University of Mumbai

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

(Under TCET-Autonomy Scheme-2019)

Estd. in 2001

Scheme & Syllabus under Autonomy

(w.e.f. Academic Year 2019-20 onwords)

Approved by Board of Studies and Academic Council

(Meeting held on 30th November, 2019 & 21st December, 2019 respectively)

S.E. (Sem-IV)

T.E. (Sem-VI)

B.E. (Sem-VIII)

M.E. (Sem-II)

DEPARTMENT OF COMPUTER ENGINEERING(COMP)

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

Jagdu 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

Institute Accredited by National Assessment and Accreditation Council (NAAC), Bangalore#

Programmes Accredited by National Board of Accreditation (NBA), New Delhi*

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

Amongst Top 200 Colleges in the Country where Ranked 193rd in NIRF India Ranking 2019 in Engineering College category

*Permanent Affiliated UG Programmes : • Computer Engineering • Electronics & Telecommunication Engineering • Information Technology (w.e.f. A.Y. 2015-16)
• Electronics Engineering (w.e.f. A.Y. 2017-18)

*3rd cycle NBA Accredited UG Programmes : • Computer Engineering • Electronics & Telecommunication Engineering • Information Technology (3 years w.e.f. 01-07-2019)

1st cycle of NAAC Accreditation : • "A" Grade for 5 years (w.e.f. 30-10-2017)

O 9001:2015 rtified stitute | NBA Accredited Programs | NAAC Accredited Institute with 'A' Grade | AICTE-CII Survey rating in Platinum category for Industry linkages | Among Top 200 Colleges in the Country Ranked 193rd in NIRF India Ranking 2019 in Engineering Category | 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. A.Y. 2019-20

9001:2015 ified itute	NBA Accredited Programs	NAAC Accredited Institute with 'A' Grade	AICTE-CII Survey rating in Platinum category for Industry linkages	Amongst Top 200 Colleges in the Country Ranked 193rd in NIRF India Ranking 2019 in Engineering Category	68th & 78th in All India Rank by Outlook survey published in June 2019 & May 2018 respectively

tcet ES&H ENGINEERS | tcet DYNAMIC E&TC ENGINEERS | tcet BRIGHT IT ENGINEERS | tcet SMART COMP ENGINEERS | tcet RADIANT ELEX ENGINEERS | tcet VIBRANT MECH ENGINEERS | tcet CONCRETE CIVIL ENGINEERS

Nurturing Budding Engineers to become Global Professionals with Human Values

Driving Academic Excellence through...

oice Based Credit Grading System with Holistic Student Development

(CBCGS-H 2019)

(Under TCET-Autonomy Scheme-2019)

Jagdu Singh Charitable Trust's (Regd.)

HAKUR 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

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 online 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 importance of science to the students which could later be useful for Research in Applied Science and Engineering. The scheme also emphasizes on Professional Skills which includes 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.

Estd. in 2001

Zagdu Singh Charitable Trust's (Regd.)

THAKUR COLLEGE OF ENGINEERING & TECHNOLOGY

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

Amongst Top 200 Colleges in the Country, Ranked 193rd in NIRF India Ranking 2019 in Engineering College category

• *ISO 9001:2015 Certified* • *Programmes Accredited by National Board of Accreditation (NBA), New Delhi*

• *Institute Accredited by National Assessment and Accreditation Council (NAAC), Bangalore*

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 online 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

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

The Department of Computer Engineering is committed to nurture budding Engineers to become global professionals with social sensitivity. It believes that the CBCGS-H 2019 scheme is learner-centric & the Faculty members will deploy the scheme for the benefit of students at large.

