University of Mumbai

Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS-H 2019)

(Under TCET-Autonomy Scheme-2020)

Estd. in 2001

Conferred Autonomous Status by University Grants Commission (UGC) for 10 years w.e.f. AY 2019-20

ISO 9001:2015 Certified Institute	NBA Accredited Programs	NAAC Accredited Institute with 'A' Grade	AICTE-CII Survey rating in Platinum category for Industry linkages	Among Top 250 Colleges in NIRF Ranking	68th & 78th in All India Rank by Outlook survey published in June 2019 & May 2018 respectively

Scheme & Syllabus under Autonomy

(w.e.f. Academic Year 2022-2023 onwards)

B. E. Computer Engineering

(Semester – I to VIII)

TCET

DEPARTMENT OF COMPUTER ENGINEERING (COMP)

[Accredited by NBA for 3 years, 3rd Cycle Accreditation w.e.f. 1st July 2019]

Choice Based Credit Grading Scheme (CBCGS)

Under TCET Autonomy

Zagdu Singh Charitable Trust's (Regd.)

THAKUR COLLEGE OF ENGINEERING & TECHNOLOGY

Autonomous College Affiliated to University of Mumbai

Approved by All India Council for Technical Education(AICTE) and Government of Maharashtra

A - Block, Thakur Educational Campus, Shyamnarayan Thakur Marg,Thakur Village, Kandivali (East), Mumbai - 400 101 • Tel.: 022-6730 8000 / 8106 / 8107 Telefax: 022-2846 1890

Email: tcet@thakureducation.org • Website: www.tcetmumbai.in www.thakureducation.org

Conferred Autonomous Status by University Grants Commission (UGC) for 10 years w.e.f. AY 2019-20

- ISO 9001:2015 Certified Institute
- NBA Accredited Programs
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- AICTE-CII Survey rating in Platinum category for Industry linkages
- Among Top 250 Colleges in NIRF Ranking
- 68th & 78th in All India Rank by Outlook survey published in June 2019 & May 2018 respectively

VISION

Thakur College of Engineering and Technology will excel in Technical Education to become an internationally renowned premier Institute of Engineering and Technology

MISSION

To provide state-of-the-art infrastructure and right academic ambience for developing professional skills as well as an environment for growth of leadership and managerial skills to students which will make them competent engineers to deliver quality results in the industry

CORE VALUES

- Integrity & Accountability
- Respect for each Individual
- Sensitive towards Social Responsibilities
- Unfettered spirit of learning, Exploration, Rationality & Enterprise
- Exploration & Enterprise for both Faculty and Students

CORE COMPETENCIES

- Structured & Guided Teaching Learning Methodology Maintaining Academic Rigor
- System - Driven - Student - Centric Services
- Proactive Student Professional and Personality Development Programmes
- State - of - the - art Infrastructure meeting International Standards

Estd. in 2001

Conferred Autonomous Status by University Grants Commission (UGC) for 10 years w.e.f. AY 2019-20

ISO 9001:2015 Certified Institute | NBA Accredited Programs | NAAC Accredited Institute with 'A' Grade | AICTE-CII Survey rating in Platinum category for Industry linkages | Among Top 250 Colleges in NIRF Ranking | 68th & 78th in All India Rank by Outlook survey published in June 2019 & May 2018 respectively

Nurturing Budding Engineers to become Global Professionals with Human Values

Driving Academic Excellence through...

Choice Based Credit Grading Scheme

Holistic Student Development (CBCGS-H 2019)

(Under TCET-Autonomy Scheme-2020)

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Tel.: 022-6730 8000 / 8106 / 8107 Telefax: 022-2846 1890 • Email: tcet@thakureducation.org • Website: www.tcetmumbai.in www.thakureducation.org

Foreword

Thakur College of Engineering & Technology (TCET) since its inception has been instrumental in offering quality technical education to aspiring students through System-Driven-Student-Centric approach. In the last decade it has put its best efforts to focus on broad based education leading to holistic student development as per international graduate attributes. Based on our strengths, we are happy to share that, the University Grants Commission (UGC) has conferred "Autonomous Status" for 10 years to TCET under the revised UGC graded Autonomy Scheme 2018.

As per the mandate of UGC under Graded Autonomy Scheme, TCET aspires to strengthen its program offerings to make our budding Engineers "Globally Competent, Locally Relevant and Skill Oriented" through:

- Program Specific curricula with focus on research in the emerging areas of Engineering and Technology.
- Industry Specific/Industry Linked curricula through an "Employ ability Enhancement Scheme".
- All Round Personality Development model through its "Holistic Development Scheme".
- Extra ordinary Credits for National level Achievements, National level Competitive Exams, Standard Industrial Certifications and Major Contributions to the Society.
- Credits for specialized courses and online courses done through graded online MOOCS and other graded on line courses offered by the department from time to time.

The Choice Based Credit Grading System for Holistic Student Development (CBCGS - H 2019) is based on AICTE Model Curriculum and UGC (Minimum standards of instruction for grant of First Degree through Formal Education) Regulations, 2003 Autonomy Scheme includes Scholastic, Co-Scholastic and Non-scholastic Credits which are Compulsory for every student. Additional Credits are assigned for the Student Achievers under Specialization (optional credits in Emerging Areas) and Achievers credits (National/International level).

The Under-Graduate and the Post-Graduate curriculum has been designed with a thought of creating an inspiring Academic Culture in the institution, essential for teachers and students to access deeper knowledge and participate in its expansion and smooth transmission. The curriculum also focuses on to develop problem-solving skill in students and strengthen academic knowledge. The Doctoral Program will follow the UGC Guidelines/Norms from time to time.

The First Year (F.E.) proposed scheme is aligned with the Model Curriculum which offers courses on Basic Sciences, Engineering Sciences along with Humanities which imparts the fundamental which could later be useful for Research in Applied Science and Engineering. The scheme also emphasizes on professional skills which include Aptitude/ Logic Building and Life/Presentation Skills. In addition to the above, the course also comprises of Activity Based Learning which focuses on Society Outreach Programs and Yogic Practices. This will help students to develop Aptitude and Positive Attitude in life.

The Second Year (S.E.) proposed scheme includes Program Specific core subjects which would introduce to them the core areas of the particular course giving them in-depth knowledge and form the basic foundation in them.

The Third Year (T.E.) scheme offers Domain Specific "Industry Electives" which satisfies the current Industry demands and requirements. The student's knowledge enhances and makes them abreast with the current technology. The syllabus scheme provides credits for on line courses from Semester VI onwards. This is to motivate the students to enhance their knowledge and encourage Self-Learning amongst students.

The Final Year, Bachelor of Engineering (B.E.) scheme is aligned towards Generalized Knowledge which is an important component of crystallized intelligence. It is done by offering them "Open Electives" which would help them grow both on personal as well as academic level and develop the openness to experience and analyze situations for better solutions.

The impact of these could be seen under Project Based Learning (PBL), Activity Based Learning (ABL) and Research Based Learning (RBL) as students adopt these methodologies to do projects based on Technological Solutions or real-world scenarios.

The curriculum also focuses on promoting Holistic Student Development (HSD) which includes courses on Professional Skills which focus on Basic Technology Skills for Second Year, Industry/Research/Entrepreneurship Skills for Third and Final Year. PBL is common for SE, TE and BE under HSD along with ABL (Co-curricular/ Extra-curricular/Extension) for SE students and RBL (Online/MOOCS) for TE and BE students. The students are also encouraged to take up Internships at core companies which would enhance their skills and make them updated with the current industry needs.

The Examination Scheme is also revised and has been made keeping in view the kind of pressure; a student undergoes during continuous evaluation. The proposed scheme includes Formative and Summative Evaluation methods which would help in foster development and improvement in student during the course and simultaneously be able to assess whether the results have been able to meet the set target. This system would be deployed systematically which would drastically reduce the burden on the students.

This scheme would help students to grow academically, professionally and holistically to become Globally Competent Professionals with Values.

Sd/-
(Dr. B. K. Mishra)
Principal

Board of Studies Chairman's Preamble

The B. E. Computer Engineering programme is no doubt an exciting and extraordinary creative discipline propelling students towards innovation and technology. Students studying this discipline learn technical skills such as programming, problem-solving, and many more.

The objective of the programme is to make learners industry ready by enabling them to apply his/her enhanced skill and knowledge to solve complex problems using advanced analytical tools and algorithms for processing, analyzing and drawing meaningful insights out of it to identify, formulate, and solve engineering problems. Studying Computer Science is much more than just logic, algorithms, abstraction, and computability. However, it expands to Operating System, Computer Graphics, Software Engineering, Networking, Machine Learning, programming languages and many more.

Now a day Computer Engineering field has become so popular. These are being used in various domains. It is used in Finance, Travel, business, marketing, sales, automation, credit and insurance, social media, government sectors, healthcare, education, expert systems, speech recognition and machine vision, and a host of other emerging areas. It comes with a range of opportunities for the students such as agile learning, technical innovations, and global job prospects.

The pedagogical sequence is learner centric starting with basic engineering sciences introductory courses in mathematics , programming and professional core courses to provide a strong technical foundation and then to specific areas of, Machine Learning, Soft Computing, Data Warehousing and Mining, Big Data Analytics etc. The programme is flexible enough to allow a learner to specialize in any topic of interest by opting elective courses and working on a research project in that area.

Thakur College of Engineering & Technology has taken a lead in incorporating philosophy of Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS-H 2019) in the process of curriculum development.

The Program Educational Objectives, Program Outcomes and Program Specific Outcomes for the program are proposed and are part of the scheme and syllabus. My sincere thanks to contributors from academia and industry for their inputs in framing the syllabus. I appreciate and thank the Principal, Dr. B.K. Mishra and Vice-Principal, Dr. Deven Shah of Thakur College of Engineering and Technology for their valuable inputs. I appreciate the efforts taken by the Vice- Principal, Dr. Deven Shah for conducting several brainstorming sessions with all BOS points in the curriculum. Special Thanks to the Members of the Board of Studies and Academic Council for the critical inputs that has helped in adding value to the curriculum.

I trust and believe that the curriculum appeals and meets the expectation of all stakeholders.

Sd/-

Dr. Harshali Patil
Chairman, Board of Studies, Department of Computer Engineering
TCET

TCET

DEPARTMENT OF COMPUTER ENGINEERING (COMP)

(Accredited by NBA for 3 years, 3rd Cycle Accreditation w.e.f. 1st July 2019)

Choice Based Credit Grading System with Holistic Student Development (CBCGS - H 2019)

Under TCET-Autonomy Scheme - 2019

Estd. in 2001

B.E. Computer Engineering

SPECIFIC
MEASURABLE
ATTAINABLE
REALISTIC
TIMEBOUND

tcet COMP ENGINEERS

Nurturing Budding Engineers to become SMART Professionals with Social Sensitivity

VISION

To Become the Department of National Relevance in the Field of Computer Engineering.

MISSION

"To nurture students with sound engineering knowledge in the field of computing through effective use of modern tools with a focus on global employability by imbibing leadership qualities, ethical attitude, lifelong learning and social sensitivity"

Program Educational Objectives

- PEO 1: To attract and prepare learners to attain sound knowledge in the field of Computer engineering.
  a)

1.1. To attract students by providing conducive academic environment and to enhance quality of students by rigorous monitoring and control.

1.2. To prepare learners with a sound foundation in the mathematical, scientific and engineering fundamentals.

1.3. To prepare learners to use modern tools effectively to solve real life problems.

1.4 To equip learners with broad education relevant to field of computing in the global and social context.

- PEO 2: To prepare learners to attain need-based skills and competencies with a focus on futuristic needs at the national and international level.

2.1. To ensure employability by need-based training spread over the entire course and contemporary local and global requirements.

2.2. To prepare Learners for higher studies and life-long learning through active involvement of learners with research oriented and industry-based projects.

- PEO 3: To prepare learners to become valued professionals and responsible citizens.

3.1. To encourage and motivate students through well planned co-curricular and extra-curricular activities for all-round personality development.

3.2. To inculcate professional and ethical attitude, leadership qualities and commitment to social responsibilities.

Program Specific Outcomes

- PSO 1 :Ability to develop academic aptitude and apply knowledge of computing and mathematics to computer science problems and thereby design and develop Software and Hardware Systems.
- PSO 2 :Ability to enhance research skills and utilize advanced computing tools for analysis, design and implementation of computing systems for resolving real life / social problems
- PSO 3 : Ability to utilize multidisciplinary knowledge required for satisfying industry / global requirements and hence develop an attitude for life-long learning
- PSO 4 : Ability to have all round personality with skills like leadership, verbal & written communication , team work, sensitivity towards society in order to become valued and responsible professionals.

Programme Outcomes:

PO 01	**ENGINEERING KNOWLEDGE:** **Apply** Knowledge of Mathematics, Science, engineering fundamentals and an engineering specialization to the **solution** of **complex** engineering **problems.**
PO 02	**PROBLEM ANALYSIS:** **Identify, Formulate,Research** Literature and **Analyze c**omplex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
PO 03	**DESIGN / DEVELOPMENT OF SOLUTIONS:** **Design** solutions for complex engineering problems and design system components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal and environmental considerations.
PO 04	**CONDUCT INVESTIGATIONS OF COMPLEX PROBLEMS:** Using research based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of information to provide valid conclusions
PO 05	**MODERN TOOL USAGE:** **Create**, **select** and **apply** appropriate techniques, resources and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of limitations.
PO 06	**THE ENGINEER AND SOCIETY:** **Apply** reasoning informed by contextual knowledge to **assess** societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice

Programme Outcomes:

PO 07	**ENVIRONMENT AND SUSTAINABILITY:** **Understand** the impact of professional engineering solutions in societal and environmental contexts and **demonstrate** knowledge of and need for sustainable development.
PO 08	**ETHICS:** **Apply** ethical principles and commit to professional ethics and responsibilities and norms of engineering practices.
PO 09	**INDIVIDUAL AND TEAM WORK:** **Function** effectively as an individual, and as a member of leader in diverse teams and in multi-disciplinary 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	**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.
PO 12	**PROJECT MANAGEMENT & FINANCE:** **Demonstrate** *knowledge* and *understanding* of engineering and management and leaders in a team to manage projects and in multidisciplinary environments.

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SE. Semester –III (Computer Engineering)
Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education (CBCGS-HME 2020)
Proposed TCET Autonomy Scheme (w.e.f. A.Y. 2021-22)

Course Description			Teaching Scheme (Program Specific)					Examination scheme					
			Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation					
Sr. No.	Course Code	Course Title	Hours Per Week				Credits	Theory (100/50)			Practical / Oral / Presentation (25)	Term Work (25)	Total
								40/20 IA		60/30 ESE			
			Theory	Tutorial	Practical	Contact Hours		ISE	IE		PR/OR	TW	
1	BSC-CS301	Mathematics-III	3	1	-	4	4	20	20	60	-	25	125
2	PCC-CS301	Data Structures	3	-	2	5	4	20	20	60	25	25	150
3	PCC-CS302	Database Management System	3	-	2	5	4	20	20	60	25	25	150
4	PCC-CS303	Digital Logic Design & Analysis	3	-	2	5	4	20	20	60	25	25	150
5	PCC-CS304	Computer Organization & Architecture	3	-	2	5	4	20	20	60	25	25	150
		Total	**15**	**1**	**8**	**24**	**20**	**Total marks (Academic)**					**725**
Course Description			**Non Credited Mandatory Course (Passing is mandatory for this course)**									**Term Work**	
1	MC-CS301	Environmental Studies	1	-	-	1	(Non Credit)	-				25	**25**
Course Description			**Contact Hrs. during Week End / Semester Break/ End of Semester (Between 21st and 25th Week)**										
1	SI-CS301	Summer Intership	-	-	-	160*	-	-		-	-	-	-
Course Description			**Contact Hrs. during Week End / Semester Break/ End of Semester (Between 21st and 25th Week)/During Semester**										
1	AP-CS301	Activity Points	-	-		48@	-	-		-	-	-	-
Course Description			**Teaching scheme (Holistic and Multidisciplinary Education-HME) (Conducted in the beginning of Semester during first 3 Weeks)**					**Assessment/Evaluation Scheme**					
								Presentation AC			**Report AC**		**Term Work**
1	ESD-CS301	Employability Skill Development - I	-	-	30	30	1	Based on Parameters Decided by Training and Placement Cell					50
2	HME - CSPS301	Professional Skills- III (Object-oriented Programming using Java)	15	-	30	45	2	50			25		75
3	HME - CSPBL301	Project Based Learning - I	-	-	30	30	1	25			-		25
4	HME - CSABL301	Activity Based Learning-III (Co-curricular/Extra Curricular/Extension)	-	-	30	30	1	25			25		50
		Total	**15**	**-**	**120**	**135**	**5**	**Total marks (HME)**					**200**
		Total					**25**	**Grand Total marks**					**950**

IA- In-Semester Assessment, ESE- End Semester Examination, PR- Practical Examination, TW – Term Work Examination, OR- Oral Examination, AC- Activity evaluation,ISE-In-Semester Examinations,IE-Innovative Examination

Guidelines for the Semester:

1. During Academic conduct, practical load shall be conducted in batches.
2. For continuous evaluation, examination shall be conducted under two heads: IA – In-Semester Assessment, ESE – End Semester Examination. Under IA, 20 marks of ISE (In-Semester Examination) shall be conducted for 1 hour. 20 marks of IE (Innovative Examination) shall also be conducted under IA. ESE shall be conducted for 60 marks with duration of 2 hours.
3. Three In-Semester Examinaions (ISE) will be conducted during each semester. Out of Three, Average of Best Two ISE marks will be considered. There is no provision for the Retest in any ISE.
4. Innovative Examination (IE) will be accessed based on the project report with presentation.
5. Professional Skills-III , Project Based Learning-I and Activity Based Learning-III activities will run in the form of integrated theory and practical course.
6. * Under the head of Summer Internship, student can complete internship from winter to summer with 160 hours and acquire 4 credits till the end of Semester 4. The summer Internship will be conducted in the form of in-house internship which is mandatory for all students in summer semester break. Credits will be awarded at the end of 4th Semester and will be reflected in the Grade Card of 4th Semester. Student will get 1-year span to acquire the credits and complete total contact hours. Student shall submit a report to earn Term work marks in internship.
   - **Following activities should be considered for Summer Internship:-**

   1) Participation in inhouse internship at the end of 3rd and 4th Semester of 2 week each.

   2) Other activity which also will be considered are : Participation in Hackathon, Development of new Product/ Business Plan / Registration of start-up, Participation in IPR workshop/Leadership talks/Idea/ Design / Innovation/Technical Expos, Internship with Industry / Govt. / NGO/ PSU/MSME/Online Internship, Long Term Goals under Rural Internship

   Note:- For Above Activities mentioned in point 2, if Student is part of Organizing Committee or Participating a Competition at University/State/National/international Level then it will be considered as Internship else it will be considered as Activity Points.
7. @ As per AICTE, Students has to earn 100 Points by participating in 400 Hrs. of activities during 4 years of Engineering. After Completing 48 hrs. of Activities, Students can earn 12 Points. This Points will not be reflected in Grade Card. Separate transcript will be issued to students after completion of Final Year.

S.E. Semester –IV (Computer Engineering)
Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education (CBCGS-HME 2020)
Proposed TCET Autonomy Scheme (w.e.f. A.Y. 2021-22)

Course Description			Teaching Scheme (Program Specific)					Examination scheme					
Sr. No.	Course Code	Course Title	Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation					
			Hours Per Week				Credits	Theory (100/50)			Practical / Oral / Presentation (25)	Term Work (25)	Total
								40/20 IA		60/30			
			Theory	Tutorial	Practical	Contact Hours		ISE	IE	ESE	PR/OR	TW	
1	BSC-CS401	Mathematics-IV	3	1	-	4	4	20	20	60	-	25	125
2	PCC- CS401	Design & Analysis of Algorithms	3	-	2	5	4	20	20	60	25	25	150
3	PCC- CS402	Operating Systems	3	-	2	5	4	20	20	60	25	25	150
4	PCC -CS403	Computer Networks	3	-	2	5	4	20	20	60	25	25	150
5	PCC-CS404	Computer Graphics	3	-	2	5	4	20	20	60	25	25	150
		Total	**15**	**1**	**8**	**24**	**20**	**Total marks (Academic)**					**725**
Course Description			**Non Credited Mandatory Course (Passing is mandatory for this course)**									**Term Work**	
1	MC-CS401	Value Education	1	-	-	1	(Non-Credit)	-				25	**25**
Course Description			**Contact Hrs. during Week End / Semester Break/ End of Semester(Between 21st and 25th Week)**									**Term Work**	
1	SI-CS401	Summer Intership	-	-	–	160*	4*	-		-	-	50	**50**
Course Description			**Contact Hrs. during Week End / Semester Break/ End of Semester (Between 21st and 25th Week) / During Semester**										
1	AP-CS401	Activity Points	-	-	-	**52@**	-	-		-	-	-	-
Course Description			**Teaching scheme (Holistic and Multidisciplinary Education-HME) (Conducted in the beginning of Semester during first 3 Weeks)**					**Assessment/Evaluation Scheme**					
								Presentation			**Report**		**Term Work**
								AC			**AC**		
1	ESD-CS401	Employability Skill Development - II	-	-	30	30	1	Based on Parameters Decided by Training and Placement Cell					50
2	HME-CSPS401	Professional Skills- IV (Introduction to Python)	15	-	30	45	2	50			25		75
3	HME - CSPBL401	Project Based Learning - II	-	-	30	30	1	25			-		25
4	HME - CSABL401	Activity Based Learning- IV (Co-curricular/Extra Curricular/Extension)	-	-	30	30	1	25			25		50
		Total	**15**	**-**	**120**	**135**	**5**	**Total marks (HME)**					**200**
		Total					**29**	**Grand Total marks**					**1000**

IA- In-Semester Assessment, ESE- End Semester Examination, PR- Practical Examination, TW – Term Work Examination, OR- Oral Examination, AC- Activity evaluation,ISE-In-Semester Examinations,IE-Innovative Examination

Guidelines for the Semester:

1. During Academic conduct, practical load shall be conducted in batches.
2. For continuous evaluation, examination shall be conducted under two heads: IA – In-Semester Assessment, ESE – End Semester Examination. Under IA, 20 marks of ISE (In-Semester Examination) shall be conducted for 1 hour. 20 marks of IE (Innovative Examination) shall also be conducted under IA. ESE shall be conducted for 60 marks with duration of 2 hours.
3. Three In-Semester Examinaions (ISE) will be conducted during each semester. Out of Three, Average of Best Two ISE marks will be considered. There is no provision for the Retest in any ISE.
4. Innovative Examination (IE) will be accessed based on the project report with presentation.
5. Professional Skills-IV , Project Based Learning-II and Activity Based Learning-IV activities will run in the form of integrated theory and practical course.
6. * Under the head of Summer Internship, student can complete internship from winter to summer with 160 hours and acquire 4 credits till the end of Semester 4. The summer Internship will be conducted in the form of in-house internship which is mandatory for all students in summer semester break. Credits will be awarded at the end of 4th Semester and will be reflected in the Grade Card of 4th Semester. Student will get 1-year span to acquire the credits and complete total contact hours. Student shall submit a report to earn Term work marks in internship.
   - **Following activities should be considered for Summer Internship:-**

   a. Participation in inhouse internship at the end of 3rd and 4th Semester of 2 week each.

   b. Other activity which also will be considered are : Participation in Hackathon, Development of new Product/ Business Plan / Registration of start-up, Participation in IPR workshop/Leadership talks/Idea/ Design / Innovation/Technical Expos, Internship with Industry / Govt. / NGO/ PSU/MSME/Online Internship, Long Term Goals under Rural Internship

   Note:- For Above Activities mentioned in point 2, if Student is part of Organizing Committee or Participating a Competition at University/State/National/international Level then it will be considered as Internship else it will be considered as Activity Points.
7. # As per AICTE, Students has to earn 100 Points by participating in 400 Hrs. of activities during 4 years of Engineering. After Completing 48 hrs. of Activities, Students can earn 12 Points. This Points will not be reflected in Grade Card. Separate transcript will be issued to students after completion of Final Year.

T.E. Semester –V (Computer Engineering)
Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education (CBCGS-HME 2020)
TCET Autonomy Scheme (w.e.f. A.Y. 2022-23)

Course Description			Teaching Scheme (Program Specific)					Examination scheme					
			Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation					
Sr. No.	Course Code	Course Title	Hours Per Week				Credits	Theory (100/50) 40/20 IA		60/30	Practical / Oral / Presentation (25)	Term Work (25)	Total
			Theory	Tutorial	Practical	Contact Hours		ISE	IE	ESE	PR/OR	TW	
1	HSMC- CS501	Soft Skill & Interpersonal Communication	3	-	-	3	3	20	20	60	-	-	100
2	PCC-CS501	Theory of Computer Science	3	1	-	4	4	20	20	60	-	25	125
3	PCC-CS502	Introduction to Intelligent System	3	-	2	5	4	20	20	60	25	25	150
4	PCC-CS503	Microprocessor	3	-	2	5	4	20	20	60	25	25	150
5	PEC-CS501X	Professional Elective 1	3	-	2@	5	4	20	20	60	25	25	150
		Total	**15**	**1**	**6**	**22**	**19**	**Total marks (Academic)**					**675**
Course Description			**Non Credited Mandatory Course(Passing is mandatory for this course)**									**Term Work**	
1	MC-CS501	Indian Constitution	1	-	-	1	(Non-Credit)	-				25	**25**
Course Description			**Contact Hrs. during Semester Break/ End of Semester(Between 21st and 25th Week)**										
1	SI-CS501	Summer Internship	-	-	-	160*	-	-		-	-	-	-
Course Description			**Contact Hrs. during Week End / Semester Break/ End of Semester (Between 21st and 25th Week) / During Semester**										
1	AP-CS501	Activity Points	-	-		48#	-	-		-	-	-	-
Course Description			**Teaching scheme (Holistic Student Development -HSD) (Conducted in the beginning of Semester during first 3 Weeks)**					**Assessment/Evaluation Scheme**					
								Presentation AC			**Report AC**		**Term Work**
1	ESD-CS501	Employability Skill Development - III	-	-	30	30	1	Based on Parameters Decided by Training and Placement Cell					50
2	HSD - CSPS501	Professional Skill V (Web Development)	15	-	30	45	2	50			25		75
3	HSD - CSPBL501	Project Based Learning - III	-	-	30	30	1	25			-		25
4	HSD - CSRBL501	Research Based Learning-I	-	-	30	30	1	25			25		50
		Total	**15**	**-**	**120**	**135**	**5**	**Total marks (HSD)**					**200**
		Total					**24**	**Grand Total marks**					**900**

PROFESSIONAL ELECTIVE I		
Course Code	**Course name**	**Domain**
PEC-CS5011	Advanced Operating Systems	1
PEC-CS5012	Mobile Computing	2
PEC-CS5013	Advanced Database Management System	3
PEC-CS5014	Multimedia Systems	4
PEC-CS5015	Machine Learning	5

IA- In-Semester Assessment, ESE- End Semester Examination, PR- Practical Examination, TW – Term Work Examination, OR- Oral Examination, AC- Activity evaluation

Guidelines for the Semester:

1. During Academic conduct, practical load shall be conducted in batches.
2. For continuous evaluation, examination shall be conducted under two heads: IA – In-Semester Assessment, ESE – End Semester Examination. Under IA, 20 marks of ISE (In-Semester Examination) shall be conducted for 1 hour. 20 marks of IE (Innovative Examination) shall also be conducted under IA. ESE shall be conducted for 60 marks with a duration of 2 hours.
3. Three In-Semester Examinaions (ISE) will be conducted during each semester. Out of Three, Average of Best Two ISE marks will be considered. There is no provision for the Retest in any ISE.
4. Innovative Examination (IE) will be accessed based on the project report with presentation.
5. @-Professional Elective Courses Lab will be conducted in the form of Capstone Project
6. Professional Skills-V and Project Based Learning-III activities will run in the form of integrated theory and practical courses.
7. * Under the head of Summer Internship, student can complete internship from winter to summer with 160 hours and acquire 4 credits till the end of Semester 6. The summer Internship will be conducted in the form of in-house internship which is mandatory for all students in summer semester break. Credits will be awarded at the end of 6th Semester and will be reflected in the Grade Card of 6th Semester. Student will get 1-year span to acquire the credits and complete total contact hours. Student shall submit a report to earn Term work marks in internship.
   - **Following activities should be considered for Summer Internship:-**
     1. Participation in inhouse internship at the end of 3rd and 4th Semester of 2 week each.
     2. Other activity which also will be considered are : Participation in Hackathon, Development of new Product/ Business Plan / Registration of start-up, Participation in IPR workshop/Leadership talks/Idea/ Design / Innovation/Technical Expos, Internship with Industry / Govt. / NGO/ PSU/MSME/Online Internship, Long Term Goals under Rural Internship

   Note:- For Above Activities mentioned in point 2, if Student is part of Organizing Committee or Participating a Competition at University/State/National/international Level then it will be considered as Internship else it will be considered as Activity Points.
8. # As per AICTE, Students has to earn 100 Points by participating in 400 Hrs. of activities during 4 years of Engineering. After Completing 48 hrs. of Activities, Students can earn 12 Points. This Points will not be reflected in Grade Card. Separate transcript will be issued to students after completion of Final Year.

SMART tcet COMP ENGINEERS

TCET
DEPARTMENT OF COMPUTER ENGINEERING (COMP)

[Accredited by NBA for 3 years, 3rd Cycle Accreditation w.e.f. 1st July 2019]

Choice Based Credit Grading Scheme (CBCGS)

Under TCET Autonomy

tcet Estd. in 2001

T.E. Semester –VI (Computer Engineering)

Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education (CBCGS-HME 2020)

TCET Autonomy Scheme (w.e.f. A.Y. 2022-23)

Course Description			Teaching Scheme (Program Specific)					Examination scheme					
Sr. No.	CourseCode	Course Title	Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation					
			Hours Per Week				Credits	Theory (100/50)			Practical / Oral / Presentation (25)	Term Work (25)	Total
			Theory	Tutorial	Practical	Contact Hours		40/20 IA		60/30	PR/OR	TW	
								ISE	IE	ESE			
1	PCC-CS601	Cryptography & System Security	3	1	2	6	5	20	20	60	25	25	150
2	PCC-CS602	System Programming & Compiler Construction	3	-	2	5	4	20	20	60	25	25	150
3	PCC-CS603	Software Engineering	3	-	2	5	4	20	20	60	25	25	150
4	PEC-CS601X	Professional Elective II	3	-	2@	5	4	20	20	60	25	25	150
5	OEC-CS601X	Open Elective 1	3	-	-	3	3	20	20	60	-	-	100
		Total	**15**	**1**	**8**	**24**	**20**	-		-	**Total marks (Academic)**		**700**
Course Description			**Non-Credited Mandatory Course (Passing is mandatory for this course)**									**Term Work**	
1	MC-CS601	Essence of Indian Knowledge Tradition	1	-	-	1	(Non-Credit)	-				25	**25**
Course Description			**Contact Hrs. during Semester Break/ End of Semester (Between 21st and 25th Week)**									**Non-Grant Term Work (based on the Presentation and Report)**	
1	SI-CS601	Summer Internship	-	-	-	160*	4*	-		-	-	50	**50**
Course Description			**Contact Hrs. during Weekend / Semester Break/ End of Semester (Between 21st and 25th Week) / During Semester**										
1	AP-CS601	Activity Points	-	-		52#	-	-		-	-	-	-
Course Description			**Teaching scheme (Holistic Student Development -HSD) (Conducted in the beginning of Semester during first 3 Weeks)**					**Assessment/Evaluation Scheme**					
								Presentation AC			**Report AC**		**Term Work**
1	ESD-CS601	Employability Skill Development – IV	-	-	30	30	1	Based on Parameters Decided by Training and Placement Cell					50
2	HSD - CSPS601	Professional Skill VI (Android App Development)	15	-	30	45	2	50			25		75
3	HSD - CSPBL601	Project Based Learning-IV	-	-	30	30	1	25			-		25
4	HSD -CSRBL601	Research Based Learning-II	-	-	30	30	1	25			25		50
		Total	**15**	**-**	**120**	**135**	**5**	**Total marks (HSD)**					**200**
		Total					**29**	**Grand Total marks:**					**975**

PROFESSIONAL ELECTIVE II			OPEN ELECTIVE I	
Course Code	**Course name**	**Domain**	**Course Code**	**Course name**
PEC-CS6011	Advanced Algorithm	1	OEC-CS6011	Digital Marketing
PEC-CS6012	Internet Programming	2	OEC-CS6012	Software Process Automation
PEC-CS6013	Data Warehousing & Mining	3	OEC-CS6013	Entrepreneurship development andmanagement
PEC-CS6014	Digital Signal Processing	4	OEC-CS6014	Cyber Security and Laws
PEC-CS6015	Soft Computing	5	OEC-CS6015	Reliability Engineering
			OEC-CS6016	Product life cycle management

IA- In-Semester Assessment, ESE- End Semester Examination, PR- Practical Examination, TW – Term Work Examination, OR- Oral Examination, AC- Activity evaluation

Guidelines for the Semester:

1. During Academic conduct, practical load shall be conducted in batches.
2. For continuous evaluation, examination shall be conducted under two heads: IA – In-Semester Assessment, ESE – End Semester Examination. Under IA, 20 marks of ISE (In-Semester Examination) shall be conducted for 1 hour. 20 marks of IE (Innovative Examination) shall also be conducted under IA. ESE shall be conducted for 60 marks with duration of 2 hours.
3. Three In-Semester Examinaions (ISE) will be conducted during each semester. Out of Three, Average of Best Two ISE marks will be considered. There is no provision for the Retest in any ISE.
4. Innovative Examination (IE) will be accessed based on the project report with presentation.
5. @-Professional Elective Courses Lab will be conducted in the form of Capstone Project
6. Professional Skills-VI and Project Based Learning-IV activities will run in the form of integrated theory and practical course.
7. * Under the head of Summer Internship, student can complete internship from winter to summer with 160 hours and acquire 4 credits till the end of Semester 6. The summer Internship will be conducted in the form of in-house internship which is mandatory for all students in summer semester break. Credits will be awarded at the end of 6th Semester and will be reflected in the Grade Card of 6th Semester. Student will get 1-year span to acquire the credits and complete total contact hours. Student shall submit a report to earn Term work marks in internship.
   - **Following activities should be considered for Summer Internship:-**
   a. Participation in inhouse internship at the end of 3rd and 4th Semester of 2 week each.
   b. Other activity which also will be considered are : Participation in Hackathon, Development of new Product/ Business Plan / Registration of start-up, Participation in IPR workshop/Leadership talks/Idea/ Design / Innovation/Technical Expos, Internship with Industry / Govt. / NGO/ PSU/MSME/Online Internship, Long Term Goals under Rural Internship

   Note:- For Above Activities mentioned in point 2, if Student is part of Organizing Committee or Participating a Competition at University/State/National/international Level then it will be considered as Internship else it will be considered as Activity Points.

8. # As per AICTE, Students has to earn 100 Points by participating in 400 Hrs. of activities during 4 years of Engineering. After Completing 48 hrs. of Activities, Students can earn 12 Points. This Points will not be reflected in Grade Card. Separate transcript will be issued to students after completion of Final Year.

B.E. Semester –VII (Computer Engineering)

Choice Based Credit Grading Scheme with Holistic Student Development(CBCGS- H 2019)

TCET Autonomy Scheme (w.e.f. A.Y. 2021-22)

Course Description			Teaching Scheme (Program Specific)					Examination scheme				
Sr. No.	Course Code	Course Title	Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation				
			Hours Per Week				Credits	Theory (100)		Practical/Oral (25/75)	Term Work (25/50)	Total
			Theory	Tutorial	Practical	Contact Hours		IA(25/15)	ESE(75/35)	PR/OR	TW	
1	PCC-CS701	Software Architecture	3	-	2	5	4	25	75	25	25	150
2	PEC-CS701X	Professional Elective III	3	-	2@	5	4	25	75	25	25	150
3	PEC-CS702X	Professional Elective IV	3	-	2@	5	4	25	75	25	25	150
4	OEC-CS701X	Open Elective II	3	-	-	3	3	25	75	-	-	100
5	HSMC-CS701	Finance Management	3	-	-	3	3	25	75	-	-	100
6	PROJ-CS701	Project I	-	-	6	6	3	-	-	25	25	50
		Total	**15**	**-**	**12**	**27**	**21**				**Total marks**	**700**
Course Description			Contact Hrs. during Semester Break/ End of Semester(Between 21st and 25th Week)									
1	SI-CS701	Summer Internship	-	-	-	120*	-	-	-	-	-	-
2	AP-CS701	Activity Points	-	-	-	48#	-	-	-	-	-	-
Course Description			Teaching scheme (Holistic Student Development - HSD) (Conducted in the beginning of Semester during first 3 Weeks)					Assessment/Evaluation Scheme				
								Presentation AC		Report AC		Term Work
1	HSD-CSPS701	Professional Skill VII (Software Testing)	15	-	30	45	2	50		25		75
2	HSD-CSRBL701	Research Based Learning-III	-	-	30	30	1	25		25		50
		Total	**15**	-	60	75	3				**Total marks**	**125**
		Total					**24**				**Grand Total marks:**	**825**

PROFESSIONAL ELECTIVE III			PROFESSIONAL ELECTIVE IV			OPEN ELECTIVE II	
Course Code	**Course name**	**Domain**	**Course Code**	**Course name**	**Domain**	**Course Code**	**Course name**
PEC-CS7011	Parallel Computing	1	PEC-CS7021	Internet of Things (IoT)	1	OEC-CS7011	Management Information System
PEC-CS7012	Network Infrastructure	2	PEC-CS7022	Wireless Network	2	OEC-CS7012	Human Resource Management
PEC-CS7013	Enterprise Resource Planning	3	PEC-CS7023	Data Analytics	3	OEC-CS7013	Design Thinking and Problem Solving
PEC-CS7014	Image Processing	4	PEC-CS7024	Human Computer Interaction	4	OEC-CS7014	Disaster management and mitigation measures
PEC-CS7015	Deep Learning	5	PEC-CS7025	Robotics	5	OEC -CS7015	Research Methodology
						OEC- CS7016	Operation Research

IA- In-Semester Assessment, ESE- End Semester Examination, PR- Practical Examination, TW – Term Work Examination, OR- Oral Examination, AC- Activity evaluation

Guidelines for the Semester:

1. During Academic conduct, practical load shall be conducted in batches.
2. For continuous evaluation, examination shall be conducted under two heads: IA – In-Semester Assessment, ESE – End Semester Examination. Under IA, 25 marks of ISE (In-Semester Examination) shall be conducted for 1.5 hours. ESE shall be conducted for 75 marks with duration of 3 hours.
3. @-Professional Elective Courses Lab will be conducted in the form of Capstone Project
4. Professional Skills-VII activity will run in the form of integrated theory and practical course.
5. * Under the head of Summer Internship, student can complete internship from winter to summer with 120 hours and acquire 3 credits till the end of Semester 8. Credits will be awarded at the end of 8th Semester and will be reflected in the Grade Card of 6th Semester. Student will get 1-year span to acquire the credits and complete total contact hours. Student shall submit a report to earn Term work marks in internship.
6. # As per AICTE, Students has to earn 100 Points by participating in 400 Hrs. of activities during 4 years of Engineering. After Completing 48 hrs. of Activities, Students can earn 12 Points. This Points will not be reflected in Grade Card. Separate transcript will be issued to students after completion of Final Year.

B.E. Semester –VIII (Computer Engineering)

Choice Based Credit Grading Scheme with Holistic Student Development(CBCGS- H 2019)

TCET Autonomy Scheme (w.e.f. A.Y. 2021-22)

Course Description			Teaching Scheme (Program Specific)					Examination Scheme				
			Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation				
Sr. No.	Course Code	Course Title	Hours Per Week				Credits	Theory (100)		Practical/Oral (25/50)	Term Work (25/100)	Total
			Theory	Tutorial	Practical	Contact Hours		IA(25/15)	ESE(75/35)	PR/OR	TW	
1	PCC-CS801	Distributed Computing	3	-	2	3	4	25	75	25	25	150
2	PEC-CS801X	Professional Elective V	3	-	2@	5	4	25	75	25	25	150
3	OEC-CS801X	Open Elective III	3	-	-	3	3	25	75	-	-	100
4	OEC-CS802X	Open Elective IV	3	-	-	3	3	25	75	-	-	100
5	PROJ-CS801	Project II	-	-	12	12	6	-	-	100	50	150
		Total	**12**	**-**	**16**	**26**	**20**	-	-	**Total marks**		**650**
Course Description			**Contact Hrs. during Semester Break/ End of Semester(Between 21st and 25th Week)**									
1	SI-CS801	Summer Internship	-	-	**-**	120*	**3***	-	-	-	50	**50**
1	AP-CS801	Activity Points	-	-	-	52#	-	-	-	-	-	-
Course Description			**Teaching scheme (Holistic Student Development - HSD)** **(Conducted in the beginning of Semester during first 3 Weeks)**					**Assessment/Evaluation Scheme**				
								Presentation		**Report**		**Term Work**
								AC		**AC**		
1	HSD-CSPS801	Professional Skill VIII (Cloud Computing)	15	-	30	45	2	50		25		75
2	HSD-CSRBL801	Research Based Learning-IV	-	-	30	30	1	25		25		50
		Total	**15**	**-**	**60**	**75**	**3**			**Total marks**		**125**
		Total					**26**			**Grand Total marks:**		**825**

PROFESSIONAL ELECTIVE V			OPEN ELECTIVE III		OPEN ELECTIVE IV	
Course Code	**Course name**	**Domain**	**Course Code**	**Course name**	**Course Code**	**Course name**
PEC-CS8011	Graph Theory	1	OEC-CS8011	Project Management	OEC-CS8021	Managerial Economics
PEC-CS8012	Advanced System Security and Digital Forensics	2	OEC-CS8012	Energy Audit and Management	OEC-CS8022	Digital Business Management
PEC-CS8013	Data Science	3	OEC-CS8013	Innovation Management	OEC-CS8023	Social Network Analysis
PEC-CS8014	Augmented & Virtual Reality	4	OEC-CS8014	Environment management	OEC-CS8024	Basic Taxation for Engineers
PEC-CS8015	Natural Language Processing	5	OEC-CS8015	Intellectual Property Rights (IPR) & Patenting	OEC-CS8025	Product Design and Development
		6	OEC-CS8016	Supply Chain Management	OEC-CS8026	Development Engineering

IA- In-Semester Assessment, ESE- End Semester Examination, PR- Practical Examination, TW – Term Work Examination, OR- Oral Examination, AC- Activity evaluation

Guidelines for the Semester:

1. During Academic conduct, practical load shall be conducted in batches.
2. For continuous evaluation, examination shall be conducted under two heads: IA – In-Semester Assessment, ESE – End Semester Examination. Under IA, 25 marks of ISE (In-Semester Examination) shall be conducted for 1.5 hours. ESE shall be conducted for 75 marks with duration of 3 hours.
3. @-Professional Elective Courses Lab will be conducted in the form of Capstone Project
4. Professional Skills-VIII activity will run in the form of integrated theory and practical course.
5. Under the head of Summer Internship, student can complete internship from winter to summer with 120 hours and acquire 3 credits till the end of Semester 8. Credits will be awarded at the end of 8th Semester and will be reflected in the Grade Card of 6th Semester. Student will get 1-year span to acquire the credits and complete total contact hours. Student shall submit a report to earn Term work marks in internship.
6. # As per AICTE, Students has to earn 100 Points by participating in 400 Hrs. of activities during 4 years of Engineering. After Completing 48 hrs. of Activities, Students can earn 12 Points. This Points will not be reflected in Grade Card. Separate transcript will be issued to students after completion of Final Year.

S.E. Semester –III

Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education (CBCGS-HME 2020)

Proposed TCET Autonomy Scheme (w.e.f. A.Y. 2021-22)

<table>
<tr><td colspan="7">B.E. (Computer Engineering)</td><td colspan="3">S.E. SEM : III</td></tr>
<tr><td colspan="7">Course Name : Mathematics-III</td><td colspan="3">Course Code :BSC- CS301</td></tr>
<tr><td colspan="5">Teaching Scheme (Program Specific)</td><td colspan="5">Examination Scheme (Academic)</td></tr>
<tr><td colspan="5">Modes of Teaching / Learning / Weightage</td><td colspan="5">Modes of Continuous Assessment / Evaluation</td></tr>
<tr><td colspan="5" rowspan="2">Hours Per Week</td><td colspan="3">Theory (100)</td><td rowspan="2">Practical/Oral/ Presentation (25)</td><td rowspan="2">Term Work (25)</td><td rowspan="2">Total</td></tr>
<tr><td colspan="2">40/20</td><td>60/30</td></tr>
<tr><td rowspan="2">Theory</td><td rowspan="2">Tutorial</td><td rowspan="2">Practical</td><td rowspan="2">Contact Hours</td><td rowspan="2">Credits</td><td colspan="2">IA</td><td rowspan="2">ESE</td><td rowspan="2">PR/OR</td><td rowspan="2">TW</td><td rowspan="3">125</td></tr>
<tr><td>ISE</td><td>IE</td></tr>
<tr><td>3</td><td>1</td><td>-</td><td>4</td><td>4</td><td>20</td><td>20</td><td>60</td><td>-</td><td>25</td></tr>
<tr><td colspan="11">IA: In-Semester Assessment - Paper Duration – 1 Hour
ESE: End Semester Examination - Paper Duration – 2/1 Hours
The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)</td></tr>
<tr><td colspan="11">Prerequisite: Computer Basics, Procedural Programming Languages</td></tr>
</table>

Course Objectives: The objective of the course is to understand the discrete mathematical preliminaries and apply the knowledge of sets, relations, functions, graphs, lattices and transform calculus in formal representation of various computing constructs.

Course Outcomes: Students will be able to:

SN	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Understand the basic concepts of set theory and able to apply basic set operations in problem solving.	L1, L2, L3
2	Understand relation and function and their properties and also able to understand their use in programming applications.	L2, L3
3	Understand Partially ordered set, lattice concept in various application.	L1, L2, L3
4	Understand the concept of graph, Euler graph, Hamiltonian graph and special kind of graph and also able to model real world problems using graph theory.	L1, L3
5	Apply the Laplace Transform, Inverse Laplace Transform and its properties to solve ODE.	L1, L2, L3
6	Apply the concept of Fourier Transform and Inverse Fourier transform through properties.	L1, L3

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Introduction to Set Theory and Proofing Techniques** Definition of Sets, Venn Diagrams, complements, cartesian products, power sets, counting principle, cardinality and countability (Countable and Uncountable sets) Laws of set theory, Power set and Products Partitions of sets. The Principle of Inclusion and Exclusion Pigeonhole Principle, Mathematical Induction.	6	L1, L2, L3
2	**Relation and Functions** **Relation**: Definition, types of relation, composition of relations, pictorial representation of relation (Digraphs), properties of relation, partial ordering relation. Operations on relations, Closures, Warshall's algorithm. **Function**: Definition and types of function, composition of functions, Generating Functions.	7	L2, L3
3	**Lattices** Posets, Hasse Diagram, chain , Upper bounds, Lower bounds, GLB & LUB of sets, Definition & properties of Lattice, sublattice Distributive& modular Lattices, complemented & bounded Lattices , Complete lattices.	7	L1, L2, L3
4	**Graph Theory** Definitions: graphs, digraphs, Multigraphs, Paths and cycles (Hamiltonian and Eulerian), Subgraphs, Isomorphism, Special kinds of graphs: bipartite graphs, planer graphs, Graph coloring, trees.	8	L1, L3
5	**Transform Calculus -I** Laplace Transform, Properties of Laplace Transform, Laplace transform of periodic functions, Finding inverse Laplace transform by first shifting, partial fraction and differentiation method.	8	L1, L2, L3
6	**Transform Calculus -II** Convolution theorem, Solving ODEs by Laplace Transform method, Fourier Transform and Inverse Fourier transform of constant and exponential function, Properties of Fourier Transform	9	L1, L3
	Total Hours	**45**	

Books and References:

SN	Title	Authors	Publisher	Edition	Year
1	Elements of Discrete Mathematics	C. L. Liu and D. P. Mohapatra	McGraw Hill	2nd Edition	2010
2	Discrete Mathematical Structures with Applications to Computer Science	J. P. Trembley, R. Manohar	McGraw Hill	5th Edition	2011
3	Discrete Mathematics	Seymour Lipschutz, Marc Lars Lipson,“	McGraw Hill	5th Edition	2010
4	Advanced Engineering Mathematics	Erwin kreyszig	John Wiley & Sons	Ninth Edition	2006
5	Higher Engineering Mathematics	B.S. Grewal	Khanna Publishers	Thirty Sixth Edition	2010

List of Tutorials:

Sr. No	Topic	Hrs.	Cognitive levels of attainment as per Bloom’s Taxonomy
1	Tutorial on Set theory	1	L1, L2
2	Tutorial on Principle of Inclusion and Exclusion	1	L1, L2, L3
3	Tutorial on Pigeonhole Principle	1	L1, L2, L3
4	Tutorial on Relation	1	L1, L2
5	Tutorial on Warshall’s Algorithm	1	L1, L2, L3
6	Tutorial on Functions	1	L1, L2
7	Tutorial on isomorphism	1	L1, L2, L3
8	Tutorial on poset, Hasse diagram	1	L1, L2
9	Tutorial on Lattice, Sublattice	1	L1, L2, L3
10	Tutorial on types of lattice	1	L1, L2, L3
11	Tutorial on planar graphs	1	L1, L2
12	Tutorial on Eulerian and Hamiltonian Graphs	1	L1, L2, L3
13	Tutorial on Laplace Transform	1	L1, L2
14	Tutorial on Inverse Laplace Transform	1	L1, L2, L3
15	Tutorial on Fourier Transform	1	L1, L2, L3
	Total Hours	**15**	

S.E. Semester –III
Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education (CBCGS-HME 2020)
Proposed TCET Autonomy Scheme (w.e.f. A.Y. 2021-22)

<table>
<tr><td colspan="7">B.E. (Computer Engineering)</td><td colspan="4">S.E. SEM : III</td></tr>
<tr><td colspan="7">Course Name : Data Structures</td><td colspan="4">Course Code :PCC- CS301</td></tr>
<tr><td colspan="5">Teaching Scheme (Program Specific)</td><td colspan="6">Examination Scheme (Academic)</td></tr>
<tr><td colspan="5">Modes of Teaching / Learning / Weightage</td><td colspan="6">Modes of Continuous Assessment / Evaluation</td></tr>
<tr><td colspan="5" rowspan="2">Hours Per Week</td><td colspan="3">Theory (100)</td><td rowspan="2">Practical/Oral/ Presentation (25)</td><td rowspan="2">Term Work (25)</td><td rowspan="2">Total</td></tr>
<tr><td colspan="2">40/20</td><td>60/30</td></tr>
<tr><td rowspan="2">Theory</td><td rowspan="2">Tutorial</td><td rowspan="2">Practical</td><td rowspan="2">Contact Hours</td><td rowspan="2">Credits</td><td colspan="2">IA</td><td rowspan="2">ESE</td><td rowspan="2">PR/OR</td><td rowspan="2">TW</td><td rowspan="3">150</td></tr>
<tr><td>ISE</td><td>IE</td></tr>
<tr><td>3</td><td>-</td><td>2</td><td>5</td><td>4</td><td>20</td><td>20</td><td>60</td><td>25</td><td>25</td></tr>
<tr><td colspan="11">IA: In-Semester Assessment - Paper Duration – 1 Hour
ESE: End Semester Examination - Paper Duration – 2/1 Hours
The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)</td></tr>
<tr><td colspan="11">Prerequisite: Computer Basics, Procedural Programming Languages</td></tr>
</table>

Course Objective: The course intends to deliver the fundamentals of data structures by providing a platform to learn, compare and apply them in real world scenario.

Course Outcomes: **Upon completion of the course students will be able to:**

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Describe linear and non-linear data structures.	L1, L2,L3
2	Apply operations like insertion, deletion, searching and traversing on stack and queue data structure.	L1, L2, L3,L4
3	Apply operations like insertion, deletion, searching and traversing on linked list data structure.	L1, L2, L3,L4
4	Apply operations like insertion, deletion, searching and traversing on tree data structure.	L1, L2, L3,L4
5	Apply operations like insertion, deletion, searching and traversing on graph data structure.	L1, L2, L3.L4
6	Analyze appropriate sorting and searching technique for given problem.	L1, L2, L3, L4,L6

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Introduction to Data Structure** Introduction, Types of data Structures, Abstract data type, Importance of ADT, Operations on data structures.	3	L1, L2,L3
2	**Stacks and Queues** **Stack**: ADT of stack, operations on stack, array implementation of stack, applications of stack. **Queue:** ADT of queue, operations on queue, array implementation of queue, Types of queues: circular queue, priority queue, double ended queue, applications of queue.	8	L1, L2, L3,L4
3	**Linked lists** **Linked list**: ADT of Linked lists, operations on linked list, Types of linked lists: Single linked list, Double Linked list, Circular linked list, Implementation of linked list, stack implementation using linked list, queue implementation using linked list, Applications of linked list. **Matrix Data Structure:** Introduction to matrix data structure	12	L1, L2, L3,L4
4	**Introduction to Non Linear Data Structure** **Trees:** Terminologies, Binary tree and its types, Binary tree operations and implementation, Tree traversing techniques, Expression tree, AVL tree, Threaded Binary Tree, B Tree and B+Tree & applications.	10	L1, L2, L3,L4
5	**Graphs** **Graph:** Terminologies, Graph representation: Matrix and Adjacency list, Graph traversing techniques: BFS, DFS, Applications of graph,Graph Application: Topological sort.	5	L1, L2, L3,L4
6	**Searching and Sorting** **Searching:** Linear search, Binary search **Sorting:** Insertion sort, Merge sort, Bucket sort,Heap sort. Introduction to Hashing.	7	L1, L2, L3, L4,L6
	Total Hours	**45**	

Books and References:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Data Structures using C	Reema Thareja	Oxford	Second Edition	2014
2	Data Structures: A Pseudocode Approach with C	Richard F. Gilberg & Behrouz A., Forouzan	CENGAGE Learning	Second Edition	2011
3	Data Structures Using C	Aaron M Tenenbaum, Yedidyah Langsam, Moshe J Augenstein	Pearson	Second Edition	2006
4	Data Structures with C	Seymore Lipschutz	Tata McGraw-Hill	India Special Edition	2011

Online References:

Sr. No.	Website Name	URL	Modules Covered
1	www.geeksforgeeks.org	https://www.geeksforgeeks.org/stack-data-structure/	M1-M6
2	www.studytonight.com	https://www.studytonight.com/data-structures/introduction-to-data-structures	M1-M3, M6
3	www.w3schools.in	https://www.w3schools.in/category/data-structures-tutorial/	M1-M4, M6

List of Practical/ Experiments:

Practical Number	Type of Experiment	Practical/ Experiment Topic	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Basic Experiments**	Build a Program for stack using an array (Menu driven program)	2	L1, L2, L3
2		Build a Program for Queue using an array. (Menu driven program)	2	L1, L2, L3
3	**Design Experiments**	Develop a code for circular queue. (Menu driven)	2	L1, L2, L3
4		Develop a code for Single Linked List. (Menu driven program)	2	L1, L2, L3
5		Develop a code for Doubly linked list. (Menu driven program)	2	L1, L2, L3
6		Develop a code for Binary Search Tree (Menu driven program)	2	L1, L2, L3
7		Develop a code for BFS. (Menu driven program)	2	L1, L2, L3
8		Develop a code for DFS. (Menu driven program)	2	L1, L2, L3
9		Develop a code for Binary search technique.	2	L1, L2, L3
10		Develop a code for Quick Sort.	2	L1, L2, L3
11	**Advanced Experiments**	Develop a code for circularly linked doubly linked list.	2	L1, L2, L3
12		Develop a code for Hashing technique with collision resolution.	2	L1, L2, L3
13	**Mini/Minor Projects/ Seminar/ Case Studies**	**Case study:** 1. Red-Black tree 2. Binomial heap **Mini Project:** 1. Build a Snakes & Ladders game 2. Sudoku Solver 3. Maze generator 4. Dictionary implementation 5. Employee Record System 6. Super market Billing System	6	L1, L2, L3, L4
		Total Hours	**30**	

S.E. Semester –III

Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education (CBCGS-HME 2020)

Proposed TCET Autonomy Scheme (w.e.f. A.Y. 2021-22

B.E. (Computer Engineering)								**S.E. SEM : III**		
Course Name : Database Management System								Course Code : PCC- CS302		
Teaching Scheme (Program Specific)					**Examination Scheme (Academic)**					
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**					
Hours Per Week					**Theory (100)**			**Practical/Oral/ Presentation (25)**	**Term Work (25)**	**Total**
					40/20		**60/30**			
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**		**ESE**	**PR/OR**	**TW**	
					ISE	**IE**				
3	-	2	5	4	20	20	60	25	25	**150**

IA: In-Semester Assessment - Paper Duration – 1 Hour

ESE: End Semester Examination - Paper Duration – 2/1 Hours

The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)

Prerequisite: Computer Basics

Course Objective: The course intends to deliver the fundamental knowledge of database management system and apply this knowledge for implementing and analyzing real world problems.

Course Outcomes: **Upon completion of the course students will be able to:**

SN	Course Objectives	Cognitive levels of attainment as per Bloom'sTaxonomy
1	Demonstrate the fundamental elements of relational database Management Systems	L1, L2
2	Outline ER and EER diagram for the real life problem and convert it to Relational Database.	L1, L2,L3
3	Solve and build basic SQL Queries on given Data.	L1, L2, L3
4	Solve and build Advanced SQL Queries on given Data.	L1, L2, L3
5	Develop a relational database using concept of functional dependencies.	L1, L2, L3
6	Interpret the concepts of transaction, concurrency and recovery	L1, L2

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Introduction to Database Concepts** Basic Concepts of Data, Database and DBMS, Applications of Databases, Advantages of DBMS over File Processing System, Three Level Architecture of Database System, Database Schema and Instance Data Abstraction and Data Independence, Database Languages, Database Users, Database Administrator and its roles, Overall System structure.	3	L1, L2
2	**Entity Relationship Model(ER), Relational Model and Extended ER Model** **The Entity-Relationship (ER) Model:** Entity with its types Attributes with its types, Relationships with its Types. Real life Examples of ER Diagram. **Relational Model**: Structure of Relational Databases, Keys with its Types **Extended ER Model (EER):** Concept of Specialization**,** Generalization and Aggregation, Mapping of ER and EER to Relational Model.	6	L1, L2,L3
3	**Introduction to Structured Query Language (SQL)** Overview of SQL, Data Definition Language Commands, Data Manipulation Language Commands, Data Control Language Commands, Transaction Control Language Commands, Constraints, Set and String Operations, Aggregate Functions, Group by and Having Clause.	9	L1, L2, L3
4	**Advanced SQL with Integrity, Security and Authorization** Nested Sub queries, Referential Integrity in SQL, Joins, Views, Assertion, Trigger, Database Security and Authorization, Granting of Privileges, Revoking of Authorization in SQL Relational Algebra Operations and Tuple relational calculus	11	L1, L2, L3
5	**Relational Database Design** Pitfalls in Relational Database Design, Concept of Normalization, Functional Dependencies, 1 NF, 2 NF, 3 NF, BCNF, 4 NF	8	L1, L2, L3
6	**Transaction, Recovery and Concurrency Control** **Transaction Management:** Transaction Concept, Transaction States, ACID Properties of Transaction, Serial and Concurrent Executions, Conflict and View Serializability. **Concurrency Control:** Lock Based Protocols, Deadlock Handling **Recovery:** Failure Classification, Log based recovery, Checkpoint, Shadow Paging.	8	L1, L2
	TotalHours	**45**	

Books and References:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Database System Concepts	Korth, Slberchatz,Sudarshan	McGraw Hill	Seventh Edition	2019
2	Fundamentals of Database Systems	Elmasri and Navathe	Pearson education	Seventh Edition	2016
3	Database Management Systems	Raghu Ramkrishnan and Johannes Gehrke	McGraw Hill	Third Edition	2014

Online References:

Sr. No.	Website Name	URL	Modules Covered
1	www.guru99.com	https://www.guru99.com/dbms-tutorial.html	M1,M2,M6
2	www.javatpoint.com	https://www.javatpoint.com/dbms-tutorial	M1-M6
3	www.studytonight.com	https://www.studytonight.com/dbms/	M1 to M3,M5
4	www.w3schools.in	https://www.w3schools.in/dbms/ https://www.w3schools.com/sql/default.asp	M1,M2,M5,M6 M3,M4
5	www.geeksforgeeks.org	https://www.geeksforgeeks.org/dbms/	M1- M6
6	www.tutorialcup.com	https://www.tutorialcup.com/dbms	M1, M2, M5,M6

S.E. Semester –III

Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education (CBCGS-HME 2020)

Proposed TCET Autonomy Scheme (w.e.f. A.Y. 2021-22)

<table>
<tr><td colspan="7">B.E. (Computer Engineering)</td><td colspan="4">S.E. SEM : III</td></tr>
<tr><td colspan="7">Course Name: Digital Logic Design & Analysis</td><td colspan="4">Course Code: PCC-CS303</td></tr>
<tr><td colspan="5">Teaching Scheme (Program Specific)</td><td colspan="6">Examination Scheme (Academic)</td></tr>
<tr><td colspan="5">Modes of Teaching / Learning / Weightage</td><td colspan="6">Modes of Continuous Assessment / Evaluation</td></tr>
<tr><td colspan="5" rowspan="2">Hours Per Week</td><td colspan="3">Theory (100)</td><td rowspan="2">Practical/Oral/ Presentation (25)</td><td rowspan="2">Term Work (25)</td><td rowspan="2">Total</td></tr>
<tr><td colspan="2">40/20</td><td>60/30</td></tr>
<tr><td rowspan="2">Theory</td><td rowspan="2">Tutorial</td><td rowspan="2">Practical</td><td rowspan="2">Contact Hours</td><td rowspan="2">Credits</td><td colspan="2">IA</td><td rowspan="2">ESE</td><td rowspan="2">PR/OR</td><td rowspan="2">TW</td><td rowspan="3">150</td></tr>
<tr><td>ISE</td><td>IE</td></tr>
<tr><td>3</td><td>-</td><td>2</td><td>5</td><td>4</td><td>20</td><td>20</td><td>60</td><td>25</td><td>25</td></tr>
<tr><td colspan="11">IA: In-Semester Assessment - Paper Duration – 1 Hour
ESE: End Semester Examination - Paper Duration – 2/1 Hours
The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)</td></tr>
<tr><td colspan="11">Prerequisite: Engineering Mathematics</td></tr>
</table>

Course Objective: The course intends to provide the basic knowledge of digital logic levels and apply knowledge to understand digital electronics circuits.

