transmission Media, LAN: Wired LAN, Wireless LANs, Connecting LAN and Virtual LAN, Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum.

Unit 2:

Data Link Layer and Medium Access Sub Layer: Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go back –
N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols -Pure ALOHA, Slotted ALOHA,CSMA/CD,CDMA/CA.

Unit 3:

Network Layer: Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP– Delivery, Forwarding and Unicast Routing protocols.

Unit 4:

Transport Layer: Process to Process Communication, User Datagram Protocol (UDP),Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm.

Unit 5:

Application Layer: Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls, Basic concepts of Cryptography.

Course code: PCC -CS -502	**Category:**
Course Title: Database Management Systems	**Semester: V**
L-T-P : 3-0-0	**Credit: 3**
Objective:	
1	To understand the different issues involved in the design and implementation of a database system.
2	To study the physical and logical database designs, database modeling, relational, hierarchical, and network models
3	To understand and use data manipulation language to query, update, and manage a database
4	To develop an understanding of essential DBMS concepts such as: database security, integrity, concurrency, distributed database, and intelligent database, Client/Server (Database Server), Data Warehousing.
5	To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.
6	To understand the different issues involved in the design and implementation of a database system.

Detailed content

UNIT-I: Database system architecture:

Data Abstraction, Data Independence, Data Definition Language (DDL),Data Manipulation Language(DML).

Data models: Entity-relationship model, network model, relational and object oriented data models, integrity constraints, data manipulation operations.

Unit-II: **Relational query languages and Relational algebra and calculus:**

Relational algebra, Tuple and domain relational calculus, SQL3, DDL and DML constructs, Open source and Commercial DBMS - MYSQL, ORACLE, DB2, SQLserver.

Relational database design: Domain and data dependency, Armstrong's axioms, Normal forms, Dependency preservation, Lossless design.

Query processing and optimization: Evaluation of relational algebra expressions,Query equivalence, Join strategies, Query optimization algorithms.

Unit-III: Storage strategies: Indices, B-trees, hashing.

Unit-IV TRANSACTION PROCESSING:

Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp based schedulers, Mult-

version and optimistic Concurrency Control schemes, Database recovery.

Unit-V Database Security:

Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection.

Unit-VI Advanced topics:

Object oriented and object relational databases, Logical databases, Web databases, Distributed databases, Data warehousing and data mining.

Course code: PCC -CS -503	**Category:**
Course Title: Machine Learning	**Semester: V**
L-T-P : 3-0-0	**Credit: 3**
Objective:	
1	Ability to comprehend the concept of supervised and unsupervised learning techniques
2	Differentiate regression, classification and clustering techniques and to implement their algorithms.
3	To analyze the performance of various machine learning techniques and to select appropriate features for training machine learning algorithms.

Course Outcomes:

1. Understand the concepts of various machine learning strategies.
2. Handle computational data and learn ANN learning models.
3. Solve real world applications by selecting suitable learning model.
4. Boost the performance of the model by combining results from different approaches.
5. Recognize and classify sequencing patterns using HMM.
6. Infer the association and relationship between the data objects.

Construct machine learning model for unseen data and can solve real world application.

Detailed Content:

Unit 1: Introduction to Machine Learning

Introduction to Machine Learning (ML); Feature engineering; Learning Paradigm, Generalization of hypothesis, VC Dimension, PAC learning, Applications of ML.

Unit 2: Data Handling and ANN

Feature selection Mechanisms, Imbalanced data, Outlier detection- Artificial neural networks including backpropagation- Applications

Unit 3: ML Models and Evaluation

Regression: Multi-variable regression; Model evaluation; Least squares regression; Regularization; LASSO; Applications of regression, Classification – KNN, Naïve Bayes, SVM, Decision Tree; Training and testing classifier models; Cross- validation; Model evaluation (precision,recall, F1-mesure, accuracy, area under curve); Statistical decision theory including discriminant functions and decision surfaces

Unit 4: Model Assessment and Inference

Model assessment and Selection –Ensemble Learning–Boosting, Bagging, Model Inference and Averaging, Bayesian Theory, EM Algorithm

Unit 5: Hidden Markov Models

Hidden Markov Models (HMM) with forward-backward and Vierbi algorithms; Sequence classification using HMM; Conditional random fields; Applications of sequence classification such as part-of-speech tagging.

Unit6:AssociationRules: MiningAssociationRulesinLargeDatabases.MiningFrequentPatterns--basic concepts-Efficient andscalablefrequentitemsetmining-methods,Apriorialgorithm,FP-Growthalgorithm.

Unit 7: **Clustering**
KMeans,HierarchicalClustering–Single,complete,Averagelinkage;Ward'salgorithm;minimum spanning tree clustering; BIRCH clustering

Name of the Course: **Computer Graphics**	
Course Code: PEC-CS-501 A	
L-T-P- 3-1- 0	Credit- 4
Unit	Content
1	**Introductiontocomputergraphics&graphicssystems**: Overview of computergraphics, representing pictures, preparing, presenting & interacting with pictures for presentations; Visualization & image processing; RGB color model, direct coding, lookup table; storage tube graphicsdisplay,Rasterscandisplay,3Dviewingdevices,Plotters,printers,digitizers,Lightpens etc.;Active&Passivegraphicsdevices; Computer graphicssoftware. **Scan conversion :** Points & lines, Line drawing algorithms; DDA algorithm, Bresenham'sline algorithm,Circlegenerationalgorithm; Ellipsegeneratingalgorithm;scanlinepolygon,fill algorithm, boundary fill algorithm, flood fill algorithm.
2	**2D transformation & viewing :** Basic transformations: translation, rotation, scaling; Matrix representations & homogeneous coordinates, transformations between coordinate systems; reflection shear; Transformation of points, lines, parallel lines, intersecting lines. Viewing pipeline, Window to view port co-ordinate transformation, clipping operations, point clipping, line clipping, clipping circles, polygons & ellipse. Cohenand Sutherland line clipping, Sutherland-Hodgeman Polygon clipping, Cyrus-beck clipping method **3Dtransformation&viewing:**3Dtransformations:translation, rotation, scaling &other transformations. Rotation about an arbitrary axis in space, reflection through an arbitrary plane; general parallel projection transformation;clipping, view port clipping, 3D viewing.

3	**Curves :** Curve representation, surfaces, designs, Bezier curves, B- spline curves, end Conditions for periodic B-spline curves, rational B-spline curves. **Hidden surfaces :** Depth comparison, Z-buffer algorithm, Back face detection, BSP tree method, the Painter's algorithm, scan-line algorithm; Hidden lineelimination, wire frame Methods,fractal - geometry. **Color&shadingmodels:** Light&colormodel;interpolative shading model;Texture. **Introduction to Ray-tracing:** Human vision and color, Lighting, Reflection and transmission models.

Name of the Course:	**Artificial Intelligence**
Course Code**:** PEC-CS-501B	Semester: V
LTP:3-1-0	Credit:4

Unit	Content
1	**Introduction** OverviewofArtificialintelligence-ProblemsofAI,AItechnique,Tic -Tac-Toeproblem. **Intelligent Agents** Agents & environment, nature of environment, structure of agents,goal based agents, utility based agents, learning agents. **Problem Solving** Problems,ProblemSpace&search:Definingtheproblemasstate spacesearch,production system,problemcharacteristics, issues in the design of search programs.
2.	**Search techniques** Solving problems by searching :problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search,depth limited search, bidirectional search, comparing uniform search strategies. **Heuristic search strategies** Greedy best-first search, A* search, memory bounded heuristic search: local search algorithms & optimization problems:Hill climbing search, simulated annealing search, local beam search, genetic algorithms; constraint satisfaction problems, local search for constraint satisfaction problems. **Adversarial search** Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, additional refinements, iterative deepening.

3	**Knowledge & reasoning** Knowledge representation issues, representation & mapping, approaches to knowledge representation, issues in knowledge representation.
4	**Using predicate logic** Representing simple fact in logic, representing instant & ISA relationship, computable functions & predicates, resolution, natural deduction. **Probabilistic reasoning** Representing knowledge in an uncertain domain, the semantics of Bayesian networks, Dumpster-Shafer theory, Fuzzy sets & Fuzzy logics.
5	**Natural Language processing** Introduction, Syntactic processing, semantic analysis, discourse & pragmatic processing. **Learning** Forms of learning, inductive learning, learning decision trees, explanation based learning, learning using relevance information, neural net learning & genetic learning. **Expert Systems** Representing and using domain knowledge, expert system shells, and knowledge acquisition.

Course Title: E-commerce and ERP Course
code- PEC-CS-501C
LTP: 3-1-0

Unit	Content
1	Overview, Definitions, Advantages & Disadvantages of E– Commerce, Threats of E–Commerce, Managerial Prospective, Rules & Regulations For Controlling E – Commerce, Cyber Laws.
2.	Technologies: Relationship Between E – Commerce & Networking, Different Types of Networking Commerce, Internet, Intranet & Extranet, EDI Systems Wireless Application Protocol: Definition, Hand Held Devices, Mobility & Commerce, Mobile Computing, Wireless Web, Web Security, Infrastructure Requirement For E -Commerce.
3	Business Models of e – commerce: Model Based On Transaction Type, Model Based On Transaction Party - B2B, B2C, C2B, C2C, E – Governance.
4	E–Strategy: Overview, Strategic Methods for developing E– commerce.
5	Four C's: (Convergence, Collaborative Computing, Content Management & Call Center). Convergence: Technological Advances in Convergence – Types, Convergence and its implications, Convergence & Electronic Commerce. Collaborative Computing: Collaborative product development, contract as per
	CAD, Simultaneous Collaboration, Security. **Content Management:** Definition of content, Authoring Tools & Content Management, Content–partnership, repositories, convergence, providers, Web Traffic & Traffic Management ; Content Marketing. **Call Center :** Definition, Need, Tasks Handled, Mode of Operation, Equipment , Strength & Weaknesses of Call Center, Customer Premises Equipment (CPE).
	Supply Chain Management : E–logistics, Supply Chain Portal, Supply Chain Planning Tools(SCP Tools), Supply Chain Execution (SCE), SCE - Framework, Internet's effect on Supply Chain Power.