Degree/Programme	Employability Skill Enhancement Programme (1200 hrs. duration) (960 hrs. Professional Training + 240 hrs. Internship)
B.E(Computer Engineering)	Professional Skill Development Curriculum with **Project Based Learning(PBL)** experience of 480 hrs. duration
	Advanced Skill Development(Industry Specific) Curriculum with **Industry Based Learning(IBL)** experience during Winter of 240 hrs. duration leading to employment in IT & Service Sectors
	Research Oriented Curriculum with **Research Based Learning (RBL)** experience of 120 hrs. duration leading to higher studies in the emerging research areas
	Personality Development Curriculum with Society Outreach/ Extension & Co/Extra-Curricular through **Activity Based Learning (ABL)** experience of 120 hrs. duration
	Summer Internship (In-house/Out-house)/Professional Training Curriculum of 6 to 8 weeks duration (240 to 320 hrs.) leading to exposure to the Industrial Environment as per AICTE Internship Scheme

Dual Advantage Advanced Certification Courses in Emerging Technology Areas (Courses offered during Summer & Winter Break after semester II to VII)

B.E(Computer Engineering) As per AICTE Model Curriculum with TCET-Autonomy Scheme (CBCGS-H 2019) → **Employability Skill Development Offerings by T&P Cell As per TCET-Autonomy Scheme (Winter & Summer)** → **Specialization in Data Science/ Artificial Intelligence/ Interdisciplinary (Self-Study graded Courses offered through online portals)** → **B.E(Computer Engineering) with Specialization in Data Science/ Artificial Intelligence/ Interdisciplinary Courses and Advanced Certificate in computing**

Additional Specialization in Emerging Technology Areas (Optional)

Specialization-I (Artificial Intelligence - Interdisciplinary)

Specialization-II (Data Science - Interdisciplinary)

Graded Course offered through Self-Study Mode & Online Credit Transfer through NPTEL-MOOCs (SWAYAM portal) & graded courses offered through other portals like Coursera, Udemy etc. The students should opt for online graded courses offered by the Department from time to time. One course per semester may be registered for certification under a faculty mentor.

TCET

DEPARTMENT OF COMPUTER ENGINEERING (COMP)

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

Under TCET-Autonomy Scheme - 2019

B.E(Computer Engineering)-Under Graduate Programme

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: Attain Sound Engineering knowledge and use of modern tools effectively to solve real life problems (KNOWLEDGE)
- PEO 2: Attain need based skills and lifelong learning to ensure global employability (SKILL)
- PEO 3: Become successful professionals and responsible citizens with good leadership qualities and strong ethical values (PROFESSIONALISM)

Program Specific Outcomes

- PSO 1 : 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 : Enhance research skills and utilize advanced computing tools for analysis, design and implementation of computing systems for resolving real life / social problems
- PSO 3 : Utilize multi-disciplinary knowledge required for satisfying industry / global requirements and hence develop an attitude for lifelong learning.
- PSO 4 : Have all round personality with skills like leadership, verbal and 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** complex 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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Under TCET-Autonomy Scheme - 2019

SPECIFIC MEASURABLE ATTAINABLE REALISTIC TIMEBOUND

M.E(Computer Engineering)-Post Graduate Programme

Nurturing Budding Engineers to become SMART Professionals with Social Sensitivity

VISION

To become the premier center for post graduate studies with focus on research in Engineering & Technology.

MISSION

To create an academic environment that enriches the students' knowledge with emphasis on multi-disciplinary learning interwoven with research.

Program Educational Objectives

- PEO 1 : To prepare technically sound professionals with depth of knowledge having designing capabilities by providing awareness of open source technology.
- PEO 2 : To prepare learner to develop competency in specific domain/field to the level for providing solution to industry problems
- PEO 3 : To equip learners to explore every course as research and development opportunity
- PEO 4 : To prepare the mind set of learner to explore avenues for publishing their research work in the national or international journals of repute.
- PEO 5 : To inculcate professional abilities leadership qualities with sensitivity towards ethical, societal and legal issues.

Program Specific Outcomes

PSO 1 :Apply knowledge of computing to classic problems of various domains.