Course Outcomes: **Upon completion of the course students will be able to:**

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Build different number systems forms	L1, L2, L3
2	Solve Boolean expressions	L1, L2, L3
3	Explain the basics of TTL and CMOS logic families	L1, L2
4	Illustrate the design of Combinational circuits	L1, L2,L3
5	Illustrate the design of Sequential circuits	L1, L2,L3
6	Understand the concepts in designing of counters and registers	L1, L2, L3

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Number Systems and codes** Introduction to number system and conversions: Binary, Octal, Decimal and Hexadecimal number Systems, Conversion of Number system, Binary arithmetic: addition, subtraction (1's and 2's complement), multiplication and division. Octal and Hexadecimal arithmetic: Addition and Subtraction (7's and 8's complement method for octal), Direct subtraction of octal Numbers, Octal Multiplication, Hexadecimal Multiplication and (15's and 16's complement method for Hexadecimal). Codes: Gray Code, BCD Code, Excess-3 code, ASCII Code. Error Detection and Correction: Hamming codes.	8	L1, L2, L3
2	**Boolean Algebra & Logic Gates** Theorems and Properties of Boolean Algebra, Boolean functions, Boolean function reduction using Boolean laws, Canonical forms, Standard SOP and POS form. Basic Digital gates: NOT , AND , OR , NAND , NOR , EXOR , EXNOR, positive and negative logic, K-map method 2 variable, 3 variable, 4 variable, Don't care condition, Quine-McClusky Method, NAND, NOR Realization.	7	L1, L2, L3
3	**Digital Logic Families** Introduction: Terminologies like Propagation Delay, Power Consumption, Fan in and Fan out, current and voltage parameters, current sourcing and current sinking, noise margin, with respect to TTL and CMOS Logic and their comparison	3	L1, L2
4	**Analysis and Design of Combinational Logic** Introduction, code converters, Half and Full Adder, Half subtractor and Full Subtractor, One digit BCD Adder, Multiplexer, Multiplexer tree, Demultiplexer, Demultiplexer tree, Encoders, Priority encoder, Decoders, One bit, Two bit, 4-bit Magnitude Comparator, ALU IC 74181.	9	L1, L2, L3
5	**Latches and Flip Flops** Introduction: SR latch, Concepts of Flip Flops: SR, D, J-K, T, Truth Tables and Excitation Tables of all types, Race around condition, Master Slave J- K Flip Flops, Timing Diagram, Flip-flop conversion, State machines, state diagrams, State table, concept of Moore and Mealy machine	9	L1, L2, L3
6	**Counters and Shift registers** Counters: Design of Asynchronous and Synchronous Counters, Modulus of the Counters, UP- DOWN counter. Shift Registers: SISO, SIPO, PIPO, PISO Bidirectional Shift Register, Universal Shift Register, Ring and twisted ring/Johnson Counter, sequence generator.	9	L1, L2, L3
	Total Hours	**45**	

Books and References:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Modern Digital Electronics	R. P. Jain	McGraw Hill	Fourth Edition	2010
2	Digital Logic and computer Design	M. Morris Mano	Pearson	Sixth Edition	2017
3	Digital Principles and Applications	Donald p Leach, Albert Paul Malvino	McGraw Hill	Seventh Edition	2011

Online References:

Sr. No.	Website Name	URL	Modules Covered
1	www.crectirupati.com	http://www.crectirupati.com/sites/default/files/lecture_notes/DLD%20lecture%20notes.pdf	M11-M2, M4-M6
2	www.engrcs.com	https://www.engrcs.com/courses/engr250/engr250lecture.pdf	M1-M6
3	www.uptusuccess.com	https://uptusuccess.com/digital-logic-design-rec301/	M1-M3

List of Practical/ Experiments:

Practical Number	Type of Experiment	Practical/ Experiment Topic	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	Basic Experiments	Utilize logic gates to realize Boolean expressions	2	L1, L2, L3
2		Make use of universal gates to implement Basic gates	2	L1, L2, L3
3		Build parity generator and detector.	2	L1, L2, L3
4	Design Experiments	Build basic gates using Xilinx.	2	L1, L2, L3
5		Build binary to gray code and gray code to binary converter	2	L1, L2, L3
6		Construct arithmetic circuits i) Half adder ii) Full adder iii) Half subtractor iv) Full subtractor.	2	L1, L2, L3
7		Construct 4:1 multiplexer using Xilinx.	2	L1, L2, L3
8		Develop full adder using multiplexer IC	2	L1, L2, L3
9		Develop 4 bit binary adder using IC 7483	2	L1, L2, L3
10		Develop full adder using multiplexer IC	2	L1, L2, L3
11		Construction of 2-bit magnitude Comparator.	2	L1, L2, L3
12		Make use of NAND and NOR gates to Verify state tables of R-S flip-flop, J - K flip-flop, T Flip-Flop, D Flip-Flop	2	L1, L2, L3

13	**Mini/Minor Projects/ Seminar/ Case Studies**	1. Water Level Indicator 2. Rain Alarm Circuit 3. RFID based Attendance System 4. PC Based Digital IC Tester 5. K-map using 5 Variables 6. Very High Speed Integrated Circuit Hardware Description Language	6	L1, L2, L3
		Total Hours	**30**	

S.E. Semester –III

B.E.(Computer Engineering)							**S.E. SEM : III**		
Course Name: Computer Organization & Architecture							**Course Code:** PCC-C304		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	
3	-	2	5	4	25	75	25	25	**150**
IA: In-Semester Assessment - Paper Duration – 1.5 Hours **ESE: End Semester Examination - Paper Duration - 3 Hours** **The weightage of marks for continuous evaluation of Term work/Report:** Formative (40%), Timely completion of practical (40%) and Attendance/Learning Attitude (20%)									
Prerequisite: Basic Mathematics									

Course Objective: This course intends to deliver basics of modern computer organization and architectures, covering the interaction between computer hardware and software at various levels and to analyze performance issues in processor and memory design of a digital computer.

Course Outcomes: **Upon completion of the course students will be able to:**

Sr. No.	**Course Outcomes**	**Cognitive levels of attainment as per Bloom's Taxonomy**
1	Explain basic structure and working of computer.	L1, L2
2	Apply various computer arithmetic operations.	L1, L2, L3
3	Explain the working of control unit.	L1, L2
4	Understand various types of memory of digital computer.	L1, L2, L3
5	Compare between different types I/O modes of transfer.	L1, L2
6	Understand basic concepts of pipelining.	L1, L2, L3

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Introduction of Computer Organization and Architecture** Basic organization of computer and block level description of the functional units. Introduction to computer organization & Architecture, ALU and its organization, Evolution of Computers, Von Neumann model, Instruction cycle, Machine Instructions (Types of Operands & Operations), Addressing Modes, Instruction Format, Interconnection Structures, Bus Interconnection.	8	L1, L2
2	**Data Representation and Arithmetic Algorithm** Signed number representation, fixed point computation algorithms, Booth multiplication, Division - non-restoring and restoring techniques, floating point arithmetic algorithms. IEEE 754 floating point number representation.	7	L1, L2, L3
3	**Control Unit Design** Micro operations, Control of the Processor, Hardwired Control Unit-Control Memory, Address Sequencing, Micro Instruction Format, Design of Control Unit: Microprogram Sequencer, Concepts of nano programming, Introduction to RISC and CISC architectures and design issues.	6	L1, L2
4	**Memory Organization** Classifications of primary and secondary memories, Types of RAM and ROM, Memory hierarchy and characteristics, Cache memory: concept, architecture, mapping, Cache coherency, Interleaved and Associative memory, Memory management unit, Magnetic Hard disks.	8	L1, L2
5	**I/O Organization** Peripheral Devices, Input-Output Interface, Modes of Transfer: Programmed I/O, Interrupt-Initiated I/O: Priority Interrupt, Direct Memory Access and DMA controller, Interface circuits - Parallel and serial port.	7	L1, L2
6	**Pipelining & Parallel Processing** Introduction to pipelining, Performance measures of pipelining, Synchronous and Asynchronous pipelining, Instruction level pipelining (ILP), Pipelining hazards, Handling of Branch instructions. Multiprocessor (loosely & tightly coupled) and Multicomputer (UNA, NUMA, COMA).	9	L1, L2
	Total Hours	**45**	

Books and References:

	Title	Authors	Publisher	Edition	Year
1	Computer organization	V. Carl, G. Zvonko and S. G. Zaky	McGraw Hill	Sixth Edition	2011
2	Computer Architecture and organization	Morris Mano	McGraw Hill	Third Edition	2010
3	Computer Organizations and Architecture	John P. Hayes	McGraw-Hill	Fifth Edition	2017

Online Resources:

S. No.	Website Name	URL	Modules Covered
1	www.nptel.ac.in	https://nptel.ac.in/courses/106102062/	M1-M6
2	www.edx.org	https://www.edx.org/course/computation-structures-2-computer-architecture	M1-M6
3	www.coursera.org	https://www.coursera.org/learn/comparch	M1-M6

List of Practical/ Experiments:

Practical Number	Type of Experiment	Practical/ Experiment Topic	Hrs.	RBT Levels
1	Basic Experiments	Demonstrate Computer Anatomy- Memory, Ports, Motherboard and add-on cards.	2	L1, L2
2		Develop a program to calculate 1's compliment and 2's compliment of a Binary number.	2	L1, L2, L3
3		Develop a program to calculate Binary and octal addition and multiplication	2	L1, L2, L3
4	Design Experiments	Construct of Register and Counter	2	L1, L2, L3
5		Develop a program to convert in IEEE 754 format	2	L1, L2, L3
6		Develop a program to perform Booth's Multiplication on binary numbers	2	L1, L2, L3
7		Develop a C/Java program for Restoring Division	2	L1, L2, L3

8		Build a C/Java program for Interrupt Handling	2	L1, L2, L3
9	**Mini/Minor Projects/ Seminar/ Case Studies**	1. Case Study: A Recent Intel Processor 2. Parallel Architectures 3. Bus Arbitration 4. Direct Memory Access 5. Cache Mapping 6. Nano Programming	10	L1, L2, L3
	Total Hours		**26**	

S.E. Semester –III

Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education (CBCGS-HME 2020)

Proposed TCET Autonomy Scheme (w.e.f. A.Y. 2021-22)

<table>
<tr><td colspan="7">B.E. (Computer Engineering)</td><td colspan="3">S.E. SEM : III</td></tr>
<tr><td colspan="7">Course Name : Environmental Studies</td><td colspan="3">Course Code :MC-CS301</td></tr>
<tr><td colspan="5">Teaching Scheme (Program Specific)</td><td colspan="5">Examination Scheme (Formative/ Summative)</td></tr>
<tr><td colspan="5">Modes of Teaching / Learning / Weightage</td><td colspan="5">Modes of Continuous Assessment / Evaluation</td></tr>
<tr><td colspan="5">Hours Per Week</td><td colspan="2">Theory (100)</td><td>Practical/Oral (25)</td><td>Term Work (25)</td><td>Total</td></tr>
<tr><td>Theory</td><td>Tutorial</td><td>Practical</td><td>Contact Hours</td><td>Credits</td><td>IA</td><td>ESE</td><td>PR/OR</td><td>TW</td><td rowspan="2">25</td></tr>
<tr><td>1</td><td>-</td><td>-</td><td>1</td><td>(Non Credit)</td><td>-</td><td>-</td><td>-</td><td>25</td></tr>
<tr><td colspan="10">IA: In-Semester Assessment - Paper Duration – 1.5 Hours
ESE: End Semester Examination - Paper Duration - 3 Hours
The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance/Learning Attitude (20%)</td></tr>
<tr><td colspan="10">Prerequisite: Biology, chemistry, geography, geology, physics.</td></tr>
</table>

Course Objective:

The course intends to deliver the fundamental concepts of Environmental Sciences. It will also help in understanding & analyzing the major challenges and current issues in Environment and evaluate possible solutions.

Course Outcome: **Upon completion of the course students will be able to:**

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Relate the concept of Environmental Sciences and provide solutions to the major challenges and current issues in Environment.	L1, L2
2	Relate the fundamentals and importance of Natural Resources and understand the importance of Biodiversity and its Conservation.	L1, L2
3	Interpret and Analyze various types of Environmental Pollution and their effects on plants and animals	L1, L2, L3, L4
4	Relate and Apply various laws available in the country to protect the Environment.	L1, L2, L3
5	Interpret and Analyze address social issues for sustainable development.	L1, L2, L3, L4
6	Relate and Analyze the importance of Environmental Monitoring.	L1, L2, L3, L4

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Concepts of Environmental Sciences**		
	Environment, Levels of organizations in environment, Structure and functions in an ecosystem; Biosphere, its Origin and distribution on land in water and in air.	2	L1, L2
2	**Natural Resources, Biodiversity and its conservation**		
	Renewable and Non-renewable Resources, Forests, water, minerals, Food and land (with example of one case study); Energy, Growing energy needs, energy sources (conventional and alternative), Biodiversity at global, national and local levels; India as a mega-diversity nation; and strategies for conservation of Biodiversity.	3	L1, L2
3	**Environmental Pollution**		
	Types of pollution- Air, water (including urban, rural, marine), soil, noise, thermal, nuclear; Pollution prevention; Management of pollution-Rural/Urban/Industrial waste management [with case study of any one type, e.g., power (thermal/nuclear), fertilizer, tannin, leather, chemical, sugar], Solid/Liquid waste management, disaster management.	3	L1, L2, L3, L4
4	**Environmental Biotechnology**		
	Biotechnology for environmental protection- Biological indicators, bio-sensors; Remedial measures- Bio-remediation, photo remediation, bio-pesticides, bio-fertilizers; Bio-reactors- Design and application	2	L1, L2, L3
5	**Social Issues and Environment**		
	Problems relating to urban environment- Population pressure, water scarcity, industrialization; remedial measures; Climate change- Reasons, effects (global warming, ozone layer depletion, acid rain) with one case study; Legal issues-Environmental legislation (Acts and issues involved), Environmental ethics	3	L1, L2, L3, L4
6	**Environmental Monitoring**		
	Monitoring- Identification of environmental problem, tools for monitoring (remote sensing, GIS); Sampling strategies- Air, water, soil sampling techniques	2	L1, L2, L3, L4
	Total Hours	**15**	

Books and References:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Textbook of Environmental Studies for Undergraduate Courses	Erach Bharucha	University's Press	Second Edition	2013
2	Fundamentals of Environmental Studies	Mahua Basu& Xavier Savarimuthu SJ	Cambridge Publication	First Edition	2016
3	Environmental Studies	Benny Joseph	Tata McGraw – Hill Publishing Company Limited	First Edition	2015
4	Environmental Studies	R.J.Ranjit Daniels, Jagadish Krishnaswamy	Wiley India Private Ltd., New Delhi.	First Edition	2013
5	Introduction to Environmental Engineering and Science	Gilbert M. Masters	Pearson- Education	Third Edition	2008

Online References:

Sr. No.	Website Name	URL	Modules Covered
1.	www.conserve-energy-future.com	https://www.conserve-energy-future.com/what-is-environmental-science-and-its-components.php	M1
2.	www.vikaspedia.in/InDG	http://vikaspedia.in/energy/environment/biodiversity-1/conservation-of-biodiversity	M2
3.	www.encyclopedia.com	https://www.encyclopedia.com/earth-and-environment/ecology-and-environmentalism/environmental-studies/environmental-toxicology	M3
4.	www.environmentalscience.org	https://www.environmentalscience.org/career/environmental-biotechnology	M4
5.	www.forestresearch.gov.uk	https://www.forestresearch.gov.uk/tools-and-resources/urban-regeneration-and-greenspace-partnership/greenspace-in-practice/practical-considerations-and-challenges-to-greenspace/social-and-environmental-justice/	M5
6.	www.unece.org/info/ece-homepage.html	https://www.unece.org/environmental-policy/environmental-monitoring-and-assessment/areas-of-work/environmental-monitoring.html	M6

S.E. Semester –III

Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education (CBCGS-HME 2020)

Proposed TCET Autonomy Scheme (w.e.f. A.Y. 2021-22)

<table>
<tr><td colspan="7">B.E. (Computer Engineering)</td><td colspan="3">S.E. SEM: III</td></tr>
<tr><td colspan="7">Course Name: Summer Intership</td><td colspan="3">Course Code: SI-CS301</td></tr>
<tr><td colspan="5">Teaching Scheme (Program Specific)</td><td colspan="5">Examination Scheme (Formative/ Summative)</td></tr>
<tr><td colspan="5">Modes of Teaching / Learning / Weightage</td><td colspan="5">Modes of Continuous Assessment / Evaluation</td></tr>
<tr><td colspan="5">Hours Per Week</td><td colspan="2">Theory (100)</td><td>Practical/Oral (25)</td><td>Term Work (25)</td><td>Total</td></tr>
<tr><td>Theory</td><td>Tutorial</td><td>Practical</td><td>Contact Hours</td><td>Credits</td><td>IA</td><td>ESE</td><td>PR/OR</td><td>TW</td><td rowspan="2">-</td></tr>
<tr><td>-</td><td>-</td><td>-</td><td>160*-240*</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td colspan="10">IA: In-Semester Assessment
ESE: End Semester Examination</td></tr>
<tr><td colspan="10">Prerequisite: Mathematical Foundation, Computing Methods</td></tr>
</table>

Course Objective: To familiarize students with emerging technologies used in industry. Also, to expose the students with developments in the various Program Specific Research (PSR) domains offered by the department.

Course Outcomes: Upon completion of the course students will be able to:

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	To comprehend the different emerging technologies used in the industry	L1, L2
2	To apply different emerging technologies for solving the problems in the domains.	L1, L2,L3

Detailed Syllabus:

Module No.	Topics	Hrs	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Computing and System Design domain**	5	L1, L2, L3
	Seminar on Emerging Technologies used in the industry.Hands-on Workshop on Industry special skills.Industry Connect / Alumni Connect Seminar		
2	**Communication Networking and Web Engineering domain**	5	L1, L2, L3
	Seminar on Emerging Technologies used in the industry,Hands-on Workshop on Industry special skills,Industry Connect / Alumni Connect Seminar		
3	**Multimedia System Design and Development domain**	5	L1, L2, L3
	Seminar on Emerging Technologies used in the industry,Hands-on Workshop on Industry special skills,Industry Connect / Alumni Connect Seminar		
4	**Software Development and Information Management System domain**	5	L1, L2, L3
	Seminar on Emerging Technologies used in the industry,Hands-on Workshop on Industry special skills,Industry Connect / Alumni Connect Seminar		
5	**Intelligent System Design and Development**	5	L1, L2, L3
	Seminar on Emerging Technologies used in the industry,Hands-on Workshop on Industry special skills,Industry Connect / Alumni Connect Seminar		
6	**Case study on the Emerging Tools and techniques under Program Specific Research domains**	5	L1, L2, L3
	Total Hours	30	

Books and References:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Emerging Technologies in Computer Science: Introducing The New IT & The Internet of Things	Andrew Moss	Amazon	I	2019
2	Emerging Technologies in Computing	Miraz, M.H., Excell, P., Ware, A., Soomro, S., Ali, M.	Springer	I	2018

Online References:

Sr. No.	Website Name	URL	Modules Covered
1	Advanced Topics in Computer Science	http://m.el-dosuky.com/course.php?c=advanced-topics-in-computer-science	M1-M6
2	https://interestingengineering.com	https://interestingengineering.com/5-technology-trends-to-watch-in-2019	M1-M6

S.E. Semester –III
Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education (CBCGS-HME 2020)
Proposed TCET Autonomy Scheme (w.e.f. A.Y. 2021-22)

<table>
<tr><td colspan="7">B.E. (Computer Engineering)</td><td colspan="3">S.E. SEM : III</td></tr>
<tr><td colspan="7">Course Name : Professional Skills-III
(Object Oriented Programming using Java)</td><td colspan="3">Course Code :HME-CSPS301</td></tr>
<tr><td colspan="5">Teaching Scheme (Program Specific)</td><td colspan="5">Examination Scheme (Formative/ Summative)</td></tr>
<tr><td colspan="5">Modes of Teaching / Learning / Weightage</td><td colspan="5">Modes of Continuous Assessment / Evaluation</td></tr>
<tr><td colspan="5">Conducted in the beginning of Semester during first 3 Weeks</td><td colspan="2">Theory (100)</td><td>Presentation (25)</td><td>Report (25)</td><td rowspan="3">Total

75</td></tr>
<tr><td>Theory</td><td>Tutorial</td><td>Practical</td><td>Contact Hours</td><td>Credits</td><td>IA</td><td>ESE</td><td>(AC)</td><td>(AC)</td></tr>
<tr><td>15</td><td>-</td><td>30</td><td>45</td><td>2</td><td>-</td><td>-</td><td>50</td><td>25</td></tr>
<tr><td colspan="10">IA: In-Semester Assessment - Paper Duration – 1.5 Hours
ESE: End Semester Examination - Paper Duration - 3 Hours
AC: Activity
The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance/Learning Attitude (20%)</td></tr>
<tr><td colspan="10">Prerequisite: Computer Basics, Procedural Programming Languages</td></tr>
</table>

Course Objective: The course intends to deliver the OOP concepts using Java and to help students design and implement real world applications.

Course Outcomes: **Upon completion of the course students will be able to:**

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Apply fundamental programming constructs.	L1, L2, L3
2	Experiment with concept of class, objects, strings, arrays and vectors.	L1, L2, L3
3	Experiment with concept of inheritance and interfaces.	L1, L2, L3
4	Experiment with concept of exception handling.	L1, L2, L3
5	Experiment with notion of multithreading and packages.	L1, L2, L3
6	Develop GUI based application	L1, L2, L3

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Object Oriented Concepts** Basics of object oriented programming , OOP Concepts: Object, Class, Encapsulation, Abstraction, Inheritance, Polymorphism	2	L1, L2, L3
2	**Introduction to Java** Basics of Java programming, Data types, Variables, Operators, Looping ,Strings, Arrays in java ,Input / Output in java , objects and classes in java, , Constructor and its types, Visibility modifiers, this reference	3	L1, L2, L3
3	**Inheritance and Polymorphism** Inheritance in java, Super and sub class, Polymorphism, Dynamic binding, Abstract class, Interface in java	2	L1, L2, L3
4	**Exception Handling** Exception and Error, Use of try, catch, throw, throws and finally, Built in Exception, Custom exception, Throwable Class	2	L1, L2, L3
5	**Multithreading in java** Thread life cycle and methods, Thread class, Runnable interface, Thread synchronization, Package in java	2	L1, L2, L3
6	**Event and GUI programming** Event handling in java, Event types, Mouse and key events, GUI Basics, Panels, Frames, Layout Managers: Flow Layout, Border Layout, Grid Layout, GUI components like Buttons, Check Boxes, Radio Buttons, Labels, TextFields, Text Areas, Combo Boxes, Lists, Scroll Bars, Sliders, Windows, Menus, Dialog Box, Applet and its life cycle, Introduction to swing.. Database Connectivity	4	L1, L2, L3
	Total Hours	15	

Books and References:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Programming with Java(Fifth Edition)	E Balagurusamy	McGraw Hill	Sixth Edition	2019
2	Java Programming, D. S. Malik	D. S. Malik	Cengage Learning	First Edition	2009
3	Programming in Java	Sachin Malhotra &Saurabh Chaudhary	Oxford University Press	Second Edition	2018
4	The Complete Reference, Java 2	Herbert Schild	McGraw Hill.	Fourth Edition	2011
5	Head First Java: A Brain-Friendly Guide	Kathy Sierra and Bert	O'Reilly Media	Second Edition	2005

Online References:

Sr. No.	Website Name	URL	Modules Covered
1	www.javatpoint.com	https://www.javatpoint.com/java-oops-concepts	M1,M2,M3
2	www.w3schools.com	https://www.w3schools.com/java/	M1-M6
3	www.programiz.com	https://www.programiz.com/java-programming	M1-M6

List of Practical/ Experiments:

Practical Number	Type of Experiment	Practical/ Experiment Topic	Hrs.	RBT Levels
1	**Basic Experiments**	Apply installation steps to set the environment variables and run a simple java program.	2	L1, L2
2		Experiment with various ways to accept data through keyboard for 1D and 2D array	2	L1, L2
3	**Design Experiments**	Experiment with class creation including members and methods, accepting and displaying details for single object.	2	L1, L2, L3
4		Experiment with constructor and constructor overloading	2	L1, L2, L3
5		Experiment with String and String Buffer	2	L1, L2, L3
6		Experiment with single and multilevel inheritance (Use super keyword).	2	L1, L2, L3
7		Experiment with demonstration of try, catch, throw, throws and finally	2	L1, L2, L3
8		Experiment with creating user defined package	2	L1, L2, L3
9		Experiment with implementing multithreading using Thread class and Runnable interface	2	L1, L2, L3
10		Experiment with Applet to demonstrate Graphics, Font and Color class	2	L1, L2, L3
11		Experiment with creation of GUI application with event handling using AWT controls	2	L1, L2, L3
12		Make use of database connectivity to develop java application.	2	L1, L2, L3
13	**Mini/Minor Projects/ Seminar/ Case Studies**	Mini Project based on content of the syllabus. (Group of 2-3 students) 1. Gaming System 2. Hotel Reservation System 3. Airline Reservation System 4. Hospital Management System 5. Online chat application 6. E-commerce website	6	L1, L2, L3
	Total Hours		**30**	

S.E. Semester –III

Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education (CBCGS-HME 2020)

Proposed TCET Autonomy Scheme (w.e.f. A.Y. 2021-22)

B.E. (Computer Engineering)						**S.E. SEM : III**	
Course Name: Project Based Learning – I						**Course Code :**HME-CSPBL301	
Teaching scheme (Holistic Student Development - HSD) Industry Specific/Interdisciplinary					**Examination Scheme (Formative/ Summative)**		
Modes of Teaching / Learning / Weightage					**Assessment/Evaluation Scheme**		
Conducted in the beginning of Semester during first 3 Weeks					**Presentation (25)**	**Report (25)**	**Term Work**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**(AC)**	**(AC)**	
-	-	30	30	1	25	-	**25**
IA: In-Semester Assessment - Paper Duration – 1.5 Hours							
ESE: End Semester Examination - Paper Duration - 3 Hours AC: Activity **The weightage of marks for continuous evaluation of Term work/Report:** Formative (40%), Timely completion of practical (40%) and Attendance/Learning Attitude (20%)							
Prerequisite: Computer Fundamentals and Knowledge of Programming Languages							

<u>Course Objective:</u> The Course intends to aid students identify real world problems and apply computing fundamental and technical skill to find solutions to them.

<u>Course Outcomes:</u> **Upon completion of the course students will be able to:**

Sr. No.	**Course Outcomes**	**Cognitive levels of attainment as per Bloom's Taxonomy**
1	Interpret the basic real time problems.	L1, L2
2	Apply appropriate technologies and programming constructs to solve problems.	L1, L2, L3
3	Inspect the results obtained for documentation and presentation.	L1, L2, L3, L4

Projects Listing:

Sr. No.	Title of Project	Type of Project
1	Implementing system for text encryption and decryption	Application
2	Implementing Hospital Management System	Application
3	Implementing Employee Management System	Application
4	Implementation of Payroll System	Application
5	Implementing system for Bus Booking	Application
6	Implementation of Currency Converter System	Application
7	Design and Development of Game	Core
8	Design and Development of system for scheduling of events	Core
9	Design and development of IQ Test System	Core
10	Develop an app for Invoice	Core

S.E. Semester –III

Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education (CBCGS-HME 2020)

Proposed TCET Autonomy Scheme (w.e.f. A.Y. 2021-22)

B.E.(Computer Engineering)							**S.E. SEM : III**		
Course Name : Activity Based Learning-III							**Course Code:** HME-CSABL301		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Conducted in the beginning of Semester during first 3 Week					**Theory (25)**		**Presentation (25)**	**Report (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**(AC)**	**(AC)**	**50**
-	-	30	30	1	-	-	25	25	
IA: In-Semester Assessment - Paper Duration – 1.5 Hours **ESE: End Semester Examination - Paper Duration - 3 Hours** **AC: Activity** **The weightage of marks for continuous evaluation of Term work/Report:** Formative (40%), Timely completion of practical (40%) and Attendance/Learning Attitude (20%)									
Prerequisite: Basics of Computer Programming, General knowledge, Social awareness									

Course Objective: The larger objective of the course is to develop the Socially Sensitive Citizens by creating awareness among students through Activity mode.

The course intends to deliver the understanding of the concepts by encouraging the students to look beyond their textual knowledge, establish the relationship between theory and the applications of the learned concepts. It also intends to address the social issues and create awareness.

Course Outcomes: **Upon completion of the course students will be able to:**

Sr. No.	Course Outcome	Cognitive levels of attainment as per Bloom's Taxonomy
1	Construct his views independently and demonstrate various debate styles.	L1, L2, L3
2	Identify the various benefits of quiz competitions.	L1, L2, L3
3	Utilize the society awareness in various social issues	L1, L2, L3

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Extempore/Debate** **I. Introduction to debate**, Definition and types of Debate Brainstorming session among students on various topics floated for debate. Topics can be Academic or Parliamentary, Financial, International affairs, technology trends, Technical or philosophical. Extempore speech by each student for /against topic for 1 minute. **II.Debate competition**. Formation of four teams for two topics. Two teams (For and against) for topic I will debate first and the other two team will be audience and for topic II vice-versa. **Evaluation by faculty as per format.**	4	L1, L2, L3
2	**General Knowledge (Technical and Current Affairs)** **I. Introduction to Quiz**, Definition, Types of quiz, Rules of quiz, quiz rounds. Quiz competition on Technical topic with 50 MCQ. **II.** Puzzle/**Quiz competition on current affairs** with 50 MCQ. **Evaluation by faculty as per format.**	4	L1, L2, L3
3	**Personality Development** **I. Word association (Test Sentence Building) (2 Hrs.)** Students are shown 60 English words one after other and a short sentence using the words shown are to be written. Each word will appear for 15 seconds and sentence is to be written within this period only. At least 45 words are to be attempted to get good marks **II. Thematic Apperception Test (Short Story Writing)(2 Hrs.)** 12 Slides will be projected, and stories are to be written in 03 Minutes. Discussions on Stories written by students **Evaluation by faculty as per format.**	4	L1, L2, L3
4	**Extended Work** **Introduction to Street play-T**ypes of Street play, Writing and demonstration of street Play on social Issues:-Water conservation Waste Management Plastic Ban etc. **Evaluation by faculty as per format**	6	L1, L2, L3
5	**Awareness creationon social issues** Students will develop material like placard, posters etc. for creating awareness on issue like • Education on social Issues like social media, youth related issues etc. • Education on health issues • Education on issues related to senior citizen etc. **The education/ awareness** needs to be conducted in campus through presentation(placards, posters etc.). **Evaluation by faculty as per format** **Data collection and Analysis:** survey's needs to be developed and conducted, data analysis and results interpretation	6	L1, L2, L3

	Evaluation by faculty as per format		
6	**Extempore/Debate** **I. Introduction to debate**, Definition and types of Debate Brainstorming session among students on various topics floated for debate. Topics can be Academic or Parliamentary, Financial, International affairs, technology trends, Technical or philosophical. Extempore speech by each student for /against topic for 1 minute. **II. Debate competition**. Formation of four teams for two topics. Two teams (For and against) for topic I will debate first and the other two team will be audience and for topic II vice-versa. **Evaluation by faculty as per format.**	6	L1, L2, L3
	Total Hours	**30**	

Books and References:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Competitive Debate	Richard Earl	Alpha	-	2008
2	Times Quiz book by Times Mind Games	Olav, Bjortomt	Times Books	-	2016
3	Cracking the coding Interview	Gayle Laakmann	Createspace	-	2011

Online References:

Sr. No.	Website Name	URL	Modules Covered
1	www.cleverism.com	https://www.cleverism.com/18-best-idea-generation-techniques/	M1
2	www.thebetterindia.com	https://www.thebetterindia.com/111/teaching-street-children-a-thing-or-two/	M6

Semester-IV

Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education (CBCGS-HME 2020)

Proposed TCET Autonomy Scheme (w.e.f. A.Y. 2021-22)

<table>
<tr><td colspan="7">B.E. (Computer Engineering)</td><td colspan="4">S.E. SEM: IV</td></tr>
<tr><td colspan="7">Course Name: Mathematics-IV</td><td colspan="4">Course Code: BSC-CS401</td></tr>
<tr><td colspan="5">Teaching Scheme (Program Specific)</td><td colspan="6">Examination Scheme (Academic)</td></tr>
<tr><td colspan="5">Modes of Teaching / Learning / Weightage</td><td colspan="6">Modes of Continuous Assessment / Evaluation</td></tr>
<tr><td colspan="5" rowspan="2">Hours Per Week</td><td colspan="3">Theory (100)</td><td rowspan="2">Practical/Oral/ Presentation (25)</td><td rowspan="2">Term Work (25)</td><td rowspan="2">Total</td></tr>
<tr><td colspan="2">40/20</td><td>60/30</td></tr>
<tr><td rowspan="2">Theory</td><td rowspan="2">Tutorial</td><td rowspan="2">Practical</td><td rowspan="2">Contact Hours</td><td rowspan="2">Credits</td><td colspan="2">IA</td><td rowspan="2">ESE</td><td rowspan="2">PR/OR</td><td rowspan="2">TW</td><td rowspan="3">125</td></tr>
<tr><td>ISE</td><td>IE</td></tr>
<tr><td>3</td><td>1</td><td>-</td><td>4</td><td>4</td><td>20</td><td>20</td><td>60</td><td>-</td><td>25</td></tr>
<tr><td colspan="11">IA: In-Semester Assessment - Paper Duration – 1 Hour
ESE: End Semester Examination - Paper Duration – 2/1 Hours
The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)</td></tr>
<tr><td colspan="11">Prerequisite: Basic Mathematics</td></tr>
</table>

Course Objective: The course intends to apply the concept of probability, Correlation and Regression, Laplace Transform and Fourier transform to the engineering problems and to evaluate the optimization of two and three variables.

Course Outcomes: **Upon completion of the course students will be able to:**

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Apply the concept of probability random variables, mathematical expectations and variance.	L1, L2, L3
2	Differentiate the discrete and continuous random variables.	L1, L3
3	Evaluate the Maximization and minimization of two and three variables.	L1, L2, L3
4	Apply the concept of Correlation and Regression to the engineering problems.	L1, L2, L3
5	Develop an understanding of how to read and construct valid mathematical statements, arguments and understand mathematical statements.	L1, L3
6	Understand use of groups and codes in Encoding-Decoding and apply discrete structures into other computing problems such as formal specification, verification, artificial intelligence, cryptography, Data Analysis and Data Mining.	L1, L3

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Basic Probability** Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, sums of independent random variables; Expectation of Discrete and Continuous Random Variables, Moments, Variance of a sum, Conditional Probability	6	L1, L2, L3
2	**Basic Statistics** Measures of Central tendency, Moments, skewness and Kurtosis, Binomial, Poisson and Normal distribution and evaluation of statistical parameters for these three distributions	6	L1, L3
3	**Linear Programming problems** Types of solutions to linear programming problems, standard form of L.P.P. Simplex method, Big M method (Penalty method) to solve L.P.P, Duality, Dual simplex method and Revised simplex method to solve L.P.P.	8	L1, L2, L3
4	**Applied Statistics** Correlation and regression – Rank correlation, Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves	8	L1, L2, L3
5	**Logic** Propositions and logical operations, Truth tables Equivalence, Implications Laws of logic, Normal Forms, Predicates and Quantifiers, Mathematical Induction	7	L1, L3
6	**Algebraic Structures** Algebraic structures with one binary operation: semigroup, monoid and group, Abelian group, Cyclic groups Homomorphism, Isomorphism, Field and Extension of field. Coding theory: Coding of binary information and error detection, decoding and error correction.	10	L1, L3
	Total Hours	**45**	

Books and References:

SN	Title	Authors	Publisher	Edition	Year
1	Advanced Engineering Mathematics	Erwin kreyszig	John Wiley & Sons	Ninth Edition	2006
2	A text book of Engineering Mathematics	N.P. Bali and Manish Goyal	Laxmi Publications	Tenth Edition	2008
3	Elements of Discrete Mathematics	C. L. Liu and D. P. Mohapatra	McGraw Hill	2nd Edition	2010
4	Engineering Mathematics	Veerarajan T	Tata McGraw-Hill, New Delhi	Third Edition	2008
5	Introduction to Probability Theory	P. G. Hoel, S. C. Port and C. J. Stone	Universal BookStall	Reprint	2003
6	Operations Research	S.D. Sharma	S. Chand & CO.	-	-
7	A First Course in Probability	S. Ross	Pearson Education India	Sixth Edition	2002

Online References:

S. No.	Website Name	URL	Modules Covered
1	www.statisticssolutions.com	https://www.statisticssolutions.com/continuous-probability-distribution/	M1, M2, M4
2	nptel.ac.in	https://nptel.ac.in/courses/111105123/	M5, M6
3	www.analyticsvidhya.com	https://www.analyticsvidhya.com/blog/2017/02/lintroductory-guide-on-linear-programming-explained-in-simple-english/	M3

List of Tutorials:

Sr. No	Topic	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	Tutorial on Conditional Probability and Bayes theorem	1	L1, L2, L3
2	Tutorial on discrete random variable	1	L1, L2
3	Tutorial on continuous random variable	1	L1, L2, L3
4	Tutorial on measure of Central Tendency and Dispersion	1	L1, L2, L3
5	Tutorial on Binomial and PoissonDistribution	1	L1, L2
6	Tutorial on Normal Distribution	1	L1, L2
7	Tutorial on Simplex method	1	L1, L2
8	Tutorial on Dual Simplex method	1	L1, L2, L3
9	Tutorial on Correlation	1	L1, L2, L3
10	Tutorial on Regression	1	L1, L2, L3
11	Tutorial on Curve fitting	1	L1, L2, L3
12	Tutorial on logic operations and truth tables equivalence	1	L1, L2, L3
13	Tutorial on Normal Forms, Predicates and Quantifiers	1	L1, L2, L3
14	Tutorial on Algebraic structures with one binary operation	1	L1, L2, L3
15	Tutorial on Field and Coding theory	1	L1, L2, L3
	Total Hours	**15**	

Semester-IV

Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education (CBCGS-HME 2020)

Proposed TCET Autonomy Scheme (w.e.f. A.Y. 2021-22)

<table>
<tr><td colspan="7">B.E. (Computer Engineering)</td><td colspan="4">S.E. SEM : IV</td></tr>
<tr><td colspan="7">Course Name : Design and Analysis of Algorithm</td><td colspan="4">Course Code :PCC- CS401</td></tr>
<tr><td colspan="5">Teaching Scheme (Program Specific)</td><td colspan="6">Examination Scheme (Academic)</td></tr>
<tr><td colspan="5">Modes of Teaching / Learning / Weightage</td><td colspan="6">Modes of Continuous Assessment / Evaluation</td></tr>
<tr><td colspan="5" rowspan="2">Hours Per Week</td><td colspan="3">Theory (100)</td><td rowspan="2">Practical/Oral/ Presentation (25)</td><td rowspan="2">Term Work (25)</td><td rowspan="2">Total</td></tr>
<tr><td colspan="2">40/20</td><td>60/30</td></tr>
<tr><td rowspan="2">Theory</td><td rowspan="2">Tutorial</td><td rowspan="2">Practical</td><td rowspan="2">Contact Hours</td><td rowspan="2">Credits</td><td colspan="2">IA</td><td rowspan="2">ESE</td><td rowspan="2">PR/OR</td><td rowspan="2">TW</td><td rowspan="3">150</td></tr>
<tr><td>ISE</td><td>IE</td></tr>
<tr><td>3</td><td>-</td><td>2</td><td>5</td><td>4</td><td>20</td><td>20</td><td>60</td><td>25</td><td>25</td></tr>
<tr><td colspan="11">IA: In-Semester Assessment - Paper Duration – 1 Hour
ESE: End Semester Examination - Paper Duration – 2/1 Hours
The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)</td></tr>
<tr><td colspan="11">Prerequisite: Computer Basics, Procedural Programming Languages</td></tr>
</table>

Course Objective: The objective of the course is to study various techniques for effective problem solving along with different algorithm designing paradigms in computer science, to illustrate the efficient ways of problem solving for any given problem.

Course Outcomes: **Upon completion of the course students will be able to:**

SN	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Analyze the complexities of various problems in different domains.	L1, L2, L3, L4
2	Apply and analyze the complexity of divide and conquer strategy.	L1, L2, L3, L4
3	Apply and analyze the complexity of greedy method, dynamic programming strategy, backtracking and branch and bound strategy.	L1, L2, L3, L4
4	Understand, apply and analyze different string matching algorithms	L1, L2, L3, L4
5	Compare and contrast various algorithm designing strategies to apply in real world problems.	L1, L2, L3, L4
6	Demonstrate the classes P, NP, and NP-Complete.	L1, L2

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Introduction to Algorithm Analysis** Performance analysis, space and time complexity, Order of Growth of function. Asymptotic notations, Mathematical background for algorithm analysis, Analysis of selection sort, insertion sort. Recurrences: -The substitution method -Recursion tree method -Master method. **Divide and Conquer:** Finding Minimum and maximum, Binary search, Merge sort, Quick sort.	9	L1, L2, L3, L4
2	**Greedy Method** **Greedy Method**: General method, Single source shortest path, Knapsack problem, Minimum cost spanning trees-Kruskal and prim's algorithm, Job sequencing with deadlines.	5	L1, L2, L3, L4
3	**Dynamic Programming** **Dynamic Programming**: General method, Multistage graphs, single source shortest path, all pair shortest path, 0/1 knapsack, Travelling salesman problem, Longest common subsequence.	6	L1, L2, L3, L4
4	**Backtracking and Branch & Bound** **Backtracking**: General method, 8 queen problem (N-queen problem), Sum of subsets. **Branch and Bound**: General method, 15 puzzle problem, Travelling salesman problem.	10	L1, L2, L3, L4
5	**String Matching Algorithms** The naïve string matching Algorithm, The Rabin Karp algorithm, String matching with finite automata, The knuth-Morris-Pratt algorithm, Boyer Moore algorithm.	8	L1, L2, L3, L4
6	**Introduction to Non Deterministic algorithm** Polynomial time, Polynomial time verification, classes NP, NP Completeness and polynomial time reduction.	7	L1, L2
	Total Hours	**45**	

Books and References:

	Title	Authors	Publisher	Edition	Year
1	Introduction to algorithms	T.H. Coreman, C.E. Leiserson, R.L. Rivest, and C. Stein	PHI	Third Edition	2009
2	Fundamentals of computer algorithms	Ellis Horowitz, Sartaj Sahni, S. Rajsekaran	University Press	Second Edition	2017
3	Algorithms	Sanjoy Dasgupta, Christos Papadimitriou, Umesh Vazirani	Tata McGraw-Hill Edition.	Featured Edition	2017
4	Design Methods and Analysis of Algorithm	S. K. Basu	PHI.	--	2005
5	Algorithm Design	John Kleinberg, Eva Tardos	Pearson	--	2005

Online Resources:

S. No.	Website Name	URL	Modules Covered
1	www.geeksforgeeks.org	https://www.geeksforgeeks.org/fundamentals-of-algorithms/#AnalysisofAlgorithms	M1-M6
2	www.tutorialspoint.com	https://www.tutorialspoint.com/design_and_analysis_of_algorithms/index.htm	M1-M3, M6
3	www.w3schools.in	https://www.w3schools.in/category/data-structures-tutorial/	M1,M4

List of Practical/ Experiments:

Practical Number	Type of Experiment	Practical/ Experiment Topic	Hrs.	RBT Levels
1	**Basic Experiments**	Develop a code for Quick Sort	2	L1, L2, L3
2		Develop a code for Dijkstra's algorithm using Greedy method and analyze it.	2	L1, L2, L3
3	**Design Experiments**	Develop a code Minimum spanning tree, Kruskal's algorithm using Greedy method and analyze it.	2	L1, L2, L3
4		Develop a code for all pair shortest path problem using dynamic programming and analyze it.	2	L1, L2, L3
5		Develop a code for Longest common subsequence using dynamic programming and analyze it.	2	L1, L2, L3
6		Develop a code for 8 queen's problem using backtracking approach and analyze it.	2	L1, L2, L3
7		Develop a code for 15 puzzle problem and analyze it.	4	L1, L2, L3
8		Develop a code for naïve string matching Algorithm	2	L1, L2, L3
9	**Case study:**	Various string matching algorithms and their time and space complexities.	4	L1, L2, L3
10	**Mini Project:**	1. Build a Snakes & Ladders game 2. Sudoku Solver 3. Maze generator 4. Dictionary implementation 5. Employee Record System 6. Super market Billing System	8	L1, L2, L3
	Total Hours		**30**	

Semester-IV

Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education (CBCGS-HME 2020)

Proposed TCET Autonomy Scheme (w.e.f. A.Y. 2021-22)

B.E. (Computer Engineering)								**S.E. SEM : IV**		
Course Name: Operating System								**Course Code :**PCC- CS402		
Teaching Scheme (Program Specific)					**Examination Scheme (Academic)**					
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**					
Hours Per Week					**Theory (100)**			**Practical/Oral/ Presentation (25)**	**Term Work (25)**	**Total**
					40/20		**60/30**			
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**		**ESE**	**PR/OR**	**TW**	
					ISE	**IE**				
3	-	2	5	4	20	20	60	25	25	**150**
IA: In-Semester Assessment - Paper Duration – 1 Hour										
ESE: End Semester Examination - Paper Duration – 2/1 Hours										
The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)										
Prerequisite: Computer Organization and Architecture, Fundamentals of Data Structures										

<u>Course Objective:</u> The course intends to deliver the fundamental knowledge of Operating system and apply this knowledge for implementing and analyzing Process, Memory, I/O disk and File management techniques.

<u>Course Outcomes:</u> Upon completion of the course students will be able to:

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Understand the role of operating system in a computer	L1, L2
2	Make use of various Scheduling algorithms.	L1, L2, L3
3	Apply the principles of concurrency.	L1, L2, L3
4	Examine deadlock, prevention and avoidance algorithms	L1, L2, L3
5	Compare and contrast various memory management schemes	L1, L2
6	Develop a prototype file systems.	L1, L2, L3

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Overview of Operating System** Operating System Objectives and Functions, The Evolution of Operating Systems, Operating System Structures, System Calls, Developments Leading to Modern Operating Systems, Virtual Machines	4	L1, L2
2	**Process Management** **Processes and Threads:** Process: Concept of a Process, Process States, Process Description, Operations on Processes, Execution of the Operating System; Threads: Processes and Threads, Concept of Multithreading, Types of Threads, Thread programming Using Pthreads; Scheduling: CPU Scheduling, Thread Scheduling.	4	L1, L2, L3
3	**Concurrency Control and Deadlock Handling** **Concurrency Control:** Principles of Concurrency, Requirements for Mutual Exclusion, Mutual Exclusion: Hardware Support, Operating System Support (Semaphores and Mutex), Programming Language Support (Monitors), Classical synchronization problems: Readers/Writers Problem, Producer and Consumer problem, Inter-process communication. **Deadlock:** Principles of Deadlock, Deadlock Modeling, Strategies to deal with deadlock: The Ostrich Algorithm, Deadlock Prevention, Deadlock Avoidance, Deadlock detection and recovery, An Integrated Deadlock Strategy, Example: Dining Philosophers Problem.	10	L1, L2,L3
4	**Memory Management** **Memory Management:** Memory Management Requirements, Memory Partitioning: Fixed Partitioning, Dynamic Partitioning, Buddy System, Relocation, Paging, Segmentation. **Virtual Memory:** What is Virtual Memory, Demand Paging, Page Replacement, Allocation, Thrashing; Allocating Kernel Memory.	10	L1, L2, L3
5	**Input / Output And File Management** I/O Management and Disk Scheduling: I/O Devices, Organization of the I/O Function, Operating System Design Issues, I/O Buffering, Disk Scheduling(FIFO, SSTF, SCAN, C-SCAN, LOOK, C-LOOK), Disk Cache. File Management: Overview, File Organization and Access, File Directories, File Sharing, Record Blocking, Secondary Storage Management.	10	L1, L2
6	**Case Study: LINUX Operating System** Overview of Linux, Architecture, Process management, Memory Management, I/O Management, BASH Shell scripting: Basic shell commands, shell as a scripting language.	7	L1, L2,L3
	Total Hours	**45**	

Books and References:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Operating System: Internals and Design Principles	William Stallings,	Prentice Hall	Eighth Edition	2018
2	Operating System Concepts	Abraham Silberschatz, Peter Baer Galvin and Greg Gagne	WILEY	Ninth Edition	2009
3	Modern Operating System,	Andrew S. Tanenbaum& Herbert Bos	Pearson	Fourth Edition	2015

Online References:

Sr. No.	Website Name	URL	Modules Covered
1	www.tutorialspoint.com	https://www.tutorialspoint.com/computer_fundamentals/computer_operating_system	M1-M6
2	www.geeksforgeeks.org	https://www.geeksforgeeks.org/operating-systems-need-and-functions/	M1-M6
3	nptel.ac.in	https://nptel.ac.in/courses/106106144/2	M1-M6

List of Practical/ Experiments:

Practical Number	Type of Experiment	Practical/ Experiment Topic	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	Basic Experiments	Explore LINUX Commands (Basic and Advanced)	2	L1, L2, L3
2		Write a program to implement any two CPU scheduling algorithms like FCFS, SJF, Round Robin etc.	2	L1, L2, L3
3	Design Experiments	Write a program to implement Dinning Philosopher Problem.	2	L1, L2, L3
4		Write a program to implement Banker's algorithm.	2	L1, L2, L3
5		Build a program to implement FIFO and LRU page replacement policies.	2	L1, L2, L3
6		Build a program to implement SRTF and Priority page replacement policies.	2	L1, L2, L3
7		Develop a program to implement dynamic partitioning placement algorithms i.e. Best Fit, First-Fit, Worst-Fit etc.	4	L1, L2, L3
8		Build a program to implement FCFS and SSTF disk scheduling algorithm	4	L1, L2, L3

9	**Case Study**	**Case Study** 1. Windows Operating System. 2. LINUX Operating System. 3. Multiprocessor Scheduling and Linux Scheduling.	4	L1, L2, L3
10	**Mini Project**	**4. Develop a Client-Server application (use the concepts of inter-process communication, multithreading, synchronization and so).** **5. Build a file system.** **6. Write a shell interpreter for LINUX.** **Build an online compiler (with interface for inserting the code to be compiled).**	**6**	
	Total Hours		**30**	

S.E. Semester –IV

Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education (CBCGS-HME 2020)
Proposed TCET Autonomy Scheme (w.e.f. A.Y. 2021-22)

B.E. (Computer Engineering)										**S.E. SEM : IV**
Course Name : Computer Networks										**Course Code :**PCC-CS403
Teaching Scheme (Program Specific)					**Examination Scheme (Academic)**					
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**					
Hours Per Week					**Theory (100)** 40/20		60/30	**Practical/Oral/ Presentation (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA** ISE	**IA** IE	**ESE**	**PR/OR**	**TW**	
3	-	2	5	4	20	20	60	25	25	**150**

IA: In-Semester Assessment - Paper Duration – 1 Hour

ESE: End Semester Examination - Paper Duration – 2/1 Hours

The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)

Prerequisite: Computer System Basics, Programming Language (C/C++/Java)

Course Objective: The course intends to deliver fundamental knowledge about various aspects of computer networks and apply the knowledge acquired to understand/solve problems in networking.

Course Outcomes: **Upon completion of the course students will be able to:**

Sr. No.	Course Objectives	Cognitive levels of attainment as per Bloom's Taxonomy
1	Explain the basic concepts of digital communication.	L1, L2
2	Explain the concepts and fundamentals of computer networks and reference models.	L1, L2
3	Differentiate between types of transmission media, multiplexing techniques and switching techniques	L1, L2, L3
4	List the functionalities of Data link layer and analyze various design issues.	L1, L2, L3, L4
5	List the routing protocols of Network layer and solve subnetting and super-netting problems.	L1, L2, L3, L4
6	Illustrate how the application layer protocols utilizes transport layer protocols (TCP/UDP)	L1, L2, L3, L4

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Basics of Digital Communication** Introduction: Theoretical basis for communication; Maximum data rate of a channel: Transmission impairments; Attenuation distortion, Delay distortion, Noise; Data transmission modes: Serial & Parallel, Simplex, Half duplex & full duplex, Synchronous & Asynchronous transmission	5	L1, L2
2	**Introduction to Computer Networks** Definition of a Computer Network; Components of a computer network: Classification of networks, network types, Network topologies, networking devices. **Network Software &Network Standardization:** Networks Software; Protocol hierarchy, Design issues for the layers, Service Primitives: **Reference models:** Introduction and comparison of the OSI Reference Model and TCP/IP Reference Model	6	L1, L2
3	**Physical Layer** **Introduction:** Switching Techniques; Comparison of switching techniques; Multiplexing: FDM,TDM,WDM **Transmission Medium:** Guided & Unguided Transmission medium: Twisted pair, Coaxial cable, Optical fiber, Wireless transmission **DLL Design Issues** (Services, Framing, Error Control, Flow Control)	7	L1, L2, L3
4	**Data Link Layer** **Error Detection and Correction** (Hamming Code, CRC, Checksum), Elementary Data Link protocols for flow control, **Medium Access Control sub layer:** Channel Allocation problem, Types of Multiple Access Protocol, Local Area Networks -Ethernet (802.3)	8	L1, L2, L3, L4
5	**Network Layer** **Introduction and Design issues** of Network layer; Routing: Principles of Routing, Types of routing algorithms, Comparison of routing algorithms; Protocols at network layer; **Congestion**: Factors of congestion and Congestion control algorithms: Open loop congestion control, Closed loop congestion control, QoS parameters, Token & Leaky bucket algorithms	10	L1, L2, L3, L4
6	**Transport Layer & Application Layer** **The Transport Service**: Transport service primitives, Connection management (Handshake), UDP, TCP, TCP Flow control (sliding Window), TCP Congestion Control: Slow Start **Application layer:** DNS: Name Space, Resource Record and Types of Name Server. HTTP, SMTP, Telnet, FTP, DHCP	9	L1, L2, L3, L4
	Total Hours	**45**	

Books and References:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Computer Networks	A.S. Tanenbaum	Pearson Education	Fifth Edition	2013
2	Data Communications and Networking	B.A. Forouzan	McGraw Hill	Fifth Edition	2017
3	Computer Networking, A Top-Down Approach Featuring the Internet	James F. Kurose, Keith W. Ross,	Addison Wesley	Sixth Edition	2017

Online References:

Sr. No.	Website Name	URL	Modules Covered
1	NPTEL	https://nptel.ac.in/courses/106105081/	M1-M5
2	Stanford University	https://lagunita.stanford.edu/courses/Engineering/Networking-SP/SelfPaced/about	M1-M6
3	www.tutorialpoint.com	https://www.tutorialspoint.com/computer_fundamentals/computer_networking	M1-M6

List of Practical/ Experiments:

Practical Number	Type of Experiment	Practical/ Experiment Topic	Hrs.	RBT Levels
1	Basic Experiments	Classify the types of cabling used in networking	2	L1, L2, L3
2		Survey various networking devices using Packet Tracer	2	L1, L2, L3, L4
3	Design Experiments	Apply CRC/ Hamming code for error detection and correction	2	L1, L2, L3
4		Explain Basic Networking Operations and troubleshooting	2	L1, L2, L3
5		Prepare a network and configure it for IP addressing, subnetting, masking.	2	L1, L2, L3
6		Demonstrate working of Static Routing Protocols	2	L1, L2, L3
7		Demonstrate working of Dynamic Routing Protocols	4	L1, L2, L3
8		Show implementation of Socket programming using TCP and Remote Login using Telnet/SSH	4	L1, L2, L3

9	**Case Studies**	**1.** Analyze Stop and wait protocol/ sliding window (selective repeat / Go back N) in NS2 **2.** Simulate congestion control (leaky bucket / token bucket) in NS2.	4	L1, L2, L3, L4
10	**Seminars/ Project**	**Mini Project:** 1. Network Desktop Manager (Java) 2. Cloud Network in packet tracer 3. IoT network in Cisco Packet Tracer	6	L1, L2, L3, L4
		4. MAC Protocols in NS2 5. A Network Based Multi-Player Eater Game Use simulator (E.g. NS2) to understand functioning of ALOHA, CSMA/CD.		
	Total Hours		**30**	

Semester-IV

Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education (CBCGS-HME 2020)

Proposed TCET Autonomy Scheme (w.e.f. A.Y. 2021-22)

B.E. (Computer Engineering)										**S.E. SEM : IV**		
Course Name : Computer Graphics										**Course Code :**PCC-CS404		
Teaching Scheme (Program Specific)					**Examination Scheme (Academic)**							
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**							
Hours Per Week					**Theory (100)**					**Practical/Oral/ Presentation (25)**	**Term Work (25)**	**Total**
					40/20			**60/30**				
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**			**ESE**		**PR/OR**	**TW**	
					ISE		**IE**					
3	-	2	5	4	20		20	60		25	25	**150**

IA: In-Semester Assessment - Paper Duration – 1 Hour

ESE: End Semester Examination - Paper Duration – 2/1 Hours

The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)

Prerequisite: Knowledge of C Programming, Basic Data Structures and Mathematics

Course Objective: The course intends to give the student a understating of drawing basic primitive techniques, 2D-3D transformation and apply the concepts for rendering 3D objects.

Course Outcomes: **Upon completion of the course students will be able to:**

SN	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Understand the basic concepts of Computer Graphics.	L1, L2
2	Demonstrate various algorithms for scan conversion and filling of basic objects and their analysis.	L1, L2, L3
3	Apply 2D geometric transformations on graphical objects.	L1, L2, L3
4	Apply viewing and clipping transformation on graphical objects.	L1, L2, L3
5	Explore 3D solid model representation techniques and projections.	L1, L2, L3
6	Understand visible surface detection techniques, illumination models and applications of animation.	L1, L2,L3

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Introduction to Computer Graphics** Definition, applications, Raster and Random scan display, Input Device, Output Device (Cathode Ray Tube, CRTs for Color Display, The Shadow - Mask CRT, Direct View Storage Tube, Tablets, The light Pen)	4	L1, L2
2	**Basic Drawing Primitives** Coordinate system, Pixel plotting, Line Drawing algorithm: Digital Differential Analyzer, Bresenhem Line Drawing, Bresenhem and midpoint Circle Drawing algorithm, Midpoint Ellipse drawing algorithm, Aliasing , Antialiasing techniques(Pre and post filtering , super sampling , and pixel phasing) Filled area primitives: Inside-outside test, boundary and flood-fill, scan-line fill	8	L1, L2, L3
3	**2D Geometric Transformation** Homogenous coordinates, Translation, scaling, fixed point. scaling, rotation, rotation about arbitrary point, , shearing, reflection, composite transformations	6	L1, L2, L3
4	**Viewing and Clipping** Viewing transformation and Window to Viewport coordinate transformation, Line Clipping Algorithms: Cohen Sutherland, Midpoint Subdivision, Liang Barsky, Polygon Clipping Algorithms: Sutherland Hodgeman, Weiler Artherton	9	L1, L2, L3
5	**3D Transformation** 3D display methods, Wireframe model, sweep representation, Octrees, Binary space partitioning, curved lines and surfaces, cubic spline interpolation methods, Bezier, B-spline curves, Fractals, parallel and perspective projection,3D translation, scaling, rotation, Rotation about arbitrary axis	9	L1, L2, L3
6	**Hidden Surface Removal and Animation** Visible surface detection concepts, back-face detection, Z buffer method, Painters algorithm, Warnock algorithm, Illumination and Shading Models: Ambient, Specular and Diffuse reflections, Phong and Gouraud shading, Halftoning and Dithering techniques Animation: Key Frame Animation, Animation Sequence, Motion Control Methods, Morphing, Warping- Mesh Warping.	9	L1, L2,L3
	Total Hours	**45**	

Books and References:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Computer Graphics C version,	Hearn & Baker	Pearson	Second Edition	2002
2	Computer Graphics	Samit Bhattacharya	Oxford Publication.	-	2018
3	Computer Graphics Principles and Practice in C	James D. Foley, Andries van Dam, Steven K Feiner, John F. Hughes	Pearson	Second Edition	2002
4	Computer Graphics	Rajesh K. Maurya	Wiley India Publication	-	2011
5	Computer Graphics using OpenGL	Francis S Hill, Jr. and Stephen M Kelley	Prentice Hall	3 edition	2007

Online References:

Sr. No.	Website Name	URL	Modules Covered
1	www.tutorialspoint.com	https://www.tutorialspoint.com/computer_graphics/	M1-M6
2	www.amityhub.com	https://www.amityhub.com/computer-graphics-notes/	M1-M6
3	learnengineering.in	https://learnengineering.in/cs6504-computer-graphics/	M1-M5

List of Practical/ Experiments:

Practical Number	Type of Experiment	Practical/ Experiment Topic	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	Basic Experiments	Develop a program for DDA and Bresenham Line Drawing algorithms	2	L1, L2, L3
2		Implement midpoint Circle/Ellipse algorithm	2	L1, L2, L3
3		Develop a program for Boundary fill and Flood fill algorithm(using 4-connected and 8-connected approaches)	2	L1, L2, L3
4		Develop a program for Basic transformation on 2D objects (Translation, Scaling, Rotation)	2	L1, L2, L3

5	**Design Experiments**	Design and develop a program for line Clipping Algorithm	2	L1, L2, L3
6		Design and Develop a program for Polygon clipping	4	L1, L2, L3
7		a) Develop a program for Bezier curve for n control points b) Design a program to draw Fractals	4	L1, L2, L3
8		Implement Basic primitives using Open GL	2	L1, L2, L3
9	**Case Studies**	**Case Study** 1. Computer Graphics in Automotive Design 2. Code sign case study in Computer Graphics 3. Computer Graphics for Office Automation.	2	L1, L2, L3
10	**Mini/Minor Projects/ Seminar**	**Mini Project** 1. Walking Robot 2. Maze Game 3. Bus Stop Simulation 4. Bull's Eye	8	L1, L2, L3,L4
		Total Hours	**30**	

SE Semester-IV

Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education (CBCGS-HME 2020)

Proposed TCET Autonomy Scheme (w.e.f. A.Y. 2021-22)

<table>
<tr><td colspan="7">B.E. (Computer Engineering)</td><td colspan="3">S.E. SEM : IV</td></tr>
<tr><td colspan="7">Course Name :Value Education</td><td colspan="3">Course Code : MC-CS401</td></tr>
<tr><td colspan="5">Teaching Scheme (Program Specific)</td><td colspan="5">Examination Scheme (Formative/ Summative)</td></tr>
<tr><td colspan="5">Modes of Teaching / Learning / Weightage</td><td colspan="5">Modes of Continuous Assessment / Evaluation</td></tr>
<tr><td colspan="5">Hours Per Week</td><td colspan="2">Theory (100)</td><td>Practical/Oral (25)</td><td>Term Work (25)</td><td>Total</td></tr>
<tr><td>Theory</td><td>Tutorial</td><td>Practical</td><td>Contact Hours</td><td>Credits</td><td>IA</td><td>ESE</td><td>PR/OR</td><td>TW</td><td rowspan="2">25</td></tr>
<tr><td>1</td><td>-</td><td>-</td><td>1</td><td>-</td><td>-</td><td>-</td><td>-</td><td>25</td></tr>
<tr><td colspan="10">The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)</td></tr>
<tr><td colspan="10">Prerequisite: NA.</td></tr>
</table>

Course Objective: The course intends to deliver fundamental knowledge of various aspects to understand the concept of Ethics in Engineering & Human values, significance of values in Self-development, ethical human value and apply values needed for peaceful society, aware value education, towards personal, national and global development.

Course Outcomes: **Upon completion of the course students will be able to:**

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Develop commitment to professional ethics, responsibilities and norms of the engineering practice.	L1, L2, L3
2	Develop a good moral character and social attitude.	L1, L2, L3
3	Determine the proper use of engineering knowledge to bring uplift in quality of life, along with peace and conflict resolution.	L1, L2, L3
4	Propagate ethics and values in society.	L1, L2, L3
5	Apply values such as care and compassion; honesty and trustworthiness;	L1, L2, L3
6	Global development through integrity; respect; responsibility and understanding tolerance and inclusion.	L1, L2, L3, L4

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Value Education - Introduction** Understanding the importance of Value Education, Need in modern Society, Benefits for students, Adding Value to Life, Self-Exploration as the Process for Value Education.	2	L1, L2,L3
2	**Values and Ethics** Definition, Concept, Classification, value based life, Present day materialistic approach, importance of value in human lives, Humility, Attitude, self-confidence, Theory, Criteria and Sources of values. Ethics, Role of Ethics, Educational Ethics, imparting ethics in educational age, integrating spirituality with education.	3	L1, L2, L3
3	**Right Understanding** Providing the Basis for Universal Human values and Ethical Human Conduct, Basis for the Holistic Alternative Unit Universal Human Order, Professional Ethics in the Light of Right Understanding, Vision for Holistic Technologies, and Journey towards the Holistic Alternative- The Road Ahead.	3	L1, L2, L3
4	**Dealing with Habits** Introduction to Habits- Simple , Serious and Grave bad Habits, Cause of Addiction to bad habits, How some bad habit are bad though they feel good, what implies one to go on with bad habits, How to have right perception ,The Power of Good habits, importance of right association.	2	L1, L2, L3
5	**Dealing with Stress** About Stress, definition and causes, Positive stress, Negative Stress, Statistics of Stress, and Suicides the present day Stupid idea. How to deal with cries in our life, Art of Tolerance, Making Right Choice, Life Style Management.	3	L1, L2, L3
6	**Harmony at Various Levels** Understanding the Human Being as co-existence of self and body Harmony in Self, Harmony with the body, Harmony in the Family, Harmony in the Society, Harmony in Nature, Harmony in Existence.	2	L1, L2, L3, L4
	Total Hours	**15**	

Books and References:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Value Education for Young Leaders	Dr. P Hari Krishna	Vashnavi Krishna Publication	Second Edition	2015
2	Value education	Singh Y K	APH Publishing Corporation	Second Edition	2009
3	Professional Ethics	R. Subramanian	Oxford Publication	Fourth Edition	2017
4	Beyond Illusion and Doubt	A. C Bhaktivedanta Swami	BBT	Fifth Edition	2017
5	Open eye Meditation	Shubha Vilas Das	FinGer Print Belief	SecondEdition	2016
6	Life Amazing Secrete	Gaur Gopal Das	Penguin India	First Edition	2018
7	Ethics from Epic	Govinda Das	Tulsi Publication	First Edition	2015
8	Peace and Value Education	Kiruba Charles & V. Arul Selvi	Neelkamal Publications	First Edition	2016

Online References:

Sr. No.	Website Name	URL	Modules Covered
1	http://www.yourarticlelibrary.com	http://www.yourarticlelibrary.com/education/values-education/value-education-meaning-objectives-and-needs-india/86967	M1,M2
2	https://ed100.org	https://ed100.org/lessons/valueshabits	M4
3	http://www.indiancurrents.org	http://www.indiancurrents.org/article-new-education-policy-stress-on-value-education-in-schools-103.php	M5

S.E. Semester –IV

Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education (CBCGS-HME 2020)

Proposed TCET Autonomy Scheme (w.e.f. A.Y. 2021-22)

<table>
<tr><td colspan="7">B.E. (Computer Engineering)</td><td colspan="3">S.E. SEM: IV</td></tr>
<tr><td colspan="7">Course Name: Summer Internship</td><td colspan="3">Course Code: SI-CS401</td></tr>
<tr><td colspan="5">Teaching Scheme (Program Specific)</td><td colspan="5">Examination Scheme (Formative/ Summative)</td></tr>
<tr><td colspan="5">Modes of Teaching / Learning / Weightage</td><td colspan="5">Modes of Continuous Assessment / Evaluation</td></tr>
<tr><td colspan="5">Total Hours : Maximum 2 Weeks (60 to 80 Hours) during summer vacation (Week 21st to 25th Week)</td><td colspan="2">Theory (100)</td><td>Practical/Oral (25)</td><td>Term Work (25)</td><td>Total</td></tr>
<tr><td>Theory</td><td>Tutorial</td><td>Practical</td><td>Contact Hours</td><td>Credits</td><td>IA</td><td>ESE</td><td>PR/OR</td><td>TW</td><td rowspan="2">50</td></tr>
<tr><td>-</td><td>-</td><td>-</td><td>160*-240*</td><td>4*-6*</td><td>-</td><td>-</td><td>-</td><td>50</td></tr>
<tr><td colspan="10">IA: In-Semester Assessment
ESE: End Semester Examination</td></tr>
<tr><td colspan="10">Prerequisite: Fundamental knowledge of Computer Science and Engineering</td></tr>
</table>

Course Objectives:

The Course intends to get industry like exposure in the college laboratories by carrying out projects using subject studied till 4th semester. Also design innovative techniques / methods to develop the products.
To gain knowledge of marketing and publicizing products developed.