	E–PaymentMechanism:Paymentthroughcardsystem,E– Cheque,E–Cash,E– PaymentThreats&Protections. E – Marketing :. Home –shopping, E-Marketing, Tele-marketing
	Electronic Data Interchange (EDI) : Meaning, Benefits, Concepts, Application, EDI Model,Protocols (UN EDI FACT / GTDI, ANSI X – 12), Data Encryption (DES / RSA).
	Risk of E – Commerce : Overview, Security for E – Commerce, Security Standards, Firewall, Cryptography, Key Management, Password Systems, Digital certificates, Digital signatures.
	Enterprise Resource Planning (ERP) : Features, capabilities and Overview of Commercial Software, re-engineering work processes for IT applications, Business Process Redesign, Knowledge engineering and data warehouse . Business Modules: Finance, Manufacturing (Production), Human Resources, Plant Maintenance, Materials Management, QualityManagement, Sales&Distribution ERPPackage, ERP Market: ERP Market Place, SAP AG, PeopleSoft, BAAN, JD Edwards, Oracle Corporation ERP-Present and Future: Enterprise Application Integration (EAI), ERP and E-Commerce, ERP and Internet, Future Directions in ERP.

Course Title: Computer Networks Laboratory
Course code: PCC -CS -591
L-T-P: 0-0-2

1. **NIC Installation & Configuration (Windows/Linux).**
2. **Understanding IP address, subnet etc.**

Familiarization with

- Networking cables (CAT5, UTP)
- Connectors (RJ45, T-connector)
- Hubs, Switches **3.**

TCP/UDP 3. Socket Programming

- Simple, TCP based, UDP based
- Multicast & Broadcast Sockets
- Implementation of a Prototype Multithreaded

Server

4. **Implementation of Data Link Layer Flow Control Mechanism (Stop & Wait, Sliding Window) Data Link**

   Layer ErrorDetection Mechanism (Cyclic Redundancy Check) Data Link Layer Error Control Mechanism (Selective Repeat, Go Back N)

5. **Server Setup/Configuration : FTP, Telnet, NFS, DNS, Firewall**

Course code: PCC -CS -592	**Category:**
Course Title: Data Base Management System Laboratory	**Semester: V**
L-T-P : 0-0-4	**Credit: 02**

Structured Query Language

1. **Creating Database**
   - Creating a Database
   - Creating a Table
   - Specifying Relational Data Types
   - Specifying Constraints
   - Creating Indexes

2. **Table and Record Handling**
   - INSERT statement
   - Using SELECT and INSERT together
   - DELETE, UPDATE, TRUNCATE statements
   - DROP, ALTER statements

3. **Retrieving Data from a Database**
   - The SELECT statement
   - Using the WHERE clause
   - Using Logical Operators in the WHERE clause
   - Using IN, BETWEEN, LIKE , ORDER BY, GROUP BY and HAVING **Clause**
   - Using Aggregate Functions
   - Combining Tables Using JOINS
   - Subqueries

4. **Database Management**
   - Creating Views
   - Creating Column Aliases

5. **Creating Database Users and using Grant and Revoke**

Course code: PCC -CS -593	**Category:**
Course Title: Machine Learning using Python Laboratory	**Semester: V**
L-T-P :0-0-4	**Credit: 02**

Lab Experiments:

1. Implement and demonstrate the FIND algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
3. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
4. Build an Artificial Neural Network by implementing the Back propagation algorithm and test thesame using appropriate datasets.
5. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
6. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
7. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML libraryclasses/API.
8. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and commenton the quality of clustering. You can add Java/Python ML library classes/API in the program.
9. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
10. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

CourseTittle:Design&AnalysisofAlgorithm
Course code:PCC-CS-601
LTP: 3-0-0 Credit-03
Objective:

1. Theaimofthismoduleistolearnhowtodevelopefficientalgorithmsforsimplecomputational tasks and reasoning about the correctness of them.
2. Through the complexity measures, different range of behaviours of algorithms and the notion of tractable and intractable problems will be understood.

Unit	Content	Hrs/Unit	Marks/Unit
1	**Introduction:** Characteristics of algorithm.Analysis of algorithm: Asymptotic analysis of complexity bounds – best,average and worst-case behavior; Performance measurements of Algorithm, Time and space trade-offs, Analysisofrecursivealgorithmsthroughrecurrence relations: Substitution method, Recursion tree method andMasters'theorem	8	
2	**Fundamental Algorithmic Strategies:** Brute-Force, Greedy, Dynamic Programming, Branch and-Bound and Backtrackingmethodologies for the design of algorithms; Illustrations of these techniques for Problem-Solving, Bin Packing, Knap Sack TSP. Heuristics –characteristics and theirapplication domains.	8	
3	**Graph and Tree Algorithms:** Traversal algorithms: Depth First Search (DFS) and Breadth First Search(BFS);Shortest path algorithms, Transitive closure, Minimum Spanning Tree, Topological sorting, Network Flow Algorithm. Tractable and Intractable Problems: Computability.	6	
4	DesignofAlgorithms,Computabilityclasses–P,NP,NP-complete and NP-hard. Cook's theorem, Standard NP-complete problems and Reduction techniques.	10	
6	Advanced Topics: Approximation algorithms, Randomized algorithms, Class of problems beyondNP – P SPACE	4	

Tbooks/ reference books:

ntroductiontoAlgorithms,4THEdition,ThomasHCormen,CharlesELieserson,RonaldLRivestand Clifford Stein, MITPress/McGraw-Hill.
Fundamentals of Algorithms – E. Horowitz et al.
Algorithm Design, 1ST Edition, Jon Kleinberg and ÉvaTardos, Pearson.
Algorithm Design: Foundations, Analysis, and Internet Examples, Second Edition,Michael T Goodrich and Roberto Tamassia, Wiley.
Algorithms--ACreativeApproach,3RDEdition,UdiManber,Addison-Wesley,Reading,MA Design & Analysis of Algorithms, Gajendra Sharma, Khanna Publishing House (AICTE Recommended Textbook –2018) Algorithms Design and Analysis, Udit Agarwal, Dhanpat Rai.

Course Outcomes

On completion of the course students will be able to

PCC-CS601.1 For a given algorithms analyze worst-case running times of algorithms based on asymptoticanalysis and justify the correctness of algorithms.

PCC-CS601.2 Describe the greedy paradigm and explain when an algorithmic design situation calls for it.For a given problem develop the greedy algorithms.

PCC-CS601.3 Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it. Synthesize divide-and-conquer algorithms. Derive and solve recurrence relation.

PCC-CS601.4 Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it. For a given problems of dynamic-programming and

PCC-CS601.5 develop the dynamic programming algorithms, and analyze it to determineits computational complexity.

PCC-CS601,6 For a given model engineering problem model it using graph and write thecorrespondingalgorithm to solve the problems.

PCC-CS601.7 Explain the ways to analyze randomized algorithms (expected running time, probability of error).

PCC-CS601.8 Explain what an approximation algorithm is. Compute the approximation factor of an approximation algorithm (PTAS and FPTAS).

Course Title: Web Technology

Course code: PCC-CS-602

LTP: 2-1-0

Web Development:

HTML, Structure, Tags, Lists, Table, Link and it's types ,Images, Form, Frame, Style sheets and it's type

Introduction to Java:

Java and Java applications, Java Virtual Machine(JVM), Java Runtime Environment(JRE)Java Development Kit(JDK,) Byte code, Java characteristics, Object oriented Programming, Simple java programs, Data types, Operators, Expressions, control statements, Selection statements, Iteration statements, Jump statements

Classes, Inheritance :

Classes in java, Declaring a class, Creating instances of class, Constructors, Argument Passing, use of static keyword, Innner class. Method overloading, Inheritance, use of super keyword ,Method overriding, Abstract class, Dynamic method dispatch, use of final keyword

Interface, Package:

Package, Acesss control mechanism, Interface, Dynamic Method look up

Exception Handling:

Java Exception Handling Mechanism, try, catch, throw, throws and finally, Exception types, Built in Exceptions: checked and unchecked exceptions, User defined Exceptions

String Handling:

String and String Buffer, Constructors, String operations : character extractions, String comparisons, searching, strings, modifying a string. To String() and valueOf() methods, String Buffer operations

Java I/O Stream:

I/O basics, Byte stream, Character stream, Reading console input, Writing console output, Reading and writing files

Java Utility package:

Collection overview, Collection interfaces, Collection classes: ArrayList, LinkedList, Accessing a collection using, iterator and for-Each statement

Applet:

Applet class, Applet architecture, Applet Skeleton, Life cycle methods, setForeground() and set Bachground()methods, Using the status window,HTML Applet tag, Passing parameters to an applet, GetCodebase() and Get Documentbase() methods.

Event Handling and AWT:

Delegation Event Model, Event classes, Sources of Events, Event Listener interfaces,Event handling using adapter class, Inner and anonymous class, AWT classes: Label,Button,TextField etc.

Course Title: Compiler Design

Course code: PEC-CS-601 A

LTP: 3-0-0

Objective:

1. To understand and list the different stages in the process of compilation.
2. Identify different methods of lexical analysis
3. Design top-down and bottom-up parsers
4. Identify synthesized and inherited attributes
5. Develop syntax directed translation schemes
6. Develop algorithms to generate code for a target machine

Unit 1: Introduction to Compiling

Compilers, Analysis of the source program, The phases of the compiler, Cousins of the compiler.