PSO 2 :Strengthen multidisciplinary research skills by illustrating various approaches and techniques, utilizing advanced computing tools for resolving national relevance problems.

PSO 3 :Develop life-long learning attitude by acquiring multidisciplinary knowledge for satisfying global requirements.

PSO 4 :Acquire knowledge of cyber security & Laws, management information systems, professional ethics, IPR & patenting, digital business & environment management to have all round personality in order to become valued and responsible professionals.

M.E(Computer Engineering)-Post Graduate Programme

Nurturing Budding Engineers to become SMART Professionals with Social Sensitivity

Programme Outcomes:

PO 01	Apply knowledge of computing to classic problems of various domains.
PO 02	Strengthen multidisciplinary research skills by illustrating various approaches and techniques, utilizing advanced computing tools for resolving national relevance problems.
PO 03	Develop life-long learning attitude by acquiring multidisciplinary knowledge for satisfying global requirements.
PO 04	Acquire knowledge of cyber security & Laws, management information systems, professional ethics, IPR & patenting, digital business & environment management to have all round personality in order to become valued and responsible professionals.

Specialization-I (Artificial Intelligence - Interdisciplinary)
Under Faculty Mentor

Course Description			Teaching Scheme (Programe Specific)			
			Weightage			
Semester	Course Category	Course Title	Contact Hours Per week	Credits	Modes of Teaching / Learning	Examination Scheme
III	Artificial Intelligence	Artificial Intelligence Search Methods for Problem Solving	3	3	Online learning platforms like MOOCS,NPTEL,SWAYAM portal	Online Certification will be attained through MOOCS,NPTEL,SWAYAM portal
IV	Artificial Intelligence	Machine Learning for Engineering & Science Applications	3	3	Online learning platforms like MOOCS,NPTEL,SWAYAM portal	Online Certification will be attained through MOOCS,NPTEL,SWAYAM portal
V	Artificial Intelligence	Practical Machine Learning with Tensorflow	3	3	Online learning platforms like MOOCS,NPTEL,SWAYAM portal	Online Certification will be attained through MOOCS,NPTEL,SWAYAM portal
VI	Artificial Intelligence	Applied Natural Language Processing	3	3	Online learning platforms like MOOCS,NPTEL,SWAYAM portal	Online Certification will be attained through MOOCS,NPTEL,SWAYAM portal
VII	Artificial Intelligence	Deep Learning	3	3	Online learning platforms like MOOCS,NPTEL,SWAYAM portal	Online Certification will be attained through MOOCS,NPTEL,SWAYAM portal
VIII	Artificial Intelligence	Reinforcement Learning	3	3	Online learning platforms like MOOCS,NPTEL,SWAYAM portal	Online Certification will be attained through MOOCS,NPTEL,SWAYAM portal
	Project			2		
		Total		20		

Specialization-II (Data Science - Interdisciplinary)
Under Faculty Mentor

Course Description			Teaching Scheme (Programe Specific)			
			Weightage			
Semester	Course Category	Course Title	Contact Hours Per week	Credits	Modes of Teaching / Learning	Examination Scheme
III	Data Science	Fundamentals of Database System	3	3	Online learning platforms like MOOCS,NPTEL,SWAYAM portal	Online Certification will be attained through MOOCS,NPTEL,SWAYAM portal
IV	Data Science	Introduction to Data Analytics	3	3	Online learning platforms like MOOCS,NPTEL,SWAYAM portal	Online Certification will be attained through MOOCS,NPTEL,SWAYAM portal
V	Data Science	Probability and Statistics	3	3	Online learning platforms like MOOCS,NPTEL,SWAYAM portal	Online Certification will be attained through MOOCS,NPTEL,SWAYAM portal
VI	Data Science	Practitioners Course In Descriptive, Predictive And Prescriptive Analytics	3	3	Online learning platforms like MOOCS,NPTEL,SWAYAM portal	Online Certification will be attained through MOOCS,NPTEL,SWAYAM portal
VII	Data Science	Big Data Computing	3	3	Online learning platforms like MOOCS,NPTEL,SWAYAM portal	Online Certification will be attained through MOOCS,NPTEL,SWAYAM portal
VIII	Data Science	Data Science For Engineers	3	3	Online learning platforms like MOOCS,NPTEL,SWAYAM portal	Online Certification will be attained through MOOCS,NPTEL,SWAYAM portal
	Project			2		
		Total		20		