Course Outcomes: **Upon completion of the course students will be able to:**

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	To apply subjects knowledge in the college laboratories for carrying out projects	L1, L2,L3
2	Able to developed innovative techniques / methods to develop the products	L1, L2,L3
3	Able to do marketing and publicity of products developed	L1, L2,L3

Detailed Syllabus:

Module No.	Topics	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Program Specific Internship** Emerging technologies in domains offered by Department of Computer Engineering Applying classroom and laboratory knowledge to design, develop and deploy the products	L1, L2, L3
2	**Inter disciplinary Internship** To explore and understand issues and challenges in the other disciplines (EXTC, ELEX, MECH and CIVIL) Design , develop and deploy cost effective products using multidisciplinary approach	L1, L2, L3
3	**Industry Specific Internship** issues and challenges in industry Industry specific problems Design , develop and deploy products for startup and SMEs	L1, L2, L3
4	**Interpersonal Internship** Interpersonal skills such as leadership, marketing ,publicity and corporate ethics and communication Problem solving , presentation , negotiation skills	L1, L2, L3
5	**Social Internship** Different real life issues in the society Identify societal problems and provide engineering solutions to solve these problems	L1, L2, L3
6	**Academic Internship** Report preparation, preparation of presentations, copy table book preparation , business proposal and IPR Capture aspirations & expectations through interviews of students. Ways to connect research in technical institutes with industry. Taking inputs from self, local stakeholders and global stake holders which will help to develop process with comparative and competitive study.	L1, L2, L3

Books and References:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	The Ultimate Guide to Internships: 100 Steps to Get a Great Internship and Thrive in It (Ultimate Guides)	Eric Woodard	Allworth	I	2015

Online References:

Sr. No.	Website Name	URL	Modules Covered
1	https://www.letsintern.com/	https://www.letsintern.com/internships/summer-internships	M1-M6
2	https://codegnan.com	https://codegnan.com/blog/benefits-of-internships-and-importance	M1-M6
3	https://www.honorsociety.org	https://www.honorsociety.org/articles?category=internships	M1-M6

S.E. Semester –IV

Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education (CBCGS-HME 2020)

Proposed TCET Autonomy Scheme (w.e.f. A.Y. 2021-22)

<table>
<tr><td colspan="7">B.E. (Computer Engineering)</td><td colspan="3">S.E. SEM : IV</td></tr>
<tr><td colspan="7">Course Name :Professional Skills - IV
(Introduction to Python)</td><td colspan="3">Course Code :HME-CSPS401</td></tr>
<tr><td colspan="5">Teaching Scheme (Program Specific)</td><td colspan="5">Examination Scheme (Formative/ Summative)</td></tr>
<tr><td colspan="5">Modes of Teaching / Learning / Weightage</td><td colspan="5">Modes of Continuous Assessment / Evaluation</td></tr>
<tr><td colspan="5">Conducted in the beginning of Semester during first 3 Weeks</td><td colspan="2">Theory
(100)</td><td>Presentation
(25)</td><td>Report
(25)</td><td rowspan="3">Total

75</td></tr>
<tr><td>Theory</td><td>Tutorial</td><td>Practical</td><td>Contact Hours</td><td>Credits</td><td>IA</td><td>ESE</td><td>AC</td><td>AC</td></tr>
<tr><td>15</td><td>-</td><td>30</td><td>45</td><td>2</td><td>-</td><td>-</td><td>50</td><td>25</td></tr>
<tr><td colspan="10">AC: Activity
The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)</td></tr>
<tr><td colspan="10">Prerequisite: Computer Basics, Procedural Programming Languages</td></tr>
</table>

Course Objective: The course intends to make students learn how to design and program Python applications. The course intends to develop professional skills necessary for becoming technically skilled personnel.

Course Outcomes: **Upon completion of the course students will be able to:**

SN	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Understand basic concepts in python.	L1, L2
2	Describe various decision making techniques using Python programming language	L1, L2, L3
3	Illustrate various OOP concepts in Python	L1, L2, L3
4	Comprehend contents of files, directories and text processing with python	L1, L2
5	Apply Python programming for data structure using built in functions	L1, L2, L3
6	Show GUI and communication with database using python	L1, L2, L3

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Introduction to Python** Data types in python, Operators in python, Input and Output, Arrays in python, String and Character in python, Importing Packages and Modules	2	L1, L2
2	**Decision Making and Functions** If statement, if-elif-else, while loop, for loop, break statement, Functions	3	L1, L2, L3
3	**Object Oriented Programming in Python** Object Oriented Programming features in Python: Implementing Classes , Objects, methods, encapsulation, Inheritance and polymorphism	2	L1, L2, L3
4	**Advanced Python** Exception Handling, Files handling in Python, Text Processing, Regular expression in python, Reading data	2	L1, L2
5	**Data Structure in Python** List and Tuples, Vectors and DataFrames, Introduction to Numpy and Pandas libraries	2	L1, L2, L3
6	**Python Integration Primer** Graphical User interface, Python database connectivity	4	L1, L2, L3
	Total Hours	**15**	

Books and References:

SN	Title	Authors	Publisher	Edition	Year
1	Core Python Programming	Dr. R. Nageswara Rao	Dreamtech Press, Wiley Publication	Second Edition	2018
2	Learn Python 3 The Hard Way	Zed A. Shaw	Pearson Education	First Edition	2017
3	Head First Python: A Brain-Friendly Guide	Paul Barry	Shroff/O'Reilly	Second edition	2016
4	Beginning Python: Using Python 2.6 and Python 3.1	James Payne	Wrox Publication	First Edition	2010
5	Beginning Python From Novice to Professional	Magnus Lie Hetland	Apress Publication	Second Edition	2005

Online References:

S. No.	Website Name	URL	Modules Covered
1	www.learnpython.org	https://www.learnpython.org/	M1,M2,M3
2	www.w3schools.com	https://www.w3schools.com/python/	M1-M6
3	www.tutorialspoint.com	https://www.studytonight.com/dbms/	M1-M6

List of Practical/ Experiments:

Practical Number	Type of Experiment	Practical/ Experiment Topic	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1.	**Basic Experiments**	Demonstrate basics of python like data types (strings, array) and Importing Packages and Modules	2	L1, L2
2.		Develop a program based on control statements	2	L1, L2
3.	**Design Experiments**	Build a program to implement encapsulation, Inheritance and polymorphism in Python.	2	L1, L2, L3
4.		Build Python program demonstrating use of text processing.(regular expression)	2	L1, L2, L3
5.		Build Python program to explore 1. Files and directories (display file, count number of lines) 2. Exception Handling	4	L1, L2, L3
6.		Build Python program to demonstrate Data Structures in Python (List, Tuples, Vectors, DataFrames)	2	L1, L2, L3
7.		Develop Python program to convert arrays into DataFrames and merge them together using Numpy and Pandas Library.	4	L1, L2, L3
8.		1. Build Python program to create GUI in python using tkinter. 2. Develop Python program to demonstrate CRUD (create, read, update and delete) operations on database (SQLite/ MySQL) using python.	4	L1, L2, L3
9.	**Case Studies**	1. Python libraries in data science 2. Python case study to analyse the eligibility of loan.	2	L1, L2, L3
10.	**Mini Project**	1. Text processing in python 2. Desktop application using python (GUI and database) 3. SPAM mail checking system using python 4. Project based on numpy and pandas.	6	L1, L2, L3
		Total Hours	**30**	

S.E. Semester –IV

Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education (CBCGS-HME 2020)
Proposed TCET Autonomy Scheme (w.e.f. A.Y. 2021-22)

<table>
<tr><td colspan="6">B.E. (Computer Engineering)</td><td colspan="2">S.E. SEM : IV</td></tr>
<tr><td colspan="6">Course Name :Project Based Learning – II</td><td colspan="2">Course Code :HME-CSPBL401</td></tr>
<tr><td colspan="5">Teaching scheme (Holistic Student Development - HSD)
Industry Specific/Interdisciplinary</td><td colspan="3">Examination Scheme (Formative/ Summative)</td></tr>
<tr><td colspan="5">Modes of Teaching / Learning / Weightage</td><td colspan="3">Assessment/Evaluation Scheme</td></tr>
<tr><td colspan="5">Conducted in the beginning of Semester during first 3 Weeks</td><td>Presentation</td><td>Report</td><td>Term Work</td></tr>
<tr><td>Theory</td><td>Tutorial</td><td>Practical</td><td>Contact Hours</td><td>Credits</td><td>(AC)</td><td>(AC)</td><td rowspan="2">25</td></tr>
<tr><td>-</td><td>-</td><td>30</td><td>30</td><td>1</td><td>25</td><td>-</td></tr>
<tr><td colspan="8">AC : Activity
The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)</td></tr>
<tr><td colspan="8">Prerequisite: Computer Fundamentals and Knowledge of Programming Languages</td></tr>
</table>

Course Objective: The Course intends to aid students identify real world problems and apply computing fundamental and technical skill to find solutions to them.

Course Outcomes: Upon completion of the course students will be able to:

SN	Course Objectives	Cognitive levels of attainment as per Bloom's Taxonomy
1	Able to modify the existing project (PBL 1) with additional functionalities.	L1,L2,L3
2	Able to evaluate the performance of existing projects by implementing it in different programming languages.	L1,L2,L3
3	Able to implement solution using multidisciplinary /Interdisciplinary approaches.	L1,L2,L3,L4

Projects Listing:

SN	Title of Project	Type of Project
1	Design and Development of Data Compression Algorithm for SMS	Core
2	Design and Development of System for Detecting Handwritten Images using CNN	Core
3	Implementing System for File Transfer through Cryptography	Application
4	Implementing System for Attendance Management Using Face Recognition	Application
5	Advanced Application for Weather Forecasting using IoT	Application/ Multidisciplinary
6	Advanced System for Security Using Biometric Authentication	Application/ Multidisciplinary
7	Advanced System for Avoiding Phishing Attack	Application
8	Design and Development of Recommender system for online shopping portal	Core
9	Implementation of Medical Prescription Reader	Application
10	Implementing System for File Transfer through Cryptography	Application
11	Design and development of web portal for Smart City Traveler	Application/ Multidisciplinary
12	Design and Development of an application for Automated Railway Concession Form System	Application

S.E. Semester –IV

Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education (CBCGS-HME 2020)
Proposed TCET Autonomy Scheme (w.e.f. A.Y. 2021-22)

B.E. (Computer Engineering)							**S.E. SEM : IV**		
Course Name : Activity Based Learning-IV							**Course Code:** HME-CSABL401		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Conducted in the beginning of Semester during first 3 Weeks					**Theory (25)**		**Presentation**	**Report**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**(AC)**	**(AC)**	**50**
-	-	30	30	1	-	-	25	25	
AC : Activity **The weightage of marks for continuous evaluation of Term work/Report:** Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)									
Prerequisite: Basics of Computer Programming, General knowledge, Social awareness									

Course Objectives:he larger objective of the course is to develop the Society Sensitive Citizens by creating awareness among students and take up the initiatives in the Activity mode for the needy. The course intends to deliver the understanding of the concepts of critical thinking, encourage the students to look beyond their textual knowledge, establish the relationship between theory and the applications of the learned concepts. It also intends to address the social issues and help the society in the area of work.

Course Outcomes: **Upon completion of the course students will be able to:**

SN	Course Outcome	Cognitive level attainment as per revised Bloom Taxonomy
1	Apply procedures for Creative writing, which will give them wings of imagination with self-expression in the topic. Learn on multidisciplinary subjects.	L1, L2, L3
2	Understand the importance of the *extempore* speech which will help them to think and develop presence of mind. Exposure to Group discussion will provide an opportunity to all team members to give their ideas and opinion on a certain topic. It increases one's listening skills and confidence in speaking. Team building improves.	L1, L2
3	Interpret the strengths of survey research including its effectiveness, generalizability, reliability, and versatility. Students will be able to make the awareness about various social issues.	L1, L2, L3

Detailed Syllabus:

Module No.	Topics	Hrs	Cognitive level attainment as per revised Bloom Taxonomy
1	**Creative writing (technical/non-technical** **I. Introduction to creative writing**. a) Orientation and Introduction to Writing skills both article form and paper writing. Information about the rules and regulations about original writing. Templates of good journals eg. (IEEE format) with emphasize on originality, plagiarism check. Topic distribution in different categories as per choice of students Select the topic of article/ paper either from choice or in consultation with teacher. Discussion forum or Use of internet is allowed for the same. **Brainstorming and prewriting** Form teams divide into 8 teams. 5 students per team. Form the skeleton of the paper with data properly designed. check the plagiarism and shaping the article/paper with the team. **II. Drafting and editing** Continuation of the article/paper shaping, taking care of plagiarism Submit the article /paper introduction in one page outlining the salient features of the topic in hard copy. Students can have the freedom of choosing mentor faculty from college if needed. Finalizing the article/ paper. **Demonstration by students** and evaluation (Presentation of papers of 4 teams with inputs from mentors/teachers) **Evaluation by faculty as per format.**	2 2	L1, L2, L3
2	**Lecturette (Extempore speech)** **I. Introduction** Orientation and Introduction to lecturette/ extempore rules The candidate is required to deliver a short talk for 03 minutes to the group watching him. Choice of topic discussion. Technical/ Non-technical **A suitable topic** is to be chosen out of 04 topics given. 03 minutes will be given for thinking, jotting down points and organizing the speech without any help. Candidate has to introduce himself/herself in brief before starting the talk. **II. Extempore/Presentation by each student Evaluation by faculty as per format.**	2	L1, L2, L3
3	**Group Discussion** **I. Introduction and orientation about Group discussion and rules** . GDs form an important part of the short-listing process for recruitment or admission in a company or institution. Types of GD Topics such as social, political, economic, technical etc. Topic choice to be given to students and based on that Team formation on the chosen topic Brainstorming among the students to form teams on topics selected. **.Prepare the points for group discussion.** Formation of four teams for two topics.	2	L1, L2, L3

	Two teams (For and against) for topic I will debate first and the other two team will be audience and for topic II vice-versa. **II. Paraphrasing/summarizing.** Evaluation will be based on Creativity skills supported by listening and participating proactively by presentation of teams. Group discussion among the teams members sequentially, other teams will be audience to discussing team and vice versa. **Evaluation by faculty as per format**	2	
4	**Survey designing and study**		L1, L2, L3
	I. Introduction and Orientation to research methodology emphasizing on survey designing. Surveys can be administered in many modes, including: online surveys, email surveys, social media surveys, paper surveys, mobile surveys, telephone surveys, and face-to-face interviewsurveys. Brainstorming and establishing the goal of the project Form teams, divide into 8 teams. 5 students per team. Select the topic of survey topic with feasible insight either from choice or in consultation with teacher. Discussion forum or Use of internet is allowed for the same. **Structuring and Designing the Questionnaire** Create the sample questionnaires(max 10) mapping with goal established Interview the peer team members for data (all students should be asked.) Field survey topics can also be collected. **II. Collection of the data** and use the tools for analyses of the survey incorporated if any. Finalizing the results Data analyses in the form of written article and graphs projection for the same. Presentation of survey results by teams (a)Demonstration by students 4 teams b) Presentation of another 4 teams Submission of projects as hard copy Evaluation by faculties	2 2	
5	**Extended Work**		L1, L2, L3
	I Orientation and Introduction about social responsibilities. Team formation 5 students in each team. Visit to nearby community to provide necessary help based on the following topics **(a)Food Waste (TCET canteen) and societies.** Keep record of food waste daily in kilogram, help in designing the display of food wastage every day. Similarly extend the idea in their own society during festivals, gatherings. **(B) Health awareness** Take the record of the societies in which they reside, collect the information about vaccinations (age wise , validity of time etc) Record maintenance **(c) 3-minute Film making or case study** on the above two themes by teams and presentation. **Evaluation by faculty as per format.**	4 4 6	
	Total Hours	**30**	

Books and References:

S. No.	Title	Authors	Publisher	Edition	Year
1	Creative Writing Book	Louie StowelL	Usborne Publishing Ltd	-	2016
2	Group Discussion on Current Topics	Major (retd.) P. N. Joshi	Upkar Prakashan	-	2010
3	Complete Guide to Group Discussion	PRASOON. PROF SHRIKANT	V&S Publishers	-	2011
4	Extempore speech, how to acquire and practice it	William Pittenger	Palala Press	-	2015
5	http://theconversation.com/awareness-of-food-waste-can-help-us-appreciate-holiday-meals-105798				
6	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5072240/				

Online References:

S. No.	Website Name	URL	Modules Covered
1	theconversation.com	http://theconversation.com/awareness-of-food-waste-can-help-us-appreciate-holiday-meals-105798	M1-M5
2	https://www.ncbi.nlm.nih.gov	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5072240/	M5

T.E. Semester –V
Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS- HME 2020)
TCET Autonomy Scheme (w.e.f. A.Y. 2020-21)

B.E. (Computer Engineering)										**T.E. SEM :** V		
Course Name : Soft Skills and Interpersonal Communication										**Course Code** : HSMC-CS501		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**							
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment/ Evaluation**							
Hours Per Week					**Theory (50)**			**Practical/Oral**		**Term Work (25)**		**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**		**ESE**	**IA**	**ESE**	**IA**	**ESE**	**100**
					ISE	IE						
3	-	-	3	3	20	20	60	-	-	-	-	
	IA: In-Semester Assessment - Paper Duration – 1.5 Hour **ESE: End Semester Examination - Paper Duration - 3 Hours** **The weightage of marks for continuous evaluation of Term work/Report:** Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)											
	Prerequisite- Basic knowledge of English language, Grammar and Vocabulary											

Course Objectives: The course intends to understand basics of soft skills, learn essential life skills, understand and develop self and incorporate ethics and etiquette in day to day life

Course Outcomes:

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Understand basics of soft skills	L1,L2,L3
2	Learn essential life skills	L1,L2,L3
3	Understand and develop self	L1,L2,L3
4	Understand others with empathy	L1,L2,L3
5	Use employment skills for placement and higher studies	L1,L2,L3
6	Incorporate ethics and etiquette in day to day life	L1,L2,L3

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Introduction to Soft Skills** 1. Meaning and Concept 2. Importance of soft Skills 3. Soft Skills for Lifelong learning- Building a better world	6	L1,L2,L3
2	**Essential Soft Skills** 1. Personal integrity 2. Taking responsibility 3. Professionalism 4. Communication 5. Critical Thinking 6. Creativity and Innovation	8	L1,L2,L3
3	**Self-Development** 1. Self-assessment, Awareness, Perception and Attitudes, Values and belief, Personal goal setting, career planning, Self-esteem. 2. Personal memory 3. Rapid reading & Taking notes 4. Complex problem solving 5. Creativity	8	L1,L2,L3
4	**Introduction to Interpersonal Skills** 1. Team work: Mentorship, Motivation 2. Problem Solving 3. Decision Making 4. Time Management 5. Emotional Intelligence 6. Negotiation Skills 7. Stress Management	8	L1,L2,L3
5	**Employability Skills** 1. Cover letter 2. Resume 3. Group Discussion 4. Presentation skills 5. Interview skills	8	L1,L2,L3
6	**Introduction to Corporate Ethics and Etiquette** Business etiquette (meeting etiquette, Dining etiquette, Interview etiquette, Professional and work etiquette and Social Skills),Greetings and art of conversation 1. Dressing and grooming 2. Ethical codes of conduct in business Intonation Pattern for effective presentation	7	L1,L2,L3
	Total Hours	**45**	

Books and References:

Sr. No	Name of the Book	Name of the Author	Publisher	Edition	Year
1	Practical English Usage	Michael Swan	OUP	4th Edition	1995
2	Remedial English Grammar	F.T. Wood	Macmillan	2014 Edition	2007
3	Pocket Style Manual	Diane Hacker	Bedford publication, New York	2003 Edition (ISBN 0312406843)	2003
4	You Can Win	Shiv Khera	Macmillan Books, New York	2003 Edition	2003
5	Technical Writing & Professional Communication for non-native speakers of English	Thomas N. Huckin & Leslie A. Olsen	McGraw Hill Education	2011 Edition	2011
6	The 7 Habits of Highly Effective People	Stephen Covey	Free Press	2016 Edition	2016

T.E. Semester –V

Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS- HME 2020)

TCET Autonomy Scheme (w.e.f. A.Y. 2020-21)

<table>
<tr><td colspan="8">B.E. (Computer Engineering)</td><td colspan="4">T.E. SEM: V</td></tr>
<tr><td colspan="8">Course Name: Theory of Computer Science</td><td colspan="4">Course Code: PCC-CS501</td></tr>
<tr><td colspan="5">Teaching Scheme (Program Specific)</td><td colspan="7">Examination Scheme (Formative/ Summative)</td></tr>
<tr><td colspan="5">Modes of Teaching / Learning / Weightage</td><td colspan="7">Modes of Continuous Assessment / Evaluation</td></tr>
<tr><td colspan="5">Hours Per Week</td><td colspan="3">Theory
(100)</td><td>Practical/Oral
(25)</td><td>Term Work (25)</td><td>Total</td></tr>
<tr><td rowspan="2">Theory</td><td rowspan="2">Tutorial</td><td rowspan="2">Practical</td><td rowspan="2">Contact Hours</td><td rowspan="2">Credits</td><td colspan="2">IA</td><td rowspan="2">ESE</td><td rowspan="3">-</td><td rowspan="3">25</td><td rowspan="3">125</td></tr>
<tr><td>ISE</td><td>IE</td></tr>
<tr><td>3</td><td>1</td><td>-</td><td>4</td><td>4</td><td>20</td><td>20</td><td>60</td></tr>
<tr><td></td><td colspan="10">IA: In-Semester Assessment - Paper Duration – 1.5 Hours
ESE: End Semester Examination - Paper Duration - 3 Hours
The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)</td></tr>
<tr><td></td><td colspan="10">Prerequisite: Basic Mathematics</td></tr>
</table>

Course Objective: The Objective of this course is to deliver the fundamental concepts of theory of computation describing formal mathematical models of computation such as FA,PDA,LBA and TM by comparing their power, limitations, languages and their applications in computation and complexity theory and also to learn that not all problems are solvable by computers.

Course Outcomes: **Upon completion of the course students will be able to:**

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Describe formal models of computation, such as finite automata, pushdown automata, and Turing machines.	L1, L2, L3
2	Design Finite Automata's for different Regular Expressions and Languages.	L1, L2, L3
3	Compare different types of Grammars and design context free grammars for formal languages.	L1, L2, L3
4	Construct and analyze Push Down automata and Turing Machine for formal languages.	L1, L2, L3,L4
5	Classify machines by their power to recognize languages.	L1, L2, L3,L4
6	Express the understanding of the decidability and decidability problems.	L1,L2

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Basic Concepts and Finite Automata**		
	Basic Concepts: Alphabets, Strings, Languages, Closure properties. **FA without output:** Finite Automata (FA), Deterministic Finite Automata (DFA) and Nondeterministic Finite Automata (NFA): Definitions, transition diagrams and Language recognizers , NFA to DFA Conversion, Equivalence of Deterministic and Nondeterministic Finite Automata, Applications of Finite Automata, Finite Automata with Epsilon Transitions, Eliminating Epsilon transitions, Minimization of DFA. **FA with output:** Definition and construction of Moore and Mealy machines and Equivalence, Applications and limitations of FA.	9	L1, L2, L3
2	**Regular Expressions and Languages**		
	Regular Expression (RE): Equivalence of RE and FA, Arden's Theorem, RE Applications. Grammars and Chomsky hierarchy. **Regular Language (RL):** Proving languages to be Nonregular -Pumping lemma and Closure properties of regular languages.	6	L1,L2, L3
3	**Context Free Grammar**		
	Definition, Sentential forms, Leftmost and Rightmost derivations, Parse tree, Ambiguity. Simplification and Applications. Normal Forms: Chomsky Normal Forms (CNF) and Greibach Normal Forms (GNF), CFLs - Pumping lemma, Closure properties	7	L1,L2, L3
4	**Push Down Automata**		
	Definition, Model, Acceptance of CFL, Acceptance by Final State and Acceptance by Empty stack and its Equivalence, Deterministic PDA , Non-Deterministic PDA , Equivalence of CFG and PDA, Application of PDA	7	L1, L2,L3,L4
5	**Turing Machine**		
	Definition, Transitions, Design of TM as generator, decider and acceptor. Variants of TM: Multitrack, Multitape , Universal TM, Equivalence of Single and Multi Tape TMs. Applications, Power and Limitations of TMs.	10	L1, L2, L3,L4
6	**Undecidability**		
	Properties of recursive and recursively enumerable languages, Decidability and Undecidability , Halting problem , Linear bounded automata (LBA), Rice's Theorem , Post's correspondence problem (PCP).	6	L1, L2
	Total Hours	**45**	

Books and References:

SN	Title	Authors	Publisher	Edition	Year
1	Introduction to Automata Theory, Languages and Computation	John. E. Hopcroft, Rajeev otwani, J. D. Ullman,	Pearson Education Asia	3rd Edition	2006
2	Elements of the Theory of computation	H.R. Lewis and C.H.Papadimitrou	Prentice Hall Inc	2nd Edition	1997
3	Introduction to languages and the Theory of Computation	John C Martin	TMH	4th Edition	2010
4	Introduction to Computer Theory	Daniel I.A. Cohen	John Wiley	2nd Edition	2007

Online References:

S. No.	Website Name	URL	Modules Covered
1	www.coursera.org	https://www.coursera.org/learn/cs-algorithms-theory-machines	M6
2	nptel.ac.in	https://nptel.ac.in/noc/individual_course.php?id=noc16-cs14	M1-M6

List of Tutorials:

Sr. No.	Topic	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	Tutorial on Construction of Finite Automata.	1	L1, L2, L3
2	Tutorial on Regular Expression.	1	L1, L2, L3
3	Tutorial on Regular Expression to Non-Deterministic Finite Automata.	1	L1, L2, L3
4	Tutorial on Conversion of NFA to DFA.	1	L1, L2, L3
5	Tutorial on Construction of Mealy and Moore Machine.	1	L1, L2, L3
6	Tutorial on Construction of CFG and Derivations.	1	L1, L2, L3
7	Tutorial on Simplification of Context Free Grammar.	1	L1, L2, L3
8	Tutorial on Conversion of CFG into Normal Forms (CNF & GNF).	1	L1, L2, L3
9	Tutorial on Construction of PDA.(I)	1	L1, L2, L3
10	Tutorial on Construction of PDA.(II)	1	L1, L2, L3
11	Tutorial on Application of Pumping Lemma.	1	L1, L2, L3
12	Tutorial on Conversion of CFG to PDA.	1	L1, L2, L3
13	Tutorial on Construction of Turing Machine.(I)	1	L1, L2, L3, L4
14	Tutorial on Construction of Turing Machine (II)	1	L1, L2, L3, L4
15	Tutorial on Post Correspondence Problem.	1	L1, L2
	Total Hours	**15**	

T.E. Semester –V
Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS- HME 2020)
TCET Autonomy Scheme (w.e.f. A.Y. 2020-21)

<table>
<tr><td colspan="8">B.E. (Computer Engineering)</td><td colspan="4">T.E. SEM : V</td></tr>
<tr><td colspan="8">Course Name : Introduction to Intelligent System</td><td colspan="4">Course Code : PCC-CS502</td></tr>
<tr><td colspan="5">Teaching Scheme (Program Specific)</td><td colspan="7">Examination Scheme (Formative/ Summative)</td></tr>
<tr><td colspan="5">Modes of Teaching / Learning / Weightage</td><td colspan="7">Modes of Continuous Assessment / Evaluation</td></tr>
<tr><td colspan="5">Hours Per Week</td><td colspan="3">Theory (100)</td><td>Practical/ Oral (25)</td><td>Term Work (25)</td><td>Total</td></tr>
<tr><td rowspan="2">Theory</td><td rowspan="2">Tutorial</td><td rowspan="2">Practical</td><td rowspan="2">Contact Hours</td><td rowspan="2">Credits</td><td colspan="2">IA</td><td rowspan="2">ESE</td><td rowspan="3">25</td><td rowspan="3">25</td><td rowspan="3">150</td></tr>
<tr><td>ISE</td><td>IE</td></tr>
<tr><td>3</td><td>-</td><td>2</td><td>5</td><td>4</td><td>20</td><td>20</td><td>60</td></tr>
<tr><td></td><td colspan="10">IA: In-Semester Assessment - Paper Duration – 1.5 Hours
ESE: End Semester Examination - Paper Duration - 3 Hours
The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)</td></tr>
<tr><td></td><td colspan="10">Prerequisite: Computer and Programming Basics, Analysis of Algorithm</td></tr>
</table>

Course Objective: To make students understand and explore the techniques underlying the design of Intelligent Systems.

Course Outcomes: Upon completion of the course students will be able to:

SN	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Understand foundation and applications of Intelligent Systems	L1, L2
2	Understand AI building blocks presented in intelligent agents.	L1, L2
3	Understand and Apply various AI search algorithms uninformed, informed, local, adversarial and backtracking search algorithms and constraint satisfaction problems to real-world problems.	L1, L2, L3
4	Analyze AI approaches for knowledge representation and Uncertain knowledge and reasoning.	L1, L2, L3
5	Understand various types of planning and forms of learning. Apply decision tree learning to a given problems.	L1, L2, L3
6	Understand various sub areas of Intelligent Systems.	L1, L2

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Introduction** Introduction, History of Artificial Intelligence, Intelligent System Categorization, Components of AI, Foundations of AI, Applications and Current trends in AI.	4	L1, L2
2	**Intelligent Agents** Agents and Environments, The concept of rationality, The nature of environment, The structure of Agents, Types of Agents, Learning Agent, AI applications for various types of agents.	4	L1, L2
3	**Problem Solving and Search** Problem Solving Agent, Formulating Problems, Example Problems, Uninformed Search Methods, Informed Search Methods, Local Search Methods, Genetic algorithms, Adversarial Search, Constraint Satisfaction Problems, Realtime applications of all search methods.	10	L1, L2, L3
4	**Knowledge and Reasoning** Knowledge based Agents, The Wumpus World, The Propositional logic, First Order Logic: Syntax and Semantic, Inference in FOL, Forward chaining, backward Chaining, Knowledge Engineering in First-Order Logic, Unification, Resolution, Uncertain knowledge and reasoning: Uncertainty, Representing knowledge in an uncertain domain, Real time application of certain & uncertain knowledge and reasoning, The semantics of belief network, Inference in belief network	10	L1, L2, L3
5	**Planning and Learning** The planning problem, Planning with state space search, Partial order planning, Hierarchical planning, Conditional Planning. Learning: Forms of Learning, Inductive Learning, Learning Decision Tree	8	L1, L2, L3
6	**Expert Systems and Sub Areas of Intelligent Systems** Expert System: Introduction, ES vs Traditional System, Phases in building Expert Systems, ES Architecture, Soft Computing, Machine Learning, Deep Learning, Artificial Neural Network, Fuzzy Systems, Natural Language Processing, Robotics, HCI	9	L1, L2
	Total Hours	**45**	

Books and References:

	Title	Authors	Publisher	Edition	Year
1	Artificial Intelligence a Modern Approach	Stuart J. Russell and Peter Norvig	McGraw Hill	3rd Edition	2009
2	A First Course in Artificial Intelligence	Deepak Khemani	McGraw Hill Education (India)	1st Edition	2013
3	Artificial Intelligence and Intelligent Systems	N. P. Padhy	Oxford	1st Edition	2005
4	Artificial Intelligence	Elaine Rich and Kevin Knight	Tata McGraw-Hill Education Pvt. Ltd.	3rd Edition	2008
5	Artificial Intelligence	Rob Callan	Palgrave macmillan	1st Edition	2003

Online Resources:

S. No.	Website Name	URL	Modules Covered
1	nptel.ac.in	https://nptel.ac.in/courses/106102220/	M1-M6

List of Practical/ Experiments:

Practical Number	Type of Experiment	Practical/ Experiment Topic	Hrs.	RBT Levels
1	Basic Experiments	Specify PEAS description and environment type for at least 2 Agent.	2	L1, L2
2	Design Experiments	Apply AI problem formulation approach to solve any problem.	2	L1, L2, L3
3		Apply informed and uninformed search on given problem.	2	L1, L2, L3
4		Apply genetic algorithm on given problem.	2	L1, L2, L3
5		Apply Minimax with Alpha-Beta Pruning on given problem.	2	L1, L2, L3
6		Apply Constraint Satisfaction Problem.	2	L1, L2, L3
7		Apply local search methods on given problem.	2	L1, L2, L3
8		Apply unification to Solve a reasoning problem.	2	L1, L2, L3
9		Apply Decision Tree Learning on given problem.	2	L1, L2, L3
10	Case Studies and Mini Project	Game Development Smart Apps Chatbot Prediction Systems Any small scope Intelligent Systems	12	L1, L2, L3,L4,L5, L6
Total Hours			**30**	

T.E. Semester –V
Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS- HME 2020)
TCET Autonomy Scheme (w.e.f. A.Y. 2020-21)

B.E. (Computer Engineering)										**T.E. SEM: V**
Course Name: Microprocessor										**Course Code** : PCC-CS504
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**					
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**					
Hours Per Week					**Theory (100)**			**Practical/Oral (25)**	**Term Work (25)**	**Total**
					40/20		**60/30**			
					IA					
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**ISE**	**IE**	**ESE**	**PR/OR**	**TW**	
3	-	2	5	4	20	20	60	25	25	**150**
IA: In-Semester Assessment - Paper Duration – 1 Hours										
ESE: End Semester Examination - Paper Duration – 2/1 Hours										
The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)										
Prerequisite: Computer Organization and Architecture, Digital Logic Design & Analysis										

Course Objective: The course intends to introduce basic and advanced software and hardware architecture of Intel X86 processors, use of assembly language and mixed mode programming. It also introduces microcontroller and its applications.

Course Outcomes: **Upon completion of the course students will be able to:**

Sr. No.	**Course Outcomes**	**Cognitive levels of attainment as per Bloom's Taxonomy**
1	Describe 16-bit architecture of 8086 Microprocessor.	L1, L2
2	Apply the assembly and mixed language programming to develop small embedded application.	L1, L2, L3
3	Sketch 8086 based system using memory and peripheral chips.	L1,L2, L3
4	Analyse the role of 32bit microprocessor architecture over 16 bit architecture.	L1,L2,L3,L4
5	Compare Pentium family microprocessors.	L1, L2, L3,L4
6	Differentiate between microprocessor and microcontroller.	L1, L2,L3,L4

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Intel 8086 Microprocessor** Architecture of 8086 processor , Register set, Memory segmentation, Functional Pin Diagram, Operating Modes, Minimum mode 8086 system and Timing diagrams , Maximum mode 8086 system and Timing diagrams.	8	L1, L2
2	**Instruction set and Assembly Language Programming** Instruction set, Addressing Modes, Assembler Directives, Macros and Procedure, Assembly Language Programming, Mixed Mode programming	6	L1, L2, L3
3	**Memory and Peripheral Interfacing with 8086** Memory Interfacing - RAM and ROM 8259 PIC – Interrupt, Types of Interrupts, Interrupt Service Routine, Interrupt Vector Table, Block Diagram of 8259, Interfacing the 8259 in single and cascaded mode with 8086. 8255 PPI - Block diagram, Command word format, Interfacing 8255 with 8086.	8	L1,L2, L3
4	**Intel 80386DX Processor** Architecture of 80386DX processor, Register Organization: General purpose Registers, EFLAGS and Control registers, Operating Modes: Real Mode, Protected Mode and Virtual 8086 Mode, Protected mode Address Translation mechanism: Segmentation and Paging.	8	L1,L2,L3,L4
5	**Pentium processor** Pentium Architecture, Superscalar Operation, Integer & Floating-Point Pipeline Stages, Branch Prediction Logic, Cache Organization and MESI Model, Comparative study of Pentium family processors.	7	L1, L2, L3,L4
6	**The Microcontroller 8051** Introduction to 8051 Microcontroller, Architecture, Pin configuration, Memory organization, Input /Output Ports, Serial communication, Interrupts	8	L1, L2, L3,L4
	Total Hours	**45**	

Books and References:

SN	Title	Authors	Publisher	Edition	Year
1	8086/8088 family: Design Programming and Interfacing	John Uffenbeck	PHI	First Edition	2009
2	Advanced Microprocessors and Peripherals	K M Bhurchandani, A k Ray	McGraw Hill	Third Edition	2006
3	The 80386DX Microprocessor: hardware, Software and Interfacing	Walter A Triebel	Prentice Hall	First Edition	1992

4	Pentium Processor System Architecture	Tom Shanley & Don Anderson	Addison-Wesley	Fourth Edition	2008
5	Intel Microprocessors	Barry B. Brey	Pearson Education India	Eighth Edition	2009
6	Microprocessor and Interfacing	Douglas Hall	Tata McGraw Hill	Third Edition	2006
	IBM PC Assembly language and Programming	Peter Abel	PHI	Fifth edition	2002
7	The 8051 microcontroller and embedded systems	Mazidi Ali, Muhammad Mazidi Gillispie Janice	PHI	Second Edition	2012
8	The 8051 Microcontroller: Architecture, Programming, and Applications	Kenneth Ayala J	Thomson Delmar learning	Second Edition	1996

Online References:

S. No.	Website Name	URL	Modules Covered
1	www.datasheetspdf.com	https://datasheetspdf.com/pdf/544568/Intel/8086/1	M1, M2, M4
2	nptel.ac.in	https://nptel.ac.in/courses/106108100/	M1,M2,M3, M4,M5
3	www.alldatasheet.com	https://www.alldatasheet.com/view.jsp?Searchword=80386D &sField=2	M4

List of Practical/ Experiments:

Practical Number	Type of Experiment	Practical/ Experiment Topic	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Basic Experiments**	Apply Assembly Language Programing to enter and display 8 bit & 16 bits number	2	L1, L2, L3
2		Apply Assembly Language Programing to covert HEX to BCD and BCD to HEX.	2	L1, L2, L3
3	**Design Experiments**	Apply Assembly Language Programing to perform addition and subtraction of two 16 bits numbers using macros and procedure. (Menu Based).	2	L1,L2,L3
4		Apply Assembly Language Programing to perform string operations. (i)Accept, (ii) Display, (iii) Concatenation (iv) Compare	2	L1,L2,L3
5		Make use of 8086 Trainer kits in: 1. Hexkey pad Mode 2. Serial Mode	4	L1,L2,L3

6		Illustrate Interfacing on Intel 8086 with 8255-Programmable Peripheral Interface.	2	L1,L2,L3,L4
7	**Advanced Experiments**	Apply Mixed Language Programing to design a calculator.	2	L1,L2,L3
8		Develop program to interface mouse driver/keyboard/printer drivers.	4	L1,L2,L3,L4
9	**Mini/Minor Projects/ Seminar/**	1. Game development using mouse driver 2. Develop an application on Mixed mode programming. 3. Develop an application using Arduino Controller. 4. Develop an application using Raspberry-PI.	6	L1,L2,L3,L4
10	**Case Studies/ Group Presentation**	1. Compare Multicore processors i3,i5, i7. 2. Latest Trends In Microcontroller & Microprocessor 3. Recent development in hardware components.	4	L1,L2,L3,L4
	Total Hours		**30**	

T.E. Semester –V

Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS- HME 2020)

TCET Autonomy Scheme (w.e.f. A.Y. 2020-21)

<table>
<tr><th colspan="8">B.E. (Computer Engineering)</th><th colspan="3">T.E. SEM: V</th></tr>
<tr><td colspan="8">Course Name: Professional Elective 1(Advanced Operating System)</td><td colspan="3">Course Code: PEC-CS5011</td></tr>
<tr><th colspan="5">Teaching Scheme (Program Specific)</th><th colspan="6">Examination Scheme (Formative/ Summative)</th></tr>
<tr><th colspan="5">Modes of Teaching / Learning / Weightage</th><th colspan="6">Modes of Continuous Assessment / Evaluation</th></tr>
<tr><th colspan="5" rowspan="3">Hours Per Week</th><th colspan="3">Theory (100)</th><th rowspan="3">Practical/Oral (25)</th><th rowspan="3">Term Work (25)</th><th rowspan="3">Total</th></tr>
<tr><th colspan="2">40/20</th><th>60/30</th></tr>
<tr><th colspan="2">IA</th><th></th></tr>
<tr><th>Theory</th><th>Tutorial</th><th>Practical</th><th>Contact Hours</th><th>Credits</th><th>ISE</th><th>IE</th><th>ESE</th><th>PR/OR</th><th>TW</th><th rowspan="2">150</th></tr>
<tr><td>3</td><td>-</td><td>2@</td><td>5</td><td>4</td><td>20</td><td>20</td><td>60</td><td>25</td><td>25</td></tr>
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<tr><td colspan="11">Prerequisite: Computer and Programming Basics</td></tr>
</table>

Course Objective: To make students understand and explore the techniques underlying the design and implementation of various concepts of advance operating system.

Course Outcomes: **Upon completion of the course students will be able to:**

SN	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Demonstrate understanding of design issues of Advanced operating systems and compare different types of operating systems.	L1, L2, L3
2	Analyse design aspects and data structures used for file subsystem, memory subsystem and process subsystem of Unix OS	L1, L2, L3, L4
3	Demonstrate understanding of different architectures used in Multiprocessor OS and analyse the design and data structures used in Multiprocessor operating systems.	L1, L2, L3, L4
4	Differentiate between threads and processes and compare different processor scheduling algorithms used in Multiprocessor OS	L1, L2, L3, L4
5	Classify Real Time OS and analyse various real time scheduling algorithms.	L1, L2, L3, L4
6	Explore architectures and design issues of Mobile OS,Virtual OS, Cloud OS.	L1, L2, L3

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Introduction** Functions of operating systems, Design approaches: layered, kernel based and virtual machine approach, types of advanced operating systems (NOS, DOS, Multiprocessor OS, Mobile OS, RTOS, Cloud OS)	4	L1, L2, L3
2	**Unix Kernel and File Management** System Structure, User Perspective, Architecture of Unix Operating System, Buffer cache: Header, Buffer Pool, Retrieving, Reading and Writing Buffer, File Representation: inodes: Structure of file Directories, Path conversion to inode, superblock, inode assignment, allocation of disk blocks	4	L1, L2, L3, L4
3	**Unix Process and Memory management** Detailed design of Process Structure: Kernel Data structures for process, Structure of Uarea and Process table, Process states and Transitions, Context of a Process: Static and Dynamic area of context, Saving the Context Layout of System Memory, Regions, Mapping regions with Process, page table and mapping virtual address to physical address.	10	L1, L2, L3, L4
4	**Distributed Operating system concepts** Goals, Distributed Computing Models, Hardware Concepts, Software Concepts, Architecture of DOS. Design Issues: Transparency, Flexibility, Scalability, Reliability, Performance, fault tolerance	10	L1, L2, L3, L4
5	**Multiprocessor Operating System** Introduction, Basic multiprocessor system architectures, design issues, Threads, Process synchronization: the test and set instruction, the swap instruction, implementation of the process wait, Processor scheduling: Issues, Co-scheduling, Smart scheduling, Affinity Based scheduling	9	L1, L2, L3, L4
6	**Real Time Operating Systems and Mobile OS** Characteristics of Real Time operating Systems, Classification of Real Time Operating Systems, Scheduling in RTOS: Clock driven cyclic, Event driven: EDF and rate monotonic scheduling. Mobile OS: Architecture, Android OS, iOS, Virtual OS, Cloud OS and their design issues	8	L1, L2, L3
	Total Hours	**45**	

Books and References:

	Title	Authors	Publisher	Edition	Year
1	Distributed Systems: Principles and Paradigms	Andrew S. Tanenbaum and Maarten Van Steen	Pearson Education	2nd edition	2016
2	Real-Time Systems: Theory and Practice	Rajib Mall	Pearson Education India	1st Edition	2006
3	Operating System: Internals and Design Principles	William Stallings	Prentice Hall	8th Edition	2014

Online Resources:

S. No.	Website Name	URL	Modules Covered
1	https://www.geeksforgeeks.org	https://www.geeksforgeeks.org/operating-systems/	M1-M6
2	https://www.tutorialspoint.com	https://www.tutorialspoint.com/operating_system/index.htm	M1-M6

Mini Project Hours Distribution:

Sr. No	Work to be done	No. of Hours	Cognitive levels of attainment as per Bloom's Taxonomy
1	Study Research papers and select a mini project topic.	4	L1.L2
2	Project Title and Modules Identification	4	L1,L2
3	Design & Methodology	2	L1,L2
4	Implementation of Module 1	4	L1,L2,L3
5	Result Phase I	4	L1,L2,L3
6	Implementation of Module 2	4	L1,L2
7	Result Phase II and Validate Modules	4	L1,L2,L3,L4, L5
8	Report Writing	4	L1,L2
	Total Hours	**30**	

T.E. Semester –V
Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS- HME 2020)
TCET Autonomy Scheme (w.e.f. A.Y. 2020-21)

<table>
<tr><th colspan="8">B.E. (Computer Engineering)</th><th colspan="3">T.E. SEM: V</th></tr>
<tr><td colspan="8">Course Name: Professional Elective 1(Mobile Computing)</td><td colspan="3">Course Code: PEC-CS5012</td></tr>
<tr><th colspan="5">Teaching Scheme (Program Specific)</th><th colspan="6">Examination Scheme (Formative/ Summative)</th></tr>
<tr><th colspan="5">Modes of Teaching / Learning / Weightage</th><th colspan="6">Modes of Continuous Assessment / Evaluation</th></tr>
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<tr><td colspan="11">Prerequisite: Basics of Programming (Java), Computer Networks</td></tr>
</table>

Course Objective: This course introduces the basic concepts and principles in mobile computing. It covers the TCP/IP extensions for mobile networking and provides opportunities to the students to gain hands-on experiences in developing mobile applications.

Course Outcomes: **Upon completion of the course students will be able to:**

SN	Course Outcomes	RBT level
1	Identify with the basic concepts and principles in mobile computing.	L1, L2
2	Understand the components and functioning of mobile networking.	L1, L2, L3
3	Describe the technologies in telecommunication with their underlying architectures.	L1, L2
4	Explain mobility management	L1, L2, L3
5	Illustrate how mobile Ad-hoc networks function	L1, L2, L3
6	Implement small android based applications.	L1, L2, L3

Detailed Syllabus:

Module No.	Topics	Hrs.	RBT Levels
1	**Introduction to mobile computing** Mobile Computing vs. Wireless Networking ; Mobile Computing Applications; Characteristics of Mobile computing; Medium Access Control: Motivation for specialized MAC, Introduction to multiple Access techniques (MACA) , Wireless MAC Issues	06	L1,L2
2	**Mobile IP and TCP** Mobile IP: IP Packet Delivery, Agent Advertisement and Discovery, Registration, Tunneling and Encapsulation, Reverse Tunneling Mobile TCP: Traditional TCP, Classical TCP Improvements (like Indirect TCP, Snooping TCP & Mobile TCP, Fast Retransmit/ Fast Recovery, Transmission/Timeout Freezing, Selective Retransmission)	09	L1, L2,L3
3	**Mobile Telecommunication Systems** GSM Mobile services, System Architecture, Radio interface, Protocols , Localization and Calling, Handover, security (A3,A5 & A8); GPRS system and protocol architecture; UTRAN , UMTS core network ; Improvements on Core Network	07	L1, L2
4	**Mobile ad-hoc networks** Ad-Hoc Networks: Basic Concept, Characteristics , Applications ;Design Issues; Vehicular Ad Hoc networks (VANET);MANET Vs VANET; Security in ad-hoc networks	06	L1, L2, L3
5	**Mobility Management** Co- channel Interference; Mobility: Types of Handoffs. Routing - Classification of Routing Algorithms, Algorithms such as DSR, AODV, DSDV etc.	08	L1, L2, L3
6	**Mobile Application Development** Structure of Mobile Computing Application; Characteristics of mobile devices; Native applications vs. Web-Applications; Internet Protocols for mobile apps; Mobile Platforms: Introduction to Android, Layers, android components, mapping application to process. Android development basics.	09	L1, L2, L3

Books and References:

S. No.	Title	Authors	Publisher	Edition	Year
1	Mobile Computing	Raj Kamal	Oxford University Press	Second Edition	2011
2	Mobile Communication	Jochen Schilller	Addision wisely, Pearson Education	Second Edition	2004
3	Fundamentals of Mobile Computing	Pattnaik, Prasant Kumar	PHI Learning Pvt. Ltd.	Second Edition	2016
4	Mobility Protocols and Handover optimization: Design, Evaluation and Application	Ashutosh Dutta, Henning Schulzrinne	IEEE Press, Wiley Publication	First Edition	2015

Online References:

S. No.	Website Name	URL	Modules Covered
1	cse.iitb.ac.in	https://www.cse.iitb.ac.in/~mythili/teaching/cs653_spring2014/index.html	M1, M2, M3
2	www.tutorialspoint.com	https://www.tutorialspoint.com/umts/umts_cellular_concepts_mobility_management.htm	M4
4	nptel.ac.in	https://nptel.ac.in/courses/106105160/	M5
3	learn.saylor.org	https://learn.saylor.org/course/view.php?id=95&sectionid=978	M6

Mini Project Hours Distribution

Sr. No	Work to be done	No. of Hours	Cognitive levels of attainment as per Bloom's Taxonomy
1	Study articles and research papers: Identification of mini-project title.	4	L1.L2,L3
2	Finalizing title and identifying different modules to be developed.	4	L1,L2,L3
3	Design and Methodology: Finalizing design approach and tools for implementation.	2	L1,L2,L3
4	Implementation of Modules Phase I	4	L1,L2,L3
5	Result Phase I	4	L1,L2,L3,L4
6	Implementation of Modules Phase II	4	L1,L2,L3
7	Result Phase II and Validate Modules	4	L1,L2,L3,L4, L5
8	Report Writing	4	L1,L2,L3
	Total Hours	**30**	

T.E. Semester –V
Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS- HME 2020)
TCET Autonomy Scheme (w.e.f. A.Y. 2020-21)

B.E. (Computer Engineering)								**T.E. SEM: V**		
Course Name: Professional Elective 1(Advance Database management system)								**Course Code:** PEC-CS5013		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**					
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**					
Hours Per Week					**Theory (100)**			**Practical/Oral (25)**	**Term Work (25)**	**Total**
					40/20 IA		**60/30**			
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**ISE**	**IE**	**ESE**	**PR/OR**	**TW**	
3	-	2@	5	4	20	20	60	25	25	**150**

IA: In-Semester Assessment - Paper Duration – 1.5 Hours
ESE: End Semester Examination - Paper Duration - 3 Hours
The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)

Prerequisite: Basics of Database

Course Objective: The objective of the course is to study various Advanced Database concepts like Query Processing, Database Security and to study various Advanced Databases like Distributed Databases, Document Oriented Databases, Temporal, Spatial, Multimedia and Mobile Databases.

Course Outcomes: **Upon completion of the course students will be able to:**

SN	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Apply appropriate security techniques database systems	L1, L2, L3
2	Apply Query Optimization and Measure Query cost	L1, L2, L3
3	Describe the concepts of Distributed Database Basics	L1, L2
4	Analyze Distributed database for better resource management.	L1, L2, L3, L4
5	Demonstrate the understanding of the concepts of Document Oriented Databases.	L1, L2, L3, L4
6	Discuss Advanced data models for real life applications	L1, L2

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Data Security** Introduction to Database Security Issues; authorization, Discretionary Access Control Based on Granting and Revoking Privileges, Mandatory Access Control and Role-Based. **Access Control for Multilevel Security** ● SQL Injection ● Introduction to Statistical Database Security, Introduction to Flow Control	6	L1, L2, L3
2	**Query processing and Optimization** Overview, Measures of Query cost, Selection operation, Sorting, Join Operations, and other Operations	7	L1, L2, L3
3	**Overview of Distributed Database System** Features and Design Issues of Distributed Databases, Types of Distributed Databases, Distributed Database Architectures.	6	L1, L2
4	**Distributed Database Design, Transaction, Concurrency and Recovery** Data Fragmentation, Replication, Allocation Techniques in Distributed Databases, Transparencies for Distributed Database Design, Distributed Transaction Management in Distributed Databases, Distributed Concurrency Control (locking), Recovery in Distributed Databases {2PC/3PC) and Deadlock management.	10	L1, L2, L3, L4
5	**Data Security** Introduction to Database Security Issues; authorization, Discretionary Access Control Based on Granting and Revoking Privileges, Mandatory Access Control and Role-Based, Access Control for Multilevel Security, SQL Injection, Introduction to Statistical Database Security Introduction to Flow Control	10	L1, L2, L3,L4
6	**Advanced Data Models** **Temporal data models**:- Aspects of valid time , Bi-temporal time and bi-temporal time with examples of each. **Spatial model** :- Types of spatial data models - Raster, Vector and Image **Mobile databases, Multimedia databases.**	6	L1, L2
	Total Hours	**45**	

Books and References:

	Title	Authors	Publisher	Edition	Year
1	Fundamentals of Database Systems	Elmasri & Navathe	PEARSON Education.	Seventh Edition	2016
2	Database systems concepts	Korth, Silberschatzsudarshan	McGraw Hill	Seventh Edition	2016
3	Database Management System	Raghu Ramkrishnan & Johannes Gehrke	Tata McGraw-Hill Edition.	Third Edition	--
4	Learning MySQL and Mariadb	Ruosell J.T. Dyer	O'Reilly	--	--

Online Resources:

S. No.	Website Name	URL	Modules Covered
1	www.techotopia.com	https://www.techotopia.com/index.php/Mandatory,_Discretionary,_Role_and_Rule_Based_Access_Control	M1
2	www.geeksforgeeks.org	https://www.geeksforgeeks.org/sql-query-processing/	M2
3	www.tutorialspoint.com	https://www.tutorialspoint.com/distributed_dbms/distributed_dbms_databases.htm	M3-M6

Mini Project Hours Distribution

Sr. No	Work to be done	No. of Hours	Cognitive levels of attainment as per Bloom's Taxonomy
1	Identification and Study of Advanced Database	8	L1,L2
2	Project Title Identification	2	L1,L2
3	Graphical User Interface Design	2	L1,L2,L3
4	Database Design	2	L1,L2,L3
5	Linking of GUI with Advanced Database	8	L1,L2,L3
6	Testing of Mini Project	2	L1,L2, L3
7	Preparation of Report	6	L1,L2
	Total Hours	**30**	

T.E. Semester –V

Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS- HME 2020)

TCET Autonomy Scheme (w.e.f. A.Y. 2020-21)

<table>
<tr><td colspan="5">B.E. (Computer Engineering)</td><td colspan="6">T.E. SEM: V</td></tr>
<tr><td colspan="5">Course Name: Professional Elective 1(Multimedia Systems)</td><td colspan="6">Course Code: PEC-CS5014</td></tr>
<tr><td colspan="5">Teaching Scheme (Program Specific)</td><td colspan="6">Examination Scheme (Formative/ Summative)</td></tr>
<tr><td colspan="5">Modes of Teaching / Learning / Weightage</td><td colspan="6">Modes of Continuous Assessment / Evaluation</td></tr>
<tr><td colspan="5" rowspan="3">Hours Per Week</td><td colspan="3">Theory (100)</td><td rowspan="3">Practical/Oral (25)</td><td rowspan="3">Term Work (25)</td><td rowspan="3">Total</td></tr>
<tr><td colspan="2">40/20</td><td>60/30</td></tr>
<tr><td colspan="2">IA</td><td></td></tr>
<tr><td>Theory</td><td>Tutorial</td><td>Practical</td><td>Contact Hours</td><td>Credits</td><td>ISE</td><td>IE</td><td>ESE</td><td>PR/OR</td><td>TW</td><td rowspan="2">150</td></tr>
<tr><td>3</td><td>-</td><td>2@</td><td>5</td><td>4</td><td>20</td><td>20</td><td>60</td><td>25</td><td>25</td></tr>
<tr><td colspan="11">IA: In-Semester Assessment - Paper Duration – 1.5 Hours
ESE: End Semester Examination - Paper Duration - 3 Hours
The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)</td></tr>
<tr><td colspan="11">Prerequisite: Computer Fundaments and Graphics</td></tr>
</table>

Course Objective: The course should be able to introduce students about basic fundamentals and key aspects of Multimedia system, provide knowledge of compression techniques of different multimedia components, students to understand multimedia communication standards along with technology environment & provide an opportunity to gain hands-on experience in building multimedia applications.

Course Outcomes: **Upon completion of the course students will be able to**

SN	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	To identify basics of multimedia and multimedia system architecture.	L1, L2, L3
2	To understand different multimedia components	L1, L2
3	To explain file formats for different multimedia components.	L1, L2, L3, L4
4	To analyze the different compression algorithms.	L1, L2, L3, L4
5	To describe various multimedia communication techniques.	L1, L2, L3
6	To apply different security techniques in multimedia environment.	L1, L2, L3, L4

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Multimedia System: An Introduction** Multimedia Elements, Multimedia Applications, Multimedia System Architecture, Evolving Technologies for Multimedia Systems, Defining Objects for Multimedia Systems, Multimedia Data Interface Standards, The need for Data Compression, Multimedia Database	8	L1, L2, L3
2	**Compression & Decompression And Data File format Standards** Types of Compression, Binary Image Compression Schemes Color, Gray Scale and Still Video Image Compression, Video Image Compression, Audio Compression, Rich Text Format, TIFF File Format, Resource Interchange File Format (RIFF), MIDI File Format JPEG DIB File Format for Still and Motion Image, AVI File Format, MPEG Standards, Differentiate between JPEG & MPEG Techniques	9	L1, L2
3	**Multimedia Input/output technologies& Storage Retrieval Technologies** Key Technologies Issues, Pen Input, Video and Image Display Systems, video comparison technique, Print output Technologies, Image Scanners ,Digital Camera, Video Images and Animation, Full-Motion Video, Magnetic Media Technology,Optical Media , Hierarchical Storage Management , Cache Management For Storage Systems, Image Stacking	9	L1, L2, L3, L4
4	**Architectural & Telecommunications Considerations And Multimedia Application Design** General Purpose Architecture for Multimedia Support: Introduction to Multimedia PC/Workstation Architecture, Characteristics of MMX instruction set, I/O systems: Overview of USB port and IEEE 1394 interface, Operating System Support for Multimedia ,Specialized Computational Processors, Memory Systems, Distributed Objects Models, Multimedia Applications Classes, Types of Multimedia System, Virtual Reality Design, Components of Multimedia Systems, Distributed Application Design Issues	9	L1, L2, L3, L4
5	**Multimedia Authoring & User Interface And Hypermedia Messaging** Multimedia Authoring System, Hypermedia Application Design Considerations, User Interface Design, Mobile Messaging, Hypermedia, Message Components, Hypermedia Linking and Embedding, Creating Hypermedia Messages, Hyper multimedia message standards, different types of hyper media, Hyper Media Application's	6	L1, L2, L3
6	**Distributed Multimedia Systems** Components of a Distributed Multimedia System, architecture of DMS,distributed Client-Server Operations , fault tolerant distributed, digital media fundamentals, Multimedia Object Servers, Multi-server Network Topologies, Distributed Multimedia Databases	4	L1, L2, L3, L4
Total Hours		**45**	

Books and Reference:

SN	Title	Authors	Publisher	Edition	Year
1	Multimedia Systems Design	Prabhat K Angleigh& Kiran Thakrar	PHI	1st	2005
2	Multimedia Communication Systems: Techniques, Standards & Networks	K. R. Rao, Zoran S. Bojkovic&Dragorad A. Milovanovic	TMH	1th	2010
3	Multimedia Systems	K. Buford	PHI	3rd	2012
4	Fundamentals of Multimedia	Ze-Nian Li & Mark S. Drew	PHI	2nd	2011
5	Multimedia Computing Communications & Applications,	Ralf Steinmetz & Klara Nahrstedt,	Pearson	1st	2012

Online Resources:

S. No.	Website Name	URL	Modules Covered
1	www.springer.com	https://www.springer.com/gp/book/9783540408673	M1-M6
2	https://books.google.co.in/	https://books.google.co.in/books?id=34Uuim67mvUC&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false	M1-M6

Mini Project Hours Distribution

Sr. No	Work to be done	No. of Hours	Cognitive levels of attainment as per Bloom's Taxonomy
1	Study tool for implementation	2	L1,L2
2	Project Title and Course Identification	2	L1,L2
3	Choose File Format and Compression techniques	4	L1,L2
4	Perform task related to compression or Authoring tool	2	L1,L2,L3
5	Select Authoring tool	4	L1,L2,L3
6	Design the project using Authoring Tool	2	L1,L2
7	Design and implement the Authoring System.	4	L1,L2,L3,L4
8	Design a project in Authoring system	2	L1,L2,L3,L4
9	Test and Evaluate Model designed in Authoring tool.	4	L1,L2,L3,L4,L5
10	Prepare report	4	L1,L2
	Total Hours	**30**	

T.E. Semester –V

Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS- HME 2020)

TCET Autonomy Scheme (w.e.f. A.Y. 2020-21)

<table>
<tr><th colspan="8">B.E. (Computer Engineering)</th><th colspan="4">T.E. SEM: V</th></tr>
<tr><td colspan="8">Course Name :Machine Learning</td><td colspan="4">Course Code : PEC-CS5015</td></tr>
<tr><th colspan="5">Teaching Scheme (Program Specific)</th><th colspan="7">Examination Scheme (Formative/ Summative)</th></tr>
<tr><th colspan="5">Modes of Teaching / Learning / Weightage</th><th colspan="7">Modes of Continuous Assessment / Evaluation</th></tr>
<tr><th colspan="5" rowspan="3">Hours Per Week</th><th colspan="3">Theory (100)</th><th rowspan="3">Practical/Oral (25)</th><th rowspan="3">Term Work (25)</th><th rowspan="3">Total</th></tr>
<tr><th colspan="2">40/20</th><th>60/30</th></tr>
<tr><th colspan="2">IA</th><th></th></tr>
<tr><th>Theory</th><th>Tutorial</th><th>Practical</th><th>Contact Hours</th><th>Credits</th><th>ISE</th><th>IE</th><th>ESE</th><th>PR/OR</th><th>TW</th><th rowspan="2">150</th></tr>
<tr><td>3</td><td>-</td><td>2@</td><td>5</td><td>4</td><td>20</td><td>20</td><td>60</td><td>25</td><td>25</td></tr>
<tr><td colspan="11">IA: In-Semester Assessment - Paper Duration – 1.5 Hour
ESE: End Semester Examination - Paper Duration - 3 Hours
The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)</td></tr>
<tr><td colspan="11">Prerequisite: Linear Algebra, Calculus, Probability, Statistics</td></tr>
</table>

Course Objective: The course should be able to introduce Machine Learning techniques and become familiar with its types.