Unit 2: Lexical Analysis

The role of the lexical analyzer, Tokens, Patterns, Lexemes, Input buffering, Specifications of a token, Recognition of a tokens, Finite automata, from a regular expression to an NFA, From a regular expression to NFA, From a regular expression to DFA, Design of a lexical analyzer generator (Lex).

Unit 3: Syntax Analysis

The role of a parser, Context free grammars, Writing a grammar, Top down Parsing, Non- recursive Predictive parsing (LL), Bottom up parsing, Handles, Viable prefixes, Operator precedence parsing, LR parsers (SLR, LALR), Parser generators (YACC). Error Recovery strategies for different parsing techniques.

Unit 4: Syntax directed translation

Syntax director definitions, Construction of syntax trees, Bottom-up evaluation of S attributed definitions, L attributed definitions, Bottom-up evaluation of inherited attributes.

Unit 5: Type checking

Type systems, Specification of a simple type checker, Equivalence of type expressions, Type conversions.

Unit 6: 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, Parameter passing (call by value, call by reference, copy restore, call by name), Symbol tables, dynamic storage allocation techniques

Unit 7: Intermediate code generation

Intermediate languages, Graphical representation, Three-address code, Implementation of three address statements (Quadruples, Triples, Indirect triples).

Unit 8: Code optimization

Introduction, Basic blocks & flow graphs, Transformation of basic blocks, Dag representation of basic blocks, The principle sources of optimization, Loops in flow graph, Peephole optimization.

Unit 9: Code generations

Issues in the design of code generator, a simple code generator, Register allocation &assignment.

Text book and Reference books:

1. Aho, Sethi, Ullman - "Compiler Principles, Techniques and Tools" - Pearson Education.
2. Holub - "Compiler Design in C" - PHI.

Course Outcomes:

On completion of the course students will be able to

1. Understand given grammar specification develop the lexical analyser
2. Design a given parser specification design top- do and bottom-up parsers
3. Develop syntax directed translation schemes
4. Develop algorithms to generate code for a target machine

Name of the Course:	**Pattern Recognition**
Course Code: PEC-CS-601B	
Credit: 3	LTP:3-0-0

Unit	Content
1	Basics of pattern recognition
2	**Bayesian decision theory** Classifiers, Discriminant functions, Decision surfaces Normal density and discriminant functions Discrete features
3	**Parameter estimation methods** Maximum-Likelihood estimation Gaussian mixture models Expectation-maximization method Bayesian estimation
4.	**Hidden Markov models for sequential pattern classification** Discrete hidden Markov models Continuous density hidden Markov models
5	**Dimension reduction methods** Fisher discriminant analysis, Principal component analysis, Parzen-window method, K-Nearest Neighbour method
6	Non-parametric estimation techniques for Density estimation
7	**Linear discriminant function based classifier** Perceptron Support vector machines
8	**Non-metric methods for pattern classification** Non-numeric data or nominal data Decision trees
9	**Unsupervised learning and clustering** Criterion functions for clustering Algorithms for clustering: K-means, Hierarchical and other methods

Course Title: Image Processing
Course code: PEC-CS-601 C
LTP: 3-0-0

Unit	Conten t
1	**Introduction** Background, Digital Image Representation, Fundamental steps in Image Processing, Elements of Digital Image Processing - Image Acquisition, Storage, Processing, Communication, Display.
2	**Digital Image Formation** A Simple Image Model, Geometric Model- Basic Transformation (Translation, Scaling, Rotation), Perspective Projection, Sampling & Quantization -Uniform & Non uniform.
3	**Mathematical Preliminaries** Neighbourofpixels,Connectivity,Relations, Equivalence & Transitive Closure; Distance Measures,Arithmetic/LogicOperations,Fourier Transformation, Properties of The Two Dimensional Fourier Transform, Discrete Fourier Transform, Discrete Cosine & SineTransform.
4.	**Image Enhancement** Spatial Domain Method, Frequency Domain Method, Contrast Enhancement -Linear & Nonlinear Stretching, Histogram Processing; Smoothing - Image Averaging, Mean Filter, Low-pass Filtering; Image Sharpening. High-pass Filtering, High- boost Filtering, Derivative Filtering, Homomorphic Filtering; Enhancement in the frequency domain - Low pass filtering, High pass filtering.
5	**Image Restoration** Degradation Model, Discrete Formulation, Algebraic Approach to Restoration - Unconstrained & Constrained; Constrained Least Square Restoration, Restoration by Homomorphic Filtering, Geometric Transformation Spatial Transformation, Gray LevelInterpolation.
6	**Image Segmentation** Point Detection, Line Detection, Edge detection, Combined detection, Edge Linking & Boundary Detection - Local Processing, Global Processing via The Hough Transform; Thresholding - Foundation, Simple Global Thresholding, Optimal Thresholding; Region Oriented Segmentation - Basic Formulation, Region Growing by Pixel Aggregation, Region Splitting & Merging.

Text book and Reference books:

1. Hearn, Baker – "Computer Graphics (C version 2nd Ed.)" – Pearson education
2. Z. Xiang, R. Plastock – "Schaum's outlines Computer Graphics (2nd Ed.)" – TMH
3. D. F. Rogers, J. A. Adams – "Mathematical Elements for Computer Graphics (2nd Ed.)" – TMH

Course Title: SOFTWARE DESIGN USING UML
Course code: PEC-CS-601 D
LTP: 3-0-0
Objective:

To understand the fundamentals of object modeling

- To understand and differentiate Unified Process from other approaches
- To design with static UML diagrams.
- To design with the UML dynamic and implementation diagrams
- To improve the software design with design patterns.
- To test the software against its requirements specification

Course outcome

Upon Completion of the course, the students should be able to:

- Express software design with UML diagrams
- Design software applications using OO concepts.
- Identify various scenarios based on software requirements
- Transform UML based software design into pattern based design using design patterns
  Understand the various testing methodologies for OO software

Unit 1: UNIFIED PROCESS AND USE CASE DIAGRAMS

Introduction to OOAD with OO Basics - Unified Process – UML diagrams – Use Case –Case study – the Next Gen POS system, Inception -Use case Modelling – Relating Use cases – include, extend and generalization – When to use Use-cases.

Unit 2: STATIC UML DIAGRAMS

Class Diagram— Elaboration – Domain Model – Finding conceptual classes and description classes – Associations – Attributes – Domain model refinement – Finding conceptual class Hierarchies – Aggregation and Composition - Relationship between sequence diagrams and use cases – When to use Class Diagrams

Unit 3: DYNAMIC AND ARCHITECTURAL MODELING UML DIAGRAMS

Dynamic Diagrams – UML interaction diagrams - System sequence diagram – Collaboration diagram – When to use Communication Diagrams - State machine diagram and Modelling – When to use State Diagrams - Activity diagram – When to use activity diagrams Implementation Diagrams - UML package diagram - When to use package diagrams - Component and Deployment Diagrams – When to use Component and Deployment diagrams

Unit 4: DESIGN PATTERNS AND ELEMENTS DESIGN PATTERNS

GRASP-Designing objects with responsibilities – Applying GoF design patterns – Creational Patterns, Structural Patterns , Behavioral Patterns, Design Elements: Architectural design elements - Interface design elements - Component level diagram elements - Deployment level design elements, Mapping design to code.

Unit 5: AGILE METHODOLOGY

Theories for Agile Management – Agile Software Development – Traditional Model vs. Agile Model - Classification of Agile Methods – Agile Manifesto and Principles – Agile Project Management – Agile Team Interactions – Ethics in Agile Teams - Agility in Design, Testing – Agile Documentations – Agile Drivers, Capabilities and Values

Course Title: Big Data Analytics Course
code: PEC -CS -602 A
LTP: 3-0-0

COURSE OBJECTIVE

Understand big data for business intelligence. Learn business case studies for big data analytics. Understand no SQL big data management. Perform map-reduce analytics using Hadoop and related tools

Unit 1:

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

Unit 2:

Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schemaless databases, materialized views, distribution models, sharding, master-slave replication, peer-peer replication, sharding and replication, consistency, relaxing consistency, version stamps, map-reduce, partitioning and combining, composing map-reduce calculations.

Unit 3:

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

Unit 4:

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

Unit 5:

HBase, data model and implementations, HBase clients, HBase examples, praxis. Cassandra, Cassandra data model, Cassandra examples, Cassandra clients, Hadoop integration.

Unit 6:

Pig, Grunt, pig data model, Pig Latin, developing and testing Pig Latin scripts.
definition, HiveQL data manipulation, HiveQL queries.
Hive, data types and file formats, HiveQL data

References:

1. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging
2. V.K. Jain, Big Data and Hadoop, Khanna Publishing House, New Delhi (2017).
3. V.K. Jain, Data Analysis, Khanna Publishing House, New Delhi (2019).
4. Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
5. P.J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2012.
6. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012.
7. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.
8. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
9. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
10. Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilley, 2010.
11. Alan Gates, "Programming Pig", O'Reilley, 2011.

Course Title: Cloud Computing

Concepts of Abstraction and Virtualization technologies: Types of virtualizations (access, application, CPU, storage), Mobility patterns (P2V, V2V, V2P, P2P, D2C, C2C, C2D, D2D).