Estd. in 2001

Conferred Autonomous Status by University Grants Commission(UGC) for 10 years w.e.f. A.Y. 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	Amongst Top 200 Colleges in the Country Ranked 193rd in NIRF India Ranking 2019 in Engineering Category	68th & 78th in All India Rank by Outlook survey published in June 2019 & May 2018 respectively

Break up of Employability Enhancement Programme Under TCET-Autonomy Scheme(Value Addition of 960 hrs. of Professional Skills Courses with 24 Credits)

Offerings/Semester	Professional Skills (12)	Project Based Learning(4)	Research Based Learning(4)	Activity Based Learning (4)
Semester- I	**Professional Skills – I :** Life Skills/ Presentation Skills using MS-Power Point and Excel			**ABL1-** Yoga Practice - I/ Society Outreach - I
Semester- II	**Professional Skills – II :** Aptitude and Logic Building			**ABL 2 -** Yoga Practice - II/ Society Outreach - II
Semester- III	**Professional Skills – III:** Object Oriented Programming using Java **Object Oriented Programming using Advanced Java** (industry specific skills will be offered during 21st and 25th week) by T&P	**Project Based Learning-I:** Mini Project using Java programming /SQL server.		**ABL3 -** Co-curricular/Extra curricular/Extension
Semester- IV	**Professional Skills – IV:** Introduction to Python Programming **Advanced Python Programming** (industry specific skills will be offered during 21st and 25th week) by T&P	**Project Based Learning-II:** Mini Project using Python programming / Java network programming/ OpenGL.		**ABL 4 -** Co-curricular/Extra curricular/Extension
Semester- V	**Professional Skills – V:** Web Development using JavaScript, JQuery, PHP **Advanced Web Development** (industry specific skills will be offered during 21st and 25th week) by T&P	**Project Based Learning-III:** Minor project using Web Development	**Research Based Learning-I:** Research based projects using professional electives/publication in conference	
Semester- VI	**Professional Skills – VI:** DevOps: GitHub, Jenkins, Selenium **MongoDB, DBMS, MySQL** (industry specific skills will be offered during 21st and 25th week) by T&P	**Project based Learning-IV** Industry Specific Campus Connect Programmes offered by TCS, Infosys and Accenture	**Research Based Learning-II:** Research based projects using professional electives/publication in conference	
Semester- VII	**Professional Skills – VII:** High end skills as per Industry requirements offered through T&P during 21st and 25th week.	Industry Specific Campus Connect Programmes offered by TCS, Infosys and Accenture	**Research Based Learning-III:** Research based projects using professional electives/major projects/publication in journals.	
Semester- VIII	**Professional Skills – VIII:** High end skills as per Industry requirements offered through T&P during 21st and 25th week.	Industry Specific Campus Connect Programmes offered by TCS, Infosys and Accenture	**Research Based Learning-IV:** Research based projects using professional electives/major projects/publication in journals.	