Course Outcomes: **Upon completion of the course students will be able to**

SN	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Understand basics of ML	L1, L2
2	Apply preprocessing techniques	L1, L2, L3
3	Apply regression for learning and assess the outcome	L1, L2, L3, L4
4	Apply classification for learning and assess the outcome	L1, L2, L3, L4
5	Apply optimization techniques for performance enhancement	L1, L2, L3, L4
6	Apply unsupervised and reinforcement learning concepts and assess the outcome	L1, L2, L3, L4

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Introduction to Machine Learning** Machine Learning terminology, Types of Machine Learning, Issues in Machine Learning, Application of Machine Learning, Steps in developing ML application, How to choose the right algorithm	6	L1, L2
2	**Data Preparation** Data Cleaning (missing value, outlier), Feature Engineering (Data Transformation (encoding, skew, scale), Feature selection (Filter, Embedded, Wrapper))	10	L1, L2, L3
3	**Supervised Learning with Regression** Simple Linear, Multiple Linear, Polynomial, Regularization, Evaluation metric , Use case	5	L1, L2, L3, L4
4	**Supervised Learning with Classification** k Nearest Neighbor, Logistic Regression, Linear SVM, Kernels, Decision Tree (CART), Issues in DT learning, Ensembles (Bagging – Random Forest, Boosting – Gradient Boost, Stacking), Evaluation metric, Use case	12	L1, L2, L3, L4
5	**Optimization Techniques** Model Selection techniques (Cross Validation), Grid Search method, Model Evaluation technique (Bias, Variance), Learning Curve, Validation Curve	6	L1, L2, L3, L4
6	**Unsupervised Learning with clustering and Reinforcement Learning** k Means algorithm, Dimensionality Reduction, Use case Elements of Reinforcement Learning, Temporal Difference Learning, Online Learning, Use case	6	L1, L2, L3, L4
	Total Hours	**45**	

Books and Reference:

SN	Title	Authors	Publisher	Edition	Year
1	Machine Learning In Action	Peter Harrington	DreamTech Press	1st	2012
2	Introduction to Machine Learning	Ethem Alpaydın	MIT Press	4th	2020
3	Machine Learning	Tom M. Mitchell	McGraw Hill	Indian	1997
4	Machine Learning An Algorithmic Perspective	Stephen Marsland	CRC Press	2nd	2011
5	Machine Learning — A Probabilistic Perspective	Kevin P. Murphy	MIT Press	1st	2012
6	Pattern Recognition and Machine Learning	Christopher M. Bishop	Springer	1st	2006
7	Elements of Statistical Learning	Trevor Hastie, Robert Tibshirani, Jerome Friedman	Springer	2nd	2017

Online Resources:

S. No.	Website Name	URL	Modules Covered
1	www.analyticvidhya.com	https://www.analyticsvidhya.com/%20machine%20learning/	M1-M6
2	www.towardsdatascience.com	https://towardsdatascience.com/machine-learning/home	M1-M6
3	www.coursera.org	https://www.coursera.org/learn/machine-learning/home/welcome	M1-M6

Mini Project Hours Distribution

Sr. No	Work to be done	No. of Hours	Cognitive levels of attainment as per Bloom's Taxonomy
1	Study tool for implementation	2	L1,L2
2	Project Title and Course Identification	2	L1,L2
3	Choose Data	2	L1,L2
4	Perform EDA	2	L1,L2,L3
5	Perform Feature Engineering	2	L1,L2,L3
6	Chose Model	2	L1,L2
7	Train and Validate Model	2	L1,L2,L3,L4
8	Tune Hyper parameters	2	L1,L2,L3,L4
9	Test and Evaluate Model	2	L1,L2,L3,L4,L5
10	Prepare report and present	2	L1,L2
	Total Hours	**30**	

T.E. Semester –V
Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS- HME 2020)
TCET Autonomy Scheme (w.e.f. A.Y. 2020-21)

B.E. (Computer Engineering)									**T.E. SEM: V**
Course Name Indian Constitution									**Course Code:** MC-CS501
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	**25**
1	-	-	1	(Non-Credit)	Passing is mandatory for this course	-	-	25	
Prerequisite: -									

Course Objectives: To understand fundamental of Indian constitutional system, Union structure, Judiciary Structure with hierarchy and it function

Course Outcomes: **Upon completion of the course students will be able to:**

SN	Course Objectives	Cognitive levels of attainment as per Bloom's Taxonomy
1	Understand the rights and duties of Individual and government	L1, L2
2	To understand the government structure and hierarchy	L1, L2
3	To understand right of Indian who residing in India or outside India and understand citizenship law	L1, L2
4	To understand and apply the personal, social and economic rights to citizens of India	L1, L2, L3
5	To analyze the functions and powers of state and its limbs i.e. Legislature, Executive.	L1, L2, L3, L4
6	Understand the structure and modalities of state i.e. legislature, executive and judiciary	L1, L2, L3, L4

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Introduction** Constitution' meaning of the term,, Indian Constitution: Sources and constitutional history, Features: Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy	2	L1, L2
2	**Union Government and its Administration** Structure of the Indian Union: Federalism, Centre- State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha	2	L1, L2
3	**Citizenship** Citizenship at the commencement of the Constitution ,Rights of citizenship of certain persons who have migrated to India from Pakistan, Rights of citizenship of certain migrants to Pakistan , Rights of citizenship of certain persons of Indian origin residing outside India , Persons voluntarily acquiring citizenship of a foreign State not to be citizens, Continuance of the rights of citizenship, Parliament to regulate the right of citizenship by law .	3	L1, L2
4	**Fundamental Rights** Definition , Laws inconsistent with or in derogation of the fundamental rights, Right to equality, Right to freedom, Right against exploitation, Right to freedom of religion, Cultural and educational Right , Right to constitution Remedies.	2	L1, L2, L3
5	**The Union** Executive(President & Vice President) ,General (office of Parliament), Conduct of Business	3	L1, L2, L3, L4
6	**The Union Judiciary** Establishment and constitution of Supreme Court Salaries	3	L1, L2, L3, L4
	Total Hours	**15**	

Books and References:

S. No.	Title	Authors	Publisher	Edition	Year
1	The Constitution of India	Bare Act	Government of India	NA	2020
2	Introduction to the Constitution of India	D.D. Basu	Lexis Nexis	24th Edition	2019
3	Indian Constitutional Law	M.P Jain	Lexis Nexis	8th Edition	2018

T.E. Semester –V

Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS- HME 2020)

TCET Autonomy Scheme (w.e.f. A.Y. 2020-21)

<table>
<tr><td colspan="6">B.E.(Computer Engineering)</td><td colspan="3">SEM: VI</td></tr>
<tr><td colspan="6">Course Name: Summer Internship</td><td colspan="3">Course Code: SI-CS501</td></tr>
<tr><td colspan="5">Teaching Scheme (Program Specific)</td><td colspan="4">Examination Scheme (Formative/ Summative)</td></tr>
<tr><td colspan="5">Modes of Teaching / Learning / Weightage</td><td colspan="4">Modes of Continuous Assessment / Evaluation</td></tr>
<tr><td colspan="5">Total Hours : Maximum 2 Weeks (60 to 80 Hours during summer vacation)</td><td></td><td></td><td>TW</td><td>Total</td></tr>
<tr><td>Theory</td><td>Tutorial</td><td>Practical</td><td>Contact Hours</td><td>Credits</td><td rowspan="2">-</td><td rowspan="2">-</td><td rowspan="2">-</td><td rowspan="2">-</td></tr>
<tr><td>-</td><td>-</td><td>-</td><td>160 *</td><td>4*</td></tr>
<tr><td colspan="9">Note :
1. Internship will be done in institute laboratory in collaboration with industries.
2. Evaluation and assessment will be done as per AICTE guidelines.</td></tr>
<tr><td colspan="9">Prerequisite: Fundamental knowledge of respective programmes</td></tr>
</table>

Course Objectives:

To get industry like exposure in the institute laboratories by carrying out activities / projects. Also design innovative techniques / methods to develop the products.

Course Outcomes: **Upon completion of the course students will be able to:**

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Apply subjects knowledge in the college laboratories for carrying out projects	L3, L4,L5
2	Developed innovative techniques / methods to develop the products	L3, L4,L5
3	Contribute for the society	L3, L4,L5

Detailed Syllabus:

Module No.	Topics	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Program Specific Internship** • Training and certification on emerging technologies in domains offered by Department of Computer Engineering • Applying classroom and laboratory knowledge to design , develop and deploy the products	L3, L4,L5
2	**Inter disciplinary Internship** • To explore and understand issues and challenges in the other disciplines (EXTC, ELEX, MECH and CIVIL) • Design , develop and deploy cost effective products using multidisciplinary approach	L3, L4,L5
3	**Industry Specific Internship** • To explore and understand issues and challenges in industry • Developing solutions for industry specific problems • Design , develop and deploy products for startup and SMEs	L3, L4,L5
4	**Interpersonal Internship** • To develop interpersonal skills such as leadership, marketing ,publicity and corporate ethics and communication • To get competence in problem solving , presentation , negotiation skills	L3, L4,L5
5	**Social Internship** • Identify and study different real life issues in the society • Identify societal problems and provide engineering solutions to solve these problems	L3, L4,L5
6	**Academic Internship** • Study report preparation, preparation of presentations, copy table book preparation , business proposal and IPR • Capture aspirations & expectations through interviews of students. • Ways to connect research in technical institutes with industry. • Taking inputs from self, local stakeholders and global stake holders which will help to develop process with comparative and competitive study.	L3, L4,L5

Books and References:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	The Ultimate Guide to Internships: 100 Steps to Get a Great Internship and Thrive in It (Ultimate Guides)	Eric Woodard	Allworth	I	2015

Online References:

Sr. No.	Website Name	URL	Modules Covered
1	https://www.letsintern.com/	https://www.letsintern.com/internships/summer-internships	M1-M6
1	https://codegnan.com	https://codegnan.com/blog/benefits-of-internships-and-importance	M1-M6
2	https://www.honorsociety.org	https://www.honorsociety.org/articles?category=internships	M1-M6

T.E. Semester –V
Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS- HME 2020)
TCET Autonomy Scheme (w.e.f. A.Y. 2020-21)

<table>
<tr><td colspan="6">B.E. (Computer Engineering)</td><td colspan="3">T.E. SEM: V</td></tr>
<tr><td colspan="6">Course Name Professional Skill V (Web Development)</td><td colspan="3">Course Code: HSD-CSPS501</td></tr>
<tr><td colspan="5">Teaching Scheme (Program Specific)</td><td colspan="4">Examination Scheme (Formative/ Summative)</td></tr>
<tr><td colspan="5">Modes of Teaching / Learning / Weightage</td><td colspan="4">Modes of Continuous Assessment / Evaluation</td></tr>
<tr><td colspan="5">Conducted in the beginning of Semester during first 3 Weeks</td><td>Presentation</td><td colspan="2">Report</td><td>Total</td></tr>
<tr><td>Theory</td><td>Tutorial</td><td>Practical</td><td>Contact Hours</td><td>Credits</td><td>AC</td><td colspan="2">AC</td><td rowspan="2">75</td></tr>
<tr><td>15</td><td>-</td><td>30</td><td>45</td><td>2</td><td>50</td><td colspan="2">25</td></tr>
<tr><td colspan="9">AC- Activity evaluation
The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance/Learning Attitude (20%)</td></tr>
<tr><td colspan="9">Prerequisite: Computer Basics, Java</td></tr>
</table>

Course Objectives: By the end of the course students will be able to design and implement static and dynamic websites.

Course Outcomes: **Upon completion of the course students will be able to**

S.N.	Course Outcomes	Cognitive level attainment as per revised Bloom's Taxonomy
1	Understand different components in web technology and to know about web servers.	L1, L2
2	Develop an interactive Web pages using HTML/XHTML.	L1, L2, L3, L4
3	Present a professional document using Cascaded Style Sheets.	L1, L2, L3, L4
4	Construct websites for user interactions using JavaScript and JQuery.	L1, L2, L3, L4, L5
5	Know the different information interchange formats like XML and JSON.	L1, L2, L3, L4
6	Develop Web applications using PHP.	L1, L2, L3, L4, L5

Detailed Syllabus:

Module No.	Topics	Cognitive level attainment as per revised Bloom's Taxonomy
1	**Introduction to the Internet** The World Wide Web, Web Browsers, Uniform Resource Locators, WWW Architecture – SMTP – POP3 – File Transfer Protocol The Hypertext Transfer Protocol, HTTP request – response — Generation of dynamic web pages- W3C Validator, How web works - Setting up the environment (LAMP/XAMP/WAMP server)	L1, L2
2	**HTML/XHTML** Basics of HTML, formatting and fonts, commenting code, color, hyperlink, lists, tables Images, forms, XHTML, Meta tags, Character entities, frames and frame sets, Browser architecture and Web site structure. Overview and features of HTML5, Syntactic Differences between HTML and XHTML	L1, L2, L3, L4
3	**Introduction to Cascading Style Sheets** Cascading Style Sheets: Levels of Style Sheets - Style Specification Formats, Selector Forms, Property-Value Forms, Font Properties, List Properties, Alignment of Text, Color, The Box Model, Background Images, The span and div Tags.	L1, L2, L3, L4
4	**Introduction to JavaScript** Introduction: client-side scripting-First program: Displaying a Line of Text-JavaScript Alert-Dynamic Page-Web Application-Variables in JavaScript-Data Types in JavaScript-Operators and Expressions-Simple If Statement- If Else Statement- Nested If Else Statement-Switch Case-For Loop-While Loop-Functions-Events-Arrays-Objects –Math and Date in JavaScript-Redirect to Another HTML Page	L1, L2, L3, L4, L5
5	**Introduction to Data Interchange Formats** XML: The Syntax of XML, XML Document Structure, Namespaces, XML Schemas, Displaying Raw XML Documents, Displaying XML Documents with CSS, XSLT Style Sheets, XML Applications. JSON(Basics Only): Overview, Syntax, Datatypes, Objects, Schema, Comparison with XML	L1, L2, L3, L4
6	**Introduction to PHP and MySQL** Basic commands with PHP examples, Connection to server, creating database, selecting a database, listing database, listing table names, creating a table, inserting data, altering tables, queries, deleting database, deleting data and tables, PHP myadmin and database bugs	L1, L2, L3, L4, L5

Books and References:

SN	Title	Authors	Publisher	Edition	Year
1	Internet &World Wide Web How to Program	P. J. Deitel, H.M. Deitel	Pearson education	4th Edition,	2010
2	Programming the World Wide Web	Robert W Sebesta	Pearson education	7th Edition,	2014
3	HTML 5	DT Editorial services	Dreamtech Press	2nd Edition	2016
4	Web Technologies Black Book	Kogent Learning Solutions	Dreamtech Press	2nd Edition	2016

Online References:

S. No.	Website Name	URL	Modules Covered
1	W3schools	https://www.w3schools.com	M1-M6
2	Tutorialspoint	https://www.tutorialspoint.com	M1-M6
3	Javatpoint	https://www.javatpoint.com	M1-M6

List of Practical/ Experiments:

Practical Number	Type of Experiment	Practical/ Experiment Topic	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	Basic Experiments	Explain Installation steps to LAMP / WAMP / XAMP.	2	L1
2		Sketch Simple web page using HTML5	2	L1, L2
3	Design Experiments	Develop web page using CSS3 and HTML5.	2	L1, L2, L3
4		Develop a Javascript web page illustrating functions and events	2	L1, L2, L3
5		Develop simple web page using PHP functions.	2	L1, L2, L3
6		Develop XML web page using DTD, XSL.	2	
7	Advanced Experiments	Develop a login page using PHP.	4	L1, L2, L3
8		Develop interactive web pages using PHP with database connectivity MYSQL.	4	L1, L2, L3
9	Mini/Minor Projects/ Seminar/	1. Online Second-hand Book Buying & Selling Portal 2. College E Print Service Management 3. Online Pizza Ordering System	6	L1, L2, L3
10	Case Studies/ Group Presentation	1. Study on MYSQL database 2. Study on different built-in methods of JavaScript 3. Comparative study on Angular JS and Node JS	4	L1, L2, L3
	Total Hours		**30**	

T.E. Semester –V

Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS- HME 2020)TCET Autonomy Scheme (w.e.f. A.Y. 2020-21)

<table>
<tr><td colspan="5">B.E. (Computer Engineering)</td><td colspan="3">T.E. SEM: V</td></tr>
<tr><td colspan="5">Course Name Project Based Learning - III</td><td colspan="3">Course Code: HSD-CSPBL501</td></tr>
<tr><td colspan="5">Teaching Scheme (Program Specific)</td><td colspan="3">Examination Scheme (Formative/ Summative)</td></tr>
<tr><td colspan="5">Modes of Teaching / Learning / Weightage</td><td colspan="3">Modes of Continuous Assessment / Evaluation</td></tr>
<tr><td colspan="5">Conducted in the beginning of Semester during first 3 Weeks</td><td>Presentation</td><td>Report</td><td rowspan="2">Total</td></tr>
<tr><td>Theory</td><td>Tutorial</td><td>Practical</td><td>Contact Hours</td><td>Credits</td><td>AC</td><td>AC</td></tr>
<tr><td>-</td><td>-</td><td>30</td><td>30</td><td>1</td><td>25</td><td>-</td><td>25</td></tr>
<tr><td colspan="8">AC- Activity evaluation
The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance/Learning Attitude (20%)</td></tr>
<tr><td colspan="8">Prerequisite: Computer Fundamentals and Knowledge of Programming Languages</td></tr>
</table>

Course Objective: The Course intends to aid students identify real world problems and apply computing fundamental and technical skill to find solutions to them.

Course Outcomes: **Upon completion of the course students will be able to:**

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Interpret the basic real time problems.	L1, L2
2	Apply appropriate technologies and programming constructs to solve problems.	L1, L2, L3
3	Inspect the results obtained for documentation and presentation.	L1, L2, L3, L4

Projects Listing:

Sr. No.	Title of Project	Type of Project
1	Implementing Online School Administration System	Application
2	Implementing Employee Transport Management System	Application
3	Implementing Online Course and Examination System	Application
4	Implementation of Online Secondhand Book Buying and Selling Portal	Application
5	Implementing Online Logistics Chatbot System	Application
6	Implementation of Online Newspaper Delivery Management System	Application
7	Design Online Health Shopping Portal with Product Recommendation	Core
8	Design Web-based Chat Application with webcam using PHP	Core
9	Design Internet based Discussion Forum	Core
10	Develop Customer targeted E-Commerce	Core

T.E. Semester –V

Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS- HME 2020)TCET Autonomy Scheme (w.e.f. A.Y. 2020-21)

B.E. (Computer Engineering)							**T.E. SEM: V**
Course Name Research Based Learning-I							**Course Code:** HSD-CSRBL501
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**		
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**		
Conducted in the beginning of Semester during first 3 Weeks					**Presentation**	**Report**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**AC**	**AC**	**50**
-	-	30	30	1	25	25	
AC- Activity evaluation							
Prerequisite: Mathematical Foundation, Computing Methods							

Course Objectives: This course is focused to engage the learner in research by upgrading domain knowledge by participation in technical quiz and debate, critical thinking, innovative idea generation and technical writing.

Course Outcomes: **Upon completion of the course students will be able to:**

S.N.	Course Outcome	Cognitive level attainment as per revised Bloom Taxonomy
1	Upgrade the knowledge of latest technologies in their discipline in a competitive environment.	L1, L2
2	Create new idea for problem solving related to industry or societal issues.	L1, L2, L3
3	Understand research methodologies.	L1, L2, L3, L4
4	Students will be able to write a technical paper.	L1, L2, L3, L4, L5

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive level attainment as per revised Bloom Taxonomy
1	**Technical Quiz and Technical Debate** I. Quiz competition on technical topics from different domains with 50 MCQ (Questions will vary according to department). II. Formation of 8 teams for four topics. 2 teams (For and Against) for topic I will debate first and the other teams will be audience.	8	L1, L2
2	**Idea generation with design thinking aspects and related literature survey** I. Introduction to design thinking and its stages. II. Formation of groups, generation of an idea and conducting literature survey.	7	L1, L2, L3
3	**Proof of concept and validation of idea through survey** **Seminar on Research methodology** I. Validate the idea by conducting the survey (through Google docs, interviews or any other suitable method). II. Seminar on different research methods and procedures for 8designing and conducting scientific research.	8	L1, L2, L3,L4
4	**Paper writing skills (Seminar/workshop)** **Documentation of Selected Idea and its validation** I. Seminar or workshop on paper writing skills. II. Write a research paper on idea generated.	7	L1, L2, L3,L4,L5
	Total Hours	**30**	

References:

Sr. No.	Title	Authors	Publisher	Edition	Year
1.	Writing Research Papers: A Complete Guide	James D. Lester	Longman	10th	2001
2.	Creativity in Product Innovation	Jacob Goldenberg	Cambridge University Press	Kindle	2002

Online References:

Sr. No.	Website Name	URL	Modules Covered
1.	https://www.geeksforgeeks.org	https://www.geeksforgeeks.org/tag/c-quiz-references/	M1
2.	Interaction Design Foundation: Design Thinking	https://www.interaction-design.org/literature/topics/design-thinking	M2
3.	Scribbr: How to write a research methodology.	https://www.scribbr.com/dissertation/methodology/	M3
4.	https://www.statpac.com	https://www.statpac.com/online-software-manual/Basic-Research-Concepts.htm	M4
5.	https://www.slideshare.net	https://www.slideshare.net/AsirJohnSamuel/1introduction-to-research-methodology?next_slideshow=1	M4

T.E. Semester –VI

Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS- HME 2020)TCET Autonomy Scheme (w.e.f. A.Y. 2020-21)

<table>
<tr><td colspan="8">B.E. (Computer Engineering)</td><td colspan="3">T.E. SEM: VI</td></tr>
<tr><td colspan="8">Course Name : Cryptography & System Security</td><td colspan="3">Course Code : PCC-CS601</td></tr>
<tr><td colspan="5">Teaching Scheme (Program Specific)</td><td colspan="6">Examination Scheme (Formative/ Summative)</td></tr>
<tr><td colspan="5">Modes of Teaching / Learning / Weightage</td><td colspan="6">Modes of Continuous Assessment / Evaluation</td></tr>
<tr><td colspan="5" rowspan="3">Hours Per Week</td><td colspan="3">Theory (100)</td><td rowspan="3">Practical/Oral (25)</td><td rowspan="3">Term Work (25)</td><td rowspan="3">Total</td></tr>
<tr><td colspan="2">40/20</td><td>60/30</td></tr>
<tr><td colspan="2">IA</td><td></td></tr>
<tr><td>Theory</td><td>Tutorial</td><td>Practical</td><td>Contact Hours</td><td>Credits</td><td>ISE</td><td>IE</td><td>ESE</td><td>PR/OR</td><td>TW</td><td rowspan="2">150</td></tr>
<tr><td>3</td><td>1</td><td>2</td><td>6</td><td>5</td><td>20</td><td>20</td><td>60</td><td>25</td><td>25</td></tr>
<tr><td colspan="11">IA: In-Semester Assessment - Paper Duration – 1.5 Hour
ESE: End Semester Examination - Paper Duration - 3 Hours
The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)</td></tr>
<tr><td colspan="11">Prerequisite: Computer Networks</td></tr>
</table>

Course Objectives: The objective of the course is to introduce classical encryption techniques to explore the working principles and utilities of various cryptographic algorithms, the design issues of various authentication protocols and to build programs for secure communication.

Course Outcomes: **Upon completion of the course students will be able to:**

SN	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Illustrating various system security goals and concepts, classical encryption techniques and acquire fundamental knowledge on the concepts of modular arithmetic and number theory.	L1, L2, L3, L4
2	Illustrate and apply different encryption and decryption techniques to solve problems related to confidentiality and authentication	L1, L2, L3, L4
3	Evaluate the knowledge of cryptographic checksums and performance of different message digest algorithms for verifying the integrity of varying message sizes.	L1, L2, L3, L4
4	Analyze different digital signature algorithms to achieve authentication and design secure applications	L1, L2, L3, L4
5	Analyze different attacks on networks and evaluate the performance of firewalls and security protocols like SSL, IPSec, and PGP.	L1, L2, L3, L4
6	Analyze and apply system security concept to recognize malicious code.	L1, L2, L3, L4

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Introduction & Number Theory** Security Goals, Services, Mechanisms and attacks, Classical Encryption techniques, Symmetric cipher model, mono-alphabetic and polyalphabetic substitution techniques: Vigenere cipher, Playfair cipher, transpositiontechniques: keyed and keyless transposition ciphers, steganography. Modular Arithmetic and Number Theory, Euclid's algorithm-–Prime numbers-Fermat's and Euler's theorem	8	L1, L2, L3, L4
2	**Symmetric and Asymmetric key Cryptography and key Management** Block cipher principles, block cipher modes of operation, DES, Double DES, Triple DES, Advanced Encryption Standard (AES), Stream Ciphers: RC5 algorithm. Public key cryptography: Principles of public key cryptosystems-The RSA algorithm, The knapsack algorithm, Diffie Hellman Key exchange algorithm.	11	L1, L2, L3, L4
3	**Hashes, Message Digests and Digital Certificates** Cryptographic hash functions, Properties of secure hash function, MD5, SHA-1, MAC, HMAC, and CMAC. Digital Certificate: X.509, PKI	4	L1, L2, L3, L4
4	**Authentication Protocols & Digital signature schemes** User Authentication and Entity Authentication, One-way and mutual authentication schemes, Needham Schroeder Authentication protocol, Kerberos Authentication protocol. Digital Signature Schemes – RSA schemes.	6	L1, L2, L3, L4
5	**Network Security and Applications** Network security basics: TCP/IP vulnerabilities (Layer wise), Packet Sniffing, ARP spoofing, port scanning, IP spoofing, TCP syn flood, DNS Spoofing. Denial of Service: Classic DOS attacks, Source Address spoofing, ICMP flood, SYN flood, UDP flood, Distributed Denial of Service, Defenses against Denial of Service Attacks. Internet Security Protocols: SSL, IPSEC, Secure Email: PGP, Firewalls, IDS and types, Honey pots	10	L1, L2, L3, L4
6	**System Security** Software Vulnerabilities: Buffer Overflow, Format string, cross-site scripting, SQL injection, Malware: Viruses, Worms, Trojans, Logic Bomb, Bots, Rootkits.	6	L1, L2, L3, L4
	Total Hours	**45**	

Books and References:

SN	Title	Authors	Publisher	Edition	Year
1	Cryptography and Network Security, Principles and Practice	William Stallings,	Pearson Education,	Sixth Edition	2013
2	Cryptography & Network Security	Behrouz A. Ferouzan,	Tata Mc Graw Hill	Third Edition	2007
3	Cryptography & Network Security	Bernard Menezes	Cengage Learning	Second Edition	2012
4	Network Security Bible	Eric Cole	Wiley	Second Edition	2009
5	Applied Cryptography, Protocols Algorithms and Source Code in C,	Bruce Schneier	Wiley	Second Edition	1996
6	Cryptography and Network Security	Atul Kahate	Tata Mc Graw Hill.	Eighth Edition	2006

Online References:

S. No.	Website Name	URL	Modules Covered
1	www.tutorialspoint.com	https://www.tutorialspoint.com/cryptography/	M1,M2,M3,M4
2	www.engineering.purdue.edu	https://engineering.purdue.edu/kak/compsec/NewLectures/Lecture16.pdf	M5

List of Practical/ Experiments:

Practical Number	Type of Experiment	Practical/ Experiment Topic	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	Basic Experiments	a.) Understand the use of network reconnaissance tools like WHOIS, dig, trace route, nslookup to gather information about networks and domain registrars. b.) Analyze the tool nmap and use it with different options to scan open ports, perform OS fingerprinting, do a ping scan, tcp port scan, udp port scan, xmas scan etc.	2	L1, L2, L3
2		Implement and design the product cipher using Substitution and Transposition ciphers.	2	L1, L2, L3, L4
3	Design Experiments	Analyze and implement RSA cryptosystem and Digital signature scheme using RSA/El Gamal	2	L1, L2, L3, L4
4		Analyze and implement Diffie-Hellman Key exchange algorithm	2	L1, L2, L3, L4
5		Implement the following using the packet sniffer tools: wireshark, a.) Download and install wireshark and capture icmp, tcp, and http packets in promiscuous mode. b.) Explore how the packets can be traced based on different filters.	2	L1, L2, L3, L4
6		Analyze the performance and implement for varying message sizes, test integrity of message using MD-5, SHA-1 using crypt APIs	4	L1, L2, L3, L4
7		a.) Illustrate DOS attack using Hping, hping3 and other tools. b.) Illustrate ARP spoofing using nmap and/or open source tool ARPWATCH and wireshark. Use arping tool to generate gratuitous arps and monitor using wireshark.	4	L1, L2, L3, L4
8		SQL injection attack, Cross-site Scripting attack simulation	4	L1, L2, L3, L4
9	Case Studies	Setting up personal Firewall using iptables	4	L1, L2, L3, L4
10		Design a Security System for any infrastructure area.	4	L1, L2, L3, L4
		Total	**30**	

List of Tutorials:

Sr. No.	Topic	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	Tutorial on Classical Encryption Techniques	1	L1, L2, L3
2	Tutorial on Symmetric Cipher Model, Monoalphabetic and Polyalphabetic Substitution Techniques	3	L1, L2, L3
3	Tutorial on Keyed and Keyless Transposition Ciphers.	2	L1, L2, L3
4	Tutorial on Modular Arithmetic and Number Theory.	1	L1, L2, L3
5	Tutorial on Euclid's Algorithm–Prime Numbers-Fermat's and Euler's Theorem.	1	L1, L2, L3
6	Tutorial on Public Key Cryptographic Algorithm: RSA Algorithm.	2	L1, L2, L3
7	Tutorial on Public Key Cryptographic Algorithm: The Knapsack Algorithm.	2	L1, L2, L3
8	Tutorial on Diffie Hellman Key Exchange Algorithm.	1	L1, L2, L3
9	Tutorial on Man-in-the Middle Attack on Diffie Hellman Key Exchange Algorithm.	1	L1, L2, L3
10	Tutorial on Hash Functions.	1	L1, L2, L3
	Total Hours	**15**	

T.E. Semester –VI

Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS- HME 2020)TCET Autonomy Scheme (w.e.f. A.Y. 2020-21)

<table>
<tr><td colspan="8">B.E. (Computer Engineering)</td><td colspan="3">T.E. SEM: VI</td></tr>
<tr><td colspan="8">Course Name: System Programming and Compiler Construction</td><td colspan="3">Course Code: PCC-CS602</td></tr>
<tr><td colspan="5">Teaching Scheme (Program Specific)</td><td colspan="6">Examination Scheme (Formative/ Summative)</td></tr>
<tr><td colspan="5">Modes of Teaching / Learning / Weightage</td><td colspan="6">Modes of Continuous Assessment / Evaluation</td></tr>
<tr><td colspan="5" rowspan="3">Hours Per Week</td><td colspan="3">Theory (100)</td><td rowspan="3">Practical/Oral (25)</td><td rowspan="3">Term Work (25)</td><td rowspan="3">Total</td></tr>
<tr><td colspan="2">40/20</td><td>60/30</td></tr>
<tr><td colspan="2">IA</td><td rowspan="2">ESE</td></tr>
<tr><td>Theory</td><td>Tutorial</td><td>Practical</td><td>Contact Hours</td><td>Credits</td><td>ISE</td><td>IE</td><td>PR/OR</td><td>TW</td><td rowspan="2">150</td></tr>
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ESE: End Semester Examination - Paper Duration - 3 Hours
The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)</td></tr>
<tr><td colspan="11">Prerequisite: Theoretical Computer Science, Discrete Structure, Operating System</td></tr>
</table>

Course Objective: The Objective of this course is to compare the role and functioning of various system programs over application program, understand the role of various system programs from program development to program execution and design of Assemblers, Macro processor, Linker, Loader, Compiler.

Course Outcomes: **Upon completion of the course students will be able to:**

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Identify and use of various System and Application software for program development.	L1, L2, L3
2	Design and develop Assemblers and Macro processors.	L1, L2, L3
3	List various functions of loader and describe various loading scheme.	L1, L2
4	Illustrate the working of compiler and design and develop hand written and automatic lexical analyzer.	L1, L2, L3
5	Apply various parsing techniques to design new language structures with the help of grammars.	L1, L2, L3
6	Apply code optimization techniques to optimize intermediate code and generate target machine code.	L1,L2,L3

Detailed Syllabus

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Overview of System Software** **Introduction to System Software** with examples, Software Hierarchy, Differentiate between system software and application software. **Introduction to Language Processors**: Compiler, Assembler, Interpreter.	4	L1, L2, L3
2	**Assemblers and Macro Processors** **Assemblers:** Elements of Assembly Language Programming, Basic Assembler functions , Design of the Assembler, Types of Assemblers, Two pass assembler – IBM 360/370, Format of databases, Algorithm ,Single pass Assembler for Intel x86. **Macro Processors:** Macros, Basic Functions of Macro Processor, Features of Macro Facility, Design of Two pass Macro Processor, Format of Databases and Algorithm.	10	L1,L2, L3
3	**Linkers and Loaders** **Linkers:** Introduction, Relocation of Linking Concept, Design of a Linker. **Loaders:** Loader and Function of Loader, Loader schemes, Design of Direct linking loader.	5	L1,L2
4	**Introduction to Compilers and Lexical Analysis** **Introduction to Compilers**: Design issues, passes, phases. **Lexical Analysis:** The Role of a Lexical analyzer, Input buffering, specification and recognition of tokens, Automatic construction of lexical analyzer using LEX	4	L1, L2,L3
5	**Parsing** **Syntax Analysis**: The Role of Parser, Top down parsing- Predictive parsers (LL), Bottom Up parsing - Operator precedence parsing, SLR, LR (1), LALR, automatic construction of parsers using YACC. **Introduction to Semantic Analysis:** Need of semantic analysis, type checking and type conversion	12	L1, L2, L3
6	**Compilers: Synthesis Phase** **Syntax Directed Translation and Intermediate Code Generation:** Attribute grammar, S and L attributed grammar, bottom up and top down evaluations of S and L attributed grammar, Intermediate code – need, Types of Intermediate codes, and Implementation of Three address codes. **Code Optimization:** Need and sources of optimization, Code optimization techniques: Machine Dependent and Machine Independent. **Code Generation**: Issues in the design of code generator, code generation algorithm. Basic block and flow graph.	10	L1, L2,L3
	Total Hours	**45**	

Books and References:

SN	Title	Authors	Publisher	Edition	Year
1	Systems Programming	J. J. Donovan	Tata McGraw Hill	NA	1991
2	Systems programming	D. M Dhamdhere	Tata McGraw Hill	2nd Edition	1996
3	Compilers Principles, Techniques and Tools	A. V. Aho, R. Shethi, Monica Lam , J.D. Ulman	Pearson Education	2nd Edition	2006
4	Compiler construction : principles and practices	Kenneth C.Louden	CENGAGE Learning	1st Edition	1997

Online Resources:

S. No	Website Name	URL	Modules Covered
1	www.stanford.e du	https://online.stanford.edu/courses/soe-ycscs1-compilers	M3-M6
2	nptel.ac.in	https://swayam.gov.in/nd1_noc20_cs13/preview	M3-M6

List of Practical/ Experiments:

Practical Number	Type of Experiment	Practical/ Experiment Topic	Hrs.	RBT Levels
1	Basic Experiments	Apply first and follow rules to compute First () and Follow() set of given grammar.	2	L1, L2, L3
2		Apply various optimization techniques to optimize intermediate code.	2	L1, L2, L3
3	Design Experiments	Design and develop two pass Assembler.	2	L1, L2, L3
4		Design and develop two pass Macro Processor.	2	L1, L2, L3
5		Design and develop a hand written Lexical Analyzer.	2	L1, L2, L3
6		Design and develop Intermediate Code Generator using 3-Address code.	2	L1, L2, L3
7		Design and develop a Lexical Analyzer using LEX / Flex tool	4	L1, L2, L3
8		Design and develop calculator using YACC tool.	2	L1, L2, L3
9	Case study:	1. Optimizing Compiler 2. Compiler Construction Open Source Tools 3. Java Compiler 4. Cross Compiler	4	L1, L2,L3,L4
10	Mini Project:	1. Design and development of editor. 2. Design and Development of Linker and Loader. 3. Design and development of Predictive Parser. 4. Design and Development of LR parser.	8	L1, L2, L3,L4
		Total Hours	**30**	

T.E. Semester –VI

Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS- HME 2020)TCET Autonomy Scheme (w.e.f. A.Y. 2020-21)

<table>
<tr><td colspan="8">BE (Computer Engineering)</td><td colspan="3">SEM : V</td></tr>
<tr><td colspan="8">Course Name : Software Engineering</td><td colspan="3">Course Code : PCC-CS603</td></tr>
<tr><td colspan="5">Teaching Scheme (Program Specific)</td><td colspan="6">Examination scheme</td></tr>
<tr><td colspan="5">Modes of Teaching / Learning / Weightage</td><td colspan="6">Modes of Continuous Assessment / Evaluation</td></tr>
<tr><td colspan="5" rowspan="3">Hours Per Week</td><td colspan="3">Theory (100)</td><td rowspan="3">Practical/Oral (25)</td><td rowspan="3">Term Work (25)</td><td rowspan="3">Total</td></tr>
<tr><td colspan="2">40/20</td><td>60/30</td></tr>
<tr><td colspan="2">IA</td><td rowspan="2">ESE</td></tr>
<tr><td>Theory</td><td>Tutorial</td><td>Practical</td><td>Contact Hours</td><td>Credits</td><td>ISE</td><td>IE</td><td>PR/OR</td><td>TW</td><td rowspan="2">150</td></tr>
<tr><td>3</td><td>-</td><td>2</td><td>5</td><td>4</td><td>20</td><td>20</td><td>60</td><td>25</td><td>25</td></tr>
<tr><td colspan="11">IA: In-Semester Assessment - Paper Duration – 1.5 Hours
ESE: End Semester Examination - Paper Duration - 3 Hours
The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)</td></tr>
<tr><td colspan="11">Prerequisite: Object Oriented Programming, Frontend Backend connectivity</td></tr>
</table>

Course Objective: The objective of the course is to introduce to the students about the development of software product, the processes that provides a framework for the engineering methodologies and practices. Also to give the information regarding the phases including the analysis, design, testing methodologies and quality assurance.

Course Outcomes: Students will be able to:

SN	Course Outcomes	RBT level
1	Understand the use of basic and advanced models in software engineering	L1, L2
2	Analyze the scenarios to design the UML diagrams	L1, L2, L3, L4
3	Understand and apply the different techniques of project estimation an understand the tracking methods	L1, L2, L3, L4
4	Understand the design concepts and apply them to the project	L1, L2, L3, L4
5	Identify risks, manage the change to assure quality in software project.	L1, L2, L3, L4
6	Apply the principles of testing and develop test plan for the project	L1, L2, L3, L4

Detailed Syllabus:

Module No.	Topics	Hrs.	RBT Levels
1	**Introduction** Introduction to software engineering, Importance of Software engineering Software Process, Various models for Software Development (Waterfall, Spiral, Agile (Scrum), V-Model, RAD, DevOps), Capability Maturity Model (CMM).	6	L1, L2, L3
2	**Requirements Analysis and Modelling** Requirement Elicitation, Software requirement specification (SRS),Data Flow Diagram(DFD), Feasibility Analysis, Cost- Benefit Analysis, Developing Use Cases (UML), Requirement Model – Scenario-based model, Class-based model, Behavioral model.	8	L1, L2, L3, L4
3	**Project Scheduling and Tracking** Software Project Estimation: LOC, FP, Empirical Estimation Models - COCOMO II Model Project scheduling: Timeline charts, CPM Fishbone diagram	4	L1, L2, L3, L4
4	**Software Design** Design Concepts, Characteristics of Good Design, Effective Modular Design – Cohesion and Coupling. Architectural Styles, UI Design	8	L1, L2, L3
5	**Software Risk, Configuration Management & Quality Assurance** Risk Identification, Risk Assessment, Risk Projection, RMMM, Software Configuration management , Software Quality Assurance: Software Reliability, Formal Technical Review (FTR), Walkthrough, Quality Assurance Standards	8	L1, L2, L3, L4
6	**Software Testing and Maintenance** Software Testing, Unit testing, Integration testing Verification, Validation Testing, System Testing, Test plan, White-Box Testing , Basis Path Testing, Control Structure Testing, Black-Box Testing, Software maintenance and its types, Software Re-engineering, Reverse Engineering	11	L1, L2, L3, L4
	Total Hours	**45**	

Books and References:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Software Engineering: A Practitioner's Approach	Roger Pressman	McGraw-Hill Publications	Sixth Edition	2009
2	Software Engineering	Ian Sommerville	Pearson Education	9th edition	2017
3	Software Engineering Fundamentals	Ali Behfrooz and Fredeick J.Hudson	Oxford University Press	1st edition	1997
4	Software Engineering – Concepts and	Ugrasen Suman	Cengage Learning	1st edition	2012
5	An integrated approach to Software Engineering	Pankaj Jalote	Springer/Narosa	1st edition	2012

Online References:

Sr. No.	Website Name	URL	Modules Covered
1.	www.tutorialspoint .com	https://www.tutorialspoint.com/sdlc/sdlc_overview.htm	M1-M6
2.	www.guru99.com	https://www.guru99.com/software-testing-introductionimportance.html	M1-M3
3.	www.tutorialspoint .com	https://www.tutorialspoint.com/software_testing/software_testing_qa_qc_testing.htm	M4, M6
4.	https://en.wikipedi a.org	https://en.wikipedia.org/wiki/DevOps	M1

List of Practical/ Experiments:

Practical Number	Type of Experiment	Practical/ Experiment Topic	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Basic Experiments**	Apply the knowledge of SRS and prepare Software Requirement Specification (SRS) document in IEEE format for the project	2	L1, L2, L3
2		Sketch a DFD (up to 2 levels)	2	L1, L2, L3
3	**Design Experiments**	Sketch UML Use case Diagram for the project.	2	L1, L2
4		Sketch a Class Diagram for the project.	4	L1, L2
5		Sketch Activity, State Transition diagram for the project.	4	L1, L2
6		Sketch Sequence and Collaboration diagram for the project	4	L1, L2
7		Use project management tool to prepare schedule for the project.	2	L1, L2
8		Change specification and use any SCM Tool to make different versions	2	L1, L2
		Design test cases and generate test scripts in Selenium	4	
13	**Mini/Minor Projects/ Seminar/ Case Studies**	**Mini Project:** 1. Online banking system 2. Online hotel management system 3. Online sales Order Processing and Invoicing	4	L1, L2, L3, L4
		Total Hours	**30**	

T.E. Semester –VI

Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS- HME 2020)

TCET Autonomy Scheme (w.e.f. A.Y. 2020-21)

<table>
<tr><td colspan="7">B.E.(Computer Engineering)</td><td colspan="4">T.E. SEM: VI</td></tr>
<tr><td colspan="7">Course Name: Advanced Algorithm</td><td colspan="4">Course Code: PEC-CS6011</td></tr>
<tr><td colspan="5">Teaching Scheme (Program Specific)</td><td colspan="6">Examination Scheme (Formative/ Summative)</td></tr>
<tr><td colspan="5">Modes of Teaching / Learning / Weightage</td><td colspan="6">Modes of Continuous Assessment / Evaluation</td></tr>
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The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)</td></tr>
<tr><td colspan="11">Prerequisite: Introduction to Algorithms</td></tr>
</table>

Course Objective: The Objective of this course is to teach advanced algorithms and data structures to solve complex problems in real life applications.

Course Outcomes: **Upon completion of the course students will be able to:**

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Describe analysis techniques for algorithms.	L1, L2
2	Identify appropriate data structure and design techniques for different problems	L1, L2
3	Identify appropriate algorithm to be applied for the various application like geometric modeling, robotics, networking, etc.	L1, L2
4	Appreciate the role of probability and randomization in the analysis of algorithm.	L1, L2, L3
5	Analyze various algorithms.	L1, L2, L3
6	Differentiate polynomial and non-deterministic polynomial algorithms.	L1, L2, L3, L4

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Fundamental of Algorithms** Introduction- 08 Complexity-complexity of recursive algorithms, finding complexity by tree method, master method, proving technique (contradiction, mathematical induction).	8	L1, L2
2	**Probabilistic Analysis and Randomized Algorithm** The hiring problem Indicator random variables Randomized algorithms Probabilistic analysis .	8	L1,L2
3	**Maximum Flow** Flow networks , the ford Fulkerson method ,max bipartite 08 matching , push Relabel Algorithm , The relabel to front algorithm.	8	L1,L2
4	**Advanced Data Structure** Introduction to trees and heap Red-Black Trees: properties of red-black trees , Operations on Red-black trees Binomial Heaps: Binomial trees and binomial heaps, Operation on Binomial heaps Analysis of all above operations	12	L1, L2,L3
5	**Computational Geometry** Line Segment properties, Determining whether any pair of segment intersects, finding the convex hull, Finding the closest pair of points.	5	L1, L2, L3
6	**NP Completeness** NP-Completeness: NP-Completeness and reducibility, NP- 08 Completeness proofs, NP-Complete problems-The vertexcover problem, The travelling salesman problem	4	L1, L2, L3,L4
	Total Hours	**45**	

Books and References:

SN	Title	Authors	Publisher	Edition	Year
1	**Introduction to Algorithms**	Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein	PHI, India	2nd	2020
2	Fundamentals of Computer Algorithms	Horowitz, Sahani and Rajsekaran	O'Reilly	2nd Edition	2016
3	Algorithms – Design and Analysis	Harsh Bhasin	Oxford	-	2015
4	Randomized Algorithm	Rajeev Motwani, Prabhakar Raghavan	Cambridge University	2nd Edition	2014

Online References:

S. No.	Website Name	URL	Modules Covered
1	www.coursera.org	https://www.coursera.org/browse/computer-science/algorithms	M1,M2,M4,M5,M6
2	www.coursera.org	https://www.coursera.org/specializations/data-structures-algorithms	M3,M4,M6
3	nptel.ac.in	https://nptel.ac.in/courses/106/105/106105164/	M3,M4,M6

Mini Project Hours Distribution:

Sr. No	Work to be done	No. of Hours	Cognitive levels of attainment as per Bloom's Taxonomy
1	Study different algorithms approaches	6	L1, L2
2	Project Title finalization	2	L1, L2
3	Problem definition and design	4	L1, L2
4	Proposed method architecture	4	L1, L2, L3
5	Deployment	8	L1, L2, L3
6	Testing and Evaluation	4	L1, L2, L3, L4
7	Prepare report	6	L1, L2, L3, L4

T.E. Semester –VI

Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS- HME 2020)

TCET Autonomy Scheme (w.e.f. A.Y. 2020-21)

<table>
<tr><th colspan="8">B.E. (Computer Engineering)</th><th colspan="3">T.E. SEM: VI</th></tr>
<tr><th colspan="8">Course Name: Internet Programming</th><th colspan="3">Course Code: PEC-CS6012</th></tr>
<tr><th colspan="5">Teaching Scheme (Program Specific)</th><th colspan="6">Examination Scheme (Formative/ Summative)</th></tr>
<tr><th colspan="5">Modes of Teaching / Learning / Weightage</th><th colspan="6">Modes of Continuous Assessment / Evaluation</th></tr>
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<tr><td>3</td><td>-</td><td>2@</td><td>5</td><td>4</td><td>20</td><td>20</td><td>60</td><td>25</td><td>25</td></tr>
<tr><td colspan="11">IA: In-Semester Assessment - Paper Duration – 1.5 Hours
ESE: End Semester Examination - Paper Duration - 3 Hours
The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)</td></tr>
<tr><td colspan="11">Prerequisite: Basics of programming, Basics of Networks</td></tr>
</table>

Course Objective: To understand different Internet Technologies and to learn java-specific web services architecture.

Course Outcomes: **Upon completion of the course students will be able to:**

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Understand and Use HTML5 and CSS3	L1, L2,L3
2	Comprehend Client side programming	L1, L2, L3
3	Implement server side scripting	L1,L2, L3
4	Understand the main concepts of PHP	L1,L2,L3
5	Explain why XML is used and describe its syntax	L1, L2, L3
6	Explain the basics of AJAX and Web Services	L1, L2,L3,L4

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**WEB ESSENTIALS** Clients, Servers and Communication-The Internet-Basic Internet protocols-World wide web-HTTP Request/Response Message-Web Clients/Servers-HTML5-Tables-Lists-Images-HTML5:control elements-Semantic elements -Drag and Drop -Audio -Video controls -CSS3-Inline, embedded and external style sheets-Rule cascading-Inheritance-Backgrounds-Border Images-Colors-Shadows-Text-Transformations-Transitions- Animations.	6	L1, L2,L3
2	**CLIENT SIDE PROGRAMMING** Java Script: An introduction to JavaScript–JavaScript DOM Model-Date and Objects,-Regular Expressions- Exception Handling-Validation-Built-in objects-Event Handling- DHTML with JavaScript-JSON introduction – Syntax – Function Files – Http Request – SQL.	8	L1, L2, L3
3	**SERVER SIDE PROGRAMMING** Servlets: Java Servlet Architecture- Servlet Life Cycle- Form GET and POST actions- Session Handling- Understanding Cookies-Installing and Configuring Apache Tomcat Web Server- DATABASE CONNECTIVITY: JDBC perspectives, JDBC program example – JSP: Understanding Java Server Pages-JSP Standard Tag Library (JSTL)-Creating HTML forms by embedding JSP code.	8	L1,L2, L3
4	**PHP** An introduction to PHP: PHP- Using PHP- Variables- Program control- Built-in functions- Form Validation- Regular Expressions – File handling – Cookies – Connecting to Database.	8	L1,L2,L3
5	**XML** XML: Basic XML- Document Type Definition- XML Schema DOM and Presenting XML, XML Parsers and Validation, XSL and XSLT Transformation, News Feed (RSS and ATOM).	7	L1, L2, L3
6	**INTRODUCTION TO AJAX and WEB SERVICES** AJAX: Ajax Client Server Architecture-XML Http Request Object-Call Back Methods; Web Services: Introduction- Java web services Basics – Creating, Publishing, Testing and Describing a Web services (WSDL)-Consuming a web service, Database Driven web service from an application –SOAP.	8	L1, L2,L3,L4
	Total Hours	**45**	

Books and References:

SN	Title	Authors	Publisher	Edition	Year
1	Internet and World Wide Web - How to Program	Deitel and Nieto	Prentice Hall	5th	2011
2	Web Technologies A Computer Science Perspective	Jeffrey C and Jackson	Pearson Education	1st	2011
3	Web Technology	Gopalan N.P. and Akilandeswari J	Prentice Hall of India	-	2011
4	Web Programming – Building Intranet Applications	Chris Bates	Wiley Publications	3rd	2009

Online References:

S. No.	Website Name	URL	Modules Covered
1	www.w3school.com	https://datasheetspdf.com/pdf/544568/Intel/8086/1	M1-M6
2	Tutorialpoints.com	https://nptel.ac.in/courses/106108100/	M1,M2
3	https://www.codecademy.com/	https://www.codecademy.com/	M1-M3

Mini Project Hours Distribution:

Sr. No	Work to be done	No. of Hours	Cognitive levels of attainment as per Bloom's Taxonomy
1	Study tool for implementation	4	L1, L2
2	Project Title Identification	2	L1, L2
3	Decide major modules of the project	2	L1, L2
4	Designing of UI	2	L1, L2, L3
5	Implementation phase 1	4	L1, L2, L3
6	Testing phase 1	4	L1, L2, L3, L4
7	Implementation phase 2	4	L1, L2, L3, L4
8	Testing phase 2	4	L1, L2, L3, L4
9	Prepare report	4	L1, L2

T.E. Semester –VI

Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS- HME 2020)

TCET Autonomy Scheme (w.e.f. A.Y. 2020-21)

<table>
<tr><td colspan="5">B.E. (Computer Engineering)</td><td colspan="5">T.E. SEM: VI</td></tr>
<tr><td colspan="5">Course Name : Data Warehousing and Mining</td><td colspan="5">Course Code : PEC-CS6013</td></tr>
<tr><td colspan="5">Teaching Scheme (Program Specific)</td><td colspan="5">Examination Scheme (Formative/ Summative)</td></tr>
<tr><td colspan="5">Modes of Teaching / Learning / Weightage</td><td colspan="5">Modes of Continuous Assessment / Evaluation</td></tr>
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<tr><td>3</td><td>-</td><td>2@</td><td>5</td><td>4</td><td>25</td><td>75</td><td>25</td><td>25</td></tr>
<tr><td colspan="10">IA: In-Semester Assessment - Paper Duration – 1.5 Hour
ESE: End Semester Examination - Paper Duration - 3 Hours
The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)</td></tr>
<tr><td colspan="10">Prerequisite: Basic concepts of Database and algorithm design and analysis</td></tr>
</table>

Course Objective: The course should be able to introduce methods and theory for development of data warehouses and data analysis using data mining and familiarize students with pre-processing of data, modelling and design of data warehouses, algorithms for classification, clustering and association rule analysis.

Course Outcomes: **Upon completion of the course students will be able to**

SN	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Understand fundamentals of Data warehouse and Dimensional modelling	L1, L2, L3, L4
2	Design data warehouse with dimensional modelling and apply OLAP operations	L1, L2, L3, L4, L5
3	Apply appropriate data mining algorithms to solve real world problems	L1, L2, L3, L4, L5
4	Compare and evaluate different data mining techniques like classification, prediction and clustering	L1, L2, L3, L4, L5
5	Apply association rule mining technique on large dataset	L1, L2, L3, L4, L5
6	Describe complex data types with respect to spatial and web mining	L1, L2, L3

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Introduction to Data Warehouse and Dimensional modelling** Introduction to Strategic Information, Need for Strategic Information, Features of Data Warehouse, Data warehouses versus Data Marts, Top-down versus Bottom-up approach. Data warehouse architecture, metadata, E-R modelling versus Dimensional Modelling, Information Package Diagram, STAR schema, STAR schema keys, Snowflake Schema, Fact Constellation Schema, Factless Fact tables, Update to the dimension tables, Aggregate fact tables	8	L1, L2, L3, L4
2	**ETL Process and OLAP** Major steps in ETL process, Data extraction: Techniques, Data transformation: Basic tasks, Major transformation types, Data Loading: Applying Data, OLTP Vs OLAP, OLAP definition, Dimensional Analysis, Hypercubes, OLAP operations: Drill down, Roll up, Slice, Dice and Rotation, OLAP models : MOLAP, ROLAP, HOLAP	6	L1, L2, L3, L4, L5
3	**Introduction to Data Mining, Data Exploration and Preprocessing** Data Mining Task Primitives, Architecture, Techniques, KDD process, Issues in Data Mining, Applications of Data Mining, Data Exploration :Types of Attributes, Statistical Description of Data, Data Visualization, Data Preprocessing: Cleaning, Integration, Reduction: Attribute subset selection, Histograms, Clustering and Sampling, Data Transformation & Data Discretization: Normalization, Binning, Concept hierarchy generation, Concept Description: Attribute oriented Induction for Data Characterization.	9	L1, L2, L3, L4, L5
4	**Classification, Prediction and Clustering** Basic Concepts, Decision Tree using Information Gain, Induction: Attribute Selection Measures, Tree pruning, Bayesian Classification: Naive Bayes, Classifier Rule - Based Classification: Using IFTHEN Rules for classification, Prediction: Simple linear regression, Multiple linear regression Model Evaluation & Selection: Accuracy and Error measures, Holdout, Random Sampling, Cross Validation, Bootstrap, Clustering: Distance Measures, Partitioning Methods (k-Means, k-Medoids), Hierarchical Methods(Agglomerative, Divisive)	12	L1, L2, L3, L4, L5
5	**Mining Frequent Patterns and Association Rules** Market Basket Analysis, Frequent Item sets, Closed Item sets, and Association Rule, Frequent Pattern Mining, Efficient and Scalable Frequent Item set Mining Methods: Apriori Algorithm, Association Rule Generation, Improving the Efficiency of Apriori, FP growth, Mining frequent Item sets using Vertical Data Format, Introduction to Mining Multilevel Association Rules and Multidimensional Association Rules	6	L1, L2, L3, L4, L5
6	**Spatial and Web Mining** Spatial Data, Spatial Vs. Classical Data Mining, Spatial Data Structures, Mining Spatial Association and Co-location Patterns, Spatial Clustering Techniques: CLARANS Extension, Web Mining: Web Content Mining, Web Structure Mining, Web Usage mining, Applications of Web Mining	4	L1, L2, L3
	Total Hours	**45**	

Books and Reference:

SN	Title	Authors	Publisher	Edition	Year
1	Data Warehousing Fundamentals for IT Professionals	Paulraj Ponniah	Wiley	Second	2010
2	Data Mining Concepts and Techniques	Jiawei Han, Micheline Kamber, Jian Pei	Morgan Kaufmann	Third	2011
3	Data warehousing	ReemaTheraja	Oxford University press	Fourth	2009
4	Data Mining Introductory and Advanced Topics	Margaret H. Dunham	Prentice Hall/Pearson Education	First	2003

Online References:

S. No.	Website Name	URL	Modules Covered
1	www.nptel.ac.in	https://onlinecourses.nptel.ac.in/noc20_cs12/preview	M3 – M6
2	www.coursera.org	https://www.coursera.org/learn/dwdesign	M1, M2
3	www.coursera.org	https://www.coursera.org/specializations/data-mining	M3 – M6

Mini Project Hours Distribution:

Sr. No	Work to be done	No. of Hours	Cognitive levels of attainment as per Bloom's Taxonomy
1	Study tool for implementation	4	L1, L2
2	Project Title Identification	2	L1, L2
3	Choose Data	2	L1, L2
4	Data Preparation and Analysis	4	L1, L2, L3
5	Perform Feature Engineering	2	L1, L2, L3
6	Model selection	2	L1, L2, L3, L4
7	Train and Validate Model	6	L1, L2, L3, L4
8	Test and Evaluate Model	4	L1, L2, L3, L4, L5
9	Prepare report	4	L1, L2
	Total Hours	**30**	

T.E. Semester –VI
Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS- HME 2020)
TCET Autonomy Scheme (w.e.f. A.Y. 2020-21)

B.E. (Computer Engineering)										**T.E. SEM: VI**
Course Name: Digital Signal Processing										**Course Code:** PEC-CS6014
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**					
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**					
Hours Per Week					**Theory (100)**			**Practical/Oral (25)**	**Term Work (25)**	**Total**
					40/20		**60/30**			
					IA					
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**ISE**	**IE**	**ESE**	**PR/OR**	**TW**	
3	-	2@	5	4	20	20	60	25	25	**150**
IA: In-Semester Assessment - Paper Duration – 1.5 Hour										
ESE: End Semester Examination - Paper Duration - 3 Hours										
The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)										
Prerequisite: Basic Mathematics and signals systems										

Course Objective: The objective of this course is to understand the basic concept of DT Signal, perform signal manipulation, Compute Convolution and Correlation operations and illustrate DFT and FFT algorithms

Course Outcomes: **Upon completion of the course students will be able to:**

Sr. No	Course Outcome	Cognitive levels of attainment as per Bloom's Taxonomy
1	Understand the concept of DT Signal and perform signal manipulation.	L1, L2, L3, L4, L5
2	Analyze the DT system in time domain.	L1, L2, L3, L4
3	Evaluate DTFT and DFT of signals in time domain.	L1, L2, L3, L4, L5
4	Develop and sketch FFT flow-graph.	L1, L2, L3, L4, L5
5	Evaluate Fast DSP Algorithms.	L1, L2, L3, L4, L5
6	Understand the concept of digital filters	L1, L2

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Discrete Time Signal** Introduction to Digital Signal Processing, Discrete Time Signals, Continuous Signals, Sampling and Reconstruction, Standard DT Signals, Concept of Digital Frequency, Representation of DT signal using Standard DT Signals, Mathematical Operations on Signal (shifting, addition, subtraction, multiplication), Classification of Signals, Linear Convolution formulation (without mathematical proof), Circular Convolution formulation (without mathematical proof), Matrix Representation of Circular Convolution, Linear by Circular Convolution. Auto and Cross Correlation formula evaluation.	12	L1, L2, L3, L4, L5

2	**Discrete Time System** Introduction to Discrete Time System, Classification of DT Systems (Linear/Non Linear, Causal/Non Causal, Time Invariant/Time Variant Systems, Stable/ Unstable), BIBO Time Domain Stability Criteria. LTI system, Concept of Impulse Response and Step Response	8	L1, L2, L3, L4
3	**Discrete Fourier Transform** Introduction to DTFT, DFT, Relation between DFT and DTFT, Properties of DFT without mathematical proof (Scaling and Linearity, Periodicity, Time Shift and Frequency Shift, Time Reversal, Convolution Property and Parseval's Energy Theorem). DFT computation using DFT properties. Transfer function of DT System in frequency domain using DFT. Linear and Circular Convolution using DFT, Introduction to 2-D DFT	10	L1, L2, L3, L4, L5
4	**Fast Fourier Transform** Radix-2 DIT-FFT algorithm, DIT-FFT Flowgraph for N=4, 6 & 8, Inverse 06 FFT algorithm. Spectral Analysis using FFT, Comparison of complex and real, multiplication and additions of DFT and FFT.	8	L1, L2, L3, L4, L5
5	**DSP Algorithms** Fast Circular Convolution Algorithm, Fast Linear Convolution Algorithm, Convolution of long sequences (Overlap Add and Overlap Save Method)	6	L1, L2, L3, L4, L5
6	**Digital Filters and Applications of DSP** Introduction to digital Filters, Concept of IIR filter and FIR filter, Case study of Real Time DSP applications to Speech Signal Processing and Biomedical Signal Processing.	4	L1, L2
	Total Hours	**48**	

Books and References:

SN	Title	Authors	Publisher	Edition	Year
1	Digital Signal Processing	A. Anand Kumar	PHI Learning Pvt. Ltd.	Second Edition	2013
2	Digital Signal Processing	Nagoor Kani	McGraw Hill Education;	2 edition	(1 July 2017)
3	Digital Signal Processing: Principles, Algorithms, and Applications	John G. Proakis, Dimitris and G.Manolakis	Pearson Education	Fourth Edition	2007
4	Digital Signal Processing	Salivahanan	McGraw Hill Education;	Third edition	(1 July 2017)

Online References:

. No.	Website Name	URL	Modules Covered
1	www.tutorialspoint.com	https://www.tutorialspoint.com/digital_signal_processi ng/	M1, M2, M3, M4, M5, M6
2	www.gnits.ac.in	https://www.gnits.ac.in/sites/default/files/ONLINERES OURCES/ECE/dsp.pdf https://lecturenotes.in/subject/44/digital-signalprocessing-dsp	M1, M2, M3, M4, M5, M6
3	www.dss.tf.uni-kiel.de/	https://dss.tf.uni-kiel.de/images/teaching/lectures/advanced_digital_signal_processing/slides/adsp_05_digital_filters.pdf	M6

Mini Project Hours Distribution:

Sr. No	Work to be done	No. of Hours	Cognitive levels of attainment as per Bloom's Taxonomy
1	Study tool/techniques used for implementation	4	L1, L2
2	Project Title Identification	2	L1, L2
3	Choose Dataset and Algorithm	2	L1, L2
4	Data Preparation and Analysis	4	L1, L2, L3
5	Perform Feature Engineering	2	L1, L2, L3
6	Application selection	2	L1, L2, L3, L4
7	Train and Validate application	6	L1, L2, L3, L4
8	Test and Evaluate application	4	L1, L2, L3, L4, L5
9	Prepare report	4	L1, L2
	Total Hours	**30**	

T.E. Semester –VI
Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS- HME 2020)
TCET Autonomy Scheme (w.e.f. A.Y. 2020-21)

<table>
<tr><th colspan="8">B.E. (Computer Engineering)</th><th colspan="3">T.E. SEM: VI</th></tr>
<tr><th colspan="8">Course Name: Soft Computing</th><th colspan="3">Course Code: PEC-CS6015</th></tr>
<tr><th colspan="5">Teaching Scheme (Program Specific)</th><th colspan="6">Examination Scheme (Formative/ Summative)</th></tr>
<tr><th colspan="5">Modes of Teaching / Learning / Weightage</th><th colspan="6">Modes of Continuous Assessment / Evaluation</th></tr>
<tr><th colspan="5" rowspan="3">Hours Per Week</th><th colspan="3">Theory (100)</th><th rowspan="3">Practical/Oral (25)</th><th rowspan="3">Term Work (25)</th><th rowspan="3">Total</th></tr>
<tr><th colspan="2">40/20</th><th rowspan="2">60/30</th></tr>
<tr><th colspan="2">IA</th></tr>
<tr><th>Theory</th><th>Tutorial</th><th>Practical</th><th>Contact Hours</th><th>Credits</th><th>ISE</th><th>IE</th><th>ESE</th><th>PR/OR</th><th>TW</th><th rowspan="2">150</th></tr>
<tr><td>3</td><td>-</td><td>2@</td><td>5</td><td>4</td><td>20</td><td>20</td><td>60</td><td>25</td><td>25</td></tr>
<tr><td colspan="11">IA: In-Semester Assessment - Paper Duration – 1.5 Hours
ESE: End Semester Examination - Paper Duration - 3 Hours
The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)</td></tr>
<tr><td colspan="11">Prerequisite: Discrete Mathematics</td></tr>
</table>

Course Objective: The Objective of this course is to introduce Soft computing concepts and techniques and foster their abilities in designing appropriate technique for a given scenario.