Course code: PEC -CS -602 B

LTP: 3-0-0

Unit 1: Definition of Cloud Computing and its Basics

Defining a Cloud, Cloud Types – NIST model, Cloud Cube model, Deployment models (Public, Private, Hybrid and Community Clouds), Service Platform as a Service, Software as a Service with examples of services/service providers, models–Infrastructure as a Service, Cloud Reference model, Characteristics of Cloud Computing – a shift in paradigm Benefits and advantages of Cloud Computing, A brief introduction on Composability, Infrastructure, Platforms, Virtual Appliances, Communication Protocols, Applications, Connecting to the Cloud by Clients, IaaS– Basic concept, Workload, partitioning of virtual private server instances, Pods, aggregations, silos PaaS – Basic concept, tools and development environment with examples SaaS - Basic concept and characteristics, Open SaaS and SOA, examples of SaaS platform Identity as a Service (IDaaS), Compliance as a Service (CaaS)

Unit 2: Use of Platforms in Cloud Computing

Concepts of Abstraction and Virtualization technologies: Types of virtualization (access, application, CPU, storage), Mobility patterns (P2V, V2V, V2P, P2P, D2C, C2C, C2D, D2D) Load Balancing and Virtualization: Basic Concepts, Network resources for load balancing, Advanced load balancing (including Application Delivery Controller and Application Delivery Network), Mention of The Google Cloud as an example of use of load balancing Hypervisors: Virtual machine technology and types, VMware vSphere Machine Imaging (including mention of Open Virtualization Format – OVF) Porting of applications in the Cloud: The simple Cloud API and AppZero Virtual Application appliance, Concepts of Platform as a Service, Definition of services, Distinction between SaaS and PaaS (knowledge of Salesforce.com and Force.com), Application development Use of PaaS Application frameworks Discussion of Google Applications Portfolio.

– Indexed search, Dark Web, Aggregation and disintermediation, Productivity applications and service, AdWords, Google Analytics, Google Translate, a brief discussion on Google Toolkit (including introduction of Google APIs in brief), major features of Google App Engine service, Windows Azure platform: Microsoft's approach.

architecture, and main elements, overview of Windows Azure AppFabric, Content Delivery Network, SQL Azure and Windows Live services.

Unit 3: Cloud Infrastructure

Cloud Management:

An overview of the features of network management systems and a brief introduction of related products from large cloud vendors, Monitoring of an entire cloud computing deployment stack – an overview with mention of some products, Lifecycle management of cloud services (six stages of lifecycle).

Concepts of Cloud Security:

Cloud security concerns, Security boundary, Security service boundary Overview of security mapping Security of data: Brokered cloud storage access, Storage location and tenancy, encryption, and auditing and compliance Identity management (awareness of Identity protocol standards)

Unit 4: Concepts of Services and Applications:

Service Oriented Architecture: Basic concepts of message-based transactions, Protocol stack for an SOA architecture, Event-driven SOA, Enterprise Service Bus, Service catalogs,

Applications in the Cloud: Concepts of cloud transactions, functionality mapping Application attributes, Cloud

service attributes, System abstraction and Cloud Bursting, Applications and Cloud APIs Cloud-based Storage: Cloud storage definition– Manned and Unmanned

Webmail Services: Cloud mail services including Google Gmail, Mail2Web, Windows Live Hotmail, Yahoo mail, concepts of Syndication services

Text book and Reference books:

1. Cloud Computing Bible by Barrie Sosinsky, Wiley India Pvt. Ltd, 2013
2. Mastering Cloud Computing by Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, McGraw Hill Education (India) Private Limited, 2013
3. Cloudcomputing: Apracticalapproach, Anthony T. Velte, Tata Mcgraw-Hill
4. Cloud Computing, Miller, Pearson
5. Building applications in cloud: Concept, Patterns and Projects, Moyer, Pearson
6. Cloud Computing – Second Edition by Dr. Kumar Saurabh, Wiley India

Course Title: Data Mining & Analytics
Course code: PEC -CS 602 C
LTP: 3-0-0

Purpose: To acquire knowledge of Data mining techniques
At the end of the course, students will be able to
Understand the concepts of Data Mining
Familiarize with association rule mining
Familiarize various classificationalgorithms
Understand the concepts of Cluster analysis
Implement the Data mining concepts with various domains

Session	Description of Topic
	UNIT I: Introduction
1	Introduction to Data Mining – Kinds of Data
2	Data mining Functionalities – Interesting Patterns
3	Task Primitives
4	Issues in DataMining
5	Data Preprocessing

	UNIT II: Association Rules
6	Basic Concepts
7	Frequent Item Set Mining Methods
8	Association Rules
9	Correlation analysis
	UNIT III: Classification and Prediction
10	Issues Regarding Classification and Prediction
11	Decision Tree Induction Classification
12	Bayesian and Rule Based Classification
13	Support Vector Machine
14	Prediction
	UNIT IV: Cluster Analysis
15	What is ClusterAnalysis
16	Types of Data in Cluster Analysis
17	Categorization of Clustering Methods
18	Hierarchical Methods
	UNIT V: PLASTIC ANALYSIS
19	Applications and Trends in Data Mining
20	Machine learning
21	Big data
22	Cloud computing

REFERENCE BOOKS/OTHER READING MATERIAL:

1. Jiawei Han and Micheline Kamber, "Data Mining – Concepts and Techniques", Second Edition, Morgan Kaufmann Publishers, 2006.
2. M. H. Dunham, "Data Mining: Introductory and Advanced Topics", Pearson Education. 2001.
3. D. Hand, H. Mannila and P. Smyth, "Principles of Data Mining", Prentice Hall. 2001.
4. I H. Witten and E. Frank, "Data Mining: Practical Machine Learning Tools and Techniques", Morgan Kaufmann. 2000.
5. Nathan Marz, James Warren, "Big Data-Principles and best practices of scalable real-time data systems", DreamTech Press, 2015
6. Arshdeep Bahga, Vijay Madisetti, "Cloud Computing: A Hands-On Approach", University Press, 2016

Course Title: Cyber Law and Ethics
Course Code: OE-CS-601 A
LTP: 3-0-0

Unit 1: Introduction of Cybercrime: What is cybercrime?,Forgery, Hacking, Software Piracy, Computer Network intrusion Category of Cybercrime: how criminals plan attacks, passive attack, Active attacks, cyberstalking.

Unit-2: Cybercrime Mobile & Wireless devices: Security challenges posted by mobile devices, cryptographic security for mobile devices, Attacks on mobile/cell phones, Theft, Virus, Hacking. Bluetooth; Different viruses on laptop

Unit: 3: Tools and Methods used in Cyber crime: Proxy servers, panword checking, Random checking, Trojan Horses and Backdoors; DOS & DDOS attacks; SQL injection: buffer over flow.

Unit: 4: Phishing & Identity Theft: Phising methods,ID Theft; Online identity method. Cybercrime Cybersecurity: Legal aspects, indian laws, IT act, Public key certificate.

Text book and Reference books:

1. Cyber security by Nina Gobole & Sunit Belapune; Pub: Wiley India.
2. Information Security & Cyber laws, Gupta & Gupta, Khanna Publishing House

Course Title: Mobile Computing
Course code: OE-CS-601 B
LTP: 3-0-0

Unit	Content
1	Introduction to Personal Communications Services (PCS): PCS Architecture, Mobility management,Networks signalling. Global System for Mobile Communication (GSM) system overview: GSM Architecture, Mobility management, Network signalling.
2	General Packet Radio Services (GPRS): GPRS Architecture, GPRS Network Nodes. Mobile Data Communication: WLANs (Wireless LANs) IEEE 802.11 standard, Mobile IP.
3	Wireless Application Protocol (WAP): The Mobile Internet standard, WAP Gateway and Protocols, wireless markup Languages (WML). Wireless Local Loop (WLL): Introduction to WLL Architecture, wireless Local Loop Technologies.
4.	Third Generation (3G) Mobile Services: Introduction to International Mobile Telecommunications 2000 (IMT 2000) vision, Wideband Code Division Multiple Access (W-CDMA), and CDMA 2000, Quality of services in 3G
5	Global Mobile Satellite Systems; case studies of the IRIDIUM and GLOBALSTAR systems. Wireless Enterprise Networks: Introduction to VirtualNetworks,Blue tooth technology, Blue tooth Protocols.
6	Server-side programming in Java, Pervasive webapplication architecture, Device independent example.

Text book and Reference books:

1. "Pervasive Computing", Burkhardt, Pearson
2. "Mobile Communication", J. Schiller, Pearson
3. "Wireless and Mobile Networks Architectures", Yi-Bing Lin & Imrich Chlamtac, John Wiley& Sons, 2001
4. "Mobile and Personal Communication systems and services", Raj Pandya, Prentice Hall ofIndia, 2001.
5. "Guide to Designing and Implementing wireless LANs", Mark Ciampa, Thomson learning,Vikas Publishing House, 2001.
6. "Wireless Web Development", Ray Rischpater, Springer Publishing,
7. "The Wireless Application Protocol", Sandeep Singhal, Pearson .
8. "Third Generation Mobile Telecommunication systems", by P.Stavronlakis, Springer Publishers,
9. Brijesh Gupta "Mobile Computing", Khanna Publishing House, New Delhi.

Course Title: Bio Informatics
Course code: OE-CS-601 C
LTP: 3-0-0

Unit 1: INTRODUCTION TO MOLECULAR BIOLOGY

Concepts of Cell, tissue, types of cell, components of cell, organelle. Functions of different organelles.Concepts of DNA: Basic Structure of DNA; Double Helix structure; Watson and crick model. Exons and Introns and Gene Concept. Concepts of RNA : Basic structure, Difference between RNA and DNA. Typesof RNA. Concept of Protein: Basic components and structure. Introduction to Central Dogma: Transcription and Tranlation Introduction to Metabolic Pathways.

Unit2:Sequence Databases: Introduction to Bioinformatics. Recent challenges in Bioinformatics. Protein Sequence Databases, DNA sequence databases. sequence database search programs like BLAST and FASTA.NCBI different modules: GenBank; OMIM, Taxonomy browser, PubMed;

Unit 3: DNA SEQUENCE ANALYSIS

DNA Mapping and Assembly: Size of Human DNA, Copying DNA: Polymerase Chain Reaction (PCR), Hybridization and Microarrays, Cutting DNA into Fragments, Sequencing Short DNA Molecules, Mapping Long DNA Molecules. DeBruijn Graph. Sequence Alignment: Introduction, local and global alignment, pair wise and

multiple alignment, Dynamic Programming Concept. Alignment algorithms: Needleman and Wunsch algorithm, Smith-Waterman.

Unit 4: Introduction Probabilistic models used in Computational Biology

Probabilistic Models; Hidden Markov Model: Concepts, Architecture, Transition matrix, estimation matrix. Application of HMM in Bioinformatics: Gene finding, profile searches, multiple sequence alignment and regulatory site identification. Bayesian networks Model

: Architecture, Principle, Application in Bioinformatics.

Unit 5: Biological Data Classification and Clustering: Assigning protein function and predicting splice sites: DecisionTree.

Course Title: Design Analysis & Algorithm Laboratory

Course code: PCC-CS-691

LTP: 0-0-2

Laboratory Experiments:	
Divide and Conquer:	
1	Implement Binary Search using Divide and Conquer approach Implement Merge Sort using Divide and Conquer approach
2	Implement Quick Sort using Divide and Conquer approach Find Maximum and Minimum element from a array of integer using Divide and Conquer approach
3	Find the minimum number of scalar multiplication needed for chain of matrix
4	Implement all pair of Shortest path for a graph (Floyed- Warshall Algorithm) Implement Traveling Salesman Problem
5	Implement Single Source shortest Path for a graph (Dijkstra , Bellman Ford Algorithm
	Brunch and Bound:
6	Implement 15 Puzzle Problem
Backtracking:	
7	Implement 8 Queen problem
8	Graph Coloring Problem Hamiltonian Problem
Greedy method	
9	Knapsack Problem Job sequencing with deadlines
10	Minimum Cost Spanning Tree by Prim's Algorithm Minimum Cost Spanning Tree by Kruskal's Algorithm
Graph Traversal Algorithm	
11	Implement Breadth First Search (BFS)
12	Implement Depth First Search (DFS)
***Faculty may add or modify experiments as per need**	

Course Title: Web Technology Laboratory
Course code: PCC -CS -692
LTP: 0-0-2

Programming Lab of JAVA

1. Write a program to input two numbers and find its sum.
2. Write a program to input principal amount, rate and time. Calculate its simple interest and compound interest.
3. Write a program to input the radius of any circle and find its area and perimeter.
4. Write a program to input a number and check it is positive or negative.
5. Write a program to input the marks of three subject (Out of 100) and calculate its percentage, total marks, total distinction in subjects and display fail if he/she gets marks less vthan 30 in any one of the subjects.
6. Write a program to input three numbers and find the greatest
   (i) By using nested if statement
   (ii) By using TernaryOperator
7. WAP to input two numbers and perform addition, substraction and multiplication by using switch statement.
8. Write a program to implement relational operator.(>,<,<=,=>,==,!=)
9. Write a program to implement bitwise operators.(&,|,^,~)
10. Write a program to implement shift operators. (<<,>>)
11. Write a program to display odd and even numbers between 5 to 50 and also display its sum separately.
12. Write a program to display and the sum of all numbers between 15 to 100, which is divisible by 7.
13. Write a program to input two numbers and swap them
    (I) By using thirdvariable.
    (II) Without using third variable (Two methods)
14. Write a program to implement the following series:- (1) 1 3 5 7 9 11
    (2) 2 5 10 17 26 37
    (3) 0 6 24 60 120 210
    (4) 2 10 30 68 130 222
    (5) 1 2 4 8 16 32
15. Write a program to find the sum of the Series:-
    (1) 1 + ½ +1/3 +1/4 +..... ..... +1/n
    (2) ½ + 2/3 + ¾ +.....+ n/n+1
    (3) 1+ 2/2! + 3/3! +.....+ n/n!
    (4) 1 + 1/3 + 1/5 + ……up to n- terms.
16. Write a program to create your own package and use it in your program.

17. Write a program to input a number and check it is prime or not.
18. Write a program to input a number and check it is palindrome or not.
19. Write a program to display all Armstrong numbers between 123 to 999.
20. Write a program to input a number and find all the prime number between 5 to 100.
21. Write a program to input a number and find its reverse.
22. Write a program to input a number and find the sum of all its digits.
23. Write a program to input a decimal number and convert it into binary.
24. Write a program to input a binary number and convert it into decimal.
25. Write a program to input an octal number and convert it into decimal.
26. Write a program to input a decimal number and convert it into octal.
27. Write a program to input the elements of array and sort them by using selection sort.
28. Write a program to input a key element and search it from the given array.
29. Write a program to find the greatest and smallest element of the array.
30. Write a program to enter a number and find its factorial.
31. Write a program to enter three numbers and find its GCD.
32. Write a program to generate Fibonacci series.
33. Write a program to input the elements of 3X3 matrix and display in matrix format.
34. Write a program to input the elements of 3X3 matrix and check it is symmetric or not.
35. Write a program to input the elements of 3X3 matrix and display the principal and reverse diagonal elements of the matrix.
36. Write a program to input the elements of 3X3 matrix and check it is sparse or dense.
37. Write a program to perform addition, substraction and multiplication of two matrix.
38. Write a program to implement all the pre-defined methods related to String .
39. Write a program to enter a string and perform:-
    (1) the length of string
    (2) reverse of string
    (3) number of vowels
40. Write a program to implement default constructor.
41. Write a program to implement parametric constructor.
42. Write a program to implement constructor overloading.
43. Write a program to calculate factorial of any number by using default constructor.
44. Write a program to generate the following series by using default constructor
    (1) 0 1 1 2 3 5 …… up to n terms.
    (2) 2 3 5 8 13 21…….. up to n terms.
45. Write a program to input n and r and implement permutation and combination.
46. Write a program to implement method overloading.
47. Write a program to implement single inheritance.
48. Write a program to implement multiple inheritances by using interface class.
49. Write a program to implement multilevel inheritance.
50. Write a program to implement hierarchal inheritance.
51. Write a program to implement abstract class.
52. Write a program to create your own package and use it in your program.
53. Write a program to implement exception handling:-

By using Arithmetic Exception, Array Index Out of Bounds Exception, Number Format Exception and Input Mismatch Exception

54. Write a program to implement Multithreading by using different methods like run(),sleep(), get Priority(),setPriority(), get Name(), set Name().
55. Write a program to implement Applet: - By using Font and Color class, different geometrical Methods
56. Programs on HTML and CSS
57. Design your own website using HTM,CSS.

****Faculty may add or modify experiments as per need**

Course Title: **Financial & Cost Accounting**
Course code: **HSMC-701**
LTP: **2-0-0**
Course Outcome(s):
This course will help students
• To create an awareness about the importance and usefulness of the accounting concepts and their managerial implications
• To develop an understanding of the financial statements and the underlying principles and learn to interpret financial statements
• To create awareness about cost accounting, different types of costing and cost management

Unit	Content
1	Accounting Concept: Introduction, Techniques and Conventions, Financial Statements- Understanding & Interpreting Financial Statements
2	Accounting Process: • Book Keeping and Record Maintenance • Fundamental Principles and Double Entry • Journal, Ledger, Trial Balance, Balance Sheet, Final Accounts • Cash Book and Subsidiary Books • Rectification of Errors
3	Financial Statements: Form and Contents of Financial Statements, Analyzing and Interpreting Financial Statements, Accounting Standards. Class Discussion: Corporate Accounting Fraud- A Case Study of Satyam
4	Cash Flow and Fund Flow Techniques: Introduction, How to prepare, Difference between them

Course Title: **Human Resource Management**
Course code: **HSMC-702**
LTP: **2-0-0**
Course Outcomes On completion of this course, the students will be able
CO1: To develop the understanding of the concept of human resource management and to understand its relevance in organizations.
CO2: To develop necessary skill set for application of various HR issues.
CO3: To analyse the strategic issues and strategies required to select and develop manpower resources.
CO4: To integrate the knowledge of HR concepts to take correct business decisions.

Unit	Content
1	1. Human Resource Management: Meaning, Scope, objectives, and functions of HRM , HR as a Factor of Competitive Advantage, Structure of HR Department, , Line and staff responsibility of HR Managers, Environmental factors influencing HRM 2. Human Resource Planning: definition, objective, process of HRP. Supply and Demand Forecasting techniques, Manpower Inventory, Career Planning& Development, Succession Planning, Rightsizing, Restructuring. Human Resource Information System (HRIS) 3. Recruitment and Selection: Process, Sources, Methods of selection, Interviewing Methods, Skills and Errors. 4. Human Resource Development: Definition, objective, process of HRD, Assessment of HRD Needs, HRD Methods: Training and Non-Training, Training Process; Designing, Implementation and Evaluation of Training Programmes, Induction Training. Developing Managerial Skills for: team management, collaboration, interaction across business functions, presentation , Negotiation, and Networking 5. Performance Appraisal Systems : Purpose, Methods, Appraisal instruments, 360 degree Appraisal, HR Score Card, Errors in appraisal, Potential Appraisal, Appraisal Interview.
2	6. Compensation Management : Concepts, Components; System of Wage

	Payment, job evaluation, wage/ salary fixation, incentives, bonus, ESOPs, Fringe Benefits, Retirement Benefits. Compensation Plans 7. Industrial Relations in India: Parties; Management and Trade Unions, Industrial Disputes: Trends, Collective Bargaining, Settlement Machineries, Role of Government, Labour Policy in India. 8. Workers' Participation in Management: Concept, Practices and Prospects in India, Quality Circles and other Small Group Activities. 9. Discipline Management: Misconduct, Disciplinary action, Domestic Enquiry, Grievance Handling 10. Strategic HRM: Meaning, Strategic HRM vs Traditional HRM, SHRM Process, barriers to SHRM. Nature of e-HRM, eRecruitment & Selection, e-Performance Management, e-Learning .