Course Outcomes: **Upon completion of the course students will be able to:**

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	To introduce the ideas of soft computational techniques based on human experience.	L1, L2
2	To conceptualize fuzzy logic and its implementation for various real world applications.	L1, L2, L3
3	To generate an ability to design, analyze and perform experiments on real life problems using various Neural Learning Algorithms.	L1, L2, L3, L4
4	To provide the mathematical background to carry out optimization using Genetic Algorithms.	L1, L2, L3
5	To introduce hybrid Soft Computing techniques.	L1, L2
6	To introduce advanced Soft Computing techniques.	L1, L2

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Introduction to Soft Computing** What is Soft Computing, Soft Computing vs Hard Computing, Evolution of Soft Computing, Constituents of Soft Computing, Applications	3	L1, L2
2	**Fuzzy Set Theory** Brief Review of Conventional Set Theory, Introduction to Fuzzy Sets, Properties of Fuzzy Sets, Operations on Fuzzy Sets, Membership Functions. Fuzzy Extension Principle, Fuzzy Relations and rules, Projection and Cylindrical Extension of Fuzzy Relations, Fuzzy Composition, Fuzzification and Defuzzification, Fuzzy Inference System, Types of Fuzzy Models, Applications.	8	L1, L2, L3
3	**Artificial Neural Networks** Biological Neurons and their Artificial Models, NN Architecture, Activation Function, Learning Rules. Linearly and Non-Linearly Separable Pattern Classification, Single Layer Perceptron, MultiLayer Perceptron, Multi-layer Feedforward Network, Back-propagation Training, ART, SOM, Application of ANN to solve Real Life problems.	14	L1, L2, L3, L4
4	**Genetic Algorithm** Biological Background, basic terminologies, simple genetic algorithm, operators in Genetic Algorithm, Types of encoding, crossover, selection, mutation, etc., Fitness function, Convergence, Problem solving using Genetic Algorithm	8	L1, L2, L3
4	**Hybrid Systems** Sequential, Auxillary and Hybrid Systems Neuro Fuzzy Hybrid systems, Neuro Genetic Hybrid systems, Fuzzy Genetic Hybrid systems	6	L1, L2, L3
6	**Introduction to Advanced Soft Computing techniques** Introduction to Deep Learning, Introduction to rough set theory, Introduction to Evolutionary Algorithms	6	L1, L2
	Total Hours	**45**	

Books and References:

S. No.	Title	Authors	Publisher	Edition	Year
1	Principles of Soft Computing	S. N. Sivanandam, S. N. Deepa	Wiley Publication.	2nd Edition	2005
2	Neural Networks, Fuzzy Logic and Genetic Algorithms	S. Rajasekaran and G. A. VijayalakshmiPai	PHI Learning.	3rd Edition	2008

Online References:

S. No.	Website Name	URL	Modules Covered
1	nptel	https://nptel.ac.in/courses/106/105/106105173/	M1-M4
2	nptel	https://nptel.ac.in/courses/111/102/111102130/	M1
3	coursera	https://www.coursera.org/projects/basic-artificial-neural-networks-in-python	M3
4	udemy	https://www.udemy.com/course/geneticalgorithm/	M4

Capstone Project Hours Distribution:

Sr. No.	Work to be done	No. of Hours	Cognitive levels of attainment as per Bloom's Taxonomy
1	Project Title selection	2	L1, L2
2	Literature Review and gap identification	4	L1, L2, L3, L4, L5
3	Propose Design methodology	2	L1, L2, L3, L4, L5
4	Tool Study	4	L1, L2, L3
5	Implementation	6	L1, L2, L3, L4, L5, L6
6	Deployment	4	L1, L2, L3
7	Testing and Evaluation	4	L1, L2, L3, L4, L5
8	Report and presentation	4	L1, L2, L3, L4

TCET

DEPARTMENT OF COMPUTER ENGINEERING (COMP)

(Accredited by NBA for 3 years, 3rd Cycle Accreditation w.e.f. 1st July 2019)

Choice Based Credit Grading Scheme (CBCGS)

Under TCET Autonomy

T T.E. Semester –VI

Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS- HME 2020)

TCET Autonomy Scheme (w.e.f. A.Y. 2020-21)

B.E. Computer Engineering									**T.E. Open Elective (SEM : VI)**	
Course Name : Digital Marketing									**Course Code :** OEC-CS6011	
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**					
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**					
Hours Per Week					**Theory (100)**			**Practical/Oral (25)**	**Term Work (25)**	**Total**
					40/20		**60/30**			
					IA					
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**ISE**	**IE**	**ESE**	**PR/OR**	**TW**	
3	-	-	3	3	20	20	60	-	-	**100**
IA: In-Semester Assessment - Paper Duration – 1.5 Hours										
ESE: End Semester Examination - Paper Duration - 3 Hours										
The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)										
Prerequisite: Marketing Fundamentals, Digital Assets, Digital System Setup and automation										

Course Objective: The course will transform you into a complete digital marketer with expertise in the top eight digital marketing domains — search engine optimization, social media, pay-per-click, conversion optimization, digital analytics, content, mobile, and email marketing. Fast-track your career in digital marketing today with practical training you can apply on the job.

Course Outcomes: Upon completion of the course students will be able to:

Sr. No.	**Course Outcomes**	**Cognitive levels of attainment as per Bloom's Taxonomy**
1	Understand Digital Business Models	L1,L2
2	Understand A.I. and machine learning terminologies, mind-set and its application in marketing	L1,L2
3	Build sophisticated machine learning models – learn how to gather and clean data, select an algorithm, train, evaluate and deploy a model	L1,L2
4	Predict churn, sales or score leads with tools	L1,L2,L5
5	Segment customers; build clustering models to drive personalization.	L1,L2,L5,L6
6	Build computer vision models for social visual listening, use natural language processing to predict consumption preferences.	L2,L5

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Introduction - Digital Marketing** Digital Marketing Skills empowered by AI :SEO, Search Engine Marketing, Social Media Marketing, Web Analytics, Email Marketing, Content Marketing, Influencer Marketing, Conversion Rate Optimization,Tools Based Marketing, Lifecycle Marketing Automation. Psychographic-segmentation	7	L1,L2
2	**Full Funnel Marketing** **Acquisition:** Content marketing, landing page testing, campaign optimization, conversion rate optimization, lead scoring, competition and trend analysis, predict sales, optimize product pricing, programmatic media buying, segmentation and clustering for targeting, personalization. **Activation** Personalization, , behavioral segmentationb Psychographic-segmentation **Retention** Predict churn, customer care chatbot, sentiment analysis, visual social listening, personalization **Revenue** Predict and maximize customer lifetimevalue, recommendersystems, market basket analysis **Referral** Predict whether user recommend your product	8	L1,L2,L3
3	**Marketing framework and tools** **Planning:**Hubspot, Brightedge, Node, Crayon, Equals3, Marketmuse, Pathmatics, Calibermind, Alegion, Netra **Production** : Acrolinx, Narrative Science,Clarifai, GumGum,phrasee, curate Attention insight **Personalization** : Uberflip, Klevu, Seventh Sense, Blueshift, **Promotion** : Yext, Albert, Onespot, Cortex, Siftrock, inPowered,**Performance :**Monkeylearn, PaveAI,	8	L1,L2,L3,L5
4	**Predictive Analytics** Fundamentals of predictive analytics, Prediction model for lead scoring and sales forecasting,churnprediction model, Predizctive modelling for customer behaviour, automatedsegmentation	7	L1,L2,L3,L5
5	**Psychographics, NLP and Computer Vision** Customer psychographics, leveraging personality traits to predict consumption preferences using NLP, Detect emotions, assign labels, understand text from images, detect news events, logos using Computer Vision	7	L1,L2,L3,L5
6	**Futuristic Marketing** IoTs Augmented Reality, Virtual Reality and XR for Marketing, Blockchain and smart contracts for marketing, NeuroMarketing, Wearable Tech, Personal Chatbots	8	L2,L3
	Total Hours	**45**	

Books and References:

Sr. No	Title	Authors	Publisher	Edition	Year
1	Artificial intelligence marketing and predicting consumer choice: an overview of tools and techniques	Struhl, S.	Kogan Page Publishers	Third	2017
2	AI for Marketing and Product Innovation: Powerful New Tools for Predicting Trends, Connecting with Customers, and Closing Sales.	Appel, A., Sthanunathan, S., Pradeep, A. K.	Wiley.	Third	2018
3	Artificial intelligence for marketing: practical applications	Sterne, J.	John Wiley & Sons	Fourth	2017..
4	Using Artificial Intelligence in Marketing: How to harness AI and maintain the competitive edge.	King, K.	Kogan Page Publishers	First	2019

Online References:

Sr. No.	Website Name	URL	Modules Covered
1	https://www.iimcal.ac.in/	https://iimcal.talentsprint.com/ai-powered-marketing/index.html?utm_source=googlesearch&utm_medium=cpc&utm_campaign=iimc-aipm-googlesearch-india&utm_content=ai-in-marketing-by-iimc&gclid=CjwKCAjwyo36BRAXEiwA24CwGVQrXnOTpcARRsFtvt8b9VAPqwV7KGPFmPyx36i1Zafl_7Br1OJEEhoChC4QAvD_BwE/	M1,M2,M3,M4,M5,M6
2	https://www.coursera.org/	https://www.coursera.org/learn/uva-darden-market-analytics	M4,M5,M6
3	https://academy.hubspot.com/	https://academy.hubspot.com/courses/artificial-~~intelligence-and-machine-learning-in-~~marketing? hstc=89107140.de4401799f3edce1fd~~42a1704a37ab4a.1598174195879.1598174195879.~~~~1598174195879.1&__hssc=89107140.1.15983363~~23938& hsfp=3825083997&hsCtaTracking=e4d097a0-ed0c-4f82-8e93-e9016ea31749%7C00439f3d-17bf-4431-af12-50a507004fcd	M1,M2,M3,M4,M5,M6

T.E. Semester –VI
Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS- HME 2020)TCET Autonomy Scheme (w.e.f. A.Y. 2020-21)

B.E. Computer Engineering								**T.E. Open Elective (SEM : VI)**		
Course Name : Software Process Automation								**Course Code : OEC- CS 6012**		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/Summative)**					
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment /Evaluation**					
Hours Per Week					**Theory (100)**			**Practical/Oral (25)**	**Term Work (25)**	**Total**
					40/20		**60/30**			
					IA					
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**ISE**	**IE**	**ESE**	**PR/OR**	**TW**	
3	-	-	3	3	20	20	60	-	-	**100**
IA: In-Semester Assessment - Paper Duration – 1.5 Hour **ESE: End Semester Examination - Paper Duration - 3 Hours** **The weightage of marks for continuous evaluation of Term work/Report:** Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)										
Prerequisite: Object Oriented Programming, Frontend Backend connectivity										

Course Objective:

The objective of the course is to introduce to the students about the integration people involved in the software process with the development and tools required for automation of the project development.

Course Outcomes: **Upon completion of the course students will be able to:**

SN	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Understand the importance of process automation and models of software process	L1, L2
2	Analyze the security and configuration management	L1, L2, L3,L4
3	Understand and apply the build concepts using a build tool	L1, L2, L3,L4
4	Understand the testing concepts and applythem to the project	L1, L2, L3,L4
5	Identify the activities in agile project management and use a tool for the same	L1, L2, L3,L4
6	Understand and identify the various principles of quality assurance	L1, L2, L3,L4

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Introduction to process Automation** Importance of process automation, types of models, prescriptive and descriptive models, Devops model, process modelling objectives and goals	6	L1, L2
2	**Automation of config management** Overview of configuration management, Github and git tool	8	L1, L2, L3,L4
3	**Build automation** Overview of build management, Jenkins tool for build management	4	L1, L2, L3,L4
4	**Test automation** Overview of testing concepts, test cases , selenium tool	8	L1, L2, L3,L4
5	**Project management** Project management concepts, agile team, Atlasian jira project management tool	8	L1, L2, L3,L4
6	**Quality management** Quality concepts and metrics, CMMI, ISO, spice, six sigma, Total Quality management	11	L1, L2, L3,L4
	Total Hours	**45**	

Books and References:

	Title	Authors	Publisher	Edition	Year
1	The DevOps handbook	Gene Kim, Jez Humble, Ptrik Debois & John Willis	IT revolution Press	first Edition	2016
2	Selenium WebDriver 3 Practical Guide: End-to-end Automation Testing for Web and Mobile Browsers with Selenium WebDriver	Satya Avasarala	Packt Publishing Ltd,	Second Edition	2018

Online Resources:

S. No.	Website Name	/URL	Modules Covered
1	www,researchgate,com	https://www.researchgate.net/publication/258865356_Software_Process_Definition_and_Management	M6

T.E. Semester –VI
Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS- HME 2020)
TCET Autonomy Scheme (w.e.f. A.Y. 2020-21)

B.E. Computer Engineering									**T.E. Open Elective (SEM : VI)**	
Course Name : Entrepreneurship Development and Management									**Course Code :** OEC-CS6013	
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**					
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**					
Hours Per Week					**Theory (100)**			**Practical/Oral (25)**	**Term Work (25)**	**Total**
					40/20		**60/30**			
					IA					
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**ISE**	**IE**	**ESE**	**PR/OR**	**TW**	
3	-	-	3	3	20	20	60	-	-	**100**
IA: In-Semester Assessment - Paper Duration – 1.5 Hour **ESE: End Semester Examination - Paper Duration - 3 Hours** **The weightage of marks for continuous evaluation of Term work/Report:** Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)										
Prerequisite: entrepreneurial mindset										

Course Objective: The course should be able to inculcate, advance, and groom entrepreneurial skills into the students aspiring to establish and successfully run an enterprise.

Course Outcomes: **Upon completion of the course students will be able to**

SN	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Recognize an overview of basic entrepreneurship concepts	L1, L2
2	Design a business plan and understand importance of capital	L1, L2, L3, L4, L5, L6
3	Discuss the rules and legislation w.r.t. entrepreneurship	L1, L2
4	Identify sources for organizational assistance in this field	L1, L2
5	Use knowledge gained for effective management of business	L1, L2, L3
6	Recognize ways of achieving success in business	L1, L2

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Overview of Entrepreneurship** Definition, Importance, Roles and Functions, Evolution of term 'Entrepreneurship', Factors influencing Entrepreneurship, Characteristics of an Entrepreneur, of Types of Entrepreneur, Contribution of Government Agencies in Sourcing information for Entrepreneurship, Role of Entrepreneurship in the National Economy	5	L1, L2
2	**Business Plans and importance of capital to Entrepreneurship** Preliminary and Marketing Plans, Management and Personnel, Start-up Costs and Financing as well as Projected Financial Statements, Legal Section, Insurance, Suppliers and Risks, Assumptions and Conclusion, Capital and its Importance to the Entrepreneur Entrepreneurship And Business Development: Starting a New Business, Buying an Existing Business, New Product Development, Business Growth and the Entrepreneur Law and its Relevance to Business Operations	10	L1, L2, L3, L4, L5, L6
3	**Rules and Legislation** Applicability of Legislation, Industries Development (Regulations) Act, 1951, Factories Act, 1948, The Industrial Employment (Standing Orders) Act, 1946, West Bengal Shops and Establishment Act, 1963, Environment (Protection) Act, 1986, The sale of Goods Act, 1950, Industrial Dispute Act 1947	6	L1, L2
4	**Organization Assistance** Assistance to an entrepreneur, New Ventures, Industrial Park (Meaning, features, & examples), Special Economic Zone (Meaning, features & examples), Financial assistance by different agencies, MSME Act Small Scale Industries, Carry on Business (COB) license, Environmental Clearance, National Small Industries Corporation (NSIC), Government Stores Purchase scheme (e-tender process), Excise exemptions and concession, Exemption from income tax, Quality Standards with special reference to ISO, Financial assistance to MSME, Modernization assistance to small scale unit, The Small Industries Development Bank of India (SIDBI), The State Small Industries Development Corporation (SSIDC), Export oriented units, Shilpabandhu-M Incentives for entrepreneurs, Other agencies for industrial assistance, Directorate General of Supplies and Disposals(DGS & D), Khadi and Village Industries Commission (KVIC), Industrial Estate	11	L1, L2
5	**Effective Management of Business** Issues and problems faced by micro and small enterprises and effective management of M and S enterprises (risk management, credit availability, technology innovation, supply chain management, linkage with large industries), exercises, e-Marketing Women Entrepreneurship Development, Social entrepreneurship-role and need, EDP cell, role of sustainability and sustainable development for SMEs, case studies, exercises	8	L1, L2, L3
6	**Achieving success in small business** Stages of the small business life cycle, four types of firm-level growth strategies, Options – harvesting or closing small business Critical Success factors of small business	5	L1, L2
	Total Hours	45	

Books and Reference:

SN	Title	Authors	Publisher	Edition	Year
1	Entrepreneurship Development and Management	Dr. A. K. Singh	Laxmi Pub. Ltd.		2009
2	Entrepreneur and Entrepreneurship	Mohd Asif Hasan			
3	Small Business and Entrepreneurship	S. Anil Kumar	I. K. International pvt. Ltd.		2008

Online References:

S. No.	Website Name	URL	Modules Covered
1	www.nptel.ac.in	https://nptel.ac.in/courses/110/106/110106141/	M1-M6
2	www.coursera.org	https://www.coursera.org/specializations/wharton-entrepreneurship	M1-M6

T.E. Semester –VI
Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS- HME 2020)
TCET Autonomy Scheme (w.e.f. A.Y. 2020-21)

B.E. Computer Engineering											**T.E. Open Elective (SEM : VI)**
Course Name : Cyber Security and Laws											**Course Code : OEC- CS6014**
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**						
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**						
Hours Per Week					**Theory (100)**			**Practical/Oral (25)**	**Term Work (25)**	**Total**	
					40/20		**60/30**				
					IA						
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**ISE**	**IE**	**ESE**	**PR/OR**	**TW**		
3	-	-	3	3	20	20	60	-	-	**100**	
IA: In-Semester Assessment - Paper Duration – 1.5 Hours											
ESE: End Semester Examination - Paper Duration - 3Hours											
The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)											
Prerequisite: Cryptography and Network Security											

Course Objective: The course intends to deliver the fundamental knowledge to understand concepts of cyber law, intellectual property, cybercrimes, trademarks, domain theft, tools used in cyber security and analyze security policies, protocols applied in Indian IT Act 2008, security standards compliances.

Course Outcomes: **Upon completion of the course students will be able to:**

SN	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Understand the concept of cybercrime and its effect on outside world	L1
2	Interpret and apply IT law in various legal issues , Analyse security challenges and issues	L1, L2, L3, L4
3	Understand and analyse various attack using tools like wire shark , key logger etc.	L1
4	Distinguish different aspects of cyber law	L1, L2, L3, L4
5	Study India IT Act and analyse different case studies	L1, L2, L3, L4
6	Apply Information Security Standards compliance during software design and development	L1, L2, L3, L4

Detailed Syllabus:

Module No	Topics	Hrs	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Introduction to Cybercrime** Introduction to Cybercrime: Cybercrime definition and origins of the world,Cybercrime and information security, Classifications of cybercrime, Cybercrime and the Indian ITA 2000, A global Perspective on cybercrimes	06	L1
2	**Symmetric and Asymmetric Cryptography** Introduction to symmetric cryptography, Substitution cipher, transposition cipher, stream and block cipher, and arithmetic modes for block ciphers, Introduction to asymmetric cryptography Primes, factorization, Fermat's little theorem, Euler's theorem, and extended Euclidean algorithm, RSA, attacks on RSA, Diffie Hellman key exchange , Message integrity, message authentication, MAC,hash function, H MAC	08	L1, L2, L3, L4
3	**Cyber offenses & Cybercrime** Cyber offenses & Cybercrime: How criminal plan the attacks, Social Engg, Cyber stalking, Cyber café and Cybercrimes, Bot nets, Attack vector, Cloud computing, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Devices-Related Security Issues, Organizational Security Policies and Measures in Mobile Computing Era, Laptops	09	L1
4	**Tools and Methods Used in Cyber line** Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Over Flow, Attacks on Wireless Networks, Phishing, Identity Theft (ID Theft)	08	L1, L2, L3, L4
5	**The Concept of Cyberspace** E-Commerce, The Contract Aspects in Cyber Law ,The Security Aspect of Cyber Law ,The Intellectual Property Aspect in Cyber Law , The Evidence Aspect in Cyber Law , The Criminal Aspect in Cyber Law, Global Trends in Cyber Law , Legal Framework for Electronic Data Interchange Law Relating to Electronic Banking , The Need for an Indian Cyber Law	08	L1, L2, L3, L4
6	**Indian IT Act.** Cyber Crime and Criminal Justice: Penalties, Adjudication and Appeals Under the IT Act, 2000, IT Act. 2008 and its Amendments	06	L1, L2, L3, L4
	Total Hours	**45**	

Books and References:

Sr. No	Title	Authors	Publisher	Edition	Year
1	Cyber Security	Nina Godbole, Sunit Belapure	Wiley India ,New Delhi	2nd	2011
2	The Indian Cyber Law	Suresh T. Vishwanathan	Bharat Law House,New Delhi	2nd	2015
3	Cyber Law & Cyber Crimes	Advocate Prashant Mali	Snow White Publications, Mumbai	2nd	2015
4	Information Systems Security	Nina Godbole	Wiley India, New Delhi	2nd	2014
5	Cyber Security & Global Information Assurance	Kennetch J. Knapp	Information Science Publishing.	1st	2009

T.E. Semester –VI

Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS- HME 2020)TCET Autonomy Scheme (w.e.f. A.Y. 2020-21)

B.E. Computer Engineering								**T.E. Open Elective SEM:VI**		
Course Name: Reliability Engineering								**Course Code**: **OEC- CS6015**		
Teaching Scheme (Program Specific)					**Examination scheme**					
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**					
Hours Per Week					**Theory (100)**			**Practical/Oral (25)**	**Term Work (25)**	**Total**
					40/20		**60/30**			
					IA					
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**ISE**	**IE**	**ESE**	**PR/OR**	**TW**	
3	-	-	3	3	20	20	60	-	-	**100**

IA : Internal Assessment **-** Paper Duration – 1Hour

ESE : - End Semester Examination Paper Duration **- 3 Hours**

The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance (20%)

Prerequisite: Signals and Systems, Control systems

Course Objective: To impart various aspects of probability theory, system reliability, and maintainability, availability and FMEA procedure.

Course Outcomes: Students will be able to:

SN	Course Outcomes	Cognitive Levels as per Bloom's Taxonomy
1	Understand and apply the concept of Probability to engineering problems	L1,L2,L3
2	Apply various reliability concepts to calculate different reliability parameters	L1,L2,L3,L4
3	3Estimate the system reliability of simple and complex systems	L1,L2,L3
4	. Carry out a Failure Mode Effect and Criticality Analysis	L1,L2,L3,L4

Detailed Syllabus:

Module No.	Topics	Hrs	Cognitive Levels as per Bloom's Taxonomy
1	**Probability theory** Probability: Standard definitions and concepts; Conditional Probability, Baye's Theorem. Probability Distributions: Central tendency and Dispersion; Binomial, Normal, Poisson, Weibull, Exponential, relations between them and their significance. Measures of Dispersion: Mean, Median, Mode, Range, Mean Deviation, Standard Deviation, Variance,Skewness and Kurtosis.	08	L1,L2,L3
2	**Reliability Concepts** Reliability Concepts: Reliability definitions, Importance of Reliability, Quality Assurance and Reliability, Bath Tub Curve Failure Data Analysis: Hazard rate, failure density, Failure Rate, MeanTime ToFailure (MTTF), MTBF, Reliability Functions. Reliability Hazard Models: Constant Failure Rate, Linearly increasing, TimeDependent Failure Rate, Weibull Model. Distribution functions and reliability analysis.	08	L1,L2,L3,L4
3	**System Reliability** System Reliability: System Configurations: Series, parallel, mixed configuration, k out of n structure, Complex systems	06	L1,L2,L3
3	**Reliability Improvement:** Reliability Improvement:Redundancy Techniques: Element redundancy, Unit redundancy, Standby redundancies. Markov analysis. System Reliability Analysis – Enumeration method, Cut-set method, Success, Path method, Decomposition method.	05	L1,L2
4	**Maintainability and Availability** Maintainability and Availability: System downtime, Design for Maintainability: Maintenance requirements, Design methods: Fault Isolation and self-diagnostics, Parts standardization and Interchangeability, Modularization and Accessibility, Repair Vs Replacement. Availability – qualitative aspects.	05	L1,L2,L3,L4
5	**Failure Mode, Effects and Criticality Analysis** Failure mode effects analysis: severity/criticality analysis, FMECA examples. Fault tree construction, basic symbols, development of functional reliability block diagram, Fau1t tree analysis and Event tree Analysis	05	L1,L2,L3,L4
Total		45 hrs	

Books and References:

S. No	Title	Authors	Publisher	Edition	Year
1	Reliability Engineering”,	L.S. Srinath,	“Affiliated East-Wast Press (P) Ltd	3rdEdition	1985
2	“Reliability and Maintainability Engineering	Charles E. Ebeling	Tata McGraw Hill.	4th Edition	2015
3	Engineering Reliability	B. S. Dhillion C. Singh,	John Wiley & Sons	5th edition	1980
4	Practical Reliability Engg.”,	P.D.T. Conor	John Wiley & Sons	3rd Edition	1985.
5.	Reliability in Engineering Design	K.C. Kapur, L.R. Lamber son	John Wiley & Sons.	3rdEdition	1989
6.	Probability and Statistics	Murray R. Spiegel	Tata McGraw-Hill Publishing Co. Ltd.	5th edition	1980

T.E. Semester –VI

Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS- HME 2020)TCET Autonomy Scheme (w.e.f. A.Y. 2020-21)

<table>
<tr><td colspan="8">B.E. Computer Engineering</td><td colspan="3">T.E. Open Elective SEM: VI</td></tr>
<tr><td colspan="8">Course Name: Product Life Cycle Management</td><td colspan="3">Course Code: OEC-CS 6016</td></tr>
<tr><td colspan="5">Teaching Scheme (Program Specific)</td><td colspan="6">Examination Scheme (Formative/ Summative)</td></tr>
<tr><td colspan="5">Modes of Teaching / Learning / Weightage</td><td colspan="6">Modes of Continuous Assessment / Evaluation</td></tr>
<tr><td colspan="5" rowspan="3">Hours Per Week</td><td colspan="3">Theory (100)</td><td rowspan="3">Practical/Oral (25)</td><td rowspan="3">Term Work (25)</td><td rowspan="3">Total</td></tr>
<tr><td colspan="2">40/20</td><td>60/30</td></tr>
<tr><td colspan="2">IA</td><td rowspan="2">ESE</td></tr>
<tr><td>Theory</td><td>Tutorial</td><td>Practical</td><td>Contact Hours</td><td>Credits</td><td>ISE</td><td>IE</td><td>PR/OR</td><td>TW</td><td rowspan="2">100</td></tr>
<tr><td>3</td><td>-</td><td>-</td><td>3</td><td>3</td><td>20</td><td>20</td><td>60</td><td>-</td><td>-</td></tr>
<tr><td colspan="11">IA: In-Semester Assessment- Paper Duration-1 .5 Hours
ESE : End Semester Examination - Paper Duration - 3 Hours
The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance (20%)</td></tr>
<tr><td colspan="11">Prerequisite: Product Design and Development, Quality and Reliability Engineering</td></tr>
</table>

Course Objectives:

Course intend to provide an exposure to new product development program and guidelines for designing and developing a product and apply the knowledge of Product Data Management & PLM strategies.

Course Outcomes:

SN	Course Outcomes	Cognitive levels as per bloom's Taxonomy
1	Illustrate knowledge about phases of PLM, PLM strategies and methodology forPLM feasibility study and PDM implementation	L1, L2
2	Illustrate various approaches and techniques for designing and developingproducts.	L1
3	Apply product engineering guidelines / thumb rules in designing productsfor moulding, machining, sheet metal working etc	L1, L2, L3, L4
4	Acquire knowledge in applying virtual product development tools for components, machining and manufacturing plant	L1, L2, L3, L4
5	Apply Integration of Environmental Aspects in Product Design	L1, L2, L3, L4
6.	Illustrate knowledge about Life Cycle Assessment and Life Cycle Cost Analysis	L1, L2

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels as per bloom's Taxonomy
1	**Introduction to Product Lifecycle Management (PLM) and PLM Strategies** Product Lifecycle Management (PLM), Need for PLM, Product Lifecycle Phases, Opportunities of Globalization, Pre-PLM Environment, PLM Paradigm, Importance & Benefits of PLM, Widespread Impact of PLM, Focus and Application, A PLM Project, Starting the PLM Initiative, PLM Applications,Industrial strategies, Strategy elements, its identification, selection and implementation, Developing PLM Vision and PLM Strategy , Change management for PLM	10	L1, L2
2	**Product Design** Product Design: Product Design and Development Process, Engineering Design, Organization and Decomposition in Product Design, Typologies of Design Process Models, Reference Model, Product Design in the Context of the Product Development Process, Relation with the Development Process Planning Phase, Relation with the Post design Planning Phase, Methodological Evolution in Product Design, Concurrent Engineering, Characteristic Features of Concurrent Engineering, Concurrent Engineering and Life Cycle Approach, New Product Development (NPD) and Strategies, Product Configuration and Variant Management, The Design for X System, Objective Properties and Design for X Tools, Choice of Design for X Tools and Their Use in the Design Process	9	L1
3	**Product Data Management (PDM)** Product Data Management (PDM):Product and Product Data, PDM systems and importance, Components of PDM, Reason for implementing a PDM system, financial justification of PDM, barriers to PDM implementation	5	L1, L2, L3, L4
4	**Virtual Product Development Tools** Virtual Product Development Tools: For components, machines, and manufacturing plants, 3D CAD systems and realistic rendering techniques, Digital mock-up, Model building, Model analysis, Modeling and simulations in Product Design, Examples/Case studies	5	L1, L2, L3, L4
5	**Integration of Environmental Aspects in Product Design** Integration of Environmental Aspects in Product Design: Sustainable Development, Design for Environment, Need for Life Cycle Environmental Strategies, Useful Life Extension Strategies,End-of-Life Strategies, Introduction of Environmental Strategies into the Design Process, Life Cycle Environmental Strategies and Considerations for Product Design	5	L1, L2, L3, L4
6	**Life Cycle Assessment and Life Cycle Cost Analysis** Life Cycle Assessment and Life Cycle Cost Analysis: Properties, and Framework of Life Cycle Assessment, Phases of LCA in ISO Standards, Fields of Application and Limitations of Life Cycle Assessment, Cost Analysis and the Life Cycle Approach, General Framework for LCCA, Evolution of Models for Product Life Cycle Cost Analysis. Introduction to Industry4.0, Design principles and Challenges, Applications of Industry 4.0	5	L1, L2

Books and References:

SN	Title	Authors	Publisher	Edition	Year
1	Product Lifecycle Management: Paradigm for 21st Century Product Realisation	John Stark	Springer-Verlag	1st Edition	2004

T.E. Semester –VI

Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS- HME 2020)TCET Autonomy Scheme (w.e.f. A.Y. 2020-21)

BE (Computer Engineering)							**T.E. (SEM :** VI)		
Course Name :Essence of Traditional Indian Knowledge							**Course Code :** MC-CS601		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Presentation (25)**	**Term work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**AC**	**AC**	**25**
1	--	--	1	Non credit	--	--	--	25	
AC- Activity Evaluation **Total weightage of marks for continuous evaluation of Term work/Report:** Formative (40%), Timely Completion of Practical (40%) and Attendance/ Learning Attitude (20%)									
Prerequisite: History, Value Education, Moral Science									

Course Objective: The course aims at imparting basic principles of thought process, reasoning and inferencing with focus on sustainability as the core of Indian Traditional knowledge Systems connecting society and nature. It also focuses on Holistic life style of yogic science and wisdom important in modern society with rapid technological advancements and societal disruptions with an introduction to Indian Knowledge Systems, Indian philosophical traditions, Indian perspective of modern scientific world-view, and basic principles of Yoga and holistic health care system..

Course Outcomes: **Upon completion of the course student will be able to:**

S.No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Develop knowledge of trade and commerce in classical and medieval India.	L1, L2
2	Correlate the understanding of Indian Knowledge System with modern Science.	L1, L2, L3
3	Develop the knowledge of Ancient Indian science and technology and India's contribution to the world.	L1, L2
4	Know and analyse the effects of colonization on Indian culture and civilization.	L1, L2, L3,L4
5	Understand the role and position of women in traditional and modern Indian society	L1, L2
6	Develop the knowledge of Globalization and growth of India Economy since Independence.	L1, L2, L3, L4

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Introduction** Ancient India –-– Classical India – Dharma as the bedrock of Indian society – Trade and commerce in classical and medieval India and the story of Indian supremacy in the Indian ocean region;	2	L1, L2
2	**Basic structure of Indian Knowledge System** The vedas, the vedic society and the Sanatana Dharma, classical sanskrit literature – Modern Science and Indian Knowledge System -Yoga and Holistic Health care Indian Philosophy – the orthodox (Vaidika) and the heterodox (atheistic) schools; Ramayana and Mahabharata; Bhagavad Gita;	3	L1, L2
3	**India's contribution to the world: spirituality, philosophy and Sciences** Saints and sages of India; Ancient Indian medicine: towards an unbiased perspective; Ancient Indian mathematics; Ancient Indian astronomy; Ancient Indian science and technology.	2	L1, L2, L3
4	**Indian economy – before and after colonization:** What attracted the rest of the world to India?; India on the eve of the arrival of European merchants; The story of colonization and the havoc it wrecked on Indian culture and civilization; Macaulay and the start of the distortion of Indian education and history; a briefsurvey; The emergence of modern India.	3	L1, L2, L3
5	**Women in Indian society** The role and position of women in Hindu civilization; Gleanings from the Vedas, Brihadarnyaka Upanishad, Saptasati Devi Mahatmyam, Ramayana, Mahabharata, Manusmriti, Kautilya'sArthasastra and Mrichchhakatikam of Sudraka; The role and position of Indian women.	3	L1, L2, L3
6	**Modern India** The national movement for freedom and social emancipation; Swami Vivekananda, Sri Aurobindo, Rabindranath Tagore; Understanding Mahatma Gandhi; A new nation is born as a republic – the pangs of birth and growth; India since Independence – the saga of socio- political movements; Problems facing the nation today; Globalization and Indian Economy; Bharatavarsha today and the way ahead: Regeneration ofIndian National Resources.	2	L1, L2,L3
Total Hrs.		**15**	

Books and References:

S.No.	Title	Authors	Publisher	Edition	Year
1.	Cultural Heritage of India-course material	V. Sivaramakrishnan	BharatiyaVidyaBhavan,	5th Edition,	2014
2.	Glimpses of Traditional Indian Life	Bhakti Vikas Swami	Bhakti Vikas Trust	2014	2010
3.	Knowledge traditions and practices of India,	-	CBSE Publication	2nd Edition	2013
4.	Value Education for Young Leaders	Dr. P Hari Krishna	Vashnavi Krishna Publication	2nd Edition	2015
5.	Open eye Meditation	Shubha Vilas Das	FinGer Print Belief	2nd Edition	2016
6.	Life Amazing Secrets	Gaur Gopal Das	Penguin India	1st Edition	2018
7.	Ethics from Epics	Govinda Das	Tulsi Publication	1st Edition	2015
8.	A Hand Book on PANCH KOSH	Rajesh A Kadam	Shishmahal Arts Co	1st Edition	2019

Online References:

S. No.	Website Name	URL	Modules Covered
1	Glimpses of Eternal India	https://www.amrita.edu/course/glimpses- eternal-india	M1- M6

T.E. Semester –VI
Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS- HME 2020)TCET Autonomy Scheme (w.e.f. A.Y. 2020-21)

<table>
<tr><td colspan="5">B.E.(Computer Engineering)</td><td colspan="3">SEM: VI</td></tr>
<tr><td colspan="5">Course Name: Summer Internship</td><td colspan="3">Course Code: SI-CS601</td></tr>
<tr><td colspan="5">Teaching Scheme (Program Specific)</td><td colspan="3">Examination Scheme (Formative/ Summative)</td></tr>
<tr><td colspan="5">Modes of Teaching / Learning / Weightage</td><td colspan="3">Modes of Continuous Assessment / Evaluation</td></tr>
<tr><td colspan="5">Total Hours : Maximum 2 Weeks (60 to 80 Hours during summer vacation)</td><td>PR</td><td>TW</td><td>Total</td></tr>
<tr><td>Theory</td><td>Tutorial</td><td>Practical</td><td>Contact Hours</td><td>Credits</td><td rowspan="2">-</td><td rowspan="2">50</td><td rowspan="2">50</td></tr>
<tr><td>-</td><td>-</td><td>-</td><td>160*</td><td>4*</td></tr>
<tr><td colspan="8">Note :
1. Internship will be done in institute laboratory in collaboration with industries.
2. Evaluation and assessment will be done as per AICTE guidelines.</td></tr>
<tr><td colspan="8">Prerequisite: Fundamental knowledge of respective programmes</td></tr>
</table>

Course Objectives:

To get industry like exposure in the institute laboratories by carrying out activities / projects. Also design innovative techniques / methods to develop the products.

Course Outcomes: **Upon completion of the course students will be able to:**

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Apply subjects knowledge in the college laboratories for carrying out projects	L3, L4,L5
2	Developed innovative techniques / methods to develop the products	L3, L4,L5
3	Contribute for the society	L3, L4,L5

Detailed Syllabus:

Module No.	Topics	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Program Specific Internship** • Training and certification on emerging technologies in domains offered by Department of Computer Engineering • Applying classroom and laboratory knowledge to design , develop and deploy the products	L3, L4,L5
2	**Inter disciplinary Internship** • To explore and understand issues and challenges in the other disciplines (EXTC, ELEX, MECH and CIVIL) • Design , develop and deploy cost effective products using multidisciplinary approach	L3, L4,L5
3	**Industry Specific Internship** • To explore and understand issues and challenges in industry • Developing solutions for industry specific problems • Design , develop and deploy products for startup and SMEs	L3, L4,L5
4	**Interpersonal Internship** • To develop interpersonal skills such as leadership, marketing ,publicity and corporate ethics and communication • To get competence in problem solving , presentation , negotiation skills	L3, L4,L5
5	**Social Internship** • Identify and study different real life issues in the society • Identify societal problems and provide engineering solutions to solve these problems	L3, L4,L5
6	**Academic Internship** • Study report preparation, preparation of presentations, copy table book preparation , business proposal and IPR • Capture aspirations & expectations through interviews of students. • Ways to connect research in technical institutes with industry. • Taking inputs from self, local stakeholders and global stake holders which will help to develop process with comparative and competitive study	L3, L4,L5

Books and References:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	The Ultimate Guide to Internships: 100 Steps to Get a Great Internship and Thrive in It (Ultimate Guides)	Eric Woodard	Allworth	I	2015

Sr. No.	**Website Name**	**UR L**	**Modules Covered**
1	https://www.letsintern.co m/	https://www.letsintern.com/internships/summer-internships	M1-M6
1	https://codegnan.com	https:/codegnan.com/blog/benefits-of-internships- and- importance	M1-M6
2	https://www.honorsociet y.org	https://www.honorsociety.org/articles?category=internships	M1-M6

T.E. Semester –VI
Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS- HME 2020)TCET Autonomy Scheme (w.e.f. A.Y. 2020-21)

<table>
<tr><th colspan="7">B.E.(Computer Engineering)</th><th colspan="3">T.E. SEM: VI</th></tr>
<tr><td colspan="7">Course Name: : Professional Skill VI (Android App Development)</td><td colspan="3">Course Code: HSD - CSPS601</td></tr>
<tr><th colspan="5">Teaching Scheme (Program Specific)</th><th colspan="5">Examination Scheme (Formative/ Summative)</th></tr>
<tr><th colspan="5">Modes of Teaching / Learning / Weightage</th><th colspan="5">Modes of Continuous Assessment / Evaluation</th></tr>
<tr><th colspan="5">Conducted in the beginning of Semester during first 3 Weeks</th><th colspan="2">Theory (100)</th><th>Practical/Oral (25)</th><th>Term Work (25)</th><th rowspan="2">Total</th></tr>
<tr><th>Theory</th><th>Tutorial</th><th>Practical</th><th>Contact Hours</th><th>Credits</th><th>IA</th><th>ESE</th><th>(AC) Presentation</th><th>(AC) Report</th></tr>
<tr><td>15</td><td>-</td><td>30</td><td>45</td><td>2</td><td>-</td><td>-</td><td>50</td><td>25</td><td>75</td></tr>
<tr><td colspan="10">IA: In-Semester Assessment - Paper Duration – 1.5 Hours
ESE: End Semester Examination - Paper Duration - 3 Hours
AC: Activity
The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)</td></tr>
<tr><td colspan="10">Prerequisite: Java Programming Basics.</td></tr>
</table>

Course Objective: The course intends to deliver the fundamental knowledge of Android platform and its architecture to apply and create Android UI designing.

Course Outcomes: Upon completion of the course students will be able to:

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Understand Android platform, Architecture and features	L1, L2
2	Design User Interface and develop activity for Android App. Development	L1, L2, L3
3	Use Intent, Broadcast receivers and Internet services in Android App. Development	L1, L2, L3
4	Design and implement Database Application and Content providers.	L1, L2, L3
5	Apply multimedia, camera and Location based services in Android App. Development	L1, L2, L3
6	Understand various security issues in Android platform.	L1, L2,

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Introduction to Android** Android overview, Features of Android, Android Applications. Setting up Java Development Kit (JDK), Setting up Android SDK, Setting up Eclipse IDE Setting up Android Development Tools (ADT) Plugin, Creating Android Virtual Device.	2	L1, L2, L3
2	**Android Architecture and Design Components** Application: Application Manifest File, Externalizing Resources, Android Application Lifecycle and Android Application Class. Android Activity: Creating activities, Activity lifecycle and Android Activity classes. User Interface: Fundamental Android UI Design, Layouts, Fragments, Designing UI with views, Creating new views, widget toolbox, Adapters.	3	L1, L2, L3
3	**Intents, Broad Cast receiver and Internet Resources** Introducing Intents, Linking Activities Using intents, Calling Built-in Applications Using intents, Displaying notifications, Creating Intent Filters and Broadcast Receivers, Downloading and Parsing Internet Resources, Using the Download Manager, Internet Services, Connecting to Google App Engine	2	L1, L2, L3
4	**Database Connectivity & Content Providers** Introducing Android Databases, Introducing SQLite, Content Values and Cursors, Working with SQLite Databases, Parsing an XML document, Parsing JSON data. Creating Content Providers, Using Content Providers.	2	L1, L2, L3
5	**Advance Android Programming** Playing Audio and Video, Manipulating Raw Audio, Using Audio , Using the Camera for Taking Pictures, Recording Video, Using Media Effects, Adding Media to the Media Store. Using Location-Based Services, Using the Emulator with Location-Based Services, Selecting a Location Provider, Finding Your Current Location.	3	L1, L2, L3
6	**Android Application Deployment** Android Security Model, Android's Manifest Permissions, Mobile Security Issues, Recent Android Attacks, Pen Testing Android. Preparing for Publishing, Deploying APK Files T	3	L1, L2, L3
	Total Hours	**15**	

Books and References:

SN	Title	Authors	Publisher	Edition	Year
1	Professional Android 4 Application Development	RETO MEIER	Wrox publication	3 rd	2012
2	Beginning Android Application Development	Abhishek Dubey, Anmol Misra	CRC Press	1 st	2013
3	Android Application Development For Dummies Android Cookbook	Ian F. Darwin	O'Reilly	1 st	2011

Online References:

S. No.	Website Name	URL	Modules Covered
1	https://developer.android.com https://www.tutorialspoint.com/	https://developer.android.com/training/basics/firstapp https://www.tutorialspoint.com/android/android_application_components	M1, M2
2	https://www.udemy.com/ https://www.coursera.org/ https://www.tutorialspoint.com/	https://www.udemy.com/learn-android-application-development-y/ https://www.coursera.org/specializations/android-app-development https://www.tutorialspoint.com/android/android_intents_filters.htm	M3. M4, M5, M6

List of Practical/ Experiments:

Practical Number	Type of Experiment	Practical/ Experiment Topic	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	Basic Experiments	Install/configurejava development kit(Jdk), android studio, android sdk and AVD	2	L1,L2
2		Write a program to display hello world on screen.	2	L1,L2
3	Design Experiments	Write program to implement frame layout, table layout and relative layout.	2	L1,L2, L3
4		Write program to implement login window using UI controls.	2	L1, L2, L3
5		Write a program to implement date and time picker.	2	L1,L2, L3
6		Write a program to implement new activity using explicit intent and implicit intent.	2	L1, L2, L3
7		Write a program to implement content provider.	2	L1, L2, L3
8		Write a program to implement database connectivity using SQLite.	2	L1,L2
9		Write a program to XML document in android.	2	L1, L2, L3
10		Write a program to design camera.	2	L1,L2
11		Write a program to implement to location service.	2	L1, L2, L3
12		Design and deploy application.	2	L1,L2, L3
13	Case Study	1. Configuring Android in Linux	2	L1, L2, L3
14	Mini Project	1. Android Bluetooth-based Chatting App 2. Smart Travel Guide Application 3. Mobile Banking App	4	L1, L2, L3
		Total Hours	**30**	

T.E. Semester –VI
Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS-HME 2020)TCET Autonomy Scheme (w.e.f. A.Y. 2020-21)

B.E (Computer Engineering)					T. E SEM: VI		
Course Name: Project based Learning-IV					**Course Code:** HSD - CSPBL601		
Teaching Scheme (Holistic Student Development - HSD) Industry Specific/Interdisciplinary					**Examination Scheme (Formative/ Summative)**		
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**		
Conducted in the beginning of Semester during first 3 Weeks					**Presentation (25)**	**Report (25)**	**Term Work (25)**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**(AC)**	**(AC)**	
-	-	30	30	1	25	-	**25**
IA: In-Semester Assessment - Paper Duration – 1.5 Hours **ESE: End Semester Examination - Paper Duration - 3 Hours** **AC: Activity** **The weightage of marks for continuous evaluation of Term work/Report:** Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)							
Prerequisite: Web Development							

Course Objective: The Course intends to aid students identify real world problems and apply android programming skills to find solutions to them.

Course Outcomes: Upon completion of the course students will be able to:

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Interpret the basic real time problems.	L1, L2
2	Apply android programming skills to solve real time problems.	L1, L2, L3
3	Interpret the results obtained for documentation and presentation.	L1-L6

Projects Listing:

Sr. No	Project Topic	Types of project
1	Smart Travel Guide Application	Application
2	Android Bluetooth-based Chatting App	Application
3	Surveillance Camera	Core
4	Android Bluetooth-based Chatting App	Application
5	Remote Password Security	Research
6	Android Voice Based Train Time-Table	Application
7	Android Vehicle Toll Payment System	Application
8	Android Based Self Attendance System Using OTP	Application
9	Automated Canteen Ordering System using Android	Application
10	Medical Search Engine Project	Application

T.E. Semester –VI
Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS-HME 2020)TCET Autonomy Scheme (w.e.f. A.Y. 2020-21)

BE (Computer Engineering)					**SEM: VI**		
Course Name: Research Based Learning II					**Course Code:** HSD - CSRBL601		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**		
Modes of Teaching / Learning / Weightage					**Assessment/Evaluation Scheme**		
Conducted in the beginning of Semester during first 3 Weeks					**Presentation**	**Report**	**Term Work**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**AC**	**AC**	**TW**
-	-	30	30	1	25	25	50
Audit course evaluated by Teacher Guardian							
Mid Semester Assessment for Term work will be on continuous basis							
Prerequisite: Subject knowledge, Domain knowledge							

Course Objectives : This course is focused to engage the learner in research using critical thinking, problem solving, coding andtechnical writing related to upcoming latest technologies.

Course Outcomes :Upon completion of the course students will be able to:

S.N.	Course Outcome	Cognitive level attainment as per revised Bloom Taxonomy
1	Upgrade the knowledge of latest technologies and developments in their domain.	L1, L2
2	Develop prototype based on idea which providing solutions to industry, research organization, academic organization, community or society as a whole.	L1, L2, L3,L4,l5,L6
3	Design and develop the code /model for given problem definition in a Competitive environment and contribute for grants.	L1, L2, L3,L4,l5,L6
4	Write a research paper and understand technical writing.	L1, L2, L3,L4,l5

Detailed Syllabus:

Module No.	Topics	Cognitive level attainment as per revised Bloom Taxonomy
1	**Participation in online community / Forums/writing Blogs** I. **Registration** on online community/forum/followblogs /Twitter etc. Creating own Blogs and Linked in profile. II. **Evaluation** is based on report submission on activities learned through registration on various platforms. Student need to submit Linkedin profile address, Blog URL is recommended **Presentation and Evaluation**	L1, L2
2	**Proto type development/ Mathematical model development based on Idea** I. **Proto type development**: Introduction to Research Methodology techniques. Introduction and importance of prototype development. Transforming Idea into prototype with implementation/working model. II. **Presentations** by students, Experience sharing by entrepreneurs or Hackathon Winners. **Presentation and Evaluation**	L1, L2, L3,L4,l5,L6
3	**Building Competitive Attitude** I. **Participation in Project competitions/Coding competitions/Working for research grant/Consultancy: a)** Participating at institute/National level/University level/ Conference /participate in competitions. **b)** Participation in funded project/consultancy projects **c)** Experience sharing by goodcoders/winners II. **Evaluation** based on Presentation/Certificates/ Grant received/Consultancy received **Presentation and Evaluation**	L1, L2, L3,L4,l5,L6
4	**Research Paper Publication** I. **Introduction to Research paper writing:** Write a paper/case studyon review of literature based on idea and developed prototype. II. **Publishing:** Identification of appropriate journal or conference at University level / State level/National level for submission and Preparation of a review paper. **Evaluation of Research paper based on quality and acceptance of research paper.**	L1, L2, L3,L4,L5,L6

References:

Sr. No.	Title	Authors	Publisher	Edition	Year
1.	Guide to Competitive Programming: Learning and Improving Algorithms Through Contests	Antti Laaksonen	Springer	Kindle	2018
2.	Writing Research Papers: A Complete Guide	James D. Lester	Longman	10th	2001
3.	Creativity in Product Innovation	Jacob Goldenberg	Cambridge University Press	Kindle	2002

Online References:

Sr. No.	Website Name	URL	Modules Covered
1.	https://www.researchgate.net	https://www.researchgate.net/publication/224372998_Idea_Generation_Techniques_among_Creative_Professionals	M2
2.	https://discuss.codechef.com	https://discuss.codechef.com/t/programming-contest-detailed-syllabus-along-with-example-problems/17791	M3
3.	https://www.statpac.com	https://www.statpac.com/online-software-manual/Basic-Research-Concepts.htm	M4
4.	https://www.slideshare.net	https://www.slideshare.net/AsirJohnSamuel/1introduction-to-research-methodology?next_slideshow=1	M4

B.E. Semester –VII
Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS-H 2019)
TCET Autonomy Scheme (w.e.f. A.Y. 2021-22)

<table>
<tr><th colspan="6">BE Computer Engineering</th><th colspan="5">B.E. SEM : VII</th></tr>
<tr><td colspan="6">Course Name: Software Architecture</td><td colspan="5">Course Code : PCC-CS701</td></tr>
<tr><td colspan="5">Teaching Scheme (Program Specific)</td><td colspan="6">Examination Scheme (Formative/ Summative)</td></tr>
<tr><td colspan="5">Modes of Teaching / Learning / Weightage</td><td colspan="6">Modes of Continuous Assessment / Evaluation</td></tr>
<tr><td colspan="5">Hours Per Week</td><td colspan="2">Theory (100)</td><td>Practical/Oral (25)</td><td>Term Work (25)</td><td rowspan="2">Total</td></tr>
<tr><td>Theory</td><td>Tutorial</td><td>Practical</td><td>Contact Hours</td><td>Credits</td><td>IA</td><td>ESE</td><td>PR/OR</td><td>TW</td></tr>
<tr><td>3</td><td>-</td><td>2</td><td>5</td><td>4</td><td>25</td><td>75</td><td>25</td><td>25</td><td>150</td></tr>
<tr><td colspan="10">IA: In-Semester Assessment - Paper Duration – 1 Hour
ESE: End Semester Examination - Paper Duration - 3 Hours
The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)</td></tr>
<tr><td colspan="10">Prerequisite: Software Engineering</td></tr>
</table>

Course Objectives: To understand the importance of software architecture in building effective, efficient & competitive software product by applying principal design decisions governing the system & designing applications from architectural perspective by identifying different functional and non-functional properties of complex software system

Course Outcomes: **Upon completion of the course students will be able to:**

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy Levels
1	Understand & gain knowledge of various approaches to document a software system	L1,L2
2	Understand to describe functional and non-functional requirements	L1, L2,L3
3	Apply & use proper architecture for software	L1, L2,L3
4	Analyze & categorize different components used in the software system	L1,L2,L3,L4
5	Identify & evaluate different architectural styles	L1,L2,L3,L4
6	Create & improve quality of software by selecting proper architecture	L1,L2,L3,L4

Detailed Syllabus (Total No. of Hours: 45):

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Introduction to Software Architecture and Software Product Life Cycle** Evolution of Software Development, Fundamentals of Software Engineering, Elements of Software Architecture. Management View, Software Engineering View, Engineering Design View, Architectural View	7	L1,L2
2	**Architectural Design Process and Introduction to Software Design** Understanding the problem, Identifying design elements and their relationship, Evaluating the Architecture, Transforming the Architecture, Problems in Software Architectural Design, Function form and Fabrication, The scope of Design, Psychology and Philosophy of Design, General Methodology ofDesign	8	L1, L2,L3
3	**Complexity, Modularity, Models and Knowledge Representation** Complexity, Modularity, What are Models, What are Models used for, What roles do Models Play, Modeling the Problem and Solution Domain, Views	10	L1, L2,L3
4	**Architecture Representation and Architectural Design Principles** Goals of Architecture Representation, Foundation of Architectural Representation, Architectural Description Language, Architectural Level of Design, Architecting with Design Operators, Functional Design Strategies	10	L1,L2,L3, L4
5	**Architectural Styles, Patterns and Meta models** Defining Architectural Patterns and Style, Common Architectural Styles, Understanding Metamodels, Applying Reference Models, Fundamental Metamodel for describing Software Component	5	L1,L2,L3, L4
6	**Architectural Description and Architectural Framework, Architecture Quality** Standardizing Architectural Description, Creating an Architectural Description, Applying Architectural Description, Software Architecture Framework, 4+1 View Model of Architecture, Reference Model for Open Distributed Processing, Importance of Assessing Software Quality, How to improve Quality. DevOps practice and Architecture	5	L1, L2, L3,L4
	Total Hours	**45**	

Books and References:

S. No.	Title	Authors	Publisher	Edition	Year
1	Software Architecture: Foundations, Theory, and Practice	Richard N. Taylor, Nenad Medvidovic, Eric Dashofy	Wiley	3rd	2010
2	Software Architecture Perspectives on an Emerging Discipline	M. Shaw	Prentice- Hall	3rd	2019
3	Software Architecture in Practice	Len Bass, Paul Clements, Rick Kazman	Pearson	3rd	2019
4	The Art of Software Architecture: Design Methods and Techniques	Stephen T.Albin,	Wiley India Private Limited	1st	2003
5	DevOps A Software Architect's Perspective	Len Bass, Ingo Weber, Liming Zhu, Addison Wesley	Addison-Wesley Professional	1st	2015

Online References:

S. No.	Website Name	URL	Modules Covered
1	Tutorialspoint	https://www.tutorialspoint.com/sdlc/sdlc_overview.htm	M1
2		https://www.tutorialspoint.com/software_architecture_design/introduction.htm	M2
3		https://www.tutorialspoint.com/object_oriented_analysis_design/ooad_object_oriented_principles.htm	M3
4		https://www.tutorialspoint.com/software_architecture_design/architecture_models.htm	M4
5		https://www.tutorialspoint.com/software_architecture_design/architecture_techniques.htm	M5
6		https://www.tutorialspoint.com/devops_tutorials.htm	M6

List of Practical/ Experiments:

Practical Number	Type of Experiment	Practical/ Experiment Topic	Hrs.	Cognitive levels as per blooms Taxonomy
1	Basic Experiments	Modeling using xADL	4	L1, L2
2		Visualization using xADL 2.0	2	L1, L2
3		Creating Web Service	2	L1, L2, L3
4	Design Experiments	Integrate software components using a middleware	2	L1, L2, L3
5		Use middleware to implement connectors	2	L1, L2, L3
6		Wrapper to connect two applications with different architectures	2	L1, L2, L3, L4
7		Identifying Design requirements for an Architecture for any specific domain	4	L1, L2, L3
8		Identifying System requirements for an Architecture for any specific domain	2	L1, L2, L3
9		Mapping of non-functional components with system requirements	2	L1, L2, L3, L4
10		Implementation of Software Architecture for identified system/application	4	L1, L2, L3
11	Case Studies	• Architecture evaluation, analysis, and design • Architecture Tradeoff Analysis Method (ATAM) • Quality Attribute Workshops (QAW) • Architecture reconstruction	4	L1, L2, L3, L4
Total Hours			**30**	

B.E. Semester –VII
Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS-H 2019)
TCET Autonomy Scheme (w.e.f. A.Y. 2021-22)

BE Computer Engineering							**B.E. SEM : VII**		
Course Name: Parallel Computing							**Course Code :** PEC-CS7011		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	**150**
3	-	2@	5	4	25	75	25	25	
IA: In-Semester Assessment - Paper Duration – 1 Hour									
ESE: End Semester Examination - Paper Duration - 3 Hours									
The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)									
Prerequisite: Software Engineering									

Course Objectives: To learn concepts of parallel processing as it pertains to parallel computing. To design, develop and analyze parallel programs on high performance computing resources using parallel programming paradigms.

Course Outcomes: **Upon completion of the course students will be able to:**

Sr. No.	**Course Outcomes**	**Cognitive levels of attainment as per Bloom's Taxonomy Levels**
1	Understand & gain knowledge of various Parallel computing, scope of parallel computing	L1,L2
2	Understand to describe System Architectures	L1, L2,L3
3	Apply & use proper Parallel Algorithms	L1, L2,L3
4	Analyze & categorize different Parallel Algorithms & Applications	L1,L2,L3,L4
5	Identify & evaluate different Parallel Programming	L1,L2,L3,L4
6	Create & improve quality of Analytical Modelling of Parallel Programs	L1,L2,L3,L4

Detailed Syllabus (Total No. of Hours: 45):

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Introduction to Parallel Computing** Parallel computing, scope of parallel computing, Abstract model of serial & parallel computation, pipelining, data parallelism, control parallelism, scalability, topologies in processor organization, parallel computing design consideration, parallel algorithms & parallel architectures, applications of parallel computing.	7	L1,L2
2	**System Architectures** Shared memory multiprocessors(UMA-Uniform memory Access), Distributed memorymultiprocessors(NUMA- Non Uniform memory Access),SIMD, Systolic processor ,Cluster computing, Grid computing, Multicore Systems	8	L1, L2,L3
3	**Parallel Algorithms** Introduction to parallel algorithms, parallel algorithm models, Decomposition Techniques, characteristics of tasks & interactions, mapping techniques for load balancing, methods for containing interaction overheads.	7	L1, L2,L3
4	**Parallel Algorithms & Applications** Matrix multiplication, parallel reduction, parallel sorting: bubble, quick sort, Graph algorithm: Minimum spanning tree (prim's algorithm), Fast Fourier transform: serial algorithm, transpose algorithm.	10	L1,L2,L3, L4
5	**Parallel Programming** Paradigms, parallel programming models, shared memory programming, message passing programming, MPI , PVM ,Threads.	8	L1,L2,L3, L4
6	**Analytical Modelling of Parallel Programs** Sources of overhead in parallel programs, performance metrics for parallel systems, effect of granularity&data mapping on performance, scalability of parallel systems, analysis of parallel programs.	5	L1, L2, L3,L4
	Total Hours	45	

Books and References:

S. No.	Title	Authors	Publisher	Edition	Year
1	Introduction to Parallel Computing	Ananth Grama ,George Karypis, Vipin Kumar , Anshul Gupta.	Wiley	2nd Edition	2018
2	Algorithms and Parallel Computing	Fayez Gebali	(Wiley Series	3rd	2018
3	Scalable Parallel Computers	Kai Hwang, Zhiwei Xu .	Pearson	3rd	2019
4	Introduction to parallel processing	M.Sasikumar , Dinesh shikhare, P. Ravi Prakash .	Wiley India Private Limited	1st	2018
5	Principles of Grid computing	Len Bass, Ingo Weber, Liming Zhu, Addison Wesley	P. Venkata Krishna, Ane's Student Edition .	1st	2018

Online References:

S. No.	Website Name	URL	Modules Covered
1	Tutorials point	https://hpc.llnl.gov/training/tutorials/introduction-parallel-computing-tutorial	M1
2		https://www-users.cs.umn.edu/~karypis/parbook/	M2
3		https://en.wikipedia.org/wiki/Parallel_computing	M3
4		https://www.coursera.org/courses?query=parallel%20computing	M4
5		https://onlinelibrary.wiley.com/doi/pdf/10.1002/9780470932025.fmatter	M5
6		https://www.cambridge.org/core/books/introduction-to-parallel-computing/F2170BB15F769C874CD62B3DB5255080	M6

Mini Project Hours Distribution:

Sr. No.	Topic	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	Problem Definition and Project Title Identification	2	L1, L2
2	Study tool for implementation	6	L1, L2
3	Deciding the modules of the project.	2	L1, L2
4	Design of the proposed architecture	4	L1, L2, L3
5	Implementation and Deployment	10	L1, L2, L3,L4
6	Testing and Evaluation	4	L1, L2, L3,L4,L5
7	Report Preparation	6	L1, L2, L3

B.E. Semester –VII
Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS-H 2019)
TCET Autonomy Scheme (w.e.f. A.Y. 2021-22)

B. E (Computer Engineering)									**B.E. SEM : VII**
Course Name : Network infrastructure									**Course Code :**PEC-CS7012
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	**150**
3	-	2@	5	4	25	75	25	25	
IA: In-Semester Assessment - Paper Duration – 1.5 Hour **ESE: End Semester Examination - Paper Duration - 3 Hours** **The weightage of marks for continuous evaluation of Term work/Report:** Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)									
Prerequisite: Computer Basics, Procedural Programming Languages, Probability									

Course Objective: The objective of this course is to impart necessary knowledge of the network and its infrastructure furthermore, to develop skills required to build optimal IT infrastructure.