Textbooks:

1. Agarwala T. - Strategic Human Resource Management, OUP
2. Aswathappa, K. - Human Resource Management, Tata McGraw Hill
3. Jyothi P. & Venkatesh, D.N. - Human Resource Management, OUP
4. Ramaswamy, E.A. - Managing Human Resources, OUP
5. Saiyadain, M.S - Human Resource Management : Tata McGraw Hill
6. Mondal Sabari & Goswami Amal - Human Resource Management: Vrinda Publications

Course Title: **Introduction to IoT**
Course code: **PEC-CS-701 A**
LTP: **3-1-0**

Unit	Content
1	Introduction to IoT and Use cases: Understanding basic concepts of IoT, Consumer IoT vs Industrial Internet, Fundamental building blocks, Use Cases of IoT in various industry domains,
2	Architecture: IoT reference architectures, Industrial Internet Reference Architecture, Edge Computing, IoT Gateways, Data Ingestion and Data Processing Pipelines, Data Stream Processing
3	Sensors and Industrial Systems: Introduction to sensors and transducers, integrating sensors to sensor processing boards, introduction to industrial data acquisition systems, industrial control systems and their functions
4	Networking and Communication for IoT: Recap of OSI 7 layer architecture and mapping to IoT architecture, Introduction to proximity networking technologies (ZigBee, Bluetooth, Serial Communication), Industrial network protocols (Modbus, CANbus), Communicating with cloud applications (web services, REST, TCP/IP and UDP/IP sockets, MQTT, WebSockets, protocols. Message encoding (JSON, Protocol Buffers)
5	IoT Data Processing and Storage: Time Series Data and their characteristics, time series databases, basic time series analytics, data summarization and sketching, dealing with noisy and missing data, anomaly and outlier detection,

TEXT BOOKS:

1. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759

3. Raspberry Pi Cookbook, Software and Hardware Problems and solutions, Simon Monk, O'Reilly (SPD), 2016, ISBN 7989352133895.

Course Title: **Introduction to Cognitive Science**
Course code: **PEC-CS-701 B**
LTP: **3-1-0**
Course Outcome: After studying this course , the students will be able to:

- Understand basics of Cognitive Computing and its differences from traditional Approaches of Computing.
- Plan and use the primary tools associated with cognitive computing.
- .Plan and execute a project that leverages Cognitive Computing.

Unit	Content
1	Introduction: Cognitive science and cognitive Computing with AI, Cognitive Computing - Cognitive Psychology - The Architecture of the Mind - The Nature of Cognitive Psychology – Cognitive architecture – Cognitive processes – The Cognitive Modeling Paradigms - Declarative / Logic based Computational cognitive modeling – connectionist models – Bayesian models. Introduction to Knowledge-Based AI – Human Cognition on AI – Cognitive Architectures
2	Cognitive Computing With Inference and Decision Support Systems: Intelligent Decision making, Fuzzy Cognitive Maps, Learning algorithms: Non linear Hebbian Learning – Data driven NHL - Hybrid learning, Fuzzy Grey cognitive maps, Dynamic Random fuzzy cognitive Maps.
3	Cognitive Computing with Machine Learning: Machine learning Techniques for cognitive decision making – Hypothesis Generation and Scoring - Natural Language Processing - Representing Knowledge - Taxonomies and Ontologies - Deep Learning.
4	Case Studies: Cognitive Systems in health care – Cognitive Assistant for visually impaired – AI for cancer detection, Predictive Analytics - Text Analytics - Image Analytics -Speech Analytics – IBM Watson

Text Books

1 Hurwitz, Kaufman, and Bowles, Cognitive Computing and Big Data Analytics, Wiley, Indianapolis, IN, 2005, ISBN: 978-1-118-89662-4.
2 Masood, Adnan, Hashmi, Adnan, Cognitive Computing Recipes-Artificial Intelligence Solutions Using Microsoft Cognitive Services and TensorFlow, 2015

Reference Books

1 Peter Fingar, Cognitive Computing: A Brief Guide for Game Changers, PHI Publication, 2015
2 Gerardus Blokdyk ,Cognitive Computing Complete Self-Assessment Guide, 2018
3 Rob High, Tanmay Bakshi, Cognitive Computing with IBM Watson: Build smart applications using Artificial Intelligence as a service, IBM Book Series, 2019

Course Title: Web and Social Media Analytics
Course code: PEC-CS-701 C
LTP: 3-1-0

Course Outcomes:
1. Knowledge on decision support systems.
2. Apply natural language processing concepts on text analytics.
3. Understand sentiment analysis.
4. Knowledge on search engine optimization and web analytics.

Unit	Content
1	An Overview of Business Intelligence, Analytics, and Decision Support: Analytics to Manage a Vaccine Supply Chain Effectively and Safely, Changing Business Environments and Computerized Decision Support, Information Systems Support for Decision Making, The Concept of Decision Support Systems (DSS), Business Analytics Overview, Brief Introduction to Big Data Analytics.
2	Text Analytics and Text Mining: Machine Versus Men on Jeopardy!: The Story of Watson, Text Analytics and Text Mining Concepts and Definitions, Natural Language Processing, Text Mining Applications, Text Mining Process, Text Mining Tools.
3	Sentiment Analysis: Sentiment Analysis Overview, Sentiment Analysis Applications, Sentiment Analysis Process, Sentiment Analysis and Speech Analytics.
4	Web Analytics, Web Mining: Security First Insurance Deepens Connection with Policyholders, Web Mining Overview, Web Content and Web Structure Mining, Search Engines, Search Engine Optimization, Web Usage Mining (Web Analytics), Web Analytics Maturity Model and Web Analytics Tools.
5	Social Analytics and Social Network Analysis: Social Analytics and Social Network Analysis, Social Media Definitions and Concepts, Social Media Analytics. Prescriptive Analytics - Optimization and Multi-Criteria Systems: Multiple Goals, Sensitivity Analysis, What-If Analysis, and Goal Seeking.

TEXT BOOK:
1. Ramesh Sharda, Dursun Delen, Efraim Turban, BUSINESS INTELLIGENCE AND ANALYTICS: SYSTEMS FOR DECISION SUPPORT, Pearson Education.

REFERENCE BOOKS:
1. Rajiv Sabherwal, Irma Becerra-Fernandez," Business Intelligence – Practice, Technologies and Management", John Wiley 2011.
2. Lariss T. Moss, ShakuAtre, "Business Intelligence Roadmap", Addison-Wesley It Service.
3. Yuli Vasiliev, "Oracle Business Intelligence: The Condensed Guide to Analysis and Reporting", SPD Shroff, 2012.

Course Title: **English Language Laboratory-III**
Course code: **HSMC-791**
LTP**: 0-0-4**

Unit-I: Soft Skills
Introduction to Soft Skills, Aspects of Soft Skills, Identifying your Soft Skills, Negotiation skills, Importance of Soft Skills, Concept of effective communication.

Unit-II: Self-Discovery
Self-Assessment, Process, Identifying strengths and limitations, SWOT AnalysisGrid.

Unit-III: Preparing Curriculum Vitae/Resume

Introduction, meaning, difference among bio-data, CV and resume, CV writing tips. Do's and don'ts of resume preparation, Vocabulary for resume, common resume mistakes, cover letters, tips for writing cover letters.

Unit-IV: Interview Skills

Introduction. Types of interview, Types of question asked, Reasons for rejections, Post-interview etiquette, Telephonic interview, Dress code at interview, Mistakes during interview, Tips to crack on interview, Contextual questions in interview skills, Emotional crack an interview, Emotional intelligence and critical thinking during interview process.

Unit-V: Developing Positive Attitude

Introduction, Formation of attitude, Attitude in workplace, Power of positive attitude, Examples of positive attitudes, Negative attitudes, overcoming negative attitude and its consequences.

Unit-VI: Improving Perception

Introduction, Understanding perception, perception and its application in organizations.

Career Planning -Introduction, Tips for successful career planning, Goal setting immediate, short term and long term, Strategies to achieve goals, Myths about choosing career.

Team Building and Team Work -Introduction, Meaning, Characteristics of an effective team, Role of a Team Leader, Role of Team Members, inter group Collaboration Advantages, Difficulties faced, Group Exercises-Team Tasks and Role-Play, Importance of Group Dynamics

Unit-VII: Time Management and Stress Management

The Time management matrix, apply the Pareto Principle (80/20 Rule) to time management issues, to prioritize using decision matrices, to beat the most common time wasters, how to plan ahead, how to handle interruptions , to maximize your personal effectiveness, how to say 'no' to time wasters, develop your own individualized plan of action.

Stress Management Introduction, meaning, positive and negative stress, Sources of stress, Case studies, signs of stress, Stress management tips, Teenage stress. Group discussion practice on current topics, Quantitative aptitude and reasoning preparation.

Text / Reference Books:

1. Butterfield, Jeff, 'Soft Skills for Everyone', Cengage Learning, New Delhi, 2010.
2. G.S. Chauhan and Sangeeta Sharma, 'Soft Skills', Wiley, New Delhi, 2016.
3. Klaus, Peggy, Jane Rohman& Molly Hamaker, 'The Hard Truth About Soft Skills', Harper Collins E-books, London, 2007.
4. S.J. Petes, Francis, 'Soft Skills and Professional Communication', Tata McGraw Hill Education, New Delhi, 2011.
5. Dr. R. S. Aggarwal, Quantitave aptitude & reasoning, S Chand & company ltd.
6. Dr. R. S. Aggarwal, A modern approach to Verbal & Non-verbal reasoning, S Chand & company ltd.

Course Title: **Introduction to Industrial Management**
Course code: **HSMC-801**
LTP: 2-0-0

Unit	Content
1	Introduction System- concept, definition, types, parameters, variables and behaviour. Management – definition and functions. Organization structure: i. Definition. ii. Goals. iii. Factors considered in formulating structure. iv. Types. v. Advantages and disadvantages. vi. Applications. Concept, meaning and importance of division of labour, scalar & functional processes, span of control, delegation of authority, centralization and decentralization in industrial management. Organizational culture and climate – meaning, differences and factors affecting them. Moral-factors affecting moral. Relationship between moral and productivity. Job satisfaction- factors influencing job satisfaction. Important provisions of factory act and labour laws
2	Critical path Method(CPM) and Programme Evaluation Review Technique (PERT): 2.1 CPM & PERT-meaning, features, difference,applications, 2.2 Understand different terms used in network diagram.Draw network diagram for a real life project containing 10-15 activities, Computation of LPO and EPO(Take minimum three examples). Determination of critical path on network. Floats, its types and determination of floats. Crashing of network, updating and its applications.
3	Materials Management: Material management-definition, functions, importance, relationship with other departments. Purchase - objectives, purchasing systems, purchase procedure, terms and forms used in purchase department. Storekeeping- functions, classification of stores as centralized and decentralized with their advantages, disadvantages and application in actual practice. Functions of store, types of records maintained by store, various types and applications of storage equipment, need and general methods for codification of stores. Inventory control: i. Definition. ii. Objectives. iii. Derivation for expression for Economic Order Quantity (EOQ) and numeric examples. iv. ABC analysis and other modern methods of analysis. v. Various types of inventory models such as Wilson's inventory model, replenishment model and two bin model. (Only sketch and understanding, no derivation.). 3.6 Material Requirement Planning (MRP)-concept, applications and brief details about software packages available in market.

4	Production planning and Control (PPC): Types and examples of production. PPC : i. Need and importance. ii. Functions. iii. Forms used and their importance. iv. General approach for each type of production. Scheduling- meaning and need for productivity and utilisation. Gantt chart- Format and method to prepare. Critical ratio scheduling-method and numeric examples. Scheduling using Gantt Chart (for at least 5-7 components having 5-6 machining operations, with processes, setting and operation time for each component and process, resources available, quantity and other necessary data), At least two examples. Bottlenecking- meaning, effect and ways to reduce.
5	Value Analysis (VA) and Cost Control: 5.1 VA-definition, terms used, process and importance. 5.2 VA flow diagram. DARSIRI method of VA. Case study of VA-at least two. Waste-types, sources and ways to reduce them. Cost control-methods and important guide lines.
6	Recent Trends in IM: ERP (Enterprise resource planning) - concept, features and applications. Important features of MS Project. Logistics- concept, need and benefits. Just in Time (JIT)-concept and benefits. Supply chain management-concept and benefits

Text book and Reference books:

1. L.S. Srinath– "CPM & PERT principles and Applications".
2. Buffa – "Modern Production Management".
3. N. Nair – "Materials Management".
4. O. P. Khanna – " Industrial Engineering & Management".
5. Mikes – "Value Analysis".
6. S.C. Sharma, "Engineering Management – Industrial Engineering & Management", Khanna Book Publishing Company, New Delhi

Course Title: **Cryptography and Network Security**

Course Code: **OE-CS-801 A**

LTP: 3-0-0

Course Outcomes:

- Student will be able to understand basic cryptographic algorithms, message and web authentication and security issues.
- Ability to identify information system requirements for both of them such as client and server.
- Ability to understand the current legal issues towards information security.

Unit	Content
1	Security Concepts: Introduction, The need for security, Security approaches, Principles of security, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security. Cryptography Concepts and Techniques: Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption, symmetric and asymmetric key cryptography, steganography, key range and key size, possible types of attacks.
2	Symmetric key Ciphers: Block Cipher principles, DES, AES, Blowfish, RC5, IDEA, Block cipher operation, Stream ciphers, RC4. Asymmetric key Ciphers: Principles of public key cryptosystems, RSA algorithm, Elgamal Cryptography, Diffie-Hellman Key Exchange, Knapsack Algorithm.
3	Cryptographic Hash Functions: Message Authentication, Secure Hash Algorithm (SHA-512), Message authentication codes: Authentication requirements, HMAC,

	CMAC, Digital signatures, Elgamal Digital Signature Scheme. Key Management and Distribution: Symmetric Key Distribution Using Symmetric & Asymmetric Encryption, Distribution of Public Keys, Kerberos, X.509 Authentication Service, Public – Key Infrastructure.
4	Transport-level Security: Web security considerations, Secure Socket Layer and Transport Layer Security, HTTPS, Secure Shell (SSH). Wireless Network Security: Wireless Security, Mobile Device Security, IEEE 802.11 Wireless LAN, IEEE 802.11i Wireless LAN Security.
5	E-Mail Security: Pretty Good Privacy, S/MIME IP Security: IP Security overview, IP Security architecture, Authentication Header, Encapsulating security payload, Combining security associations, Internet Key Exchange. Case Studies on Cryptography and security: Secure Multiparty Calculation, Virtual Elections, Single sign On, Secure Inter-branch Payment Transactions, Cross site Scripting Vulnerability.

TEXT BOOKS:

1. Cryptography and Network Security - Principles and Practice: William Stallings, Pearson Education, 6th Edition.
2. Cryptography and Network Security: Atul Kahate, Mc Graw Hill, 3rd Edition.

REFERENCE BOOKS:

1. Cryptography and Network Security: C K Shyamala, N Harini, Dr T R Padmanabhan, Wiley India, 1st Edition.
2. Cryptography and Network Security: Forouzan Mukhopadhyay, Mc Graw Hill, 3rd Edition.
3. Information Security, Principles, and Practice: Mark Stamp, Wiley India.
4. Principles of Computer Security: WM. Arthur Conklin, Greg White, TMH.
5. Introduction to Network Security: Neal Krawetz, CENGAGE Learning.
6. Network Security and Cryptography: Bernard Menezes, CENGAGE Learning

Title: **Quantum Computing**
Course Code: **OE-CS-801 B**
LTP: 3-0-0

Unit	Content
1	Qubit & Quantum States: The Qubit, Vector Spaces. Linear Combination Of Vectors, Uniqueness of a spanning set, basis & dimensions, inner Products, orthonormality, gram-schmidt orthogonalization, bra-ket formalism, the Cauchyschwarez and triangle Inequalities.
2	Matrices & Operators: Observables, The Pauli Operators, Outer Products, The Closure Relation, Representation of operators using matrices, outer products & matrix representation, matrix representation of operators in two dimensional spaces, Pauli Matrix, Hermitian unitary and normal operator, Eigen values & Eigen Vectors, Spectral Decomposition, Trace of an operator, important properties of Trace, Expectation Value of Operator, Projection Operator, Positive Operators,
3	Commutator Algebra, Heisenberg uncertainty principle, polar decomposition &singular values, Postulates of Quantum Mechanics.
4	Tensor Products: Representing Composite States in Quantum Mechanics, Computing inner products, Tensor products of column vectors, operators and

	tensor products of Matrices. Density Operator: Density Operator of Pure & Mix state, Key Properties, Characterizing Mixed State, Practical Trace & Reduce Density Operator, Density Operator & Bloch Vector
5	Quantum Measurement Theory: Distinguishing Quantum states & Measures, Projective Measurements, and Measurement on Composite systems, Generalized Measurements, Positive Operator- Valued Measures.
6	Recent trends in Quantum Computing Research, Quantum Computing Applications of Genetic Programming.

Text book and Reference books:

1. Quantum Computing without Magic by Zdzislaw Meglicki
2. Quantum Computing Explained By DAVID Mc MAHON
3. Quantum Computer Science By Marco Lanzagorta, Jeffrey Uhlmann
4. An Introduction to Quantum Computing Phillip Kaye, Raymond Laflamme, Michele Mosca.

Course Title: Numerical Methods
Course code:- OE-CS-801 C
LTP: 3-0-0

Unit: 1 Approximation in numerical computation: Truncation and rounding errors, Fixed and floating-point arithmetic, Propagation of errors.

Unit 2: Interpolation: Newton forward/backward interpolation, Lagrange's and Newton's divided difference Interpolation.

Unit 3: Numerical integration: Trapezoidal rule, Simpson's 1/3 rule, Expression for corresponding error terms.

Unit 4: Numerical solution of a system of linear equations: Gauss elimination method, Matrix inversion, LU Factorization method, Gauss-Seidel iterative method

Unit 5: Numerical solution of Algebraic equation:
Bisection method, Regula-Falsi method, Newton-Raphson method

Unit 6: Numerical solution of ordinary differential equation: Euler's method, Runge-Kutta methods, Predictor-Corrector methods and Finite Difference method.

Text book and Reference books:

1. R.S. Salaria: Computer Oriented Numerical Methods, Khanna Publishing House
2. C.Xavier: C Language and Numerical Methods.
3. Dutta & Jana: Introductory Numerical Analysis.
4. J.B.Scarborough: Numerical Mathematical Analysis.
5. Jain, Iyengar , & Jain: Numerical Methods (Problems and Solution).
6. Balagurusamy: Numerical Methods, Scitech.
7. Baburam: Numerical Methods, Pearson Education.
8. N. Dutta: Computer Programming & Numerical Analysis, Universities Press.