Course Outcomes: **Upon completion of the course students will be able to:**

SN	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Understand the complexities of various Challenges in IT infrastructure	L1, L2
2	Apply Network Infrastructure Tools to real life Examples.	L1, L2, L3
3	Demonstrate understanding of the network topologies	L1, L2,L3
4	Apply and analyze the complexity of the Network and its infrastructure	L1, L2, L3, L4
5	Demonstrate various simulation tools .	L1, L2, L3
6	Discuss applications of IT infrastructure for real life applications	L1, L2

Detailed Syllabus (Total No. of Hours: 45):

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Introduction: Network and IT infrastructure** Enterprise Network Design: Understanding Network Requirement analysis, Architecture and Design Process Network Architecture: Component Architecture Architectural models: topological, flow model, Functional model Addressing and Routing Architecture, Network Management Architecture, Performance Architecture .Approach Network Structure Model: Hierarchical Network Model, Enterprise wide network Architecture model- Enterprise Edge Area.	5	L1, L2
2	**Wired and Wireless LAN/MAN technologies** Enterprise LAN Design: Ethernet Design Rule. 100 Mbps Fast Ethernet Design rules, gigabit Ethernet Design Rules, 10 Gigabit Ethernet Design rules, 10GE Media types Understanding Working of Repeater, hub, Bridge, routers, Layer2/3 Switch Campus LAN Design Best Practice Server Farm Design, DMZ design. Campus LAN QoS consideration Multicast Traffic Consideration	6	L1, L2,L3
3	**The Data Center: Design, implementation and management** Data Center Design: Data Center Design: Technical and economic considerations, Strategic IT infrastructure investment ,TCO of Data Center , Server technologies and architectures Architecture Consideration: Infrastructure Model, Service Layers Model of Cloud computing Architecture Consideration: Telecommunications Infrastructure Standard for Data Centers Telecommunications Infrastructure Standard for Data Centers , Implementation Best Practices Purpose of TIA-942, Data Center Topology Data Center Tiers.Server virtualization: Value proposition and technical challenges	12	L1, L2,L3
4	**Wired and Wireless WAN technologies** Enterprise Wireless LAN Architecture: Key components of LAN/MAN infrastructure Hierarchical LAN design, Implementation of VLANs in a converged network , understanding 802.11X standards, LWAPP WLAN Controller. WLAN technologies and topologies, Wireless Network Components, WLAN enterprise design, WLAN performance, WLAN monitoring and troubleshooting, LAN/MAN Wireless technologies and Wi-Fi: protocols (802.11, WiMAX), WLAN security. Intra and inter controller roaming.,Video/Voice over IP	10	L1, L2, L3, L4
5	**SAN and SDN** SAN: Importance of storage Network, Data Protection Storage Network Architecture, Storage Network Backup and Recovery, Storage and Network in Storage Network, Software for Storage Network, Adopting and Managing SAN.Software Defined Network : Introduction and functions of SDN and Open Flow , OpenFlow messages.	6	L1, L2, L3
6	**Corporate Network Management**	6	L1, L2

	Functional areas of network management ,Network management architectures ,Network management protocols ,From network management towards service/business management ,Change management ,QoS management ,The future of network management		
	Total Hours	**45**	

Books and References:

	Title	Authors	Publisher	Edition	Year
1	Network Analysis, Architecture, and Design CCDA	Morgan Kaufman, James D.	Cisco official Guide	3rd Edition,	2007
2	Internetworking Technologies Handbook		Pearson.	4th	

Online Resources:

S. No.	Website Name	URL	Modules Covered
1	www.tutorialspoint .com	https://www.tutorialspoint.com/virtualization2.0/virtualization2.0_preparing_the_infrastructure.htm	M1-M6
2	Web Services and Service-Oriented Architectures	http://www.service-architecture.com/ - Service-	M3,M4
3	www.javatpoint.co m	https://www.javatpoint.com/infrastructure-as-a-service	M5
	Data Center Top-of-Rack Architecture Design”	White paper.	Cisco Systems. 1ST Edition 2011

Calendar for MiniProject

Sr. No.	Topic	Hrs.	Cognitive levels of attainment as per Bloom’s Taxonomy
1	Problem Definition and Project Title Identification	2	L1, L2
2	Study tool for implementation	6	L1, L2
3	Deciding the modules of the project.	2	L1, L2
4	Design of the proposed architecture	4	L1, L2, L3
5	Implementation and Deployment	10	L1, L2, L3,L4
6	Testing and Evaluation	4	L1, L2, L3,L4,L5
7	Report Preparation	6	L1, L2, L3

B.E. Semester –VII
Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS-H 2019)
TCET Autonomy Scheme (w.e.f. A.Y. 2021-22)

B.E. (Computer Engineering)							**B.E. SEM: VII**		
Course Name : Enterprise Resource Planning							**Course Code :** PEC-CS7013		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	**150**
3	-	2@	5	4	25	75	25	25	
IA: In-Semester Assessment - Paper Duration – 1 Hour **ESE: End Semester Examination - Paper Duration - 3 Hours** **The weightage of marks for continuous evaluation of Term work/Report:** Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)									
Prerequisite: Computer Basics, Procedural Programming Languages									

Course Objective: The objective of the course is to understand the technical aspects and life cycle of ERP systems, the steps and activities in ERP, understand tools and methodology used for designing ERP for an Enterprise and to identify and describe different types of ERP system.

Course Outcomes: **Upon completion of the course students will be able to:**

SN	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Understand the basic structure of ERP	L1, L2
2	Identify, apply and analyze implementation strategy used for ERP.	L1, L2, L3, L4
3	Apply and analyze design principles for various business modules in ERP.	L1, L2, L3, L4
4	Compare and apply different emerging technologies for implementation of ERP.	L1, L2, L3, L4
5	Analyze security issues in ERP.	L1, L2, L3, L4
6	Acquire ERP concepts for real world applications.	L1, L2, L3, L4

Detailed Syllabus (Total No. of Hours: 45):

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Introduction to Enterprise Resource Planning (ERP)** Information System and Its Components, Value Chain Framework, Organizational Functional Units, Evolution of ERP Systems, Role of ERP in Organization, Three-Tier Architecture of ERP system.	8	L1, L2
2	**ERP and Implementation** ERP implementation and strategy, Implementation Life cycle, Pre-implementation task, requirement definition, implementation Methodology.	8	L1, L2, L3, L4
3	**ERP Business Modules** Finance, manufacturing, human resources, quality management, material management, marketing, Sales distribution and service. Case study on Supply Chain management (SCM), Customer relationship Management (CRM)	8	L1, L2, L3, L4
4	**Introduction to ERP related Technologies** Business Process Re-engineering (BPR) ,Data warehousing ,Data Mining, On- line Analytical Processing(OLAP), Product Life Cycle Management (PLM),Geographical Information Management ,RFID, QR Code ,Bar Coding, E- commerce and their application in Enterprise planning	9	L1, L2, L3, L4
5	**Extended ERP and security issues** Enterprise application Integration (EAI), open source ERP, cloud ERP Managing ERP Securities: Types of ERP security Issues, System Access security, Data Security and related technology for managing data security	6	L1, L2, L3, L4
6	**Cases of ERP for Enterprises.** Cases of ERP like MySAP for Business suite implementation at ITC, ERP for Nestle GLOBE Project, Oracle ERP Implementation at Maruti Suzuki. Need of ERP for Small and Medium size enterprises, Study of Odoo ERP package.	6	L1, L2, L3, L4
	Total Hours	**45**	

Books and References:

	Title	Authors	Publisher	Edition	Year
1	ERP Demystified: II Edition, Tata	Alexis Leon	McGraw Hill	3rd Edition	2017
2	Enterprise Resource Planning, Text and cases	Rajesh Ray	Tata McGraw Hill	2nd Edition	2011
3	ERP to E2 ERP: A Case study approach	Sandeep Desai, Abhishek Srivastava	PHI	1st Edition	2013
4	Enterprise Resource Planning	Jyotindra Zaveri	Himalaya Publishing House	2nd Edition	2012

5	Enterprise Resource Planning: concepts & practices	V.K. Garg & N.K. Venkatakrishnan	PHI	2nd Edition	2003
6	Supply Chain Management Theories & Practices	R. P. Mohanty, S. G. Deshmukh	Dreamtech Press	1st edition	2005
7	Enterprise wide resource planning: Theory & practice	Rahul Altekar	PHI	1st edition	2004
8	Customer Relationship Management, Concepts and cases	Alok Kumar Rai	PHI	2nd Edition	2013

Online Resources:

S. No.	Website Name	URL	Modules Covered
1	www.geeksforgeeks.org	https://www.geeksforgeeks.org/crm-and-erp-in-cloud-computing/	M6
2	www.tutorialspoint.com	https://www.tutorialspoint.com/management_concepts/enterprise_resource_planning.htm	M1
3	www.scribd.com	https://www.scribd.com/doc/19251384/ERP-and-Related-Technologies	M4
4	www.investopedia.com	Starbucks-Value chain framework: https://www.investopedia.com/articles/investing/103114/starbucks-example-value-chain-model.asp	M1
5	www.us.syspro.com	Porters value chain framework: https://us.syspro.com/porters-value-chain-model-and-erp/	M1

B.E. Semester –VII
Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS-H 2019)
TCET Autonomy Scheme (w.e.f. A.Y. 2021-22)

<table>
<tr><td colspan="7">B.E. (Computer Engineering)</td><td colspan="3">B.E. (SEM : VII)</td></tr>
<tr><td colspan="7">Course Name : Image Processing</td><td colspan="3">Course Code : PEC-CS7014</td></tr>
<tr><td colspan="5">Teaching Scheme (Program Specific)</td><td colspan="5">Examination Scheme (Formative/ Summative)</td></tr>
<tr><td colspan="5">Modes of Teaching / Learning / Weightage</td><td colspan="5">Modes of Continuous Assessment / Evaluation</td></tr>
<tr><td colspan="5">Hours Per Week</td><td colspan="2">Theory (100)</td><td>Practical/Oral (25)</td><td>Term Work (25)</td><td>Total</td></tr>
<tr><td>Theory</td><td>Tutorial</td><td>Practical</td><td>Contact Hours</td><td>Credits</td><td>IA</td><td>ESE</td><td>PR</td><td>TW</td><td rowspan="2">150</td></tr>
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<tr><td colspan="10">IA: In-Semester Assessment - NA
ESE: End Semester Examination - NA
The weightage of marks for continuous evaluation of Term work/ Report: Formative (40%), Timely completion of practical (40%) and Attendance/Learning Attitude (20%)</td></tr>
<tr><td colspan="10">Prerequisite: Basic of Computer, Basics of Mathematics</td></tr>
</table>

Course Objective: : This course will help to understand the fundamentals of image processing and to apply various processes on images for image understanding.

Course Outcomes: Upon completion of the course students will be able to:

SN	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Demonstrate fundamental steps in digital image processing	L1, L2
2	Use Histogram Processing Techniques	L1, L2, L3
3	Demonstrate Filtering in the Frequency Domain	L1, L2, L3
4	Make use of Image Compression.	L1, L2, L3, L4
5	Develop Image Restoration and Reconstruction	L1, L2, L3
6	Understand and apply knowledge to Image Segmentation	L1, L2, L3,L4

Detailed Syllabus (Total No. of Hours: 45):

Module No.	Topics	Lectures	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Introduction and Digital Image Fundamentals** Digital Image Fundamentals, Human visual system, Image as a 2D data, Image representation – Gray scale and Color images, image sampling and quantization	**05**	L1,L2
2	**Image enhancement in Spatial domain:** Basic gray level Transformations, Histogram Processing Techniques, Spatial Filtering, Low pass filtering, High pass filtering	**8**	L1, L2, L3
3	**Filtering in the Frequency Domain:** C Preliminary Concepts, Extension to functions of two variables, Image Smoothing, Image Sharpening, Homomorphic filtering	**4**	L1, L2, L3
4	**Image Restoration and Reconstruction Color Image Processing** Noise Models, Noise Reduction, Inverse Filtering, MMSE (Wiener) Filtering Color Fundamentals, Color Models, Pseudo color image processing	**8**	L1, L2, L3, L4
5	**Image Compression and Morphological Image Processing:** Fundamentals of redundancies, Basic Compression Methods: Huffman coding, Arithmetic coding, LZW coding, JPEG Compression standard Erosion, dilation, opening, closing, Basic Morphological Algorithms: 04 08 hole filling, connected components, thinning, skeletons	**12**	L1, L2, L3
6	**Image Segmentation and Applications of Image Processing** Point, line and edge detection, Thresholding, Regions Based segmentation, Edge linking and boundary detection, Hough transform Application of Image processing in process industries	**8**	L1, L2, L3
	TOTAL HOURS	45	

Books and References:

SN	Title	Authors	Publisher	Edition	Year
1	Digital Image Processing	Gonzalez & Woods	Pearson education	3rd Edition	2008
2	Fundamentals Digital Image Processing‖,	Jain Anil K	Prentice Hall India, 2010	2nd Edition	2010
3	Digital Image Processing	Pratt W.K	John Wiley & Sons	10th Edition	2007

Online References:

Sr. No.	Website Name	UR L	Modules Covered
1	Geeksforgeeks	https://www.geeksforgeeks.org/digital-image-processing-basics/	M1 – M2
2	Udentify	https://www.udentify.co/Blog/12/2019/introduction-to-image-processing/	M3 – M5
3	Tutorialpoint	https://www.tutorialspoint.com/dip/image_processing_introduction.htm	M6

Mini Project Hours Distribution

Sr. No.	Topic	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	Problem Definition and Project Title Identification	2	L1, L2
2	Study tool for implementation	6	L1, L2
3	Deciding the modules of the project.	2	L1, L2
4	Design of the proposed architecture	4	L1, L2, L3
5	Implementation and Deployment	10	L1, L2, L3,L4
6	Testing and Evaluation	4	L1, L2, L3,L4,L5
7	Report Preparation	6	L1, L2, L3

B.E. Semester –VII
Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS-H 2019)
TCET Autonomy Scheme (w.e.f. A.Y. 2021-22)

<table>
<tr><td colspan="7">B.E. (Computer Engineering)</td><td colspan="4">B.E. SEM: VII</td></tr>
<tr><td colspan="7">Course Name: Deep Learning</td><td colspan="4">Course Code: PEC-CS7015</td></tr>
<tr><td colspan="5">Teaching Scheme (Program Specific)</td><td colspan="6">Examination Scheme (Formative/ Summative)</td></tr>
<tr><td colspan="5">Modes of Teaching / Learning / Weightage</td><td colspan="6">Modes of Continuous Assessment / Evaluation</td></tr>
<tr><td colspan="5">Hours Per Week</td><td colspan="2">Theory (100)</td><td>Practical/Oral (25)</td><td>Term Work (25)</td><td>Total</td></tr>
<tr><td>Theory</td><td>Tutorial</td><td>Practical</td><td>Contact Hours</td><td>Credits</td><td>IA</td><td>ESE</td><td>PR/OR</td><td>TW</td><td rowspan="2">150</td></tr>
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<tr><td colspan="10">IA: In-Semester Assessment - Paper Duration – 1.5 Hours
ESE: End Semester Examination - Paper Duration - 3 Hours
The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)</td></tr>
<tr><td colspan="10">Prerequisite: Basic Mathematics</td></tr>
</table>

Course Objective: The Objective of this course is to present the mathematical, statistical and computational challenges of building stable representations for high-dimensional data, such as images, text and data.

Course Outcomes: Upon completion of the course students will be able to:

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Apply MLP and Perceptron concept in Neural Network	L1, L2, L3
2	Apply forward and back propagation in DL task.	L1, L2, L3
3	Apply PCA & Auto encoders in DL task.	L1, L2, L3
4	Apply Regularization & Normalization in DL task.	L1, L2, L3,L4
5	Apply CNN in image processing.	L1, L2, L3,L4
6	Apply RNN in natural language processing.	L1,L2

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Deep Learning Fundamentals** History of Deep Learning, McCulloch Pitts Neuron, Thresholding Logic, Perceptrons, Perceptron Learning Algorithm. Multilayer Perceptrons (MLPs), Representation Power of MLPs, Sigmoid Neurons, Gradient Descent,Saturation and error correction in MLP	8	L1, L2, L3
2	**Nueral Networks** Introduction to Neural Networks Training Neural Networks ,FeedForward Neural Networks, Backpropagation.Gradient Descent (GD), Momentum Based GD, Nesterov Accelerated GD, Stochastic GD, AdaGrad, RMSProp	7	L1,L2, L3
3	**PCA & Autoencoders** Principal Component Analysis and its interpretations, Singular Value Decomposition . Autoencoders and relation to PCA, Regularization in autoencoders, Denoising autoencoders, Sparse autoencoders, Contractive autoencoders	8	L1,L2, L3
4	**Regularization & Normalization** Regularization: Bias Variance Tradeo-, L2 regularization, Early stopping, Dataset augmentation, Parameter sharing and tying. Greedy Layerwise Pre-training, Better activation functions, Better weight initialization methods, Batch Normalization	7	L1, L2,L3
5	**Convolutional Neural Networks and Recurrent Neural Networks** Convolutional Neural Networks, LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet. Learning Vectorial Representations of Words Recurrent Neural Networks, LSTM , Backpropagation through time Encoder Decoder Models	8	L1, L2, L3, L4
6	**Application of Deep-Learning** Sentiment Analysis, Virtual Assistants, Adding sounds to silent movies,Automatic Machine Translation,Automatic Handwriting Generation,Automatic Game Playing	7	L1, L2, L4
	Total Hours	**45**	

Books and References:

SN	Title	Authors	Publisher	Edition	Year
1	Deep Learning using Python	Dr. S Lovelyn Rose	Wiley	First	2019
2	Fundamentals to Deep Learning	Nikhil Buduma	Oreilly	First	2017
1	Deep Learning	Goodfellow, I., Bengio,Y., and Courville, A.	MIT Press 2016	First	2016

Online References:

Sr. No.	Website Name	URL	Modules Covered
1	https://nptel.ac.in	https://nptel.ac.in/courses/106/106/106106184/	M1,M2,M3,M4,M5,M6
2	Coursera.org	https://www.coursera.org/specializations/deep-learning	M1,M2,M3,M4,M5,M6

Mini Project Hours Distribution

Sr. No.	Topic	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	Problem Definition and Project Title Identification	2	L1, L2
2	Study tool for implementation	6	L1, L2
3	Deciding the modules of the project.	2	L1, L2
4	Design of the proposed architecture	4	L1, L2, L3
5	Implementation and Deployment	10	L1, L2, L3,L4
6	Testing and Evaluation	4	L1, L2, L3,L4,L5
7	Report Preparation	6	L1, L2, L3

B.E. Semester –VII
Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS-H 2019)
TCET Autonomy Scheme (w.e.f. A.Y. 2021-22)

<table>
<tr><th colspan="8">B.E. (Computer Engineering)</th><th colspan="3">B.E. SEM: VII</th></tr>
<tr><td colspan="8">Course Name: Internet of Things (IoT)</td><td colspan="3">Course Code: PEC-CS7021</td></tr>
<tr><td colspan="5">Teaching Scheme (Program Specific)</td><td colspan="6">Examination Scheme (Formative/ Summative)</td></tr>
<tr><td colspan="5">Modes of Teaching / Learning / Weightage</td><td colspan="6">Modes of Continuous Assessment / Evaluation</td></tr>
<tr><td colspan="5">Hours Per Week</td><td colspan="2">Theory (100)</td><td>Practical/Oral (25)</td><td>Term Work (25)</td><td rowspan="3">Total
150</td></tr>
<tr><td>Theory</td><td>Tutorial</td><td>Practical</td><td>Contact Hours</td><td>Credits</td><td>IA</td><td>ESE</td><td>PR/OR</td><td>TW</td></tr>
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ESE: End Semester Examination - Paper Duration - 3 Hours
The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)</td></tr>
<tr><td colspan="10">Prerequisite: Computer Network, Embedded System, Microprocessor and Microcontroller</td></tr>
</table>

Course Objective:

The objective of the course is to introduce the concepts of Internet of Things (IoT), RFID and Sensor technology and to make students aware of security issues in Internet of Things. To summarize the design approaches to various IoT applications.

Course Outcomes: **Upon completion of the course students will be able to:**

SN	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Describe key technologies in Internet of Things.	L1, L2
2	Differentiate between IoT and M2M.	L1, L2, L3,L4
3	Analyze basic protocols in wireless sensor network.	L1, L2, L3,L4
4	Describe IoT based business model scenarios.	L1, L2
5	Describe security model and protocol for IoT.	L1, L2
6	Design IoT applications in different domain and be able to analyze their performance.	L1, L2, L3,L4,L5

Detailed Syllabus (Total No. of Hours: 45):

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Introduction to IoT** Internet of Things: Definition, History, Technology, IoT Frameworks, IoT Architecture, Applications of IoT	7	L1, L2
2	**IoT and M2M** M2M Communication, Differentiate between IoT and M2M, Software Define Network	6	L1, L2, L3,L4
3	**Sensors, Actuator, RFIDs and Wireless Sensor Networks** Sensor Technology, Actuator , Radio Frequency Identification Technology, Wireless Sensor Network Technology	7	L1, L2, L3,L4
4	**Business Models and Processes Using IoT** Business Models and Business Model Innovation, Value Creation in the Internet of Things, Business Model Scenarios for the Internet of Things	6	L1, L2
5	**Internet Of Things Privacy, Security And Vulnerabilities Solutions** Introduction, Vulnerabilities of IoT, Security requirements, Threat analysis, Use cases and misuse cases, Identity Management and Establishment, Access control, Secure Message Communication, Security model for IoT	7	L1, L2
6	**IoT Development Boards and IoT Applications** Popular IoT Development Boards: Interoperability in IoT, Introduction to Arduino Programming, Integration of Sensors and Actuators with Arduino, Introduction to Raspberry Pi, Implementation of IoT with Raspberry Pi. IoT applications for Smart Home, Smart Cities, Wearables, Smart Retail Industrial IoT, Connected Vehicles and its Applications and Services Case Study: Agriculture, Healthcare, Activity Monitoring	12	L1, L2, L3,L4,L5
	Total Hours	**45**	

Books and References:

	Title	Authors	Publisher	Edition	Year
1	Internet of Things, Architecture and Design Principles	Raj kamal	McGraw-Hill Publications	1st edition	2017
2	Internet of Things: A Hands-On Approach	Vijay Madisetti, Arshdeep Bahga	VPT	1st Edition	2015
3	Fundamentals of Wireless Sensor Networks: Theory and Practice	Waltenegus Dargie, Christian Poellabauer	John Wiley & Sons	Second edition	2011

Online Resources:

S. No.	Website Name	URL	Modules Covered
1	https://nptel.ac.in	https://onlinecourses.nptel.ac.in/noc20_cs66/preview	M1-M6
2	www.coursera.org	https://www.coursera.org/specializations/iot	M1-M3
3	www.edx.org	https://www.edx.org/course/introduction-to-the-internet-of-things	M1,M6

Mini Project Hours Distribution:

Sr. No	Work to be done	No. of Hours	Cognitive levels of attainment as per Bloom's Taxonomy
1	Study different IoT devices.	6	L1, L2
2	Project Title finalization	2	L1, L2
3	Problem definition and design.	4	L1, L2
4	Create The Prototype	4	L1, L2, L3
5	Deployment	8	L1, L2, L3
6	Testing and Evaluation	4	L1, L2, L3, L4
7	Prepare report	6	L1, L2, L3, L4

B.E. Semester –VII
Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS-H 2019)
TCET Autonomy Scheme (w.e.f. A.Y. 2021-22)

<table>
<tr><td colspan="5">B.E (Computer Engineering)</td><td colspan="5">SEM: VII</td></tr>
<tr><td colspan="5">Course Name: Wireless Network</td><td colspan="5">Course Code: PEC-CS7022</td></tr>
<tr><td colspan="5">Teaching Scheme (Program Specific)</td><td colspan="5">Examination Scheme (Formative/ Summative)</td></tr>
<tr><td colspan="5">Modes of Teaching / Learning / Weightage</td><td colspan="5">Modes of Continuous Assessment / Evaluation</td></tr>
<tr><td colspan="5">Hours Per Week</td><td colspan="2">Theory (100)</td><td>Practical/Oral (25)</td><td>Term Work (25)</td><td rowspan="3">Total
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<tr><td>Theory</td><td>Tutorial</td><td>Practical</td><td>Contact Hours</td><td>Credits</td><td>IA</td><td>ESE</td><td>PR/OR</td><td>TW</td></tr>
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<tr><td colspan="10">Prerequisite: Computer Network</td></tr>
</table>

Course Objective: The objective of this course is to deliver the concepts of wireless networks, protocol stack and standards, 3G, 4G services and security considerations in wireless systems.

Course Outcomes: **Upon completion of the course students will be able to:**

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Understand and employ the concepts of different wireless network architecture.	L1, L2, L3
2	Experiment the network layer solutions for Wireless networks.	L1, L2, L3, L4
3	Describe about 3G network architecture and the related components.	L1, L2
4	Use the schemes to connect WLANS and 3G Networks in different applications	L1, L2, L3
5	Explain the features of 4G networks and examine the evolution of 4G services.	L1, L2, L3, L4
6	Discuss the different security issues in wireless networks and choose an appropriate handling method.	L1, L2, L3

Detailed Syllabus (Total No. of Hours: 45):

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**WIRELESS LAN** Introduction-WLAN technologies: – IEEE802.11: System architecture, protocol architecture, 802.11b, 802.11a – Hiper LAN: WATM, BRAN, HiperLAN2 – Bluetooth: Architecture, WPAN – IEEE 802.15.4, Wireless USB, Zigbee	7	L1, L2, L3
2	**MOBILE NETWORK LAYER** Introduction – Mobile IP: IP packet delivery, Agent discovery, tunneling and encapsulation, IPV6-Network layer in the internet- Mobile IP session initiation protocol – mobile ad-hoc network: Routing: Destination Sequence distance vector, IoT: CoAP	9	L1, L2, L3, L4
3	**3G OVERVIEW** Overview of UTMS Terrestrial Radio access network-UMTS Core network Architecture: 3GPP Architecture, User equipment, CDMA2000 overview-Radio and Network components, Network structure, Radio Network, TD-CDMA, TD – SCDMA.	9	L1, L2
4	**INTERNETWORKING BETWEEN WLANS AND WWANS** Internetworking objectives and requirements, Schemes to connect WLANS and 3G Networks, Session Mobility, Internetworking Architecture for WLAN and GPRS, System Description, Local Multipoint Distribution Service, Multichannel Multipoint Distribution System.	9	L1, L2, L3
5	**4G OVERVIEW** Introduction – 4G vision – 4G features and challenges – Applications of 4G – 4G Technologies: Multicarrier Modulation, Smart antenna techniques, IMS Architecture, LTE, Advanced Broadband Wireless Access and Services.	7	L1, L2, L3, L4
6	**SECURITY IN WIRELESS SYSTEMS** Introduction-Security and Privacy Needs of a Wireless System-Required Features for a Secured Wireless Communications System-Methods of Providing Privacy and Security in Wireless Systems-Wireless Security and Standards-IEEE 802.11 Security.	4	L1, L2, L3
	Total Hours	**45**	

Books and References:

SN	Title	Authors	Publisher	Edition	Year
1	Mobile Communications	Jochen Schiller	Pearson Education Asia	2nd Edition	2012
2	Wireless Communications and networking	Vijay Garg	Elsevier	1st Edition	2007
3	3G Evolution HSPA and LTE for Mobile Broadband	Erik Dahlman, Stefan Parkvall, Johan Skold and Per Beming	Academic Press	2nd Edition	2008
4	Wireless Networking	Daniel I.A. Cohen Anurag Kumar, D.Manjunath, Joy kuri	Elsevier	1st Edition	2011

5	Modern Wireless Communications	Simon Haykin , Michael Moher, David Koilpillai	Pearson Education	1st Edition	2013

Online References:

Sr. No.	Topic	URL	Modules covered
1	www.coursera.org	https://www.coursera.org/learn/wireless-communications	M1-M5
2	Nptel.ac.in	http://www.nptelvideos.in/2012/12/wirelHesrss-	M1-M4

Mini Project Hours Distribution

Sr. No.	Topic	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	Problem Definition and Project Title Identification	2	L1, L2
2	Study tool for implementation	6	L1, L2
3	Deciding the modules of the project.	2	L1, L2
4	Design of the proposed architecture	4	L1, L2, L3
5	Implementation and Deployment	10	L1, L2, L3,L4
6	Testing and Evaluation	4	L1, L2, L3,L4,L5
7	Report Preparation	6	L1, L2, L3

B.E. Semester –VII

Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS-H 2019)

TCET Autonomy Scheme (w.e.f. A.Y. 2021-22)

B.E. (Computer Engineering)									**B.E. SEM : VII**
Course Name: Data Analytics							Course Code :PEC-CS7023		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	**150**
3	-	2@	5	4	25	75	25	25	
IA: In-Semester Assessment - Paper Duration – 1 Hour									
ESE: End Semester Examination - Paper Duration - 3 Hours									
The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance/Learning Attitude (20%)									
Prerequisite: Database Management System**,** Data Warehouse and Mining, Machine Learning									

Course Objective: The course intends to provide an overview of an exciting growing field of big data analytics and equip the students with programming skills to solve complex real world problems using big data technologies.

Course Outcomes: **Upon completion of the course students will be able to:**

Sr. No.	**Course Outcomes**	**Cognitive levels of attainment as per Bloom's Taxonomy**
1	Outline the key issues in big data management and its associated applications for business decisions and strategy.	L1, L2
2	Develop problem solving and critical thinking skills in fundamental enabling techniques like Hadoop, Map-reduce and NoSQL in big data analytics.	L1, L2, L3
3	Collect, manage, store, query and analyze various forms of Big Data.	L1, L2, L3, L4
4	Interpret business models and scientific computing paradigms, and apply software tools for big data analytics.	L1, L2, L3, L4, L5
5	Appraise adequate perspectives of big data analytics in various applications like recommender systems, social media applications etc...	L1, L2, L3, L4, L5
6	Solve Complex real world problems in various applications like recommender systems, social media applications, health and medical systems, etc.	L1, L2, L3

Detailed Syllabus (Total No. of Hours: 45):

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Introduction to Data Analytics** Introduction to Data Analytics,types of analytics,Analytics vs Analysis Basic Analysis Techniques,Types of Data, properties of data,Data and Categorization, Data Cube,Data aggregation and segregation.	5	L1, L2
2	**Big Data and Hadoop** Introduction to Big Data, Big Data characteristics, types of Big Data, Traditional vs. Big Data business approach,Concept of Hadoop, Core Hadoop Components; Hadoop Ecosystem,Spark**.** **MapReduce:** The Map Tasks, Grouping by Key, The Reduce Tasks, Combiners, Details of MapReduce Execution, Coping With Node Failures,**Hadoop Limitations**.	8	L1, L2, L3
3	**NoSQL** Introduction to NoSQL, NoSQL Business Drivers, **NoSQL Data Architecture Patterns**: Key-value stores, Graph stores, Column family (Bigtable) stores, Document stores, Variations of NoSQL architectural patterns, NoSQL Case Study NoSQL solution for big data, Understanding the types of big data problems; Analyzing big data with a shared-nothing architecture; Choosing distribution models: master-slave versus peer-to- to-peer; Four ways that NoSQL systems handle big data problems	8	L1, L2, L3, L4
4	**Mining Data Streams** **The Stream Data Model**: A Data-Stream-Management System, Examples of Stream Sources, Stream Queries, Issues in Stream Processing, Sampling Data techniques in a Stream, Filtering Streams: Bloom Filter with Analysis, Counting Distinct Elements in a Stream, Count-Distinct Problem, Flajolet-Martin Algorithm **Counting Frequent Items in a Stream,** Sampling Methods for Streams, frequent Itemsets in Decaying Windows, Counting Ones in a Window: The Cost of Exact Counts, TheDatar-Gionis-Indyk-Motwani Algorithm, Query Answering in the DGIM Algorithm	10	L1, L2, L3, L4, L5
5	**Finding Similar Items and Clustering** **Distance Measures:** Definition of a Distance Measure, Euclidean Distances, Jaccard Distance, Cosine Distance, Edit Distance, Hamming Distance.CURE Algorithm, Stream-Computing	6	L1, L2, L3, L4, L5
6	**Real-Time Data Analytical Applications**	8	L1, L2, L3
	Business Intelligence:- **Healthcare:-Fitness devices and heath** **A Model for Recommendation Systems,** Content-Based Recommendations, Collaborative Filtering		
	Total Hours	**45**	

Books and References:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Mining of Massive Datasets	AnandRajaraman and Jeff Ullman	Cambridge University Press	First Edition	2012
2	Hadoop in Practice	Alex Holmes	Manning Press, Dreamtech Press	Second Edition	2015
3	Making Sense of NoSQL- A guide for managers and the rest of us	Dan Mcary and Ann Kelly	Manning Press	First Edition	2010
4	Taming The Big Data Tidal Wave: Finding Opportunities In Huge Data Streams With Advanced Analytics	Bill Franks	John Wiley & Sons	First Edition	2012

Online References:

Sr. No.	Website Name	URL	Modules Covered
1	www.mmds.org	http://www.mmds.org	M1-M6
2	www.guru99.com	https://www.guru99.com/bigdata-tutorials.html	M1,M2
3	www.edureka.co	https://www.edureka.co/blog/hadoop-tutorial/	M1, M2
4	www.tutorailride.com	https://www.tutorialride.com/big-data-analytics	M1-M6

Mini Project Hours Distribution

Sr. No.	Topic	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	Problem Definition and Project Title Identification	2	L1, L2
2	Study tool for implementation	6	L1, L2
3	Deciding the modules of the project.	2	L1, L2
4	Design of the proposed architecture	4	L1, L2, L3
5	Implementation and Deployment	10	L1, L2, L3,L4
6	Testing and Evaluation	4	L1, L2, L3,L4,L5
7	Report Preparation	6	L1, L2, L3

B.E. Semester –VII
Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS-H 2019)
TCET Autonomy Scheme (w.e.f. A.Y. 2021-22)

<table>
<tr><td colspan="7">B.E. (Computer Engineering)</td><td colspan="4">B.E. SEM: VII</td></tr>
<tr><td colspan="7">Course Name: Human Computer Interaction</td><td colspan="4">Course Code: PEC-CS7024</td></tr>
<tr><td colspan="5">Teaching Scheme (Program Specific)</td><td colspan="6">Examination Scheme (Formative/ Summative)</td></tr>
<tr><td colspan="5">Modes of Teaching / Learning / Weightage</td><td colspan="6">Modes of Continuous Assessment / Evaluation</td></tr>
<tr><td colspan="5">Hours Per Week</td><td colspan="2">Theory (100)</td><td>Practical/Oral (25)</td><td>Term Work (25)</td><td>Total</td></tr>
<tr><td>Theory</td><td>Tutorial</td><td>Practical</td><td>Contact Hours</td><td>Credits</td><td>IA</td><td>ESE</td><td>PR/OR</td><td>TW</td><td rowspan="2">150</td></tr>
<tr><td>3</td><td>-</td><td>2@</td><td>5</td><td>4</td><td>25</td><td>75</td><td>25</td><td>25</td></tr>
<tr><td colspan="10">IA: In-Semester Assessment - Paper Duration – 1 Hour
ESE: End Semester Examination - Paper Duration - 3 Hours
The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)</td></tr>
<tr><td colspan="10">Prerequisite: Web Technologies, Software Engineering</td></tr>
</table>

Course Objective: The course intends to deliver fundamental knowledge about UI design guidelines and apply the knowledge to design intuitive UI for real life applications.

Course Outcomes: Upon completion of the course students will be able to:

Sr. No	Course Outcome	Cognitive levels of attainment as per Bloom's Taxonomy
1	To design user centric interfaces.	L1, L2, L3, L4, L5, L6
2	To estimate the goal directed design.	L1, L2, L3, L4, L5, L6
3	To estimate the benefits of good GUI.	L1, L2, L3, L4, L5, L6
4	To summarize existing interface designs, and improve them based on existing design guidelines.	L1, L2, L3, L4, L5, L6
5	To apply new interactive style to design application for social and technical task.	L1, L2, L3, L4, L5, L6
6	To synthesize interactive communication while creating user interface.	L1, L2, L3, L4, L5, L6

Detailed Syllabus (Total No. of Hours: 45):

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Introduction** Evolution in Interface Design, Hardware, software and operating environment to use HCI in various fields, The psychopathology of everyday things – complexity of modern devices, human-centered design, fundamental principles of interaction, Psychology of everyday actions- how people do things, the seven stages of action and three levels of processing, human errors	6	L1, L2, L3, L4, L5, L6
2	**Understanding goal directed design** Goal directed design, Implementation models and mental models, Beginners, experts and intermediates – designing for different experience levels, Understanding users, Modeling users – personas and goals.	8	L1, L2, L3, L4, L5, L6
3	**Graphical User Interface** Benefits of a good UI, Popularity of graphics, Concept of direct Manipulation, Advantages and Disadvantages, Characteristics of GUI, Characteristics of Web UI, General design principles.	8	L1, L2, L3, L4, L5, L6
4	**Design guidelines** Perception, Gestalt principles, visual structure, reading is unnatural, color, vision, memory, six behavioral patterns, recognition and recall, learning, factors affecting learning, time.	8	L1, L2, L3, L4, L5, L6
5	**Interaction styles** Interaction styles: menus, windows, device based controls, screen based controls	8	L1, L2, L3, L4, L5, L6
6	**Communication** text messages, feedback and guidance, graphics, icons and images, colours	7	L1, L2, L3, L4, L5, L6
	Total Hours	**45**	

Books and References:

SN	Title	Authors	Publisher	Edition	Year
1	The Essential Guide to User Interface Design	Wilbert O. Galitz	Wiley publication	3rd Edition	2007
2	Galiz's Human Machine Interaction	D.R.Kalbande, Prashant Kanade, Sridari Iyer	Wiley publication	1st Edition	2015
3	Human Computer Interaction.	Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale	Pearson	3rd Edition	2004
4	About Face3: Essentials of Interaction design	Alan Cooper, Robert Reimann, David Cronin,	Wiley publication	3rd Edition	2007
5	Designing with the mind in mind	Jeff Johnson	Morgan Kaufmann Publication	2nd Edition	2015

6	Design of everyday things	Donald A. Normann	Peter Lindsay	3rd Edition	2002

Online References:

S. No.	Website Name	URL	Modules Covered
1	https://www.machinedesign.com	https://www.machinedesign.com/iot/what-are-human-machine-interfaces-and-why-are-they-becoming-more-important	M1
2	https://www.nngroup.com	https://www.nngroup.com/articles/	M2 - M6

Mini Project Hours Distribution

Sr. No.	Topic	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	Problem Definition and Project Title Identification	2	L1, L2
2	Study tool for implementation	6	L1, L2
3	Deciding the modules of the project.	2	L1, L2
4	Design of the proposed architecture	4	L1, L2, L3
5	Implementation and Deployment	10	L1, L2, L3,L4
6	Testing and Evaluation	4	L1, L2, L3,L4,L5
7	Report Preparation	6	L1, L2, L3

B.E. Semester –VII
Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS-H 2019)
TCET Autonomy Scheme (w.e.f. A.Y. 2021-22)

<table>
<tr><th colspan="6">BE (Computer Engineering)</th><th colspan="4">SEM : V11</th></tr>
<tr><td colspan="6">Course Name : Robotics</td><td colspan="4">Course Code : PEC-CS7025</td></tr>
<tr><td colspan="5">Teaching Scheme (Program Specific)</td><td colspan="5">Examination Scheme (Formative/ Summative)</td></tr>
<tr><td colspan="5">Modes of Teaching / Learning / Weightage</td><td colspan="5">Modes of Continuous Assessment / Evaluation</td></tr>
<tr><td colspan="5">Hours Per Week</td><td colspan="2">Theory (100)</td><td>Practical/Oral (25)</td><td>Term Work (25)</td><td rowspan="3">Total
150</td></tr>
<tr><td>Theory</td><td>Tutorial</td><td>Practical</td><td>Contact Hours</td><td>Credits</td><td>IA</td><td>ESE</td><td>PR/OR</td><td>TW</td></tr>
<tr><td>3</td><td>-</td><td>2@</td><td>5</td><td>4</td><td>25</td><td>75</td><td>25</td><td>25</td></tr>
<tr><td colspan="10">IA In-Semester Assessment - Paper Duration – 1.5 Hours
ESE : End Semester Evaluation- Paper Duration - 3 Hours
Mid Semester Assessment for Term work will be on continues basis</td></tr>
<tr><td colspan="10">Prerequisite: Engineering Mathematics
RBT : Revised Bloom's Taxonomy</td></tr>
</table>

Course Objectives: Course should able to Introduce the principles of robotics, and apply mathematical Kinematic modeling for manipulation of Robot in 3-D Space ,also able to evaluate workspace of the robot , It will also use various actuator and sensor to provide vision for proper task planning of the Robot.

Course Outcomes: At the end of the course student should be able:

SN	Course Outcomes	RBT Levels
1	Describe typical robot and its characteristics.	L1,L2
2	Analyze& Evaluate kinematics parameters of robotic manipulator	L1,L2,L3,L4,L5
3	Analyze Inverse kinematics parameters of robotic manipulator.	L1,L2,L3,L4
4	Analyze & Evaluate Workspace & Trajectory path of the Robot	L1,L2,L3,L4,L5
5	Analyze motion of the robot for task planning	L1,L2,L3,L4
6	Apply Robotics to solve day to day problems using vision algorithms.	L1,L2,L3,L4

Detailed Syllabus (Total No. of Hours: 45):

Module No.	Topics	Hrs.	RBT Levels
1	**Introduction and Fundamentals of Robotics** Types of automation, Introduction, definition of a Robot, Classification of Robots, Robotics, History of Robotics, Advantages and Disadvantages of Robots, Robot Applications Tasks involved in Robotics, Robot Components, Robot characteristics and classification, Sensor, Degrees of Freedom, Robot joints, Robot Coordinates, Robot Reference frames, Programming Modes, Robot Workspace, Work Envelop.	6	L1,L2
2	**Direct Kinematics** Direct (Forward) Kinematics: Homogeneous coordinates, Link coordinates, Coordinate frame, coordinate transform, Arm equations, An example –Two Axis Robot, 3 Axis Robot & Four Axis SCARA.	9	L1,L2,L3,L4, L5
3	**Inverse Kinematics** Inverse kinematics problem, Tool Configuration, Analysis and Problem solving of 2 Axis , 3 Axis 4 Axis SCARA Robot	6	L1,L2,L3,L4
4	**Work Space analysis and Trajectory Planning** Work Space analysis work envelope, Work Space Analysis of 4 Axis Robot Trajectory planning :- Pick and Path Operation, Continuous Path motion , Interpolated motion, Straight-line motion	8	L1,L2,L3,L4, L5
5	**Robot Task and Motion Planning** Task level programming, Uncertainty, Configuration Space, Gross motion planning, Fine-motion planning. Robot Motion Planning: Concept of motion planning, BUG 1, BUG 2 and Tangent Bug Algorithms	8	L1,L2,L3,L4
6	**Robot Vision** Image Representation, Template Matching, Polyhedral Objects Shape Analysis, Iterative Processing,Perspective Transformations, Camera Calibration	8	L1,L2,L3,L4
	Total Hours	**45**	

Books and References:

SN	Title	Authors	Publisher	Edition	Year
1	Introduction Robotics - Analysis, Control, Applications	Saeed B. Niku	Wiley India	2nd Edition	2010
2	Fundamentals of Robotics	Robert J. Schilling	Pearson	I st Edition	2007
3	Introduction to AI robotics	Robin Murphy	PHI	2nd Edition	2000
4	Robotics Technology and Flexible Automation	S. R. Deb	TMH	2 nd Edition	2002

Online References:

S. No.	Website Name	URL	Modules Covered
1	https://onlinelibrary.wiley.com	https://onlinelibrary.wiley.com/doi/abs/10.1111/1467-8659.1140189	M1-M2
2	https://link.springer.com	https://link.springer.com/chapter/10.1007/978-1-4615-2353-6_6	M6
3	http://www.aishack.in	http://www.aishack.in/tutorials/obstacle-avoidance-bug-algorithm/	M4

Mini Project Hours Distribution

Sr. No.	Topic	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	Problem Definition and Project Title Identification	2	L1, L2
2	Study tool for implementation	6	L1, L2
3	Deciding the modules of the project.	2	L1, L2
4	Design of the proposed architecture	4	L1, L2, L3
5	Implementation and Deployment	10	L1, L2, L3,L4
6	Testing and Evaluation	4	L1, L2, L3,L4,L5
7	Report Preparation	6	L1, L2, L3

B.E. Semester –VII
Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS-H 2019)
TCET Autonomy Scheme (w.e.f. A.Y. 2021-22)

B.E.(Computer Engineering)							**B.E. Open Elective SEM : VII**		
Course Name : Management Information System							**Course Code: OEC- CS7011**		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	**100**
3	**-**	**-**	**3**	**3**	**25**	**75**	**-**	**-**	
IA: In-Semester Assessment - Paper Duration – 1 Hour **ESE: End Semester Examination - Paper Duration - 3 Hours**									
Prerequisite: Database Design and Management									

Course Objective: The course intends to deliver the role of Management in Information Systems to understand the impact of these systems within an Organization to improvebusiness performance and decision making. It analyzes typical functional information systems, principal tools and technologies for accessing information from databases & interpreting Ethical issues & Privacy for the same.

Course Outcomes : **Upon completion of the course students will be able to:**

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Explain how information systems Transform Business	L1, L2
2	Understand about Data and Knowledge Management	L1, L2, L3
3	Analyze the Ethical issues and Privacy in Information Systems	L1, L2, L3, L4
4	Understand the principal tools and technologies for accessing information from databases to improve business performance and decision making	L1, L2, L3
5	Analyze the types of systems used for enterprise-wide knowledge management and how they provide value for businesses	L1, L2, L3, L4
6	Analyze the impact of information systems have on an organization	L1, L2, L3, L4

Detailed Syllabus:

Module No.	Topics	Hrs	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Introduction To Information Systems (IS)** Computer Based Information Systems, Impact of IT on organizations, Importance of IS to Society. Organizational Strategy, Competitive Advantages and IS	4	L1, L2
2	**Data and Knowledge Management** Database Approach, Big Data, Data warehouse and Data Marts, Knowledge Management Business intelligence (BI): Managers and Decision Making, BI for Data analysis and Presenting Results	7	L1, L2, L3
3	**Ethical issues and Privacy** Information Security. Threat to IS, and Security Controls	7	L1, L2, L3, L4
4	**Social Computing (SC)** Web 2.0 and 3.0, SC in business-shopping, Marketing, Operational and Analytic CRM, E-business and E-commerce – B2B B2C. Mobile commerce.	7	L1, L2, L3
5	**Wired and Wireless Technology** Computer Networks Wired and Wireless Technology, Pervasive computing, Cloud computing model.	6	L1, L2, L3, L4
6	**Information System within Organization** Transaction Processing Systems, Functional Area Information System, ERP and ERP support of Business Process. Acquiring Information Systems and Applications: Various System development life cycle models	8	L1, L2, L3, L4
	Total Hours	39	

Books and References:

Sr. No.	Title	Authors	Publisher	Edition	Year
1.	Management Information Systems	Kelly Rainer, Brad Prince	Wiley	Sixth Edition	2011
2.	Management Information Systems	K.C. Laudon and J.P. Laudon	Prentice Hall	Tenth Edition	2007
3.	Managing Information Systems: Strategy and Organization	D. Boddy, A. Boonstra	Prentice Hall	Tenth Edition	2008

Online References:

Sr. No.	Website Name	URL	Modules Covered
1.	https://www.tutorialspoint.com/index.htm	https://www.tutorialspoint.com/management_information_system/	M1
2.	https://www.tutorialspoint.com/index.htm	https://www.tutorialspoint.com/management_information_system/informati on_need_objective.htm	M2
3.	https://www.tutorialspoint.com/index.htm	https://www.tutorialspoint.com/management_information_system/mis_secu rity_and_ethical_issues.htm	M3
4.	https://www.tutorialspoint.com/index.htm	https://www.tutorialspoint.com/management_information_system/system_d evelopment_life_cycle.htm	M4
5.	https://pressbooks.com/	https://bus206.pressbooks.com/chapter/chapter-13-future-trends-in-information-systems/	M5
6.	https://www.tutorialspoint.com/index.htm	https://www.tutorialspoint.com/management_information_system/business _continuity_planning.htm	M6

B.E. Semester –VII
Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS-H 2019)
TCET Autonomy Scheme (w.e.f. A.Y. 2021-22)

B.E. (Computer Engineering)									**B.E. Open Elective (SEM : VII)**		
Course Name: Human Resource Management									**Course Code: OEC- CS7012**		
Teaching Scheme (Program Specific)					**Examination Scheme Formative/Summative)**						
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**						
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**		**Term Work (25)**		**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credit**	**IA**	**ESE**	**PR**		**TW**		**100**
3	**-**	**-**	**3**	**3**	**25**	**75**	**-**	**-**	**-**	**-**	
IA: In-Semester Assessment - Paper Duration – 1.5 Hours **ESE: End Semester Examination - Paper Duration - 3 Hours** **The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)**											
Pre-requisite: The course does not have any pre-requisites.											

Course Objective: The course intends to deliver basic concept, techniques and practices of the human resource Management. The course also gives opportunity of learning Human resource management (HRM) processes, related with the functions, and challenges in the emerging perspective of today‘s organizations, also helps student to acquaint the importance of inter-personal & inter-group behavioral skills in an organizational setting required for future stable engineers, leaders and managers.

Course Outcomes: Upon Completion of Course student will be able to:

SN	Course Outcomes	Cognitive levels of attainment
1	Understand the concepts, aspects, techniques and practices of the human resource management.	L1,L2
2	Understand the Human resource management (HRM) processes, functions, changes and challenges in today‘s emerging organizational perspective.	L1,L2
3	Gain knowledge about the latest developments and trends in HRM.	L1,L2,L3
4	Understand the Training and development process in HRM	L1,L2,L3
5	Applying Leadership and Decision Making qualities	L1,L2,L3,L4
6	Applythe knowledge of behavioral skills learnt and integrate it with in inter personal and Inter group environment emerging as future stable engineers and managers.	L1,L2,L3,L4

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment
1	**Human Resource Management development**	05	L1,L2
	Human Resource Management- Concept, Scope and Importance, Interdisciplinary Approach Relationship with other Sciences, Competencies of HR Manager, HRM functions. **Human resource development (HRD):** changing role of HRM – Human resource Planning, Technological change, Restructuring and rightsizing, Empowerment, TQM, Managing ethical issues.		
2	**Organizational Behaviour (OB)**	06	L1,L2
	Introduction to OB Origin, Nature and Scope of Organizational Behaviour, Relevance to Organizational Effectiveness and Contemporary issues. **Personality**: Meaning and Determinants of Personality, Personality development, Personality Types, Assessment of Personality Traits for Increasing Self Awareness. **Perception**: Attitude and Value, Effect of perception on Individual Decision-making, Attitude and Behaviour. **Motivation**: Theories of Motivation and their Applications for Behavioural Change (Maslow, Herzberg, McGregor).Group Behaviour and Group Dynamics: Work groups formal and informal groups and stages of group development, Team Effectiveness: High performing teams, Team Roles, cross functional and self-directed team. Case study.		
3	**Organizational Structure & Design**	06	L1,L2,L3
	Structure, size, technology, Environment of organization; Organizational Roles & conflicts: Concept of roles; role dynamics; role conflicts and stress. **Leadership**: Concepts and skills of leadership, Leadership and managerial roles, Leadership styles and contemporary issues in leadership. **Power and Politics**: Sources and uses of power; Politics at workplace, Tactics and strategies.		
4	**Human resource Planning**	06	L1,L2,L3
	Recruitment and Selection process, Job-enrichment, Empowerment - Job-Satisfaction, employee morale. **Performance Appraisal Systems**: Traditional & modern methods, Performance Counseling, Career Planning. Training & Development: Identification of Training Needs, Training Methods.		
5	**Emerging Trends in HR**	07	L1,L2,L3,L4

	Organizational development; Business Process Re-engineering (BPR), BPR as a tool for organizational development, managing processes & transformation in HR. Organizational Change, Culture, Environment. **Cross Cultural Leadership and Decision Making**: Cross Cultural Communication and diversity at work, Causes of diversity, managing diversity with special reference to handicapped, women and ageing people, intra company cultural difference in employee motivation.		

6	**HR&MS** **HR & MIS**: Need, purpose, objective and role of information system in HR, Applications in HRD in various industries (e.g. manufacturing R&D, Public Transport, Hospitals, Hotels and service industries. **Strategic HRM**: Role of Strategic HRM in the modern business world, Concept of Strategy, Strategic Management Process, Approaches to Strategic Decision Making; Strategic Intent – Corporate Mission, Vision, Objectives and Goals. **Labor Laws & Industrial Relations:** Evolution of IR, IR issues in organizations, Overview of Labor Laws in India; Industrial Disputes Act, Trade Unions Act, Shops and Establishments Act	**9**	**L1,L2,L3,L4**
	Total	**39**	

Books & References:

Sr. No	**Title**	**Authors**	**Publisher**	**Edition**	**Year**
1	Organizational Behavior	Stephen Robbins,	Excel publishing	16th Ed	2013
2	Human Resource Management	V S P Rao,	Excel publishing	3rd Ed	2010
3	Human resource management	Aswathapa,	Text & cases	6th Ed,	2011
4	Dynamics of Industrial Relations in India	C. B. Mamoria and S V Gankar,	Himalaya Publishing,	15th Ed	2015
5	Essentials of Human Resource management and Industrial relations	P. Subba Rao,	Himalaya Publishing,	5th Ed	2013
6	Management & Organizational Behavior	Laurie Mullins	Himalaya Publishing,	Latest Ed	2016

Online resources

S. No	**Website Name**	**URL**	**Modules Covered**
1	NPTEL	https://nptel.ac.in/courses/110105069/	M1,M2,M3
2	COURSE ERA	https://www.coursera.org/specializations/human- resource-management	M4,M5
3	SWAYAM	https://swayam.gov.in/nd1_noc19_mg51/preview	M1,M2,M5,M6

B.E. Semester –VII
Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS- H 2019)
TCET Autonomy Scheme (w.e.f. A.Y. 2021-22)

B.E. (Computer Engineering)							**B.E. Open Elective (SEM : VII)**		
Course Name: Design Thinking and Problem-Solving Skills							**Course Code: OEC-CS7013**		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	
3	-	-	3	3	25	75	-	-	**100**
IA: In-Semester Assessment- Paper Duration – **1.5 Hours** **ESE : End Semester Examination-** Paper Duration - **3 Hours**									
Prerequisite: Not Required									

Course Objective: To inculcate interdisciplinary engineering skills in students for taking real time engineering problem available in our society/industry and to come-up with the grass root innovation, can be helpful to all level of human beings.

Course Outcomes: Upon completion of the course students will be able to:

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Understand the importance of Design Thinking and Apply design thinking for product development	L1,L2
2	Evaluate the quality of your information and your emotions; keep thinking Straight and use design thinking tools	L1,L2,L3,L4
3	Identify skills and personality traits of successful problem solving.	L1,L2,L3,L4
4	Apply standard problem-solving heuristics to aid in problem solving.	L1,L2,L3,L4,L5,L6
5	Apply design thinking to improve on existing products in IT	L1,L2,L3,L4,L5,L6
6	Formulate and successfully communicate the solutions to problems.	L1,L2,L3,L4,L5,L6

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Design Thinking Introduction, Team Formation, Documentation and Canvas** Introduction, Need of Design Thinking, Traditional Problem Solving versus Design Thinking, phases of Design Thinking, Tools for Design Thinking, Relevance of Design and Design Thinking in Engineering, Team Formation, Documentation and Canvas Team Building Domain Selection (Society/Industry project), Log Books-need, types of log book, preparation of log book, Importance of Documentation, Strategy Design	7	L1,L2
2	**Design Thinking Exercise** Formation of Team and aspects for the selection, Domain selection, Observation exercise, Design activities through Canvas, Brainstorming for the problem, Users Interview conduction, generation of records via logbooks	8	L1,L2,L3,L4
3	**Problem Solving Skills Introduction** Developing logical thinking. Introduction to Problem Solving in Computer Science domain, Errors in reasoning; verbal reasoning; analogy problems lateral thinking, Problem Solving Techniques Deductive and hypothetical reasoning; computational problem solving; generating, implementing, and evaluating solutions; interpersonal problem solving, Group Activities based assignments related to problem solving skills will be given for better understanding and development of problem solving skills	8	L1,L2,L3,,L4
4	**Tools for Design Thinking** Theory and practice in Design thinking – Exploring work of Designers across globe – MVP or Prototyping ,Real-Time design interaction capture and analysis – Enabling efficient collaboration in digital space – Empathy for design – Collaboration in distributed Design	7	L1,L2,L3,L4,L5,L6
5	**Design Thinking in IT** Design Thinking to Business Process modeling – Agile in Virtual collaboration environment – Scenario based Prototyping	7	L1,L2,L3,L4,L5,L6
6	**Design Thinking For strategic innovations** DT For strategic innovations – Growth – Story telling - Predictability – Strategic Foresight - Change – Sense Making - Maintenance Relevance – Value redefinition - Extreme Competition – experience design - Standardization – Humanization - Creative Culture – Rapid prototyping, Strategy and Organization – Business Model design.	8	L1,L2,L3,L4,L5,L6
	Total Hours	**45**	

Books & References:

Sr. No	Title	Authors	Publisher	Edition	Year
1	Strategies for Creative Problem Solving	H. S. Fogler and S. E. LeBlanc	Pearson,	Second	2008
2	Problem Solving & Comprehension	A. Whimbey and J. Lochhead	Lawrence Erlbaum, Mahwah,	Sixth	1999
3	The Design of Business: Why Design Thinking is the Next Competitive Advantage	Roger Martin	Harvard Business Press	First	2009
4	Design Thinking: Understand – Improve – Apply	Hasso Plattner, Christoph Meinel and Larry Leifer	Springer, 2011 (Unit III)	First	2011
5	Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School. (Unit IV).	Idris Mootee	John Wiley & Sons 2013	First	2013
6	Effective Problem Solving	M. Levine	Prentice Hall	Second	1994

Online References:

Sr. No.	Website Name	URL	Modules Covered
1	https://www.coursera.org	https://www.coursera.org/learn/uva-darden-design-thinkinginnovation	M1,M2,M3,
2	http://www.cs.odu.edu	http://www.cs.odu.edu/~cs381/cs381content/problem_solving/problem_solving.html	M4,M5,M6
3	https://www.cs.vt.edu	https://www.cs.vt.edu/undergraduate/courses/CS2104	M1,M2,M3,M4,M5,M6
4	https://ryanstutorials.net	https://ryanstutorials.net/problem-solving-skills/	M3,M4
5	https://dschool.stanford.edu	https://dschool.stanford.edu/.../designresources/.../ModeGuideBOOTCAMP2010L.pdf	M1,M2,M3,M5
6	https://dschool.stanford.edu	https://dschool.stanford.edu/use-our-methods/	M4,M5,M6
7	https://www.interaction-design.org	https://www.interaction-design.org/literature/article/5-stages-in-the-design-thinking-process	M1,M2,M5,M6
8	http://www.creativityatwork.com	http://www.creativityatwork.com/design-thinking-strategy-for-innovation/	M1,M2,M5,M6
9	https://www.nngroup.com	https://www.nngroup.com/articles/design-thinking/	M1,M2,M3,M4,M6

10	www.designthinkingformobility.org	www.designthinkingformobility.org/wp-content/.../10/NapkinPitch_Worksheet.pdf	M4,M5,M6

B.E. SEMESTER -VII
Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS- H 2019)
TCET Autonomy Scheme (w.e.f. A.Y. 2021-22)

B.E. (Computer Engineering)									B.E. Open Elective (SEM: VII)
Course Name: Disaster Management and Mitigation Measures									Course Code: OEC- CS7014
Contact Hours Per Week: 03									Credit: 03
Teaching Scheme (Program Specific)					Examination Scheme Formative/Summative)				
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation				
Hours Per Week					Theory (100)		Practical/Oral (25)	Term Work (25)	Total
Theory	Tutorial	Practical	Contact Hours	Credits	IA	ESE	PR	Tutorial	100
3	-	-	3	3	25	75	-	-	
IA: Mid Semester Examination- Paper Duration – 1Hours ESE : Semester End Examination - Paper Duration - 3 Hours The weightage of marks for evaluation of Theory: Formative Evaluation (40%) and is conducted in 5th and 11th week through online questions using Google Docs/test in the lab.									
Prerequisite:									

Course Objectives:

Main objective of the subject is to understand causes of different types of disasters, mitigation /rehabilitation measures and existing government policies and agencies.

Course Outcomes:

SN	Course Outcomes	Cognitive levels as per bloom's taxonomy
1	Get to know natural as well as manmade disaster and their extent and possible effects on the economy.	L1, L2,L3
2	Plan of national importance structures based upon the previous history.	L1, L2,L3
3	Get acquainted with government policies, acts and various organizational structure associated	L1, L2,L3
4	Get to know the simple do's and don'ts in such extreme events and act accordingly.	L1, L2,L3

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels as per bloom's taxonomy
1	**Introduction**		
	Definition of Disaster, hazard, global and Indian scenario, general perspective, importance of study in human life, Direct and indirect effects of disasters, long term effects of disasters. Introduction to global warming and climate change	**03**	L1, L2,L3
2	**Natural Disaster and Manmade disasters**		
	Natural Disaster: Meaning and nature of natural disaster, Flood, Flash flood, drought, cloud burst, Earthquake, Landslides, Avalanches, Volcanic eruptions, Mudflow, Cyclone, Storm, Storm Surge, climate change, global warming, sea level rise, ozone depletion, Manmade Disasters: Chemical, Industrial, Nuclear and Fire Hazards. Role of growing population and subsequent industrialization, urbanization and changing lifestyle of human beings in frequent occurrences of manmade disasters	**07**	L1, L2,L3
3	**Disaster Management, Policy and Administration**		
	Disaster management: meaning, concept, importance, objective of disaster management policy, disaster risks in India, Paradigm shift in disaster management **Policy and administration:** Importance and principles of disaster management policies, command and co-ordination of in disaster management, rescue operations-how to start with and how to proceed in due course of time, study of flowchart showing the entire process.	**06**	L1, L2,L3
4	**Institutional Framework for Disaster Management in India**		
	Importance of public awareness, Preparation and execution of emergency management program. Scope and responsibilities of National Institute of Disaster Management (NIDM) and National disaster management authority (NDMA) in India. Methods and measures to avoid disasters, Management of casualties, set up of emergency facilities, importance of effective communication amongst different agencies in such situations. Use of Internet and softwares for effective disaster management. Applications of GIS, Remote sensing and GPS in this regard.	**07**	L1, L2,L3
5	**Financing Relief Measures**		
	Ways to raise finance for relief expenditure, role of government agencies and NGO's in this process, Legal aspects related to finance raising as well as overall management of disasters. Various NGO's and the works they have carried out in the past on the occurrence of various disasters, Ways to approach these teams. International relief aid agencies and their role in extreme events	**10**	L1, L2,L3
6	**Preventive and Mitigation Measures**		
	Pre-disaster, during disaster and post-disaster measures in some events in general. Structural mapping: Risk mapping, assessment and analysis, sea walls and embankments, Bio shield, shelters, early warning and communication. Non Structural Mitigation: Community based disaster preparedness, risk transfer and risk financing, capacity development and training, awareness and education, contingency plans. Do's and don'ts in case of disasters and effective implementation of relief aids.	**06**	L1, L2,L3
	Total	**39**	

Books & References:

SN	Title	Authors	Publisher	Edition	Year
1	Disaster Management	Harsh K.Gupta	Universities Press Publications	-	2003
2	Disaster Management: An Appraisal of Institutional Mechanisms in India	O.S.Dagur	Centre for land warfare studies	-	2011
3	Introduction to International Disaster Management	Damon Copolla	Butterworth Heinemann Elsevier Publications	-	2006
4	Disaster Management Handbook	Jack Pinkowski	CRC Press Taylor and Francis group	-	2008
5	Disaster management & rehabilitation	Rajdeep Dasgupta	Mittal Publications	-	2007
6	Natural Hazards and Disaster Management, Vulnerability and Mitigation	R B Singh	Rawat Publications	-	2006
7	Concepts and Techniques of GIS	C.P. Lo Albert, K.W. Yonng	Prentice Hall (India) Publications.	-	2006

B.E. Semester –VII
Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS- H 2019)
TCET Autonomy Scheme (w.e.f. A.Y. 2021-22)

B.E. (Computer Engineering)							**B.E. Open Elective SEM: VII**		
Course Name: Research Methodology							**Course Code:** OEC- CS7015		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/ Oral (25)**	**Term Work (50)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	**100**
3	-	-	3	3	25	75	-	-	
IA: In-Semester Assessment - Paper Duration –**1.5 Hours** **ESE:** End Semester Examination - Paper Duration - **3 Hours** **The weightage of marks for continuous evaluation of Term work/Report:** Formative (40%), Timely completion of practical (40%) and Attendance (20%)									
Prerequisite: Basics of Statistics									

Course Objective: The objective of this course is to make students understand research problem formulation and analyze research related information.

Course Outcomes: **Upon completion of the course students will be able to:**

S. No.	**Course Outcomes**	**Cognitive levels of attainment as per Bloom's Taxonomy**
1	Understand research problem formulation.	L1, L2, L3
2	Analyze research related information	L1, L2, L3, L4
3	Follow research ethics	L1, L2, L3
4	Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.	L1, L2, L3
5	Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.	L1, L2, L3
6	Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.	L1, L2, L3

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels as per bloom's Taxonomy
1	Foundations of Research: Meaning, Objectives, Motivation, Utility. Concept of theory, empiricism, deductive and inductive theory. Characteristics of scientific method – Understanding the language of research – Concept, Construct, Definition, Variable. Research Process	4	L1, L2, L3
2	Problem Identification & Formulation – Research Question – Investigation Question – Measurement Issues – Hypothesis – Qualities of a good Hypothesis –Null Hypothesis & Alternative Hypothesis. Hypothesis Testing – Logic & Importance	4	L1, L2, L3, L4
3	Research Design: Concept and Importance in Research – Features of a good research design – Exploratory Research Design – concept, types and uses, Descriptive Research Designs – concept, types and uses. Experimental Design: Concept of Independent & Dependent variables	4	L1, L2, L3
4	Qualitative and Quantitative Research: Qualitative research – Quantitative research – Concept of measurement, causality, generalization, replication. Merging the two approaches.	4	L1, L2, L3
5	Interpretation of Data and Paper Writing – Layout of a Research Paper, Journals in Computer Science, Impact factor of Journals, When and where to publish ? Ethical issues related to publishing, Plagiarism and Self-Plagiarism.	4	L1, L2, L3
6	Use of tools / techniques for Research: methods to search required information effectively, Reference Management Software like Zotero/Mendeley, Software for paper formatting like LaTeX/MS Office Software for detection of Plagiarism	4	L1, L2, L3
Total		24	

Books and references:

S. No.	Title	Authors	Publisher	Edition	Year
1	Research methodology: an introduction for science & engineering students	Stuart Melville and Wayne Goddard	Juta Academic	1st edition	1996
2	Research Methodology: An Introduction	Wayne Goddard and Stuart Melville	Juta and Company Ltd	2nd edition	2004
3	Research Methodology: A Step by Step Guide for beginners	Ranjit Kumar	SAGE Publications Ltd	3rd edition	2014

Online References:

S. No.	Website Name	URL	Modules Covered
1	www.nptel.ac.in	https://nptel.ac.in/courses/121/106/121106007/	M1, M2, M3, M4, M5, M6
2	www.courseera.org	https://www.coursera.org/browse/physical-science-and-engineering/research-methods	M1, M2, M3, M4, M5, M6
3	www.udemy.com	https://www.udemy.com/course/research-methods/	M1, M2, M3, M4, M5, M6

BE SEMESTER VII

Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS- H 2019)

TCET Autonomy Scheme (w.e.f. A.Y. 2021-22)

B.E. (Computer Engineering)						**B.E. Open Elective SEM:** VII			
Course Name: Operation Research						**Course Code: OEC- CS7016**			
eaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (20)**	**Term Work (20)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/ OR**	**TW**	
3	-	-	3	3	25	75	-	-	**100**
IA:In-Semester Assessment- Paper Duration-1 Hours **ESE :** End Semester Examination **-** Paper Duration **- 3 Hours** **The weightage of marks for continuous evaluation of Term work/Report:** Formative (40%), Timely completion of practical (40%) and Attendance (20%)									
Prerequisite: Engineering Mathematics									

Course Objectives: Course intend to deliver the optimization techniques so that student should be able to optimize any engineering product or process.

Course Outcome:

SN	Course Outcomes	Cognitive levels as per bloom's Taxonomy
1	Understand the theoretical workings of the simplex method, the relationship between a linear program and its dual, including strong duality and complementary slackness.	L1, L2, L3, L4
2	Perform sensitivity analysis to determine the direction and magnitude of change of a model's optimal solution as the data change	L1, L2, L3, L4
3	Solve specialized linear programming problems like the transportation and assignmentproblems, solve network models like the shortest path, minimum spanning tree, and maximum flow problems	L1, L2, L3, L4
4	Understand the applications of integer programming and a queuing model and compute important performance measures	L1, L2, L3, L4
5	To apply conflict between two players	L1, L2, L3, L4
6	To apply EOQ model in inventory	L1, L2, L3, L4

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels as per bloom's Taxonomy
	Introduction to Operations Research		
1	Introduction, , Structure of the Mathematical Model, Limitations of Operations Research **Linear Programming**: Introduction, Linear Programming Problem, Requirements of LPP, Mathematical Formulation of LPP, Graphical method, Simplex Method Penalty Cost Method or Big M- method, Two Phase Method, Revised simplex method, **Duality**, Primal – Dual construction, Symmetric and Asymmetric Dual, Weak Duality Theorem, Complimentary Slackness Theorem, Main Duality Theorem, Dual Simplex Method, Sensitivity Analysis **Transportation Problem**: Formulation, solution, unbalanced Transportation problem. Finding basic feasible solutions – Northwest corner rule, least cost method and Vogel's approximation method. Optimality test: the stepping stone method and MODI method **Assignment Problem** Introduction, Mathematical Formulation of the Problem, Hungarian Method Algorithm, Processing of n Jobs Through Two Machines and m Machines, Graphical Method of Two Jobs m Machines Problem Routing Problem, Travelling Salesman Problem **Integer Programming Problem** Introduction, Types of Integer Programming Problems, Gomory's cutting plane Algorithm, Branch and Bound Technique. Introduction to Decomposition algorithms.	14	L1, L2, L3, L4
2	**Queuing models**: queuing systems and structures, single server and multi-server models, Poisson input, exponential service, constant rate service, finite and infinite population	05	L1, L2, L3, L4
3	**Simulation:** Introduction, Methodology of Simulation, Basic Concepts, Simulation Procedure, Application of Simulation Monte-Carlo Method: Introduction, Monte-Carlo Simulation, Applications of Simulation, Advantages of Simulation, Limitations of Simulation.	05	L1, L2, L3, L4
4	**Dynamic programming.** Characteristics of dynamic programming. Dynamic programming approach for Priority Management employment smoothening, capital budgeting, Stage Coach/Shortest Path, cargo loading and Reliability problems.	6	L1, L2, L3, L4
5	**Game Theory.** Competitive games, rectangular game, saddle point, minimax (maximin) method of optimal strategies, value of the game. Solution of games with saddle points, dominance principle. Rectangular games without saddle point – mixed strategy for 2 X 2 games.	10	L1, L2, L3, L4
6	**Inventory Models** Classical EOQ Models, EOQ Model with Price Breaks, EOQ with Shortage, Probabilistic EOQ Model,	08	L1, L2, L3, L4

Books and References:

SN	Title	Authors	Publisher	Edition	Year
1	Operations Research - An Introduction	Taha, H.A.	Prentice Hall,	7th Edition,	2002-
2	Operations Research: Principles and Practice",	Ravindran, A, Phillips	John Willey and Sons	2nd Edition -	2009
3	Introduction to Operations Research	Hiller, F. S. and Liebermann	McGraw Hill	-	-
4	Operations Research	S. D. Sharma	KedarNath Ram Nath- Meerut	-	-

B.E. Semester –VII
Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS-H 2019)
TCET Autonomy Scheme (w.e.f. A.Y. 2021-22)

BE (Computer Engineering)							**B.E. SEM : VII**		
Course Name: Finance Management							**Course Code :** HSMC-CS701		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	**100**
3	-		3	3	25	75			
IA: In-Semester Assessment - Paper Duration – 1 Hour									
ESE: End Semester Examination - Paper Duration - 3 Hours									
The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)									
Prerequisite: Basic Mathematics									

Course Objectives: The course intends to give an overview of Indian financial system, instruments and market along with basic concepts of value of money, returns and risks, corporate finance, working capital and its management. It also exhibit knowledge about sources of finance, capital structure, dividend policy.

Course Outcomes: **Upon completion of the course students will be able to:**

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy Levels
1	Understand Indian Financial System with respect to financial Instruments, financial markets and institutions	L1,L2
2	Understand the concepts of Returns and risks along with time value of money	L1, L2,L3
3	Understand Corporate Finance and perform financial ratio analysis	L1, L2,L3
4	Importance of Capital Budgeting	L1,L2,L3,L4
5	Identify Sources of Finance and capital structure	L1,L2,L3,L4
6	Analyze the Dividend Policy concepts for financial decisions	L1,L2,L3,L4

Detailed Syllabus (Total No. of Hours: 45):

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Overview of Indian Financial System** Characteristics, Components and Functions of Financial System. **Financial Instruments:** Meaning, Characteristics and Classification of Basic Financial Instruments — Equity Shares, Preference Shares, Bonds-Debentures, Certificates of Deposit, and Treasury Bills. **Financial Markets:** Meaning, Characteristics and Classification of Financial Markets — Capital Market, Money Market and Foreign Currency Market **Financial Institutions:** Meaning, Characteristics and Classification of Financial Institutions — Commercial Banks, Investment-Merchant Banks and Stock Exchanges	08	L1,L2
2	**Concepts of Returns and Risks** Measurement of Historical Returns and Expected Returns of a Single Security and a Two-security Portfolio; Measurement of Historical Risk and Expected Risk of a Single Security and a Two-security Portfolio. **Time Value of Money:** Future Value of a Lump Sum, Ordinary Annuity, and Annuity Due; Present Value of a Lump Sum, Ordinary Annuity, and Annuity Due; Continuous Compounding and Continuous Discounting	08	L1, L2,L3
3	**Overview of Corporate Finance** Objectives of Corporate Finance; Functions of Corporate Finance—Investment Decision, Financing Decision, and Dividend Decision. **Financial Ratio Analysis:** Overview of Financial Statements—Balance Sheet, Profit and Loss Account, and Cash Flow Statement; Purpose of Financial Ratio Analysis; Liquidity Ratios; Efficiency or Activity Ratios; Profitability Ratios; Capital Structure Ratios; Stock Market Ratios; Limitations of Ratio Analysis.	08	L1, L2,L3
4	**Capital Budgeting** Meaning and Importance of Capital Budgeting; Inputs for Capital Budgeting Decisions; Investment Appraisal Criterion—Accounting Rate of Return, Payback Period, Discounted Payback Period, Net Present Value(NPV), Profitability Index, Internal Rate of Return (IRR), and Modified Internal Rate of Return (MIRR) **Working Capital Management:** Concepts of Meaning Working Capital; Importance of Working Capital Management; Factors Affecting an Entity's Working Capital Needs; Estimation of Working Capital Requirements; Management of Inventories; Management of Receivables; and Management of Cash and Marketable Securities	10	L1,L2,L3, L4
5	**Sources of Finance** Long Term Sources—Equity, Debt, and Hybrids; Mezzanine Finance; Sources of Short Term Finance—Trade Credit, Bank Finance, Commercial Paper; Project Finance. **Capital Structure:** Factors Affecting an Entity's Capital Structure; Overview of	07	L1,L2,L3, L4

	Capital Structure Theories and Approaches— Net Income Approach, Net Operating Income Approach; Traditional Approach, and Modigliani-Miller Approach. Relation between Capital Structure and Corporate Value; Concept of Optimal Capital Structure		
6	**Dividend Policy**		
	Meaning and Importance of Dividend Policy; Factors Affecting an Entity's Dividend Decision; Overview of Dividend Policy Theories and Approaches—Gordon's Approach, Walter's Approach, and Modigliani-Miller Approach	04	L1, L2, L3,L4
	Total Hours	**45**	

Books and References:

S. No.	Title	Authors	Publisher	Edition	Year
1	Fundamentals of Financial Management	Eugene F. Brigham and Joel F. Houston	Cengage Publications, New Delhi	Thirteenth Edition	2015
2	Analysis for Financial Management	Robert C. Higgins	McGraw Hill Education	Tenth Edition	2013
3	Indian Financial System	M. Y. Khan	McGraw Hill Education, New Delhi	Ninth Edition	2015
4	Financial Management	I. M. Pandey	S. Chand (G/L) & Company Limited, New Delhi	Eleventh Edition	2015

Online References:

S. No.	Website Name	URL	Modules Covered
1	www.splessons.com	https://www.splessons.com/lesson/indian-financial-system-overview/	M1,M3
2	finance.zacks.com	https://finance.zacks.com/concepts-return-investment-risk-3049.html	M2
3	www.edupristine.com	https://www.edupristine.com/blog/capital-budgeting	M4
4	efinancemanagement.com	https://efinancemanagement.com/sources-of-finance	M5
5	www.businessmanagementideas.com	https://www.businessmanagementideas.com/financial-management/dividends/meaning-and-types-of-dividend-policy-financial-management/3968	M6

B.E. Semester –VII
Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS-H 2019)
TCET Autonomy Scheme (w.e.f. A.Y. 2021-22)

B.E. (Computer Engineering)									**B.E. SEM : VII**
Course Name: Project-I							**Course Code : PROJ**-CS701		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	**50**
-	-	6	6	3	-	-	25	25	
Prerequisite: Computer Programming language/s, Software Engineering									

Course Objectives: The Project work enables students to develop further skills and knowledge gained during the programme by applying them to the analysis of a specific problem or issue, via a substantial piece of work carried out over an extended period. For students to demonstrate proficiency in the design of a research project, application of appropriate research methods, collection and analysis of data and presentation of results.

Guidelines:

1. Project Topic:

- To proceed with the project work it is very important to select a right topic. Project can be undertaken on any subject addressing IT programme. Research and development projects on problems of practical and theoretical interest should be encouraged.
- Project work must be carried out by the group of at least two students and maximum three and must be original.
- Students can certainly take ideas from anywhere, but be sure that they should evolve them in the unique way to suit their project requirements.
- The project work can be undertaken in a research institute or organization/company/any business establishment.
- Student must consult internal guide along with external guide (if any) in selection of topic.
- Head of department and senior staff in the department will take decision regarding selection of projects.
- Student has to submit weekly progress report to the internal guide and whereas internal guide has to keep track on the progress of the project and also has to maintain attendance report. This progress report can be used for awarding term work marks.
- In case of industry projects, visit by internal guide will be preferred.

2. Project Report Format: At the end of semester a project report should preferably contain at least following details:-

- Abstract
- Introduction
- Literature Survey
    - Survey Existing system
    - Limitation Existing system or research gap
    - Problem Statement and Objective
    - Scope
- Proposed System
    - Analysis/Framework/ Algorithm
    - Details of Hardware & Software
    - Design details
    - Methodology (your approach to solve the problem)
- Implementation
- Conclusion
- References

3. Term Work: Distribution of marks for term work shall be as follows:
a. Weekly Attendance on Project Day
b. Project work contribute
c. Project Report (Spiral Bound)
d. Term End Presentation (Internal)
The final certification and acceptance of TW ensures the satisfactory performance on the above aspects.

4. Oral & Practical:
Oral &Practical examination of Project-I should be conducted by Internal and External examiners approved by University of Mumbai. Students have to give presentation and demonstration on the Project I.

B.E. Semester –VII
Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS-H 2019)
TCET Autonomy Scheme (w.e.f. A.Y. 2021-22)

<table>
<tr><th colspan="6">BE (computer engineering)</th><th colspan="4">SEM:</th></tr>
<tr><th colspan="6">Course Name: Summer Internship</th><th colspan="4">Course Code :SI-CS 701</th></tr>
<tr><th colspan="5">Teaching Scheme (Program Specific)</th><th colspan="5">Examination Scheme (Formative/ Summative)</th></tr>
<tr><th colspan="5">Modes of Teaching / Learning / Weightage</th><th colspan="5">Modes of Continuous Assessment / Evaluation</th></tr>
<tr><td colspan="5" rowspan="3">Total Hours : Maximum 2 Weeks (60 to 80 Hours during summer vacation)</td><th colspan="2">Theory (100)</th><th>Practical/Oral(25)</th><th>Term Work (25)</th><th rowspan="3">Total</th></tr>
<tr><th rowspan="2">IA</th><th rowspan="2">ESE</th><td></td><td></td></tr>
<tr><th>PR/OR</th><th>TW</th></tr>
<tr><th>Theory</th><th>Tutorial</th><th>Practical</th><th>Contact Hours</th><th>Credits</th><td colspan="2" rowspan="2">-</td><td rowspan="2">-</td><td rowspan="2">-</td><td rowspan="2">-</td></tr>
<tr><td>-</td><td>-</td><td></td><td>120*</td><td></td></tr>
<tr><td colspan="10">Note :
1. Internship will be done in institute laboratory in collaboration with industries.
2. Evaluation and assessment will be done as per AICTE guidelines.</td></tr>
<tr><td colspan="10">Prerequisite: Fundamental knowledge of respective Programmes</td></tr>
</table>

Course Objectives:

To get industry like exposure in the institute laboratories by carrying out activities / projects. Also design innovative techniques / methods to develop the products.

Course Outcomes: **Upon completion of the course students will be able to:**

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Apply subjects knowledge in the college laboratories for carrying out projects	L3, L4,L5
2	Developed innovative techniques / methods to develop the products	L3, L4,L5
3	Contribute for the society	L3, L4,L5

Detailed Syllabus:

<table>
<tr><th>Module No.</th><th>Topics</th><th>Cognitive levels of attainment as per Bloom's Taxonomy</th></tr>
<tr><td rowspan="2">1</td><td>Program Specific Internship</td><td rowspan="2">L3, L4,L5</td></tr>
<tr><td>• Training and certification on emerging technologies in domains offered by Department of Computer Engineering
• Applying classroom and laboratory knowledge to design , develop and deploy the products</td></tr>
<tr><td></td><td>Inter disciplinary Internship</td><td>L3, L4,L5</td></tr>
</table>

2	• To explore and understand issues and challenges in the other disciplines (EXTC, ELEX, MECH and CIVIL) • Design , develop and deploy cost effective products using multidisciplinary approach	
3	**Industry Specific Internship** • To explore and understand issues and challenges in industry • Developing solutions for industry specific problems • Design , develop and deploy products for startup and SMEs	L3, L4,L5
4	**Interpersonal Internship** • To develop interpersonal skills such as leadership, marketing ,publicity and corporate ethics and communication • To get competence in problem solving , presentation , negotiation skills	L3, L4,L5
5	**Social Internship** • Identify and study different real life issues in the society • Identify societal problems and provide engineering solutions to solve these problems	L3, L4,L5
6	**Academic Internship** • Study report preparation, preparation of presentations, copy table book preparation , business proposal and IPR • Capture aspirations & expectations through interviews of students. • Ways to connect research in technical institutes with industry. • Taking inputs from self, local stakeholders and global stake holders which will help to develop process with comparative and competitive study.	L3, L4,L5

Books and References:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	The Ultimate Guide to Internships: 100 Steps to Get a Great Internship and Thrive in It (Ultimate Guides)	Eric Woodard	Allworth	I	2015

Online References:

Sr. No.	Website Name	URL	Modules Covered
1	https://www.letsintern.com/	https://www.letsintern.com/internships/summer-internships	M1-M6
1	https://codegnan.com	https://codegnan.com/blog/benefits-of-internships-and-importance	M1-M6
2	https://www.honorsociety.org	https://www.honorsociety.org/articles?category=internships	M1-M6

B.E. Semester –VII
Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS-H 2019)
TCET Autonomy Scheme (w.e.f. A.Y. 2021-22)

B.E.(Computer Engineering)					**B.E.(SEM :** VIII)		
Course Name : Professional Skills- VII (Software Testing)					**Course Code:** HSDCSPS701		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**		
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**		
Hours Per Week					**Presentation**	**Report**	**Term Work**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**AC**	**AC**	**TW**
15	-	30	45	2	50	25	75
Audit course evaluated by Teacher Guardian							
Mid Semester Assessment for Term work will be on continuous basis							
Prerequisite: Subject knowledge, Domain knowledge							

Course Objective: The course intends to make students learn how to design and program Python applications. The course intends to develop professional skills necessary for becoming technically skilled personnel.

Course Outcomes: **Upon completion of the course students will be able to:**

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Illustrate concepts of testing and types of testing.	L1, L2
2	Install Selenium IDE and illustrate the concepts of Selenium suite tools.	L1,L2, L3
3	Record test cases using the IDE.	L1,L2, L3
4	Write test cases using the selenese commands.	L1,L2, L3
5	Identify the various webdriver commands and their usage.	L1, L2, L3
6	Apply skills of writing automated test scripts in different web applications	L1, L2, L3

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Basics of testing** Introduction to testing, types of testing, writing test cases for various module. Exercise to manually test the College website and report errors. Difference between manual and Automated testing, Automation testing tools, use of automation testing	3	L1, L2
2	**Introduction to Selenium** Selenium Suite tools, Install Selenium IDE	2	L1,L2, L3
3	**Selenium IDE** Basics of Selenium IDE, test with Selenium IDE	2	L1,L2, L3
4	**Selenium Commands – Selenese** Selenium Commands – Selenese(Actions, Assessors and Assertions) , Create a script manually and test it on any website	3	L1,L2, L3
5	**Selenium Webdriver** Selenium Webdriver, Webdriver commands and its implementation., Writing script using a webdriver, Use of findElement() and findElements() methods in Webdriver	3	L1, L2, L3
6	**Case Study** Write a complete test script for testing of a website	2	L1,L2, L3
	Total Hours	**15**	

Books and References:

SN	Title	Authors	Publisher	Edition	Year
1	Selenium Testing Tools Cookbook	Unmesh Gundecha	packt	3rd	2012
2	Selenium Web Driver Practical guide	Satya Avasarala	packt	2nd	2014

Online References:

S. No.	Website Name	URL	Modules Covered
1	www.toolsqa.com	https://www.toolsqa.com/selenium-ide/selenium-ide-commands/	M1, M2,
2	www.softwaretestinghelp.com	https://www.softwaretestinghelp.com/selenium-webdriver-commands-selenium-tutorial-17/ 3.	M3,M4
3	www.javatpoint.com	https://www.javatpoint.com/selenium-webdriver-commands	M4,M5,M6
4	www.udemy.com	https://www.udemy.com/course/selenium-real-time-examplesinterview-questions/	M4,M5,M6

5	www.edureka.co	https://www.edureka.co/blog/selenium-projects/	M4,M5,M6
6	www.udemy.com	https://www.udemy.com/course/selenium-training/	M4,M5,M6

List of Practical/ Experiments:

Practical Number	Type of Experiment	Practical/ Experiment Topic	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Basic Experiments**	Write unit test cases in format	2	L1
2		Install Selenium IDE and record and playback	2	L1, L2
3	**Design Experiments**	Record test case and update test cases	2	L1, L2, L3
4		Write program using Selenese commands(Actions)	2	L1, L2, L3
5		Write program using Assessors	2	L1, L2, L3
6		Write program using Assertions	2	
7	**Advanced Experiments**	Write program using findElement() method in Webdriver	4	L1, L2, L3
8		Write program using and findElements() method in Webdriver	4	L1, L2, L3
9	**Mini/Minor Projects/ Seminar/**	1. Online Second-hand Book Buying & Selling Portal 2. College E Print Service Management 3. Online Pizza Ordering System	6	L1, L2, L3
10	**Case Studies/ Group Presentation**	1. study other tools used for Software testing	4	L1, L2, L3
		Total Hours	**30**	

B.E. Semester –VII
Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS-H 2019)
TCET Autonomy Scheme (w.e.f. A.Y. 2021-22)

BE (computer engineering)					**SEM: VII**		
Course Name: Research Based Learning III					**Course Code:** HSD-CSRBL701		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**		
Modes of Teaching / Learning / Weightage					**Assessment/Evaluation Scheme**		
Hours Per Week					**Presentation**	**Report**	**Term Work**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**AC**	**AC**	**TW**
-	-	2	2	1	25	25	50
Audit course evaluated by Teacher Guardian							
Mid Semester Assessment for Term work will be on continuous basis							
Prerequisite: Subject knowledge, Domain knowledge							

Course Objectives: This course is focused to engage the learner in testing & validation, developing business models & exploring possibilities in areas of research and consultancy.

Course Outcomes: **Upon completion of the course students will be able to:**

S.N.	Course Outcome	Cognitive level attainment as per revised Bloom Taxonomy
1	Upgrade the knowledge of latest technologies developments, tools and project development aspects.	L1, L2, L3
2	Assess their skills in competitive business environment.	L1, L2, L3,L4
3	Test their skills in the areas of consultancy.	L1, L2, L3,L4
4	Put across their work by publishing papers	L1, L2, L3,L4,l5

Detailed Syllabus:

Module No.	Topics	Cognitive level attainment as per revised Bloom Taxonomy
1	**Search of relevant industry/labs/start ups for project area** Identification of Industry for the cause, opportunity, documentation. Testing of mathematical modeled as per standards available. **Submission of report/Presentation and evaluation**	L1, L2, L3
2	**Business plan of Prototype/ Business canvas development** Preparing Business plan covering the following parameters: I. Key Partners II. Key Activities III. Value Propositions IV. Customer Relationships Customer Segments V. Key Resources VI. Channels	L1, L2, L3,L4

	VII. Cost Structure VIII. Revenue Streams **Presentation of Pitch and evaluation**	
3	**Participation in competition/Working for research grant group/consultancy group/etc.** **Participation in project competitions** **a)** Participating at institute /national level /university level /participate in competitions. **b)** Participation in funded project/consultancy projects II. Research grant: Identifying research grant proposal like University level, industry level etc, Proposal writing and preparing budget. III Evaluation : Evaluation based on level of participation , proposal made,etc **Competition and evaluation**	L1, L2, L3,L4
4	**Publish paper at institute /national level conference and Journals** I. Identification of conference and track on the basis research proposal/theme (Institute/National/International) II. Participating at conference and Publishing paper. **Evaluation of research review paper.**	L1, L2, L3,L4,L5

References:

Sr. No.	Title	Authors	Publisher	Edition	Year
1.	Guide to Competitive Programming: Learning and Improving Algorithms Through Contests	Antti Laaksonen	Springer	Kindle	2018
2.	Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers	Alexander Osterwalder, Yves Pigneur	John Wiley & Sons.	1st	2013
3.	How to Write a Good Research Paper	Peter Haisler	Samfundslitteratur	Kindle	2009

Online References:

Sr. No.	Website Name	URL	Modules Covered
1.	https://canvanizer.com	https://canvanizer.com/new/business-model-canvas	M2
2.	https://www.researchgate.net	https://www.researchgate.net/publication/224372998_Idea_Generation_Techniques_among_Creative_Professionals	M3
3.	https://www.startupindia.gov.in	https://www.startupindia.gov.in/content/sih/en/reources.html	M3
4.	https://www.slideshare.net	https://www.slideshare.net/AsirJohnSamuel/1introduction-to-research-methodology?next_slideshow=1	M4

B.E. Semester –VIII
Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS-H 2019)
Proposed Syllabus under Autonomy(w.e.f. A.Y. 2021-22)

BE (Computer Engineering)							**SEM : V11I**		
Course Name : Distributed Computing							**Course Code :** PEC-CS801		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IS**	**ESE**	**PR**	**TW**	**150**
3	-	2	5	4	25	75	25	25	
SA: In-Semester Assessment Paper Duration – **1.5 Hours** **ESE :** End Semester Evaluation- Paper Duration **- 3 Hours** Mid Semester Assessment for Term work will be on continues basis									
Prerequisite: Engineering Mathematics **RBT :** Revised Bloom's Taxonomy									

<u>Course Objectives:</u> The objective of the course is to study contemporary knowledge in distributed systems and able to analyze and design distributed applications. It provide skill to measure the performance of distributed synchronization algorithms

<u>Course Outcomes:</u> At the end of the course student should be able:

SN	Course Outcomes	RBT Levels
1	CO1: Demonstrate knowledge of the basic elements and concepts related to distributed system technologies.	L1,L2
2	CO2: Illustrate the middleware technologies that support distributed applications such as RPC, RMI and Object based middleware.	L1,L2,L3,L4 , L5,L6
3	CO3:Analyze the various techniques used for clock synchronization and mutual exclusion	L1,L2,L3,L4
4	CO4: Demonstrate the concepts of Resource and Process management and synchronization algorithms	L1,L2,L3,L4
5	CO5: Demonstrate the concepts of Consistency and Replication Management	L1,L2,L3,L4
6	CO6: Understand the knowledge of Distributed File System to analyze various file systems like NFS, AFS and experience in building large-scale distributed applications.	L1,L2

Module No.	Topics	Hrs.	RBT Levels
1	**Introduction to Distributed Systems** Characterization of Distributed Systems: Issues, Goals, and Types of distributed systems, Distributed System Models, Hardware concepts, Software Concept. Middleware: Models of Middleware, Services offered by middleware, Client Server model.	04	L1,L2
2	**Communication** Layered Protocols, Interprocess communication (IPC): MPI, Remote Procedure Call (RPC), Remote Object Invocation, Remote Method Invocation (RMI) Message Oriented Communication, Stream Oriented Communication, Group Communication	06	L1,L2,L3,L4,L5, L6
3	**Synchronization** Clock Synchronization, Logical Clocks, Election Algorithms, Mutual Exclusion, Distributed Mutual Exclusion-Classification of mutual Exclusion Algorithm, Requirements of Mutual Exclusion Algorithms, Performance measure Non Token based Algorithms: Lamport Algorithm, Ricart–Agrawala‘s Algorithm, Maekawa‘s Algorithm Token Based Algorithms: Suzuki-Kasami‘s Broardcast Algorithms, Singhal‘s Heurastic Algorithm, Raymond‘s Tree based Algorithm, Comparative Performance Analysis.	12	L1,L2,L3,L4
4	**Resource and Process Management** Desirable Features of global Scheduling algorithm, Task assignment approach, Load balancing approach, load sharing approach Introduction to process management, process migration, Threads, Virtualization, Clients, Servers, Code Migration	8	L1,L2,L3,L4
5	**Consistency, Replication and Fault Tolerance** Introduction to replication and consistency, Data-Centric and Client Centric Consistency Models, Replica Management Introduction to replication and consistency, Data-Centric and Client Centric Consistency Models, Replica Management	8	L1,L2,L3,L4
6	**Distributed File Systems and Name Services** Introduction and features of DFS, File models, File Accessing models, File-Caching Schemes, File Replication, Case Study: Distributed File Systems (DSF), Network File System (NFS), Andrew File System (AFS) Introduction to Name services and Domain Name System, Directory Services, Case Study: The Global Name Service, The X.500 Directory Service	7	L1,L2,L3,L4
	Total	45	

Books and References:

SN	Title	Authors	Publisher	Edition	Year
1	Distributed Systems: Principles and Paradigms	Andrew S. Tanenbaum and Maarten Van Steen	Pearson Education.	2nd Edition	2007
2	Distributed Systems: Concepts and Design	George Coulouris, Jean Dollimore, Tim Kindberg	Pearson education	4th Edition	2005

Online Resources:

S. No.	Website Name	URL	Modules Covered
1	www.cs.cmu.edu	www.cs.cmu.edu › slides › lec_3	M1
2	https://www.geeksforgeeks.org	https://www.geeksforgeeks.org/interprocess-communication-in-distributed-systems/	M2
3	www.tutorialspoint.com	https://www.tutorialspoint.com › Distributed-Systems	M1-M6

List of Practical/ Experiments:

Practical Number	Type of Experiment	Practical/ Experiment Topic	Hrs.	RBT Levels
1	Basic Experiments	Study of Distributed Computing system architecture and explain with various application like university , Banking system	2	L1, L2, L3
2		Built a Program for Client/server using RPC/RMI	2	L1, L2, L3
3		Demonstrate a program for Inter-process communication	2	L1, L2, L3
4	Design Experiments	Develop a program for Group Communication	2	L1, L2, L3
5		Develop a program for Election Algorithm	2	L1, L2, L3
6		Develop a program for Clock Synchronization algorithms	2	L1, L2, L3
7		Design an program to illustrate token based algorithm	2	L1, L2, L3
8		a) Design an program to illustrate non token based algorithm b) Develop a program for Mutual Exclusion Algorithm	4	L1, L2, L3
9		a) Develop a program for Load Balancing Algorithm. b) Develop a program for Distributed File System	4	L1, L2, L3,
10	Mini/Minor Projects/ Seminar/ Case Studies	**Case study:** • Facebook Distributed file system • Design And Development Of The Data Synchronization/Clock Synchronization	8	L1, L2, L3,L4,L5,L6

		• CORBA Architecture **Mini Project:** 1. Dynamic routing with security consideration Java Project 2. Adaptive Programming Model for Fault Tolerant Distributed Computing Maze generator 3. Distributed Cache Updated System for DSR Employee Record System 4. Idea on Stock Market Simulation Game 5. Project Idea on Replicated File System Distributed System on One Lane Bridge Project		
		Total	**30**	

B.E. Semester –VIII
Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS-H 2019)
Syllabus under Autonomy (w.e.f. A.Y. 2021-22)

B.E. (Computer Engineering)									**B.E. SEM: VIII**	
Course Name: Graph Theory									**Course Code:** PEC-CS8011	
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**					
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**					
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**	
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	**150**	
3	-	2@	5	4	25	75	25	25		

IA: In-Semester Assessment - Paper Duration – 1 Hour
ESE: End Semester Examination - Paper Duration - 3 Hours
The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)

Prerequisite: Discrete Mathematics, Algorithms, Data structures

Course Objective: The objective of this course is to introduce students with the fundamental concepts in graph theory, explore its modern applications and to solve live problems that can be modeled by graphs.

Course Outcomes: Upon completion of the course students will be able to:

Sr. No	**Course Outcome**	**Cognitive levels of attainment as per Bloom's Taxonomy**
1	Solve problems using basic graph theory	L1, L2, L3, L4, L5, L6
2	Identify whether a graph has a Hamiltonian circuit or path and apply the concepts for problem solving.	L1, L2, L3, L4, L5, L6
3	Solve problems involving trees and connectivity and apply suitable graph model and algorithm for solving applications.	L1, L2, L3, L4, L5, L6
4	Represent Graphs in various forms and to introduce concepts like cut-set, cut-vertex, connectivity and separability.	L1, L2, L3, L4, L5, L6
5	Solve problems involving vertex and edge coloring	L1, L2, L3, L4, L5, L6
6	To explore modern applications of graph theory and apply principles and concepts of graph theory in practical situations	L1, L2, L3, L4, L5, L6

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Introduction to Graph Theory** Introduction, Graph Terminologies, Types of Graphs, complete, regular and bipartite graphs, Isomorphic graphs, Subgraphs, Multi Graph Matrix representations of graphs, applications of graphs.	7	L1, L2, L3, L4, L5, L6
2	**Paths and Circuits** Walks, trails, paths, cycles, Connected graphs, Euler Graphs, Hamiltonian Paths and circuits, Weighted graphs and shortest paths, Dijkstra's shortest path algorithm, Floyd-Warshall shortest path algorithm. Applications-The Chinese Postman Problem, The Travelling Salesman Problem	8	L1, L2, L3, L4, L5, L6
3	**Trees and connectivity** Trees, Properties, Distance and Centers in a tree, Types: Rooted Tree and Binary tree, Labeled Tree, Unlabeled Tree, Spanning Trees, Kirchoff-matrix-tree theorem, Minimum spanning trees, Kruskal's algorithm, Prim's algorithm	8	L1, L2, L3, L4, L5, L6
4	**Representations of Graphs** Fundamental Circuits, Cut Sets, Properties, Fundamental Circuit and Cut-sets, Connectivity and Separability, Matrix Representation, Adjacency matrix, Incidence matrix, Circuit matrix, Cut-set matrix, Path Matrix, Properties.	7	L1, L2, L3, L4, L5, L6
5	**Vertex-colorings and planar graphs** Graph Coloring, Chromatic Number, Chromatic Polynomial, Chromatic Partitioning, Matching, Covering, Edge colorings, Planar Graphs: Basic concepts, Euler's formula and its consequences, Planarity testing, 5-Color-theorem	8	L1, L2, L3, L4, L5, L6
6	**Applications of Graph Theory** Applications of Graphs in switching and coding Theory, Graphs in Game theory, Graphs in Computer programming and other application in Science and engineering.	7	L1, L2, L3, L4, L5, L6
	Total Hours	**45**	

Books and References:

SN	Title	Authors	Publisher	Edition	Year
1	"Graph Theory with Application to Engineering and Computer Science",	Narsingh Deo	Prentice-Hall of India Pvt.Ltd	2nd Edition	2003
2	"Graph Theory Applications"	L.R.Foulds	Springer ,.	2nd Edition	2016
3	"Graph Theory with Applications"	Bondy, J. A. and Murty, U.S.R.,	North Holland Publication,	3rd Edition,	2008.
4	Introduction to Graph Theory	West, D. B.	Pearson Education,.	2nd Edition,	2011
5	"Graph Theory",	Diestel, R,	Springer	3rd Edition,	2006.
6	Graph Theory	J. A. Bondy and U. S. R. Murthy	Springer Verlag	7th Edition	2008

Online References:

S. No.	Website Name	URL	Modules Covered
1	Introduction to Graph Theory, Coursera	https://www.coursera.org/learn/graphs#syllabus	M1-M6
2	https://courses.lumenlearning.com/	https://courses.lumenlearning.com/math4liberalarts/chapter/introduction-euler-paths/	M1 - M6
3	Graph Theory, course on swayam portal	https://onlinecourses.nptel.ac.in/noc20_ma05/preview	M1-M6

Capstone Project Hours Distribution

Sr. No	Work to be done	No. of hours	Cognitive levels of attainment as per Bloom's Taxonomy
1	Identify an application of Graph (or a concept for demonstration of concepts)	2	L1.L2
2	Conduct a survey for usability	2	L1,L2
3	Representing and Drawing a Graph	2	L1,L2,L3
4	Project Design:(Design a prototype or mathematical model)	2	L1,L2,L3
5	Sample Implementation	2	L1,L2,L3
6	Model Research paper/demonstration of application	4	L1,L2,L3,L5,L6
7	Report Writing	4	L1,L2,L3,L4,L5,L6
8	Validate Modules	4	L1,L2,L3,L4
9	Test and Evaluate Modules	4	L1,L2,L3,L4
10	Prepare report	4	L1,L2,L3,L4
	Total Hours	**30**	

B.E. Semester –VIII
Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS-H 2019)
Syllabus under Autonomy (w.e.f. A.Y. 2021-22)

B.E. (Computer Engineering)									**B.E. SEM : VIII**
Course Name: Advanced System Security and Digital Forensics									**Course Code:** PEC-CS8012
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	
3	-	2@	5	4	25	75	25	25	**150**
IA: In-Semester Assessment - Paper Duration – 1 Hour **ESE: End Semester Examination - Paper Duration - 3 Hours** **The weightage of marks for continuous evaluation of Term work/Report:** Formative (40%), Timely completion of practical (40%) and Attendance/Learning Attitude (20%).									
Prerequisite: System Security									

Course Objective: The course intends to deliver advanced concepts about System Security todevelop security management and policies for reducing Cyber-Attacks. It will also help in understanding and explore techniques used in Digital Forensics and analyze various software vulnerabilities, attacks and protection in Web Applications& Wi-Fi Networks

Course Outcomes: **Upon completion of the course students will be able to:**

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Apply access control policies and control mechanisms to cyber-attacks	L1, L2, L3
2	Identify malicious code and targeted malicious code	L1, L2, L3
3	Analyze threats to web applications	L1, L2, L3, L4
4	Understand the vulnerabilities of Wi-Fi networks and explore different measures to secure wireless protocols, WLAN and VPN network	L1, L2, L3, L4
5	Asses ethical and legal issues associated with cyber-crimes and be able to mitigate impact of crimes with suitable policies	L1, L2, L3, L4, L5
6	Make use of different forensic tools to acquire and duplicate data from compromised systems and analyze the same	L1, L2, L3, L4

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels as per blooms Taxonomy
1	**Introduction & Access Control** Cyber-attacks, Vulnerabilities, Defense Strategies and Techniques, Authentication Methods and Protocols, Defense in Depth Strategies Access Control Policies: DAC, MAC, Multi-level Security Models: Biba Model, Bell La Padula Model	8	L1, L2, L3
2	**Program & OS Security** Malicious and Non-Malicious programming errors, Targeted Malicious codes: Salami Attack, Control against Program threats, Operating System Security: Memory and Address protection, File Protection Mechanism, Linux and Windows: Vulnerabilities, File System Security	8	L1, L2, L3
3	**Web Application Security** OWASP, Web Security Considerations, User Authentication and Session Management, SSL, Privacy on Web, Web Browser Attacks, Account Harvesting, Web Bugs, Clickjacking, Cross-Site Request Forgery, Session Hijacking and Management, Phishing and Pharming Techniques, Web Service Security, OAuth 2.0	10	L1, L2, L3, L4
4	**Wireless Security** Wi-Fi Security, WEP, WPA, WPA-2, Mobile Device Security- Security Threats, Device Security, GSM and UMTS Security, IEEE 802.11/802.11i Wireless LAN Security, VPN Security	6	L1, L2, L3, L4
5	**Legal and Ethical issues** Cybercrime and its types, Intellectual property, Privacy, Ethical issues Protecting Programs and Data, Information and the Law, Rights of Employees and Employers, Redress for Software Failures, Computer Crime, Ethical Issues in Computer Security, Case studies of ethics	6	L1, L2, L3, L4, L5
6	**Digital Forensics** Introduction to Digital Forensics, Acquiring Volatile Data from Windows and Unix systems, Forensic Duplication Techniques, Analysis of forensic images using open source tools like Autopsy and SIFT, Investigating logs from Unix and Windows systems, Investigating Windows Registry	7	L1, L2, L3, L4
	Total Hours	**45**	

Books and References:

Sr. No.	Title	Authors	Publisher	Edition	Year
1.	Computer Security Principles and Practice	William Stallings	Pearson Education	Sixth Edition	2011
2.	Security in Computing	Charles P. fleeger	Pearson Education	Fifth Edition	2015
3.	Network Security and Cryptography	Bernard Menezes	Cengage Learning	Second Edition	2014
4.	Network Security Bible	Eric Cole	Wiley	Second Edition	2009

Online Resources:

Sr. No.	Website Name	URL	Modules Covered
1.	https://www.owasp.org/index.php/Main_Page	https://www.owasp.org/index.php/Category:OWASP_Top_Ten_Project	M1-M2
2.	https://www.tutorialspoint.com/index.htm	https://www.tutorialspoint.com/operating_system/os_security	M2-M3
3.	https://www.tutorialspoint.com/index.htm	https://www.tutorialspoint.com/wireless_security/	M4
4.	https://pressbooks.com/	https://bus206.pressbooks.com/chapter/chapter-12-the-ethical-and-legal-implications-of-information-systems/	M5
5.	https://www.open.edu/openlearn/	https://www.open.edu/openlearn/science-maths-technology/digital-forensics/content-section-4.3	M6

Mini Project:

Sr. No.		Hrs.	Cognitive levels as per blooms Taxonomy
1	Study various Network Scanning Tools for acquiring information	2	L1, L2
2	Identify common vulnerabilities in computing systems / web applications / web sites	4	L1, L2
3	Perform vulnerability scanning using tools like Nessus	2	L1, L2, L3
4	Analyze web-application vulnerabilities using open source tools like Wapiti, browser exploitation framework (BeEf), etc.	2	L1, L2, L3
5	Identify SQL injection vulnerabilities in a website database using SQLMap	2	L1, L2, L3
6	Analyze static code using open source tools like RATS, Flawfinder etc	2	L1, L2, L3, L4
7	Make use of forensics tools in Kali Linux for acquiring data	2	L1, L2, L3
8	Make use of forensics tools in Kali Linux for analyzing data	2	L1, L2, L3
9	Make use of forensics tools in Kali Linux for duplicating data	2	L1, L2, L3
10	Analyze forensic images using open source tools like Autopsy, SIFT, FKT Imager	2	L1, L2, L3
11	Design mitigation technique for the identified vulnerability	4	L1, L2, L3, L4
12	Implement mitigation techniques	4	L1, L2, L3, L4
Total Hours: 30			

B.E. Semester –VIII
Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS-H 2019)
Syllabus under Autonomy (w.e.f. A.Y. 2021-22)

<table>
<tr><td colspan="6">B. E (Computer Engineering)</td><td colspan="4">B.E. SEM : VIII</td></tr>
<tr><td colspan="6">Course Name :Data Science</td><td colspan="4">Course Code :PEC-CS8013</td></tr>
<tr><td colspan="5">Teaching Scheme (Program Specific)</td><td colspan="5">Examination Scheme (Formative/ Summative)</td></tr>
<tr><td colspan="5">Modes of Teaching / Learning / Weightage</td><td colspan="5">Modes of Continuous Assessment / Evaluation</td></tr>
<tr><td colspan="5">Hours Per Week</td><td colspan="2">Theory (100)</td><td>Practical/Oral (25)</td><td>Term Work (25)</td><td>Total</td></tr>
<tr><td>Theory</td><td>Tutorial</td><td>Practical</td><td>Contact Hours</td><td>Credits</td><td>IA</td><td>ESE</td><td>PR/OR</td><td>TW</td><td rowspan="2">150</td></tr>
<tr><td>3</td><td>-</td><td>2@</td><td>5</td><td>4</td><td>25</td><td>75</td><td>25</td><td>25</td></tr>
<tr><td colspan="10">IA: In-Semester Assessment - Paper Duration – 1.5 Hour
ESE: End Semester Examination - Paper Duration - 3 Hours
The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)</td></tr>
<tr><td colspan="10">Prerequisite: Computer Basics, Procedural Programming Languages, Probability</td></tr>
</table>

Course Objective: The objective of this course is to impart necessary knowledge of the mathematical foundations needed for data science and develop programming skills required to build data science applications.

Course Outcomes: **Upon completion of the course students will be able to:**

SN	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Understand the complexities of various Challenges in Data Science	L1, L2
2	Apply Data Science Tools to real life Examples.	L1, L2, L3
3	Demonstrate understanding of the mathematical foundations needed for data science	L1, L2,L3
4	Apply and analyze the complexity of Data Management and Data Science algorithms	L1, L2, L3, L4
5	Demonstrate Data Visualization Techniques.	L1, L2, L3
6	Discuss applications of Data Science for real life applications	L1, L2

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Introduction to Data Science Key Concepts** Introduction, Terminology, Traits of Big data, Web Scraping, Analysis vs Reporting, Data Science process, Types of data, Example applications.	5	L1, L2
2	**Introduction to Programming Tools for Data Science** Toolkits using Python: Matplotlib, NumPy, Scikit-learn, NLTK Visualizing Data: Bar Charts, Line Charts, Scatterplots Working with data: Reading Files, Scraping the Web, Using APIs (Example: Using the Twitter APIs), Cleaning and Munging, Manipulating Data, Rescaling, Dimensionality Reduction	6	L1, L2,L3
3	**Mathematical Foundations** Statistics: Sample Selection, Describing and Summarizing Data, Descriptive Statistics: Describing Qualitative and Quantative Data, Histograms Probability: Dependence and Independence, Conditional Probability, Bayes's Theorem, Random Variables, Continuous Distributions, The Normal Distribution, The Central Limit Theorem Hypothesis and Inference: Statistical Hypothesis Testing, Confidence Intervals, P-hacking, Bayesian Inference	12	L1, L2,L3
4	**Data Management, Pre-processing, Exploratory Data Analysis and Statistical Techniques** Data collection and management: Introduction, Sources of data, Data collection and APIs, Recent trends in various data collection and analysis techniques, Exploring and fixing data, Data storage and management, Using multiple data Sources, Exploratory Data Analysis, Linear Discriminant analysis (LDA), Logistic regression: Bayesian logistic regression	10	L1, L2, L3, L4
5	**Data Visualization** Data Visualization: Introduction, Types of data visualization, Data for visualization: Data types, Data encodings, Retinal variables, Mapping variables to encodings, Visual encodings, Technologies for visualization, Bokeh (Python)	6	L1, L2, L3
6	**Applications of Data Science** Applications of Data Science, Recommendation System, Predictive Analytics, Text Mining, Sentiment Analysis and Case studies	6	L1, L2
	Total Hours	**45**	

Books and References:

	Title	Authors	Publisher	Edition	Year
1	Data Science from Scratch: First Principles with Python	Joel Grus	O'Reilly Media	First Edition	2015
2	Data Sciences	Jain V.K	Khanna Publishing House	First Edition	2018
3	Data Visualization – A Practical Introduction	Kieran Healy	Princeton Univ.	-	2019
4	The Data Science Handbook	Field Cady	Wiley	--	2018

Online Resources:

S. No.	Website Name	URL	Modules Covered
1	https://towardsdatascience.com	https://towardsdatascience.com	M1-M6
2	www.coursera.org	https://www.coursera.org/learn/open-source-tools-for-data-science /	M2
3	www.tutorialspoint.com	https://www.javatpoint.com/what-is-data-visualization	M5

Calendar for MiniProject

Work to be done	Hrs.
Project Title Identification with understanding of Business	2
Data Gathering	2
Data Exploration and Cleaning	6
Model Data	8
Interpret Data	6
Testing of Mini Project	2
Preparation of Report	4
Total Hours	**30**

B.E. Semester –VIII
Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS-H 2019)
Syllabus under Autonomy (w.e.f. A.Y. 2021-22)

B.E. (Computer Engineering)							B.E. SEM: VIII		
Course Name: Augmented and Virtual Reality							Course Code: PEC-CS8014		
Teaching Scheme (Program Specific)					Examination Scheme (Formative/ Summative)				
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation				
Hours Per Week					Theory (100)		Practical/Oral (25)	Term Work (25)	Total
Theory	Tutorial	Practical	Contact Hours	Credits	IA	ESE	PR/OR	TW	
3	-	2@	5	4	25	75	25	25	**150**
IA: In-Semester Assessment - Paper Duration – 1.5 Hours **ESE: End Semester Examination - Paper Duration - 3 Hours** **The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)**									
Prerequisite: Computer Graphics									

Course Objective: To provide background in perception to educate VR creators on concepts and theories of how we perceive and interact with the world around us

Course Outcomes: Upon completion of the course students will be able to

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Apply the concepts of VR and AR in real life	L1, L2, L3
2	Reduce the greatest risk to VR	L1, L2, L3
3	Design the way users interact within the scenes they find themselves in	L1, L2, L3
4	Exposed to VR, AR and today's resources	L1, L2, L3, L4
5	Effectively use open source VR software.	L1, L2, L3
6	Understand different types Modeling techniques of VR	L1, L2

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Introduction to Virtual Reality** Introduction: What Is Virtual Reality, A History of VR, An Overview of Various Realities, Immersion, Presence, and Reality Trade-Offs, The Basics: Design Guidelines, Objective and Subjective Reality, Perceptual Models and Processes, Perceptual Modalities	**7**	**L1, L2, L3**
2	**Virtual Reality Perception** Perception of Space and Time, Perceptual Stability, Attention, and Action, Perception: Design Guidelines, Adverse Health Effects, Motion Sickness, Eye Strain, Seizures, and Aftereffects, Hardware Challenges, Latency, Measuring Sickness, Reducing Adverse Effects, Adverse Health Effects: Design Guidelines	**7**	**L1, L2, L3**
3	**Virtual Reality Interaction** Content Creation, Concepts of Content Creation, Environmental Design, Affecting Behavior, Transitioning to VR Content Creation, Content Creation: Design Guidelines, Interaction, Human-Centered Interaction, VR Interaction Concepts, Input Devices, Interaction Patterns and Techniques, Interaction: Design Guidelines	**8**	**L1, L2, L3**
4	**Virtual and Augmented Reality** Design and Art Across Digital Realities, Designing for Our Senses, Virtual Reality for Art, 3D Art Optimization, Computer Vision That Makes Augmented Reality Possible Works, Virtual Reality and Augmented Reality: Cross-Platform Theory	**7**	**L1, L2,L3,L4**
5	**Virtual Reality Toolkit** Virtual Reality Toolkit: Open Source Framework for the Community, Data and Machine Learning Visualization Design and Development in Spatial Computing, Character AI and Behaviors, The Virtual and Augmented Reality Health Technology Ecosystem	**8**	**L1, L2, L3**
6	**Virtual Reality Modeling** VR Modeling and Programming Geometric Modeling: Virtual Object Shape, Object Visual Appearance. Kinematics Modeling: Object Position, Transformation Invariants, Object Hierarchies, Physical Modeling: Collision Detection, Surface Deformation, Force Computation. Behavior Modeling. Programming through VRML/X3D: Defining and Using Nodes and Shapes, VRML Browsers, Java 3D, OpenCV for augmented reality	**8**	**L1, L2**
	Total Hours	**45**	

Books and References:

SN	Title	Authors	Publisher	Edition	Year
1	The VR Book, Human Centered Design for Virtual Reality	Jason Jerald	ACM Books	First	2016
2	Creating Augmented and Virtual Realities	Erin Pangilinan, Steve Lukas, Vasanth Mohan	O'Reilly	First	2019
3	Virtual reality with VRTK4	Rakesh Baruah	APress	First	2020

Online References:

S. No.	Website Name	URL	Modules Covered
1	Courser.org	https://www.coursera.org/courses?query=augmented%20reality	M1 – M6
2	Maacindia.com	maacindia.com/ar-vr-courses/var-plus.aspx	M4, M5, M6
3	Arenaanimation.com	http://arenaanimationgoregaon.in/	M1, M2, M3

Mini Project Hours Distribution:

Sr. No	Work to be done	No. of Hours	Cognitive levels of attainment as per Bloom's Taxonomy
1	Augmented Reality- Adding 3d Character	4	L1, L2
2	Touchless ATM using Augmented Reality	2	L1, L2
3	Game Development with Augmented Reality	2	L1, L2
4	Augmented reality in Application Development	4	L1, L2, L3
5	Augmented Reality Search Project	2	L1, L2, L3
6	Medical trainings and healthcare	2	L1, L2, L3, L4
7	Advertisement and promotion	6	L1,L2,L3,L4
8	Classroom education	4	L1,L2,L3,L4, L5
9	Security Purpose	4	L1, L2
	Total Hours	30	

B.E. Semester –VIII
Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS-H 2019)
Syllabus under Autonomy (w.e.f. A.Y. 2021-22)

B.E. (Computer Engineering)							**S.E. SEM : VIII**		
Course Name : Natural Language Processing							**Course Code :** PEC-CS8015		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (50)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	
3	-	2@	5	4	25	75	25	25	**150**
IA: In-Semester Assessment - Paper Duration – 1.5 Hours **ESE: End Semester Examination - Paper Duration - 3 Hours** **The weightage of marks for continuous evaluation of Term work/Report:** Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)									
Prerequisite: Programming Language Basic, Compiler Concepts									

Course Objective: Course should be able to deliver fundamental knowledge of Natural Language Processing and applying knowledge to implement real time problems in fields of natural languages.

Course Outcomes: **Upon completion of the course students will be able to:**

SN	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Able to Understand field of natural language processing.	L1, L2
2	Able to Analyze capabilities and limitations of current natural language technologies,	L1, L2, L3, L4
3	Able to apply the model linguistic phenomena with formal grammars.	L1, L2, L3, L4
4	Be able to Analyze and test algorithms for NLP problems	L1, L2, L3, L4
5	Able to Understand the mathematical and linguistic foundations underlying approaches to the various areas in NLP	L1, L2
6	Able to apply NLP techniques to design real world NLP applications such as machine translation, text categorization, text summarization, information extraction...etc.	L1, L2,L3

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Introduction to Natural Language Processing** Introduction, History,Phases, Ambiguity ,challenges of NLP ,Applications of NLP	5	L1, L2
2	**Word Level Analysis** Morphology analysis , Inflectional morphology & Derivational morphology, Stemming and Lemmatization, Regular expression, finite automata, finite state transducers (FST) N-gram language model : Introduction and Applications	6	L1, L2, L3
3	**Syntax Analysis** Part-Of-Speech tagging(POS)- Tag set for English (Penn Treebank) , Rule based POS tagging, Stochastic POS tagging, Introduction to CFG, Hidden Markov Model (HMM), Conditional Random Field (CRF).	9	L1, L2, L3
4	**Semantic Analysis** Lexical Semantics: Introduction, Relations among lexemes & their senses –Homonymy, Polysemy, Synonymy, Hyponymy, WordNet, Robust Word Sense Disambiguation (WSD)	10	L1, L2, L3
5	**Pragmatics** Pragmatics analysis, Aspects, Discourse reference resolution, reference phenomenon, Syntactic and semantic constraints	8	L1, L2
6	**Applications of NLP** Machine translation, Information retrieval, Question answers system,Text categorization and summarization, sentiment analysis, Named Entity Recognition.	7	L1, L2,L3,L4
	Total Hours	**45**	

Books and References:

	Title	Authors	Publisher	Edition	Year
1	Speech and Language Processing	Daniel Jurafsky, James H. Martin	Prentice Hall	Third Edition	2008
2	Foundations of Statistical Natural Language Processing	Christopher D.Manning and Hinrich Schutze,	MIT Press, 1999	Second Edition	1999
3	Natural Language Processing and Information Retrieval	Siddiqui and Tiwary U.S	, Oxford University Press	--	2008

4	Multilingual natural language processing applications‖	Daniel M Bikel and Imed Zitouni —	Peasron	--	2013
5	Natural Language Processing with Python	Steven Bird, Ewan Klein,	O'Reilly	--	--

Online Resources:

S. No.	Website Name	URL	Modules Covered
1	www.geeksforgeeks.org	https://www.geeksforgeeks.org/fundamentals-of-algorithms/#AnalysisofAlgorithms	M1-M6
2	www.tutorialspoint.com	https://www.tutorialspoint.com/design_and_analysis_of_algorithms/index.htm	M1-M3, M6
3	www.w3schools.in	https://www.w3schools.in/category/data-structures-tutorial/	M1,M4

Calendar for MiniProject

Work to be done	Hrs.
Project Title Identification with understanding of Business	2
Data Gathering	2
Data Exploration and Cleaning	6
Model Data	8
Interpret Data	6
Testing of Mini Project	2
Preparation of Report	4
Total Hours	**30**

B.E. Semester –VIII
Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS-H 2019)
Syllabus under Autonomy (w.e.f. A.Y. 2021-22)

B.E. (Computer Engineering)							**B.E. Open Elective SEM : VIII**		
Course Name: Project Management							**Course Code : OEC-CS8011**		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	
3	-	-	3	3	25	75	-	-	**100**
IA: In-Semester Assessment - Paper Duration – 1 Hours **ESE: End Semester Examination - Paper Duration - 3 Hours** **The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)**									
Prerequisite: Data Structure, Software Engineering									

<u>Course Objective:</u> The objective of the course is to familiarize the students with the use of a structured methodology/approach for each and every unique project undertaken, including utilizing project management concepts, tools and techniques and appraise the students with the project management life cycle and make them knowledgeable about the various phases from project initiation through closure.

Course Outcomes: Upon completion of the course students will be able to:

Sr No.	**Course Outcomes**	**Cognitive levels of attainment as per Bloom's Taxonomy**
1	Apply selection criteria and select an appropriate project from different options	L1, L2, L3, L4
2	Write work break down structure for a project and develop a schedule based on it	L1, L2, L3, L4
3	Identify opportunities and threats to the project and decide an approach to deal with them strategically.	L1, L2, L3, L4
4	Use Earned value technique and determine & predict status of the project.	L1, L2, L3, L4
5	Compare and contrast various project execution, Monitoring and Controlling Projects, Project Contracting, Project Leadership and Ethics and Closing the Project	L1, L2, L3, L4
6	Capture lessons learned during project phases and document them for future reference	L1, L2

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Project Management Foundation** Definition of a project, Project Vs Operations, Necessity of project management, Triple constraints, Project life cycles (typical & atypical) Project phases and stage gate process. Role of project manager, Negotiations and resolving conflicts, Project management in various organization structures, PM knowledge areas as per Project Management Institute (PMI).	6	L1, L2, L3, L4
2	**Initiating Projects** How to get a project started, Selecting project strategically, Project selection models (Numeric /Scoring Models and Non-numeric models), Project portfolio process, Project sponsor and creating charter; Project proposal. Effective project team, Stages of team development & growth (forming, storming, norming &performing), team dynamics	6	L1, L2, L3, L4
3	**Project Planning and Scheduling** Work Breakdown structure (WBS) and linear responsibility chart, Interface Co-ordination and concurrent engineering, Project cost estimation and budgeting, Top down and bottoms up budgeting, Networking and Scheduling techniques. PERT, CPM, GANTT chart, Introduction to Project Management Information System (PMIS).	8	L1, L2, L3, L4
4	**Planning Projects** Crashing project time, Resource loading and levelling, Goldratt's critical chain, Project Stakeholders and Communication plan Risk Management in projects: Risk management planning, Risk identification and risk register, Qualitative and quantitative risk assessment, Probability and impact matrix. Risk response strategies for positive and negative risks	8	L1, L2, L3, L4
5	**Executing Projects, Monitoring and Controlling Projects & Project Contracting** 5.1 Executing Projects: Planning monitoring and controlling cycle, Information needs and reporting, engaging with all stakeholders of the projects, Team management, communication and project meetings 5.2 Monitoring and Controlling Projects: Earned Value Management techniques for measuring value of work completed; Using milestones for measurement; change requests and scope creep, Project audit. 5.3 Project Contracting : Project procurement management, contracting and outsourcing,	10	L1, L2, L3, L4
6	**Project Leadership and Ethics & Closing the Project** 6.1 Project Leadership and Ethics: Introduction to project leadership, ethics in projects, Multicultural and virtual projects 6.2 Closing the Project: Customer acceptance; Reasons of project termination, Various types of project terminations (Extinction, Addition, Integration, Starvation), Process of project termination, completing a final report; doing a lessons learned analysis; acknowledging successes and failures; Project management templates and other resources; Managing without authority; Areas of further study.	7	L1, L2
	Total Hours	**45**	

Books and References:

S.No	Title	Authors	Publisher	Edition	Year
1	Project Management Foundation:	Project Management: A managerial approach, Jack Meredith & Samuel Mantel.	Wiley India	Seventh Edition	2009
2	Initiating Projects & Project Planning and Scheduling	A Guide to the Project Management Body of Knowledge (PMBOK® Guide)	Project Management Institute PA, USA	Fifth Edition	--
3	Planning Projects	Project Management, Gido Clements	Cengage Learning	--	--
4	Executing Projects, Monitoring and Controlling Projects & Project Contracting	Project Management, Gopalan Wiley India	Wiley India	--	--
5	Project Leadership and Ethics & Closing the Project	Project Management, Dennis Lock.	Gower Publishing England	Ninth Edition	--

Online Resources:

S. No.	Website Name	URL	Modules Covered
1	http://www.opentextbooks.org.hk	http://www.opentextbooks.org.hk/system/files/export/15/15694/pdf/Project_Management_15694.pdf	M1-M6
2	https://www.nesacenter.org	https://www.nesacenter.org/uploaded/conferences/SEC/2014/handouts/Rick_Detwiler/15_Detwiler_Resources.pdf	M1-M3, M6
3	http://www.edo.ca	http://www.edo.ca/downloads/project-management.pdf	M1,M4

B.E. Semester –VIII
Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS-H 2019)
Syllabus under Autonomy (w.e.f. A.Y. 2021-22)

B.E. (Computer Engineering)							**BE Open Elective (SEM:** VIII)		
Course Name: Energy Audit and Management							**Course Code:** OEC-CS8012		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR**	**TW**	**100**
3	-	-	3	3	25	75	-	-	

IA: In-Semester Assessment - Paper Duration – 1.5 Hours
ESE: End Semester Examination - Paper Duration - 3 Hours
The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)

Prerequisite: - Knowledge of Basic Electrical and Mechanical Systems

Course objectives:
To understand the importance energy security for sustainable development and the fundamentals of energy conservation.To introduce performance evaluation criteria of various electrical and thermal installations to facilitate the energy management. To relate the data collected during performance evaluation of systems for identification of energy saving opportunities.