Course Title: Robotics and Embedded Systems
Course code: OE-CS-802 A
LTP: 3-0-0
Objective:
In engineering courses students read subjects like; C/C++, Basic Electronics/Electrical, different types Sensors and Actuators, Microcontrollers and Microprocessors, different types of communication protocols and about many more. But they do not get scope to use that knowledge during their course.

This course is especially designed to bridge that gap by providing an opportunity to the students, so that they can write embedded C/C++ programs to interface different types of input/output devices with the Microcontroller to do different projects. Now robotics is an emerging field of technology. In many sectors in our industry, robots are replacing humans very rapidly. That is why in this course students will also get some insight of robotics.

Course Outcome

After completion of the training, students will able to:

- Understand the importance of embedded systems and robotics in our daily life.
- Identify different embeddeddevices.
- Co-related embedded systems with their university courses.
- Identify different components of embedded systems and robotics.
- Know about different features of a microcontroller.
- Write embedded C/C++ programs in different embedded systems programming platforms.
- Interfaced different input/output devices with a microcontroller.
- Design mechanical structure of a robot.
- Understand the robot configuration and sub-systems
- Interface different components of robot with microcontroller.
- Understand principle of robot programming.
- Design different types of robots for different purposes.
- Design wide varieties of embedded systems projects.

Unit	Content
1	**AVR Microcontroller** Introduction to AVR Microcontroller, Mega AVR Microcontroller series, Introduction to ATmeg16/32, Features, Architecture, Pin configurations, I/O ports, Port operation registers, Interrupts, ADC, Timers/counters, SPI,USART, Memory programming, etc.
2	**Embedded C/C++** Introduction to C/C++, Use of Loops, Array, Function, etc in C/C++, Introduction to Embedded C/C++ platform like; Atmel Studio and Proteus, Introduction to port operation registers programming, Programming to interface LED with ATmega16, etc.

3	**Robotics** – Interfacing of Sensors, Motors, Display devices, etc : Introduction concept and mechanism of Robotics, Applications of Robotics, Introductions to Robotics components like; Motors, Sensors, Display devices, etc, Programming and interfacing of DC Motors, Stepper Motor, Servo Motors, Sensors (Analog & Digital), LCD, Communications modules like; Bluetooth, Xbee, etc.
4	**Application:** Digital notice board, Object counter, Digital temperature monitoring system, Range finder, Project using external interrupts, Stopwatch, Velocity control of DC Motor, Line follower Robot, Object avoider Robot, Intelligent home automation system, Solar seeker Robot, Robot communication using Bluetooth, RF Module, Xbee module, etc.

Course Title: **Financial Management**
Course Code: **OE-CS-802 B**
LTP: 3-0-0
Course Outcomes - On successful completion of the course the students shall be able to:
1) Understand the basic concepts of Management.
2) Describe the planning process to make decisions.
3) Distinguish between different organizational structures.
4) Know the group dynamic and different leadership style.
5) Diagnosis organisational conflicts and need of change.

Unit	Content
1	Introduction : Nature and Scope of Financial Management; Financial Goals Conflict of interest between the stakeholders; Functions of Financial Manager, Changing Financial Environment, Emerging Challenges faced by the Finance Manager.
2	Financing Decisions: Sources of Long Term Capital Equity, Debt, Term Loan, Preference share, Hybrid Securities, Internal Funds- Issues relating Financing Decisions. Cost of Capital : Computation of Cost of Equity-cost of Debt-Cost of Preference Capital- Cost of Internal Reserve Weighted Average Cost of Capital.
3	Leverage and Capital Structure Analysis : Analysis of Operating Leverage and Financial Leverage-Combined Financial and Operating Leverage. Concept of Capital Structure: Determinants, Theories of Capital Structure, Relevance and Irrelevance, Problems of Optimal, Capital Strucutre.
4	Long Term Investment Analysis : Investment idea Generation – Tools and techniques of Analysis- Risk Analysis in Capital Investment Decisions. Dividend Decisions: Issues in Dividend Decisions-Models and Theories of Dividend-Forms of Dividend- Corporate Dividend Behaviour.
5	Short Term Asset Management: Strategic Planning and Estimation of Short-Term Funding. Need –Financing Sources – Computation of Cost of Short term Fund.. Management of Cash, Inventory and Receivables.

References:
1. Arnold, G.C: Corporate Financial Management, Financial Times Pitmom Publishing.11
2. Atrill, P; Financial Management for Non-Specialists, Prentice Hall.

3. Besant Raj. A: Corporate Financial Management, Tata McGrow Hill.
4. Block & Hirt: Foundation of Financial Management, Irwin Homewood.
5. Boltmam & Conn: Essentials of Managerial Finance, Hongnton & Mifflin.
6. Brealy, R. A. and Myers, S: The principle of Corporate Finance, McGraw Hill Internal.
7. Brigham and Ehrhardi: Financial Management- Theory and Practice, Thompson.
8. Brigham and Houston: Fundamentals of Financial Management, Thompson
9. Chandra Prasanna: Financial Management, Tata McGraw.
10. Cooper, Kaplani and E: mastering Finance, Financial Times
11. Damodaran Aswath: Applied Corporate Finance, Wiley Student Edition
12. E. J. Mclancy: "Business Finance: Theory and Practice". Pearson Education.
13. Gitmam, L. J.: Principles of Management Finance, Addision-Wasley
14. Higgins, R. C: Analysis on Financial Management, Irwin, McGraw Hill
15. Hompton, John: Financial Decision making: Concept, problem & Cases, Prentice hall India.
16. Joseph, P. Ogden, Frank.C.Jen and Philip, F.O'Conner : Advanced Corporate Finance: Policies and Strategies, Pearson Education
17. Khan & Jain: Financial Management, Tat McGraw

Course Title: Applied **Behavioral Economics**
Course Code: **OE-CS-802 C**
LTP: 3-0-0

- To conceptualising welfare and measuring welfare
- To familiarize with behaviour economics and development economics
- To understand about behavioural economics & labour market
- To Familiarize about behavioural economics and health economics
- To have basic understanding behavioural economics and organisational behaviour

Unit	Content
1	Behaviour economics on Welfare and Policy Analysis Conceptualising and measuring welfare- saving, addiction and public good
2	Immediate barriers in education- demand for commitment – default settlement and savings default setting and financial institution- Status Quo Bias and Diffusion of Innovations- Self Serving Bias and Evaluation
3	Wage rigidity Fairness, reciprocity and wage rigidity- evidence from surveys by economist evidence from surveys from experimental economists- evidence from organisational psychology and managerial science
4	Introduction and background- models of physician behaviour- health care demand and insurance
5	Complicating the single-agent risk-incentive model- workers as members of multi-agent firms- top managers and corporate finance- organisational reactions: sorting, repairs and exploitation.

Basic Reading List

Introduction to Behavioral Economics and Its Applications- Peter Diamond and Hannu Vartiainen (ed.), Princeton University Press, 2012
Handbook of Behavioral Economics-Foundations and Applications - BD Bernheim, S DellaVigna, D Laibson(ed), North Holland ,2019
The foundations of behavioural economics –Sanjit Dhami, Oxford, 2020
Applied Behavioral Economics Research and Trends, Rodica Ianole, IGI Global, 2016

Research Methodology **PCC-CS-881**

L-T-P- 3-0-0 **Credit-3**

RESEARCH FORMULATION AND DESIGN Motivation and objectives – Research methods vs. Methodology. Types of research – Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical, concept of applied and basic research process, criteria of good research. Defining and formulating the research problem, selecting the problem, necessity of defining the problem, importance of literature review in defining a problem, literature review-primary and secondary sources, reviews, monograph, patents, research databases, web as a source, searching the web, critical literature review, identifying gap areas from literature and research database, development of working hypothesis.

DATA COLLECTION AND ANALYSIS

Accepts of method validation, observation and collection of data, methods of data collection, sampling methods, data processing and analysis strategies and tools, data analysis with statically package (Sigma
STAT,SPSS for student t-test, ANOVA, etc.), hypothesis testing.

RESEARCH ETHICS, IPR AND SCHOLARY PUBLISHING

Ethics-ethical issues, ethical committees (human & animal); IPR- intellectual property rights and patent law, commercialization, copy right, royalty, trade related aspects of intellectual property rights (TRIPS); scholarly publishing- IMRAD concept and design of research paper, citation and acknowledgement, plagiarism, reproducibility and accountability.

INTERPRETATION AND REPORT WRITING Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Project Report, Layout of the Project/Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Project/Research Report, Precautions for Writing Research Reports, Conclusions.

Text book and Reference books:

1. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. An introduction to Research Methodology, RBSA Publishers.
2. Kothari, C.R., 1990. Research Methodology: Methods and Techniques. New Age International. 418p.
3. Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, Ess Ess Publications. 2 volumes.
4. Trochim, W.M.K., 2005. Research Methods: the concise knowledge base, Atomic Dog Publishing. 270p.
5. Wadehra, B.L. 2000. Law relating to patents, trade marks, copyright designs and geographical indications. Universal Law Publishing.

Additional reading

1. Anthony, M., Graziano, A.M. and Raulin, M.L., 2009. Research Methods: A Process of Inquiry, Allyn and Bacon.
2. Carlos, C.M., 2000. Intellectual property rights, the WTO and developing countries: the TRIPS agreement and policy options. Zed Books, New York.
3. Coley, S.M. and Scheinberg, C. A., 1990, "Proposal Writing", Sage Publications.
4. Day, R.A., 1992.How to Write and Publish a Scientific Paper, Cambridge University Press.
5. Fink, A., 2009. Conducting Research Literature Reviews: From the Internet to Paper. Sage