Course outcomes: After successful completion of the course student will be able:-

SN	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	To identify and describe present state of energy security and its importance.	L1
2	To identify and describe the basic principles and methodologies adopted in energy audit of any utility.	L1, L2, L3
3	To describe the energy performance evaluation of some common electrical installations and identify the energy saving opportunities.	L1, L2, L3, L4
4	To describe the energy performance evaluation of some common thermal installations and identify the energy saving opportunities	L1, L2, L3, L4
5	To analyze the data collected during performance evaluation and recommend energy saving measures	L1, L2, L3
6	To understand the concept of Energy conservation measures in building complex	L1

Detailed Syllabus

Module No.	Unit No.	Topics	Hrs	Cognitive levels of attainment as per Bloom's Taxonomy
1		**Energy Scenario & Energy Conservation measures**	04	L1
	1.1	Present Energy Scenario		
	1.2	Renewable and Non-Renewable form of Energy		
	1.3	Greenhouse Gas effect, Acid Rain, Energy Pricing, Energy Sector Reforms,		
	1.4	Energy Conservation and its Importance: Energy Conservation Act-2001 and its features. Role of Bureau of Energy Efficiency (BEE), Energy Security, Basic idea of Material and Energy balance		
2		**Energy Audit & Energy Economics**	08	L1, L2, L3
	2.1	Energy Audit: Definition, need, types of energy audit, Steps of detailed Energy Audit, Role of Energy Manager and Internal audit Team,		
	2.2	Measuring instruments & Equipment used during Energy audit		
	2.3	Understanding energy costs, Bench marking, Energy performance, Matching energy use to requirement,		
	2.4	Maximizing system efficiencies, Optimizing the input energy requirements, Fuel and energy substitution		
	2.5	Elements of monitoring & targeting, Data and information analysis.		
	2.6	Energy Economics: Simple payback period (SPP), Net Present value (NPV), Return on investment (ROI), Internal rate of return (IRR)		
3		**Energy Management in Electrical System**	10	L1, L2, L3, L4
	3.1	Electricity billing, Basic concept of Electrical load management, Maximum demand Control, Energy management through Power factor improvement		
	3.2	Energy efficient equipment and appliances, Star ratings of Electrical Equipment.		
	3.3	Lighting System control: Occupancy sensors, daylight integration, and use of intelligent controllers. Energy efficiency measures in lighting system		
	3.4	Energy conservation opportunities in water pumps, industrial drives, induction motors, soft starters, variable speed drives.		
4		**Energy Management in Thermal Systems**	10	L1. L2, L3,L4
	4.1	Review of different thermal loads, Steam System: Basic idea of Steam distribution system, Assessment of steam distribution losses, Steam leakages, Steam trapping, Condensate and flash steam recovery system, Energy conservation in Steam distribution system,		

	4.2	Boiler System: General fuel conservation measures in Boilers and furnaces, Waste heat recovery, cogeneration, use of insulation- types and application.		
	4.3	HVAC system: Coefficient of performance, Capacity, factors affecting performance of Refrigeration and Air Conditioning system performance, Energy savings opportunities in HVAC system.		
5	**Energy Performance Assessment**		04	L1, L2, L3,
	5.1	Performance assessment of Motors, variable speed drive, pumps,		
	5.2	Lighting System calculations: Installed Load Efficacy Ratio (ILER) method,		
	5.3	HVAC system calculations; various terms used in assessment of performance		
6	**Energy conservation in Residential and Commercial Buildings**		03	L1
	6.1	Energy Conservation Building Codes (ECBC)		
	6.2	Green Building norms, LEED ratings of buildings, Use of renewable energy sources in building complex		
		Total	39	

Books of Reference

SN	Title	Authors	Publisher
1.	Handbook of Electrical Installation Practice	Geofry Stokes	Blackwell Science
2.	Designing with light: Lighting System Handbook	By Anil Valia	-
3.	Energy Management handbook	W.C. Turner	John Wiley and Sons
4.	Handbook on Energy Audits and Management	A. K. Tyagi,	Tata Energy Research Institute (TERI).
5.	Energy Management Principles	C.B. Smith	Pergamon Press
6.	Energy Conservation Guidebook	Dale R. Patrick, S. Fardo, Ray E. Richardson	Fairmont Press
7.	Handbook of Energy Audits	Albert Thumann, W. J. Younger, T. Niehus	CRC Press

Online Reference

SNo.	Website Name	URL	Modules Covered
1	Bureau of Energy Efficiency	https://beeindia.gov.in/content/energy-auditors	1-2
2	You tube	https://youtube/7hDyLuFJ0c8	1-6
3	You tube	https://www.youtube.com/watch?v=UhGZRoUlr8U	1-6
4	NPTEL by IIT Roorkee	https://www.youtube.com/watch?v=2zWt-pBCU2I	1-3

B.E. Semester –VIII
Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS-H 2019)
Syllabus under Autonomy (w.e.f. A.Y. 2021-22)

B.E. (Computer Engineering)							**B.E. Open Elective SEM VIII**				
Course Name : Innovation Management							**Course Code : OEC-CS8013**				
Contact Hours Per Week : 3							**Credits : 3**				
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**						
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**						
Hours Per Week					**Theory (100)**		**Practical/Oral/Presentation (25)**		**Term Work (25)**		**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR**		**TW**		
3	-	-	3	3	25	75	-	-	-	-	**100**
ISA: In-Semester Assessment - Paper Duration – 1 hr **ESE: End Semester Evaluation-Paper Duration-3 hrs.**											
Prerequisite: Financial Accounting and Management and Business Modelling. **RBT : Revised Bloom's Taxonomy**											

<u>Course Objective</u>: The course intends to apply the concept of Innovation in Business.

<u>Course Outcomes</u>: Upon completion of the course students will be able to:
L1: Remembering **L2:** Understanding **L3:** Applying **L4:** Analysing **L5:** Evaluating **L6:** Creating

Sr. No.	Course Outcomes	RBT level
1	Able to analyze and apply impact of innovation on society	L1,L2,L4
2	Able to understand the role of technology in creating wealth	L1,L2,L3
3	Recognize markers of business models which appear as a response to digital revolution	L1,L2,L3,L4
4	Search for real cases which represent new business models	L1,L2,L3,L4
5	Identify similar and distinguished features of business build on identical business models	L1,L2,L3,L4
6	Know the most important cases of data-driven business founded on new business models	L2,L4

Detailed Syllabus

Module No.	Topics	Hrs.	RBT Levels
01	**Sources of Innovation** Sources of Innovation: Innovation / wealth creation process, three critical trajectories impacting the innovation process creative transformations, the importance of technological Innovation, The impact of technological innovation on society. Case study on impact of technological innovation on society. Industry dynamics of technological innovation, transcending creativity into innovation, innovation as a collaborative effort.	08	L1,L2,L4
02	**Types and patterns of innovation** Types and patterns of innovation: Technology S curves, formulation of technological innovation strategy, implementing technological innovation strategies. Managing new product development. Case study on new product development.	06	L1,L2,L3
03	**Collaboration strategies and Choosing innovative projects** Collaboration Strategies: The role of technology in the creation of wealth, historical perspective, long-wave cycle, evolution of production technology, technology and national economy. Case study on Collaboration Strategies. Choosing innovative projects: Management of technology, the conceptual frame work, technology and society, knowledge and technology, technology and business. Case study on How to choose innovative projects.	08	L1,L2,L3,L4
04	**Introduction to Business Models** What is a Business Model? Importance of Business Model. History of Business Model. Type of Business Model	8	L1,L2,L3,L4
05	**Business models as a key concept of strategic management.** Variety of business model frameworks: Canvas, 'Zott-Amit' model, BM navigator, 4W approach, Hybrid business models. Resource-based view (RBV). Industrial organization.	8	L1,L2,L3,L4
06	**Digital business models.** E-commerce. Innovative business model in retail and consumer goods. Omnichannel retail. Manufacturing business models. Digital manufacturing. Developers as new decision makers. Case-study of Apple, Android, Tinkoff.	8	L2,,L4,
	Total	**46**	

Books and References:

Sr. No	Title of the book	Authors	Publisher	Edition	Year
1	Strategic management of technological Innovation	Melissa A. Schilling	McGraw-Hill	Fifth Edition	2017
2	Management of technology	Tarek M. Khalil	McGraw Hill	Second Edition	2009
3	Business model generation: a handbook for visionaries, game changers, and	Osterwalder, A., &Pigneur, Y.	John Wiley & Sons	ThirdEdition	2010

	challengers.				
4	Value creation in e-business.	Amit, R., &Zott, C.	Strategic management journal,	22(6-7), 493-520.	2001

Online Reference

SNo.	Website Name	URL	Modules Covered
1.	Ideaconnection.com	https://www.ideaconnection.com/innovation-videos/	M1,M2
2.	Ideaconnection.com	https://www.ideaconnection.com/innovation-videos/	M3,M4
3.	Ideaconnection.com	https://www.ideaconnection.com/innovation-videos/	M5,M6
4.	https://nptel.ac.in	https://nptel.ac.in/courses/110/107/110107094/	M1,M2,M3,M4,M5, M6
5.	Coursera.org	https://www.coursera.org/learn/digital-business-models/lecture/nJTB0/lesson-4-asymmetric-business-models-creating-unfair-advantage	M4,M5,M6
6.	online.stanford.edu	https://online.stanford.edu/courses/xine249-building-business-models	M1,M2,M3,M4,M5, M6

B.E. Semester –VIII
Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS-H 2019)
Syllabus under Autonomy (w.e.f. A.Y. 2021-22)

<table>
<tr><td colspan="7">B.E. (Computer Engineering)</td><td colspan="4">BE Open Elective SEM: VIII</td></tr>
<tr><td colspan="7">Course Name : Environment Management</td><td colspan="4">Course Code: OEC- CS8014</td></tr>
<tr><td colspan="7">Contact Hours Per Week : 03</td><td colspan="4">Credits : 03</td></tr>
<tr><td colspan="5">Teaching Scheme (Program Specific)</td><td colspan="6">Examination Scheme (Formative/ Summative)</td></tr>
<tr><td colspan="5">Modes of Teaching / Learning / Weightage</td><td colspan="6">Modes of Continuous Assessment / Evaluation</td></tr>
<tr><td colspan="5" rowspan="2">Hours Per Week</td><td colspan="2">Theory (100)</td><td>Practical/Oral (25)</td><td>Term Work (25)</td><td rowspan="2">Total</td></tr>
<tr><td>IA</td><td>ESE</td><td>PR</td><td>TW</td></tr>
<tr><td>Theory</td><td>Tutorial</td><td>Practical</td><td>Contact Hours</td><td>Credits</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>3</td><td>-</td><td>-</td><td>3</td><td>3</td><td>25</td><td>75</td><td>–</td><td>–</td><td>100</td></tr>
<tr><td colspan="10">IA: Internal Assessment - Paper Duration – 1 Hour
ESE: End Semester Examination - Paper Duration - 3 Hours
The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance/Learning Attitude (20%)</td></tr>
<tr><td colspan="10">Prerequisite: Fundamentals of Chemistry and biology</td></tr>
</table>

Course Objective: The course intends to give an understanding of environmental issues relevant to India and global concerns, the concept of ecology and familiarize the learner with environment related legislations.

Course Outcomes: Upon completion of the course student will be able to

S. No	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Understand the concept of environmental management and the Energy scenario.	L1 L2
2	Understand ecosystem and interdependence, food chain etc.	L1 L2
3	Understand and interpret environment related legislations	L1 L2 L3 L4

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of Attainment as per Bloom's Taxonomy
1	**Introduction and Definition of Environment** Significance of Environment Management for contemporary managers, Career opportunities, Environmental issues relevant to India, Sustainable Development, the Energy scenario.	5	L1 L2
2	**Global Environmental concerns** Global Warming, Acid Rain, Ozone Depletion, Hazardous Wastes, Endangered life-species, Loss of Biodiversity, Industrial/Man-made disasters, Atomic/Biomedical hazards, etc.	6	L1 L2
3	**Concepts of Ecology** Ecosystems and interdependence between living organisms, habitats, limiting factors, carrying capacity, food chain, etc.	7	L1 L2
4	**Scope of Environment Management** Role and functions of Government as a planning and regulating agency Environment Quality Management and Corporate Environmental Responsibility.	7	L1 L2 L3 L4
5	**Total Quality Environmental Management** ISO-14000, EMS certification.	7	L1 L2 L3 L4
6	**General overview of major legislations** Environment Protection Act, Air (P & CP) Act, Water (P & CP) Act, Wildlife Protection Act, Forest Act, Factories Act, etc.	7	L1 L2 L3
	Total	39	

Books and References:

Sr. No.	Title	Author	Publisher	Edition	Year
1	Environmental Management: Principles and Practice	C J Barrow	Routledge Publishers	1st	1999
2	A Handbook of Environmental Management	John C. Lovett and David G. Ockwell	Edward Elgar Publishing	------------	2010
3	Environmental Management	V Ramachandra and Vijay Kulkarni	TERI Press	1st	2006
4	Indian Standard Environmental Management Systems — Requirements With Guidance For Use	Bureau Of Indian Standards	-------------	-------------	2005
5	Environmental Management: An Indian Perspective	S N Chary and Vinod Vyasulu	Macmillan India	-------------	2000
6	Introduction to Environmental Management	Mary K Theodore and Louise Theodore	CRC Press	-------------	2009
7	Environment and Ecology	Majid Hussain	Access Publishing	3rd	2015

Online References:

Sr. No.	Website Name	URL
1	Alison	https://alison.com/course/introduction-to-ecology
2	ISO	https://www.iso.org/iso-14001-environmental-management.html
3	Certified Environment Law Analyst	https://www.vskills.in/certification/legal/environment-law-certification

B.E. Semester –VIII
Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS-H 2019)
Syllabus under Autonomy (w.e.f. A.Y. 2021-22)

B.E. (Computer Engineering)							**B.E. Open Elective SEM: VIII**		
Course Name: Intellectual Property Rights and Patenting							**Course Code:** OEC- CS8015		
Teaching Scheme (Program Specific)					**Examination scheme**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR**	**TW**	**100**
3	-	-	3	3	25	75	-	-	
IA: Internal Assessment - Paper Duration – **1.5 Hours** **ESE:** End Semester Examination - Paper Duration - **3Hours** **The weightage of marks for continuous evaluation of Term work/Report:** Formative (40%), Timely completion of practical (40%) and Attendance (20%)									

Course Objective:

1. To understand intellectual property rights protection system
2. To promote the knowledge of Intellectual Property Laws of India as well as International treaty procedures
3. To get acquaintance with Patent search and patent filing procedure and applications

Course Outcome

SN	**Course Outcomes**	**Cognitive Levels as per Blooms Taxonomy**
1	understand Intellectual Property assets	L1,L2
2	assist individuals and organizations in capacity building	L1,L2,L3
3	work for development, promotion, protection, compliance, and enforcement of Intellectual Property and Patenting	L1,L2,L3

Detailed Syllabus :

Module No.	Topics	Hrs	Cognitive Levels as per Blooms Taxonomy
1	**Introduction to Intellectual Property Rights (IPR)**: Meaning of IPR, Different category of IPR instruments - Patents, Trademarks, Copyrights, Industrial Designs, Plant variety protection, Geographical indications, Transfer of technology etc. **Importance of IPR in Modern Global Economic Environment:** Theories of IPR, Philosophical aspects of IPR laws, Need for IPR, IPR as an instrument of development	5	L1,L2
2	**Enforcement of Intellectual Property Rights:**	7	
	Introduction, Magnitude of problem, Factors that create and sustain counterfeiting/piracy, International agreements, International organizations (e.g. WIPO, WTO) active in IPR enforcement **Indian Scenario of IPR:** Introduction, History of IPR in India, Overview of IP laws in India, Indian IPR, Administrative Machinery, Major international treaties signed by India, Procedure for submitting patent and Enforcement of IPR at national level etc.		L1,L2,L3
3	**Emerging Issues in IPR:** Challenges for IP in digital economy, e-commerce, human genome, biodiversity and traditional knowledge etc.	5	L1,L2,L3
4	**Basics of Patents:** Definition of Patents, Conditions of patentability, Patentable and non-patentable inventions, Types of patent applications (e.g. Patent of addition etc),Process Patent and Product Patent, Precautions while patenting, Patent specification Patent claims, Disclosures and non-disclosures, Patent rights and infringement, Method of getting a patent	7	L1,L2,L3
5	**Patent Rules:** Indian patent act, European scenario, US scenario, Australia scenario, Japan scenario, Chinese scenario, Multilateral treaties where India is a member (TRIPS agreement, Paris convention etc.)	8	L1,L2
6	**Procedure for Filing a Patent (National and International):** Legislation and Salient Features, Patent Search, Drafting and Filing Patent Applications, Processing of patent, Patent Litigation, Patent Publication etc, Time frame and cost, Patent Licensing, Patent Infringement **Patent databases:** Important websites, Searching international databases	7	L1,L2,L3

Books and References:

S. No.	Title	Authors	Publisher	Edition	Year
1	Patent system and related issues at a glance	Keayla B K	National Working Group	First	2004
2	The enforcement of Intellectual Property Rights	Lous Harns	Wipo	3rd	2018

B.E. Semester –VIII
Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS-H 2019)
Syllabus under Autonomy (w.e.f. A.Y. 2021-22)

B.E.(Computer Engineering)						**B.E. Open Elective SEM:** VIII			
Course Name: Supply Change Management						**Course Code: OEC-CS8016**			
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (20)**	**Term Work (20)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/ OR**	**TW**	**100**
3	-	-	3	3	25	75	-	-	
IA: In-Semester Assessment- Paper Duration-1 Hours									
ESE : End Semester Examination - Paper Duration **- 3 Hours**									
The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance (20%)									
Prerequisite: NILL									

Course Objective:

1. To acquaint with key drivers of supply chain performance and their inter-relationships withstrategy.
2. To impart analytical and problem-solving skills necessary to develop solutions for a variety of supplychain management & design problems.
3. To study the complexity of inter-firm and intra-firm coordination in implementing programs such as e-collaboration, quick response, jointly managed inventories, and strategicalliances.

Course Outcome:

SN	Course Outcomes	Cognitive Levels as per Bloom's Taxonomy
1	To acquaint with key drivers of supply chain performance and their inter-relationships with strategy.	L1,L2,L3
2	To impart analytical and problem-solving skills necessary to develop solutions for a variety of supply chain management & design problems.	L1,L3,L4
3	To study the complexity of inter-firm and intra-firm coordination in implementing programs such as e-collaboration, quick response, jointly managed inventories and strategic alliances.	L1,L2,L4

Detailed Syllabus

Module	Detailed Contents	Hours	Cognitive Levels as per Bloom's Taxonomy
01	**Building a Strategic Framework to Analyze Supply Chains** Supply chain stages and decision phases, Process view of supply	04	L1,L2,L3
	chain: Supply chain flows, Examples of supply chains, Competitive and supply chain strategies, Achieving strategic fit: Expanding strategic scope, Drivers of supply chain performance. Framework for structuring drivers: inventory, transportation facilities, information obstacles to achieving fit.		
02	**Designing the Supply Chain Network** Distribution Networking: Role, Design, Supply Chain Network(SCN):Role, Factors, Framework for design decisions.	05	L1,L3,L4
03	**Materials Management** Scope, Importance, Classification of materials, Procurement, Purchasing policies, Vendor development and evaluation. Inventory control systems of stock replenishment, Cost elements, EOQ and its derivative modules.	06	L1,L2,L3
04	**Dimensions of Logistics** Introduction: A Macro and Micro Dimensions, Logistics interfaces with other areas, Approach to analyzing logistics system, Logistics and systems analyzing: Techniques of logistics system analysis, factors affecting the cost and Importance of logistics.	06	L1,L3,L4
05	**Warehouse and Transport Management** Concept of strategic storage, Warehouse functionality, Warehouse operating principles, Developing warehouse resources, Material handling and packaging in warehouses, Transportation Management, Transport functionality and principles, Transport infrastructure, transport economics and Pricing. Transport decision making.	07	L1,L2,L3
06	**IT in Supply Chain** 6.1 IT framework, Customer Relationship Management (CRM),internal Supply chain management, Supplier Relationship Management (SRM) and Transaction Management. Coordination in a Supply Chain 6.2 Lack of supply chain coordination and the Bullwhip effect, Obstacle to Coordination, Managerial levers, Building partnerships and trust. Emerging Trends and Issues 6.3 Vendor managed inventory-3PL-4PL, Reverse logistics: Reasons, Role, Activities; RFID systems: Components, Applications, Implementation; Lean supply chain, Implementation of Six Sigma in supply chain, Green supply chain.	08	L1,L3,L4

Books and References:

SN	Title	Authors	Publisher	Edition	Year
1	Supply Chain Management Strategy, Planning, and operations	Sunil Chopra and Peter Meindl	Pearson	6th Edition	2016
2	Designing & Managing Supply chain	David Simchi Levi, Philip Kaminsky& Edith Smichi	McGraw Hill	3rd Edition	2007
3	Supply Chain Redesign: Transforming Supply Chains into Integrated Value Systems,	Robert B Handfield, Ernest L Nicholas	Prentice Hall	--	2002
4	The Management of Business Logistics: A Supply Chain Perspective	Coyle, Bardi, Langley	Thomson learning	--	2003
5	Supply chain management: for global competitiveness	B S Sahay	Macmillan	--	1999

Online Resources:

S. No.	Website Name	URL	Modules covered
1.	https://nptel.ac.in	https://nptel.ac.in/courses/110/106/110106045/	2
2.	? https://nptel.ac.in	https://nptel.ac.in/courses/110/107/110107074/	3
3.	https://www.scmhub.com	https://www.scmhub.com/courses/BBA	2
4.	https://www.udemy.com	https://www.udemy.com/topic/supply-chain/	4

B.E. Semester –VIII
Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS-H 2019) Syllabus under Autonomy (w.e.f. A.Y. 2021-22)

B.E.(Computer Engineering)							**B.E. SEM: VIII**		
Course Name: Managerial Economics							**Course Code: OEC-CS8021**		
Contact Hours Per Week : 3							**Credits** : 3		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**			
3	-	-	3	3	25	75	-	-	**100**
IA: In Semester Assessment- Paper Duration – 1.5 Hrs **ESE :** End Semester Evaluation-									
Prerequisite: Financial Accounting **RBT :** Revised Bloom's Taxonomy									

Course Objective: By the end of the course, students will be able to understand both the theory and practice of Managerial Economics, the students will be in a position to appreciate the finer nuances of the subject, this subject will help the students in applying the knowledge so acquired in policy planning and managerial decision making.

Course Outcomes: **Upon completion of the course students will be able to:**

Sr. No.	Course Outcomes	RBT level
1	Analyze and apply the theory and practice of Managerial Economics	L1,L2,L3,L4
2	Understand the need to locate various factors affecting demand of products and plan marketing & business strategies accordingly. Also they will develop an understanding of the practical application of law of demand.	L1,L2,L3,L4
3	Understand the analytics of supply and demand and its various uses.	L1,L2,L3,L4,L5
4	Understand the holistic approach of production economy.	L1,L2,L3,L4,L5
5	Learn about the intricacies of the various market forms and their impact on the economy and business.	L1,L2,L3,L4,L5
6	Realize the importance of the different methods of capital budgeting as a tool of project management.	L1,L2,L3,L4,L5

Detailed Syllabus:

Module No.	Topics	Hrs.	RBT Levels
1	**Introduction to Managerial Economics** The meaning, scope and methods of Managerial Economics, Dominic Salvatore model of application of Economics to business decision making. Scarcity, choice & production possibility curve.	5	L1,L2,L3,L4
2	**Consumer Behavior** Demand, types of demand, factors affecting demand & demand function. Making of linear demand function & linear demand curve. Law of demand. Consumer's surplus. Concept of elasticity of demand and its significance for a businessman. Types of Elasticity – Price Elasticity of Demand, Income Elasticity of Demand, Cross elasticity of demand & Promotional Elasticity of Demand, Demand forecasting – features, significance & methods.	11	L1,L2,L3,L4
3	**Production Function** Concept, Isoquant & Iso-cost analysis. Laws of returns to scale, economies & diseconomies of scale. Revenue Analysis, Cost analysis and break even analysis	5	L1,L2,L3,L4,L5
4	**Supply** Concept of supply, factors affecting supply& the law of supply Determination of equilibrium price: effects of changes in demand & supply on equilibrium price.	7	L1,L2,L3,L4,L5
5	**Types of markets** Perfect competition, monopoly, oligopoly & monopolistic competition – features and price determination. Pricing practices: Factors affecting pricing decision. Marginal cost pricing, mark up pricing, transfer pricing, product line pricing, price skimming and penetration price.	9	L1,L2,L3,L4,L5
6	**Profit Management** • Profit management • Role of profits in a market economy • Nature and measurement of profit, profit policies • The hypothesis of profit maximization and its alternatives. Demand for capital • Supply of capital • Capital Rationing • Capital Budgeting, Net Present Value (NPV), Internal Rate of Return (IRR). • Appraising - the profitability of projects	8	L1,L2,L3,L4,L5
	Total Hours	**45**	

Books and References:

Sr. No	Title	Authors	Publisher	Edition	Year
1	Managerial Economics in a Global Economy	Dominick Salvatore	Oxford University Press	Seventh	2011
2	Managerial Economics	Suma Damodaran	Oxford University Press	Second	2010
3	Microeconomics for Business	Satya P Das	SAGE	First	2007
4	Economics	Paul Samuelson and Richard Nordhaus	MIT Press 1998.	FIRST	1998
5	Managerial Economics	Milton Spencer and Louis Siegelman	Palala Press	Second	2015
6	Managerial Economics: Concepts and Cases	Mote, Paul and Gupta	Princeton, 2010	First	2010

Online References:

Sr. No.	Website Name	URL	Modules Covered
1	NPTEL.ac.in	https://nptel.ac.in/courses/110/101/110101005/	M1,M2,M3,M4,M5,M6
2	Udemy.com	https://www.udemy.com/course/introduction-to-managerial-economics/	M1,M2,M3,M4,M5,M6
3	Swayam.ac.in	https://onlinecourses.swayam2.ac.in/imb19_mg16/preview	M1,M2,M3,M4,M5,M6
4	Harvard.edu	https://online-learning.harvard.edu/course/managerial-economics?delta=0	M1,M2,M3,M4,M5,M6
5	Courseera.org	https://www.coursera.org/courses?query=managerial%20economics	M1,M2,M3,M4,M5,M6

B.E. Semester –VIII
Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS-H 2019) Syllabus under Autonomy (w.e.f. A.Y. 2021-22)

B.E.(Computer Engineering)							B.E. SEM: VIII		
Course Name: Digital Business Management							Course Code: OEC-CS8022		
Teaching Scheme (Program Specific)					Examination scheme				
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation				
Hours Per Week					Theory (100)		Practical/Oral (25)	Term Work (25)	Total
Theory	Tutorial	Practical	Contact Hours	Credits	IA	ESE	PR	TW	100
3	-	-	3	3	25	75	-	-	
IA: Internal Assessment - Paper Duration – **1.5 Hours** **ESE:** End Semester Examination - Paper Duration - **3 Hours**									

Course Objective:

1. To understand intellectual property rights protection system
2. To promote the knowledge of Intellectual Property Laws of India as well as International treaty procedures
3. To get acquaintance with Patent search and patent filing procedure and applications

Course Outcome

SN	Course Outcomes	Cognitive Levels as per Blooms Taxonomy	
1	understand Human Resource Management	L1,L2	
2	assist Organization of Personnel Functions	L1,L2,L3	
3	work for Manpower Planning	L1,L2,L3	
4	work for Motivating Employees	L1,L2,L3	
5	work for Performance Appraisal Systems and Training	L1,L2,L3	
6	work for Development Organisation Development	L1,L2,L3	
	Detailed Syllabus :		
Module No.	**Topics**	**Hrs**	**Cognitive Levels as per Blooms Taxonomy**
1	**Introduction to Digital Business-** 1.1 Introduction, Background and current status, E-market places, structures, mechanisms, economics and impacts Difference between physical economy and digital economy,. 1.2 **Drivers of digital business-** Big Data & Analytics, Mobile, Cloud Computing, Social media, BYOD, and Internet of Things(digitally intelligent machines/services) 1.3 opportunities and Challenges in Digital Business,	6	L1,L2
2	**Overview of E-Commerce** **2.1Overview of E-Commerce** E-Commerce- Meaning, Retailing in e-commerce-products and services, consumer behavior, market research and advertisement **B2B-E-commerce**-selling and buying in private e-markets, public B2B exchanges and support services, e-supply chains, Collaborative Commerce, Intra business ECand Corporate portals	7	L1,L2,L3

	2.2 Other E-C models and applications, innovative EC System-From E-governmentand learning to C2C, mobile commerce and pervasive computing EC Strategy and Implementation-EC strategy and global EC, Economics and Justification of EC, **2.3 Using Affiliate marketing to promote your e-commerce business,** Launching a successful online business and EC project, Legal, Ethics and Societal impacts of EC		
3	**Digital Business Support services** **3.1 Digital Business Support services**: ERP as e –business backbone, knowledgeTope Apps, Information and referral system **3.2 Application Development**: Building Digital business Applications and Infrastructure	5	L1,L2,L3
4	**Managing E-Business** 4.1 Managing E-Business-Managing Knowledge, Management skills for e-business, 4.2 Managing Risks in e –business Security Threats to e-business -Security Overview, Electronic Commerce Threats,Encryption, Cryptography, Public Key and Private Key Cryptography, Digital Signatures, Digital Certificates, Security Protocols over Public Networks: HTTP,SSL, Firewall as Security Control, Public Key Infrastructure (PKI) for Security, Prominent Cryptographic Applications	8	L1,L2,L3
5	**E-Business Strategy-** 5.1 E-Business Strategy-E-business Strategic formulation- Analysis of Company's Internal and external environment, Selection of strategy. 5.2 E-business strategy into Action, challenges and E-Transition (Process of Digital Transformation)	6	L1,L2,L3
6	**Materializing e-business** 6.1 Materializing e-business: From Idea to Realization-Business plan preparation 6.2 Case Studies and presentations	7	L1,L2,L3

Books and References:

S. No.	Title	Authors	Publisher	Edition	Year
1	A textbook on E-commerce	Er Arunrajan Mishra, Dr W K Sarwade	Neha Publishers & Distributors		2011
2	E-commerce from vision to fulfilment	Elias M. Awad,	PHI-Restricted,		2002
3	Digital Business and E-Commerce Management	Ed, Dave Chaffey,	Pearson,		August 2014
4	Introduction to E-business-Management and Strategy,	Colin Combe,	ELSVIER		2006
5	Digital Business Concepts and Strategy,	Eloise Coupey	Pearson	2nd Edition,	2009
6	Trend and Challenges in Digital Business Innovation,	VinocenzoMorabito,	Springer		
7	Digital Business	Discourse Erika Darics	Palgrave Macmillan		April 2015
8	E-Governance-Challenges and Opportunities in	Proceedings in 2nd International Conference theory and practice of Electronic Governance	Oxford Publications		

9	Perspectives the Digital Enterprise –	A framework for Transformation, TCS consulting journal Vol.5			
10	Measuring Digital Economy-	A new perspective -	DOI:10.1787/9789264221796-enOECD Publishing		

B.E. Semester –VIII
Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS-H 2019)
Syllabus under Autonomy (w.e.f. A.Y. 2021-22)

B.E. (Computer Engineering)										**B.E. SEM: VIII**
Course Name: Social Network Analysis										**Course Code:** OEC-CS8023
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**					
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**					
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**	
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**		
3	-	-	3	3	25	75	-	-	**100**	
IA: In-Semester Assessment - Paper Duration – 1.5 Hours **ESE: End Semester Examination - Paper Duration - 3 Hours** **The weightage of marks for continuous evaluation of Term work/Report:** Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)										
Prerequisite: algorithmic ,programming										

Course Objective: The Objective of this course is to deliver the fundamental concepts of theory of computation describing formal mathematical models of computation such as FA,PDA,LBA and TM by comparing their power, limitations, languages and their applications in computation and complexity theory and also to learn that not all problems are solvable by computers.

Course Outcomes: **Upon completion of the course students will be able to:**

Sr. No.	**Course Outcomes**	**Cognitive levels of attainment as per Bloom's Taxonomy**
1	understand the basic concepts of social networks	L1, L2, L3
2	understand the fundamental concepts in social network mining	L1, L2, L3
3	understand the modelling and visualization of network	L1, L2, L3
4	understand the concepts of **social network graph analysis**	L1, L2, L3,L4
5	Perform visualization and exploration using Gephi software.	L1, L2, L3,L4
6	understand the **dynamic social networks**	L1,L2

Detailed Syllabus:

Module No.	Introduction	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Introduction** Introduction to Semantic Web, the Social Web - Social Network analysis, Development of Social Network Analysis – the concepts and measures in network analysis , Blogs and online communities - Web-based networks - Applications of Social Network Analysis. Advantages and disadvantages in social networks.	9	L1, L2, L3
2	**Social Network Mining** Introduction to social network mining. Social network extraction from big data, Various social network mining tasks with real-world examples. Community detection and Shingling algorithm, Social Networks as Graphs. Random graph models, ranking algorithms, Graph and Matrices, Basic measures for individuals and networks,	7	L1,L2, L3
3	**Modelling and visualization of network** Mechanisms : Homophily, Opportunity, and Balance, edges , nodes Analyze a social network by data wrangling and visualizing a network.	7	L1,L2, L3
4	**Social Network Graph Analysis** Graph kernels, Graph classification, mining and outlier detection, centrality measures , network level measures, partitioning of graphs, components and bridges, cliques	7	L1, L2,L3,L4
5	**Gephi** Download and Install Gephi, load network data, manipulate the color, structures and shapes ,get Network-Level Measures, centrality measures,	9	L1, L2, L3,L4
6	**Dynamic Social Networks** Social learning on networks, Information and Biological networks, Various applications of Social Network mining in real world applications, Social Connects: Affiliation and identity	6	L1, L2
	Total Hours	**45**	

Books and References:

SN	Title	Authors	Publisher	Edition	Year
1	Social Network Data Analytics	Charu C. Aggarwal ·	Springer	1st	2011
2	Network Graph Analysis and Visualization with Gephi	Ken Cherven	Packt	1st	2013
3	Social network analysis: A handbook	Scott, J.	Sage	2nd	2007
4	Social Network Analysis,	Knoke	Sage	2nd	2008

Online References:

S. No.	Website Name	URL	Modules Covered
1	towardsdatascience.com	https://towardsdatascience.com/how-to-get-started-with-social-network-analysis-6d527685d374	M6
2	iopscience.iop.org	https://iopscience.iop.org/article/10.1088/1742-6596/1235/1/012111/pdf	M1-M5

B.E. Semester –VIII
Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS-H 2019)
Syllabus under Autonomy (w.e.f. A.Y. 2021-22)

<table>
<tr><td colspan="7">B. E. (Computer Engineering)</td><td colspan="3">B.E. (SEM : VIII)</td></tr>
<tr><td colspan="7">Course Name : Basic Taxation for Engineers</td><td colspan="3">Course Code : OEC-CS8024</td></tr>
<tr><td colspan="5">Teaching Scheme (Program Specific)</td><td colspan="5">Examination Scheme (Formative/ Summative)</td></tr>
<tr><td colspan="5">Modes of Teaching / Learning / Weightage</td><td colspan="5">Modes of Continuous Assessment / Evaluation</td></tr>
<tr><td colspan="5">Hours Per Week</td><td colspan="2">Theory</td><td>Practical/Oral /Presentation</td><td>Term Work</td><td rowspan="2">Total</td></tr>
<tr><td>Theory</td><td>Tutorial</td><td>Practical</td><td>Contact Hours</td><td>Credits</td><td>IA</td><td>ESE</td><td>PR</td><td>TW</td></tr>
<tr><td>3</td><td>-</td><td>-</td><td>3</td><td>3</td><td>25</td><td>75</td><td>--</td><td>--</td><td>100</td></tr>
<tr><td colspan="10">IA: In-Semester Assessment - Paper Duration – 1.5 Hours
ESE: End Semester Examination - Paper Duration - 3Hours
The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)</td></tr>
<tr><td colspan="10">Prerequisite:</td></tr>
</table>

Course Objective: This course discusses taxation, its principles, its objectives, and its effects; the nature and purposes of taxation, whether taxes should be classified as direct or indirect. It also instils an awareness instudents that taxes constitute significant costs to businesses and households and therefore have a major impactin economic and other decision-making, also these costs are potentially controllable through legitimate tax minimisation strategies. The course also shall enable students to appreciate the wider economic, social, administrative-compliance and political contexts within which taxes are imposed.

Course Outcomes: Upon completion of the course students will be able to:

SN	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Understand the basic principles of taxation in India and the various provisions of Income Tax Act 1961	L2
2	Understand and apply the computation of taxable income under the heads capital gain and other sources	L3
3	Apply the provisions of clubbing of income, set off of losses and deductions permitted under the Income Tax Act, 1961.	L3
4	Analyze the computation of taxable income under the head Salaries, Income from House Property and Profits and Gains of Business or Profession	L4
5	Differentiate between Direct and Indirect Tax	L4
6	Understand the Concept of Service Tax and laws	L2

Detailed Syllabus:

Module No	Topics	Hrs	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Principles of Taxes** Objectives of Taxation, Principles related to taxation system, Characteristics of good tax system, Effects of Taxation on Production, Distribution and Employment, Taxable capacity – Absolute and Relative Capacity, Factors determining Taxable Capacity, The Income tax Act, 1922, Present system of taxation in India - Income Tax Act 1961	08	L1, L2
2	**Introduction to Income tax** Basis of Charge, Rates of Tax, Residential Status of Individual, HUF, Firm, Company, AOP/BOI, Local Authority, Practical problems on determination of residential status and incidence of tax, Scope of total income	07	L1, L2, L3
3	**Incomes Exempt from Tax** Different categories of Exempted Income, Incomes which are neither included in Total Income nor Income Tax is payable, Incomes which are included in Total Income, but no income Tax is payable.	07	L1, L2, L3
4	**Income from Salaries** Basis of Charge, Different Forms of Salary, Treatment of provident fund, Allowances, Perquisites, treatment of other items included in salary, Profit-in-lieu of Salary Gratuity, Pension and Commuted pension, Encashment of earned leave, Retrenchment compensation, Provident Fund – Types of provident fund and tax treatment, Deductions, Computation of Income from Salary.	08	L1, L2, L3, L4
5	**Direct and Indirect Taxes** Classification of Taxes, Meaning of direct tax, Basic Concepts: Assessee, Assessment Year, Previous Year, Person, Income, Gross Total Income, Total Income. Meaning of Indirect Taxes, Features, Advantages, Disadvantages, Distinction between Direct and Indirect Taxes, Central Indirect Tax Laws, Indirect Tax Laws of the States, convergence of indirect taxes, Movement to GST	08	L1, L2, L3, L4
6	**Service Tax** Service Tax Law in India, the concept of 'Negative List', Categorization of Taxable and Tax-free Services, Exemptions and Rebates from Service Tax, Provisions for Rectification of Mistakes and schemes of Assessment	07	L1, L2
	Total Hours	**45**	

Books and References:

Sr. No	Title	Authors	Publisher	Edition	Year
1	Income Tax	Vinod K. Sinhania & Monica Sinhania	Taxmann Publications Pvt. Ltd	64th	2020-21
2	Taxation Law & Practice	Mehtrotra & Goyal	Sahitya Bhavan Publication	61st	2020
3	Direct Taxes	Lal B.B	Konark Publishing House	30th	2012
4	Indirect Taxes	Datey, V.S	Taxmann Publications Pvt. Ltd	44th	2020
5	Systematic Approach to Income Tax	Girish Ahuja& Ravi Gupta	Bharat Law House Pvt. Ltd	33rd	2014-15
6	Indirect Taxation	Balachandran. V	Sultan Chand & Sons	18th	2019

B.E. Semester –VIII
Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS-H 2019)
Syllabus under Autonomy (w.e.f. A.Y. 2021-22)

B.E. (Computer Engineering)							**B.E. SEM:** VIII		
Course Name: Product Design and Development							**Course Code:** OEC-CS8025		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR**	**TW**	
3	-	-	-	3	25	75	-	-	**100**
IA: In-Semester Assessment - Paper Duration – **1.5 Hours** **ESE :** End Semester Examination - Paper Duration - **3 Hours** **The weightage of marks for continuous evaluation of Term work/Report:** Formative (40%), Timely completion of practical (40%) and Attendance (20%)									
Prerequisite: None									

Course Objectives:

Course intended to deliver the fundamental knowledge of basic principles involved in design of new product and its development.

Course Outcomes:

SN	Course Outcomes	Cognitive levels as per bloom's Taxonomy
1	Identify design and development process of industrial products, considering ergonomic requirements.	L1, L2
2	Explain market requirements and manufacturing aspects of industrial design.	L1, L2, L3
3	Identify consumer products, functions and use.	L1, L2, L3
4	Explain aesthetic concept, symmetry.	L1, L2, L3, L4
5	Explain economic considerations, value analysis and cost reduction.	L1, L2
6	Employ standard organization structure, standardization, record keeping.	L1, L2, L4, L5, L6

Detailed Syllabus

Module No.	Topics	Hrs.	Cognitive levels as per bloom's Taxonomy
1	**Introduction-Approach to Industrial Design** Approach to industrial product based on idea generation and innovations tomeet the needs of the developing society. Design and development process of industrial products, various steps such as creative process involved in idea marketing, designers, mind- criticism, design process, creation. Ergonomics and aesthetic requirements of product design, quality and maintainability consideration in product design, Use of modeling technique, prototype designs, conceptual design.	4	L1, L2
2	**Industrial Product Design** General design situations, setting specifications, requirements and ratings, their importance in the design, Study of market requirements and manufacturing aspects of industrial designs. Aspects of ergonomic design of machine tools, testing equipment, instruments, automobiles, process equipment etc. Convention of style, from and color of industrial design.	8	L1, L2, L3
3	**Design of Consumer Product** Functions and use, standard and legal requirements, body dimensions. Ergonomic considerations, interpretation of information, conversions for style, forms, colors.	8	L1, L2, L3, L4
4	**Aesthetic Concepts** Concept of unity order with variety, concept of purpose, style and environment, Aesthetic expression of symmetry, balance, contrast and continuity, proportion, rhythm, radiation. Form and style of product: visual effect of line and form, mechanics of seeing, psychology of seeing, influence of line and form, Components of style, Basic factors, effect of color on product appearance, color composition, conversion of colors of engineering products.	8	L1, L2, L3
5	**Economic Considerations** Selection of material, Design for production, use of standardization, value analysis and cost reduction, maintenance aspects in design.	10	L1, L2, L3, L4
6	**Design Organization** Organization Structure, Designer position, Drawing office procedure, Standardization, record keeping, legal procedure of Design patents.	7	L1, L2, L4, L5,L6

Books and References:

SN	Title	Authors	Publisher	Edition	Year
1	Industrial Design for Engineers	W. H. Mayall	London Hiffee books Ltd	-	1967
2	Problems of Product Design and Development	Hearn Buck	Pergamon Press	-	-
3	Industrial Designs in Engineering	Charles H. Fluerichem	-	-	-
4	Material of Invention: Materials and Design	Ezio Manzini	The MIT Press	-	1989
5	The Science of Engineering Design	Percy H. Hill	Holt, Rinehart and Winston Publication	-	1970

Online References:

Sr.No.	Website Name	URL	Modules Covered
1	https://nptel.ac.in	https://nptel.ac.in/courses	M1-M6

B.E. Semester –VIII
Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS-H 2019)
Syllabus under Autonomy (w.e.f. A.Y. 2021-22)

BE (Computer Engineering)					SEM: VIII							
Course Name: Development Engineering					**Course Code:** OEC-CS8026							
Contact Hours Per Week: 03					**Credits:** 03							
Teaching Scheme (Program Specific)					Examination Scheme (Formative / Summative)							
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation							
Hours Per Week					Theory (100)		Practical / Oral (25)		Term Work (25)		Total
Theory	Tutorial	Practical	Contact Hours	Credits	IA	ESE	PR		PR		100
03	-	-	03	03	25	75	-	-	-	-	

IA: In semester Assessment –Paper Duration – 1.5 Hours

ESE: End Semester Examination – Paper Duration – 3 Hours

The weightage of marks for continuous evaluation taken with Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance (20%)

Prerequisite: QSEV, TENDER & CONTRCT

Course Objectives:

SN	Course Objectives	RBT Level
1	To familiarize the characteristics of rural Society and the Scope, Nature and Constraints of rural Development	L1, L2, L3, L4
2	To provide an exposure to implications of 73rd CAA on Planning, Development and Governance of Rural Areas	L1, L2, L3, L4
3	An exploration of human values, which go into making a ‘good’ human being, a ‘good’ professional, a ‘good’ society and a ‘good life’ in the context of work life and the personal life of modern Indian professionals	L1, L2, L3, L4
4	To familiarize the Nature and Type of Human Values relevant to Planning Institutions	L1, L2, L3, L4

Course Outcomes:

SN	Course Outcomes	RBT Level
1	Demonstrate understanding of knowledge for Rural Development.	L1, L2, L3, L4
2	Prepare solutions for Management Issues.	L1, L2, L3, L4
3	Take up Initiatives and design Strategies to complete the task	L1, L2, L3, L4
4	Develop acumen for higher education and research.	L1, L2, L3, L4
5	Demonstrate the art of working in group of different nature	L1, L2, L3, L4
6	Develop confidence to take up rural project activities independently	L1, L2, L3, L4

Detailed Syllabus:

Module No.	Topics	Hrs.	RBT Levels
1	Introduction to Rural Development Meaning, nature and scope of development; Nature of rural society in India; Hierarchy of settlements; Social, economic and ecological constraints for rural development. Roots of Rural Development in India Rural reconstruction and Sarvodaya programme before independence; Impact of voluntary effort and Sarvodaya Movement on rural development; Constitutional direction, directive principles; Panchayati Raj - beginning of planning and community development; National extension services.	06	L1, L2, L3, L4
2	Post-Independence rural Development Balwant Rai Mehta Committee - three tier system of rural local Government; Need and scope for people's participation and Panchayati Raj; Ashok Mehta Committee - linkage between Panchayati Raj, participation and rural development.	09	L1, L2, L3, L4
3	Rural Development Initiatives in Five Year Plans Five Year Plans and Rural Development; Planning process at National, State, Regional and District levels; Planning, development, implementing and monitoring organizations and agencies; Urban and rural interface - integrated approach and local plans; Development initiatives and their convergence; Special component plan and sub-plan for the weaker section; Micro-eco zones; Data base for local planning; Need for decentralized planning; Sustainable rural development	12	L1, L2, L3, L4
4	Post 73rd Amendment Scenario 73rd Constitution Amendment Act, including - XI schedule, devolution of powers, functions and finance; Panchayati Raj institutions - organizational linkages; Recent changes in rural local planning; Gram Sabha - revitalized Panchayati Raj; Institutionalization; resource mapping, resource mobilization including social mobilization; Information Technology and rural planning; Need for further amendments.	06	L1, L2, L3, L4
5	Values and Science and Technology Material development and its values; the challenge of science and technology; Values in planning profession, research and education Types of Values Psychological values — integrated personality; mental health; Societal values — the modern search for a good society; justice, democracy, rule of law, values in the Indian constitution; Aesthetic values — perception and enjoyment of beauty; Moral and ethical values; nature of moral judgment; Spiritual values; different concepts; secular spirituality; Relative and absolute values; Human values— humanism and human values; human rights; human values as freedom, creativity, love and wisdom	07	L1, L2, L3, L4
6	Ethics Canons of ethics; ethics of virtue; ethics of duty; ethics of responsibility; Work ethics; Professional ethics; Ethics in planning profession, research and education	05	L1, L2, L3, L4
	TOTAL	**45**	

Books and References:

SN	Title	Authors	Publisher	Edition	Year
1	ITPI, Village Planning and Rural Development,	ITPI,	New Delhi	-	-
2	Thooyavan, K.R. Human Settlements:	A 2005 MA Publication, Chennai	A 2005 MA Publication, Chennai	-	-
3	GoI, Constitution (73rdGoI, New Delhi Amendment) Act,	GoI, New Delhi	GoI, New Delhi	-	-
4	Planning Commission, Five Year Plans, Planning Commission	Planning Commission, Five Year Plans, Planning Commission	Planning Commission	-	-
5	Planning Commission, Manual of Integrated District Planning, 2006,	Planning Commission New Delhi	Planning Commission New Delhi	-	-
6	Planning Guide to Beginners	Planning Guide to Beginners	Planning Guide to Beginners	-	-
7	The Urban Complex, Doubleday	Weaver, R.C.,	-	-	-
8	Ethics in Planning, American Planning Association,	Farmer, W.P. et al	Washington		
9	Normative Ethics in Planning, Journal of Planning Literature	How, E.,	Vol.5, No.2, pp. 123-150	-	-
10	Implications for Planning Theory and Ethics, Planning Theory and Practice,	Watson, V. Conflicting Rationalities:	Vol. 4, No.4, pp.395 – 407	-	-

B.E. Semester –VIII
Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS-H 2019)
Syllabus under Autonomy (w.e.f. A.Y. 2021-22)

BE Computer Engineering							**B.E. SEM : VIII**		
Course Name: Project-II							**Course Code :** PROJ-CS801		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	**150**
-	-	12	12	6	-	-	100	50	
Prerequisite: Computer Programming language/s, Software Engineering									

Course Objectives:

The primary objective is to meet the milestone s formed in the overall project plan decided in Project - I. The idea presented in Project-I should be implemented in Project -II with results, conclusion and future work. The project will culminate in the production of a thesis by each individual student.

Guidelines:

Project Report Format: At the end of semester a student need to prepare a project report should be prepared as per the guidelines issued by the University of Mumbai. Along with project report a CD containing: project documentation, Implementation code, required utilities, Software's and user Manuals need to be attached.

Term Work: Student has to submit weekly progress report to the internal guide and whereas internal guide has to keep track on the progress of the project and also has to maintain attendance report. This progress report can be used for awarding term work marks. In case of industry projects, visit by internal guide will be preferred to get the status of project.

Distribution of marks for term work shall be as follows:

a) Weekly Attendance on Project Day
b) Project work contributions as per objective
c) Project Report (Hard Bound)
d) Term End Presentation (Internal)
e) The final certification and acceptance of TW ensures the satisfactory performance on the above aspects.

B.E. Semester –VIII
Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS-H 2019)
Syllabus under Autonomy (w.e.f. A.Y. 2021-22)

BE Computer Engineering						**SEM: VIII**		
Course Name: Summer Internship						**Course Code:** SI-CS801		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**			
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**			
Total Hours : Maximum 2 Weeks (60 to 80 Hours during summer vacation)						**PR**	**TW**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	-	-	50	**50**
-	-	-	120*	3				

Note :

3. Internship will be done in institute laboratory in collaboration with industries.
4. Evaluation and assessment will be done as per AICTE guidelines.

Prerequisite: Fundamental knowledge of respective Programmes

Course Objectives:

To get industry like exposure in the institute laboratories by carrying out activities / projects. Also design innovative techniques / methods to develop the products.

Course Outcomes: **Upon completion of the course students will be able to:**

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Apply subjects knowledge in the college laboratories for carrying out projects	L3, L4,L5
2	Developed innovative techniques / methods to develop the products	L3, L4,L5
3	Contribute for the society	L3, L4,L5

Detailed Syllabus:

Module No.	Topics	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Program Specific Internship** • Training and certification on emerging technologies in domains offered by Department of Computer Engineering • Applying classroom and laboratory knowledge to design , develop and deploy the products	L3, L4,L5
2	**Inter disciplinary Internship** • To explore and understand issues and challenges in the other disciplines (EXTC, ELEX, MECH and CIVIL) • Design , develop and deploy cost effective products using multidisciplinary approach	L3, L4,L5
3	**Industry Specific Internship** • To explore and understand issues and challenges in industry • Developing solutions for industry specific problems • Design , develop and deploy products for startup and SMEs	L3, L4,L5
4	**Interpersonal Internship** • To develop interpersonal skills such as leadership, marketing ,publicity and corporate ethics and communication • To get competence in problem solving , presentation , negotiation skills	L3, L4,L5
5	**Social Internship** • Identify and study different real life issues in the society • Identify societal problems and provide engineering solutions to solve these problems	L3, L4,L5
6	**Academic Internship** • Study report preparation, preparation of presentations, copy table book preparation , business proposal and IPR • Capture aspirations & expectations through interviews of students. • Ways to connect research in technical institutes with industry. • Taking inputs from self, local stakeholders and global stake holders which will help to develop process with comparative and competitive study.	L3, L4,L5

Books and References:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	The Ultimate Guide to Internships: 100 Steps to Get a Great Internship and Thrive in It (Ultimate Guides)	Eric Woodard	Allworth	I	2015

Online References:

Sr. No.	Website Name	URL	Modules Covered
1	https://www.letsintern.com/	https://www.letsintern.com/internships/summer-internships	M1-M6
1	https://codegnan.com	https://codegnan.com/blog/benefits-of-internships-and-importance	M1-M6
2	https://www.honorsociety.org	https://www.honorsociety.org/articles?category=internships	M1-M6

B.E. Semester –VIII
Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS-H 2019)
Syllabus under Autonomy (w.e.f. A.Y. 2021-22)

B.E.(Computer Engineering)							**B.E.(SEM :** VIII)
Course Name : Cloud Computing							**Course Code :** HSD-CSPS801
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**		
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**		
Hours Per Week					**Presentation**	**Report**	**Term Work**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**AC**	**AC**	**TW**
15	-	30	45	2	50	25	75
Audit course evaluated by Teacher Guardian							
Mid Semester Assessment for Term work will be on continuous basis							
Prerequisite: Subject knowledge, Domain knowledge							

Course Objective: The course intends to introduce basics of cloud computing, virtualization technology and major concepts related to the computing environment.

Course Outcomes: **Upon completion of the course students will be able to:**

SN	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Define Cloud Computing and memorize the different Cloud service and deployment models	L1, L2
2	Describe importance of virtualization along with their technologies.	L1, L2
3	Use and Examine different cloud computing services	L1, L2, L3
4	Analyze the components of open stack & Google Cloud platform and understand Mobile Cloud Computing	L1, L2, L3, L4
5	Describe the key components of Amazon Web Service	L1, L2, L3, L4,L5
6	Design & develop backup strategies for cloud data based on features.	L1, L2, L3, L4

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Introduction** Defining Cloud Computing, Components of Cloud Computing, Cloud types: NIST and Cloud Cube Models, Cloud Deployment Models and Service Models, Cloud computing architecture, Advantages and Disadvantages of Cloud Computing	3	L1, L2
2	**Virtualization** Virtualization: Characteristics of virtualized environment, Understanding the importance of Hypervisors, Type I & Type II Hypervisors, Taxonomy of virtualization,	2	L1, L2
3	**Cloud Computing Services** Exploring Cloud Computing Services: SPI Model: Software as a service, Platform as a service, and Infrastructure as a service. Anything as a service or Everything as a service (XaaS): Security as a Service, Identity management as a Service, Database as a Service, Storage as a Service, Collaboration as a Service	3	L1, L2, L3
4	**Cloud Implementation, Programming and Mobile Cloud Computing** Open Stack Cloud Architecture: Feature of Open stack, Components of Open stack, mode of operations. Mobile Cloud Computing: Definition, architecture, benefits and challenges of mobile cloud computing	2	L1, L2, L3, L4
5	**Exploring the Components of Amazon Web Services** AWS cloud computing Platform, a) Elastic Compute Cloud (EC2): Compute Basics, Instance types, Life cycle of instances. b) Simple Storage Service (S3): Basics and Operations, Features, Amazon Glacier. c) Elastic Block Storage (EBS): Basics and Types of EBS Volumes.	2	L1, L2, L3, L4, L5
6	**Cloud Backup and Solutions** Cloud Backup Solutions and their features, Cloud data management interface (CDMI), Cloud Storage gateways (CSG), Comparison between different cloud platforms: Amazon web services & Open stack (Based on Type of deployment, Services supported and their components).	3	L1, L2
	Total Hours	**15**	

Books and References:

	Title	Authors	Publisher	Edition	Year
1	Cloud Computing Bible	Barrie Sosinsky	Wiley Publication	Second Edition	2011
2	Cloud Computing Black Book	Kailash Jayaswal, Jagannath Kallalurchi, Donald J. Houde, Dr. Deven Shah	Dreamtech Press	Second Edition	2014
3	AWS certified solution Architect	Joe Baron et.al	Sybex publication	First Edition	2017
4	Mastering Cloud Computing: Foundations and Applications Programming	Rajkumar Buyya	MGH publication	First Edition	2013

Online Resources:

S. No.	Website Name	URL	Modules Covered
1	Youtube.com	https://www.youtube.com/watch?v=EN4fEbcFZ_E	M1-M6
2	Youtube.com	https://www.youtube.com/watch?v=r4YIdn2eTm4&list=PLEiEAq2VkUULlNtIFhEQHo8gacvme35rz	M5
3	https://www.appypie.com/	https://www.appypie.com/basics-of-mobile-cloud-computing-and-mobile-cloud-applications	M4

List of Practical/ Experiments:

Practical Number	Type of Experiment	Practical/ Experiment Topic	Hrs.	RBT Levels
1	Basic Experiments	Study of NIST model of cloud computing.	2	L1, L2, L3
2		Understand different types of virtualizations, Host and bare metal hypervisors and implement horizontal scalability.	2	L1, L2, L3
3	Design Experiments	Implement IaaS using specific tool	2	L1, L2, L3
4		Simulate identity management in a private cloud	2	L1, L2, L3
5		Explore Storage as a Service for remote file access using web interface.	2	L1, L2, L3
6		Understand security of web server and data directory.	2	L1, L2

7		Deploy web applications on commercial cloud.	4	L1, L2, L3,L4
8		To create and access VM instances and demonstrate various components such as EC2, S3, Simple DB, DynamoDB in AWS	4	L1, L2, L3,L4, L5
9	**Case study:**	Fog Computing	2	L1, L2, L3
10	**Mini Project:**	Using the concepts studied throughout the semester students shall be able to 1. Create their private cloud for the institute using the available resources. 2. Apply security concepts to secure a private cloud. 3. Implement efficient load balancing. 4. Compare various virtualization technologies with given resource. 5. Create cloud applications such as messenger, photo editing website, your own social media etc.	8	L1, L2, L3,L4, L5
		Total Hours	**30**	

B.E. Semester –VIII
Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS-H 2019)
Syllabus under Autonomy (w.e.f. A.Y. 2021-22)

B.E.(Computer Engineering)							**B.E.(SEM :** VIII)
Course Name : Research Based Learning IV							**Course Code :** HSD-CSRBL801
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**		
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**		
Hours Per Week					**Presentation**	**Report**	**Term Work**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**AC**	**AC**	**TW**
-	-	30	30	1	25	25	50
Audit course evaluated by Teacher Guardian							
Mid Semester Assessment for Term work will be on continuous basis							
Prerequisite: Subject knowledge, Domain knowledge							

Course Objective: The course intends to create awareness about Intellectual Property Rights, provides an opportunity to interact with industry and helps the students in publishing papers in Conferences and Journals and encourages them to take part in consultancy projects.

Course Outcomes: Upon completion of the course student will be able to:

S. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Understand Intellectual Property Rights and its process in details	L1, L2
2	Interact with industry experts regarding their projects and analyse their projects from industry view point	L1, L2,L3
3	Evaluate their projects by publishing their project research in Conferences and Journals	L1, L2, L3, L4,L5
4	Write a research paper and understand technical writing.	L1, L2, L3,L4,l5

Detailed Syllabus:

Module No.	Topics	Contact Hrs.	Self-Study Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Intellectual Property Rights (IPR) awareness seminar** Seminar to be conducted by an industry expert who can guide and motivate students to file IPR.	**02**	**00**	L1, L2
2	**Industry linkage / visit related to product and domain/Establish start up** To understand the usability of their respective project students **can visit an Industry and conduct a survey and generate a suitable report.**	**02**	**04**	L1,L2,L3
3	**IPR filing/ Technology transfer to industry/Testing of product in real environment** **Once the product is ready, it needs to be tested first in the real environment where it will be deployed and used by the end user. Once the product is tested ok, it can be deployed in the industry in a large scale. IPR/Patent can be suitably filed for the said product.**	**06**	**10**	L1, L2, L3,L4,L5
4	**Publish paper at institute /national level conference /participate in competition /participate in funded project/consultancy projects** **The completed project with results can be converted into a research paper and the same can be published in a conference or journal. Students can participate in project competitions at institute and university level. Also they can participate in funded projects and consultancy projects.**	**02**	**04**	L1, L2, L3, L4,L5
	Total Hrs.	**12**	**18**	

Books and References:

S. No.	Title	Authors	Publisher	Edition	Year
1.	Blue Ocean Strategy	W Chan Kim and Renee Mauborgne	Harward Business School Press	1st	2005
2.	The E-Myth Revisited	Michael E. Gerber	Harper-Collins Publications	1st	2012
3.	Intellectual Property Rights	Neeraj Pandey and Kushdeep Dharni	Prentice Hall India	2nd	2014

Online Resources:

S. No.	Website Name	URL	Modules covered
1.	NPTEL	https://nptel.ac.in/courses/110105139/	M1,M3
2.	IPTSE	https://iptse.com/future-of-intellectual-property-rights-in-india/	M1, M3
3.	NPTEL	https://nptel.ac.in/courses/127105007/	M2

APPENDIX

Term work for Internship

(Reference AICTE Internship Policy: Guidelines and Procedures)

AICTE Internship Policy is flexible on the INTERNSHIP duration and prescribes a minimum of 14-20 credits of Internship/ Entrepreneurial activities / Project work/ Seminar and Inter/ Intra Institutional Training may be counted toward B. E. degree programme. One credit is equivalent to minimum 40-45 hours of work. Therefore, a full-time intern is expected to spend 40 - 45 hours per week on Internship, Training, Project work, Seminar activities etc. The total internship duration for the B.E. Programme being 600-800 hours. The flexibility of carrying out the internship based on availability of opportunities as specified by AICTE allows students to complete the requirements of internship credits over the entire duration of the B. E. Programme. The Term work for INTERNSHIP will not lead to non-grant of term. Term work for INTERNSHIP shall be in the form of report.

The academic council of the institute on 10th Sept. 2020 has approved the following internship scheme in adherence to the guidelines of AICTE

- INTERNSHIP is mandatory for all UG programmes, otherwise students will not be eligible for the degree.
- One credit of INTERNSHIP is equivalent to 40-45 hrs of engagement and therefore the institute can go for 40 hrs per credit. Students admitted at Second Year of B. E. (SE) degree through lateral entry, required to complete the credits applicable from second year onwards of the course.
- To get the required credit, 640-800 hrs of industry-oriented training to be completed over the duration of four years. In no case it should be less than 600 hrs which is the minimum requirements as per AICTE guideline. For lateral entry at SE, it will be in proportionate with credit.
- Year wise distribution of numbers of hours and equivalent credits are shown in the scheme of the B. E programme.
- Scope of internship will be as per the perspective of various activities stated in the AICTE guidelines.
- INTERNSHIP in case of TCET will be In-house or Out-house and also Online or in face to face mode.
- Online INTERNSHIP students can pursue during the semester but it should not impact the semester attendance and academics
- In case of in-house INTERNSHIP students will be encouraged to supplement the training with some online certification in the related subjects.
- INTERNSHIP credit hours can be accumulated over the years and the credit can be given in only May examinations.
- Proper balance between in-house and outhouse INTERNSHIP needs to be balanced so that all students shall complete in time and become eligible for the award of degree as per the requirement of AICTE guidelines.

Term-work Evaluation: Evaluation of the Term work will be based on presentation and report. The criteria of evaluation will take into account:

- Quality of content presented
- Proper planning for presentation.
- Effectiveness of presentation.
- Depth of knowledge and skills.
- Attendance record, daily diary, departmental reports shall also be analysed along with the Internship Report.

Programme Specific Term Work

Laboratory work must contain implementation of minimum 10 experiments. The final certification and acceptance of term work ensures the satisfactory performance of laboratory work and minimum passing marks in term work.

The weightage of marks for continuous evaluation of term work or report: Formative (40%), Timely Completion of Practical (40%) and Attendance or learning attitude (20%)
The 25 marks of the term work should be divided as below:
25 Marks (total marks) = 10 Marks Lab. Experiments + 10 Marks Formative Assessment + 05 (Attendance: theory + practical)
Term Work is not a separate head of passing; however a learner is eligible to appear for any form of examination only after satisfactorily completion of Term Work in all

Major or additional Minor Degree through Specialization

- A student will be eligible to get Under Graduate degree with Honours or additional Minor Engineering, if he/she completes an additional 20 credits. These could be acquired through MOOCs.
- TCET will offer honour degree for major specialization.
- Every department has offered two specializations. Here we will form groups of the departments such that students from any of these groups will take any specialization of department within that group will have major degree and specialization of department belongs to another group will get minor degree.

  E.g. **Group -1:** comprises of COMP, IT, ELEX, E&TC

  Group-2: Mechanical

  Group-3: Civil

  Student of Electronics if takes specialization of IT as both the branch are of the same group student will get major degree and if the student from Civil branch is taking specialization from the COMP department (other group) then he/she will be offered minor degree.
- The list of specialization courses offered by various department are as follows:

Sr. No.	Name of the Department	Specialization Courses offered by the Department
1	Information Technology(IT)	1. Block chain 2. Infrastructure Security
2	Computer Engineering(COMP)	1. Artificial Intelligence 2. Data Science
3	Electronics & Telecommunication(E&TC)	1. IoT 2. Communication Networks towards 5G
4	Electronics(ELEX)	1. IoT 2. Robotics 3. Sensor Technology
5	Mechanical(MECH)	1. Energy Engineering 2. 3 D Printing
6	Civil(CIVIL)	1. Infrastructure Engineering 2. Green Technology and Sustainability