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Website : www.tcetmumbai.in

Deployment of Semester under CBCGS-H 2019 System

- Academic Program: It means a total of 8 semesters spread over 4 years with minimum 3600 contact hours
- Academic Semester: It means a term consisting of a minimum of 450 contact hours distributed over 90 working days spread over 15 weeks with minimum 30 contact hours per week.
- At TCET with seven contact hours per day effectively 15*7*5=525 contact hours are available for semester conduct.
- Excluding 1 week of technical festival/seminar/workshop (35 hours) and up to five public holidays (35 hours) the effective contact hours per semester will be 525-70=455 hours.
- Distribution of Academic Year: The semester will be known as either Odd Semester or Even Semester. The semester from July to December will be Semesters I, III, V or VII depending upon the programme duration and similarly the semester from January to June will be Semesters II, IV, VI, and VIII.
- Summer Internship: Internship of minimum 6 weeks (240 hours) to 8 weeks (320 hours) over and above these contact hours after even semester II, IV, VI.
- Professional Training of 4-6weeks after odd semesters I, III, V (industry specific/Interdisciplinary)
- The subject code of Professional Skills – I (Life/Professional Skills) and Professional Skills – II (Aptitude/Logic Building) is changed from BSPS-I and BSPS-II to BSPS-LPS and BSPS-ALB respectively.
- The group of Computer Engineering (COMP), Civil Engineering (CIVIL) and Electronics Engineering (ELEX) is called as Group – I and that of Electronics & Telecommunication (E&TC), Information Technology (IT) and Mechanical Engineering (MECH) is called as Group – II.
- Extra Lecture / Practical / Activities shall be conducted during free slots / working Saturdays for compensation of contact hours.

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

Estd. In 2001

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ACADEMIC CALENDAR FOR THE YEAR 2019-20 (UG-SEM II, IV,VI,VIII & PG-SEM II

6TH JANUARY 2020 – 18TH APRIL 2020 (15 WEEKS)- TENTATIVE

Sr.No	Weeks	Date	Key Activities	Weeks
1.		2nd Jan-4th Jan 2020	Planning, preparation, Industrial Visit	
2.		6th January 2020	Commencement of Semester	
3.	1st Week	6th January 2020-10th January 2020	Semester Conduct-I/Semester orientation/ Induction/ESDP	1 Week
4.	2nd -6 Weeks	13th Jan-22nd Feb 2020	Semester Conduct-II	6 weeks
5.	7th Week	24th Feb- 29th Feb 2020	Research Conference (MULTICON)/Cultural Festival (Sojourn'2020), DCDC/Industry Linked Workshop/Seminar/Project Exhibition/Sports Festival (Tspark/Enertia- after college hours)	1 week
6.	8th Week	2nd Mar-7th Mar 2020	In-Semester Assessment Exam	1 Week
7.	9th Week	9th Mar-18th Apr 2020	Semester Conduct-III/ Open House	6 Weeks
8.		18th Apr 2020	Last instructional day	
				15 Weeks
9.	10th Week	20th Apr-25th Apr 2020	End Semester Exam (Practical /Oral Exam)	1 Week
10.	11th Week	27th Apr- 3rd May 2020	Preparatory Leave	1 Week
11.	12th -13th Week	4th -19th May 2020	End Semester Exam (Theory)/ Assessment of answer book/ result preparation/Vacation	2 Weeks & 2 days
12.	14th Week-19th Week	20th May-30th June 2020	Internship/Employability Skill Development Program/KT exam/supplementary exam/ Assessment of answer book/Vacation/ Open House	6 Weeks

Note:

1. Formative Assessment from 3rd Week onwards
2. ESDP of even semester can be conducted during 15 weeks

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

Examination Rules

- Formative Evaluation: To gauge initial understanding of the subject, formative evaluation should be conducted between 6th and 13th week through innovative/technology driven methods adopted by faculty (through class test/Surprise test/Multiple choice question test conducted through online questionnaire/quizzes)
- In-Semester Assessment (IA) Test: During 7th week of 25 / 15 Marks Theory for F.E. and S.E, In-Semester Assessment (IA) test during 7th week of 20 marks theory for T.E and B.E. There will be only one IA test during the semester.
- Retest: Students who have missed the IA test on Medical grounds OR Genuine Reasons can put-up their Request (with documentary Proof) to the principal. The retest shall be conducted for such students after scrutinizing the "student request" by Institute Level Committee. The retest decision shall not be taken faculty /HOD Level. The student request should be forwarded by the department.
- Result declaration: The Deceleration of provisional results is followed by "Open House" after IA test and also after at the End Semester Examination (ESE).
- End Semester Examination (ESE): Theory Examination of 75 / 35 Marks for the entire syllabus shall be conducted which should be based on the entire syllabus
- Practical (PR) and Term work (TW): Examination of 25 marks each shall be conducted at the end of semester.
- Duration of Examinations: The IA test (Theory) of 25 marks will be conducted for 90 minutes and that of 15 marks will be conducted for 60 minutes for F.E. and S.E. In IA test preferably one subject shall be conducted per day. In case of non-availability of working days during a week, maximum of two subject IA Test can be conducted in one day and it can be extended to other weeks also for F.E. to B.E. Duration of End Semester Examination (ESE) (Theory) will be 3 Hours for 75 Marks and 2 hours for 35 marks. Similarly, Duration of the IA test (Theory) is 60 minutes and one paper of 20 marks will be conducted per day for T.E and B.E. Duration of End Semester Examination (ESE) (Theory) will be 3 Hours for 80 Marks.
- Assignment/ Remedial: For better learning outcomes the Formative Assessment conducted by faculty between 6th and 13th week shall be considered as a replacement to written assignments OR remedial. The record should be maintained by the faculty/ Department. The same shall be submitted to the exam section at the end of semester.
- Other Exam Rules: All other rules for Attendance, Term grant, Eligibility, ordinances, KT examination rules, grievance re-dressal, Grade penalty etc. will be similar to University of Mumbai Guidelines.
- KT Examination: All those students with KT from 1st semester to 8th semester will be migrated to the examination scheme adopted by the institute under Autonomy. However, the weightage and credits of Theory/Internal Assessment/Term Word/Oral/Practical will remain the same as UoM scheme.
- Re- Examination: The re-examination shall be conducted within a month after the declaration of the results and the students passing in this examination shall be considered as passed in first attempt. And the students who fail in the re-examination shall be treated as students with KT and they will appear the KT exam after 6 months. The grade penalty is applicable as per UoM rules for passing the exam in this attempt and there on

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

Credit Distribution Chart (Under Graduate)

Sr. No	Course Work - Subject Area As per Model Curriculum	Credits Distribution As per Model Curriculum	Credits Distribution As per TCET Autonomy Scheme
1	Humanities and Social Sciences (HS),including Management;	12	12
2	Basic Sciences(BS) including Mathematics, Physics, Chemistry, Biology;	24	23
3	Engineering Sciences (ES), including Materials, Workshop, Drawing, Basics of Electrical/Electronics/Mechanical/Computer Engineering, Instrumentation;	29	33
4	Professional Subjects-Core (PC), relevant to the chosen specialization/branch; (May be split into Hard (no choice) and Soft (with choice), if required ;)	49	50
5	Professional Subjects – Electives (PE),relevant to the chosen specialization/ branch;	18	19
6	Open Subjects- Electives (OE), from other technical and/or emerging subject areas;	12	12
7	Project Work, Seminar and/or Internship in Industry or elsewhere.	15	16
8	Mandatory Courses (MC);	-	-
9	Audit Course (AC)	-	
	TOTAL CREDITS	159	165
	Additional credit offering for Holistic Student Development (20 percent)		
1	Professional Skills- 1-VIII(Industry Specific /Interdisciplinary/ Case Study Based Learning/ Experiential Learning)	-	12
2	Project Based Learning I-IV (Industry/Research/Interdisciplinary)	-	8
3	Research Based Learning I-III(Academic Research/Online/MOOCS	-	
4	Activity Based Learning I-IV (Societal/Life skills/Co-curricular/ Extra-curricular/Extension)	-	4
	Total		24
	Credits offering for Holistic Student Development		
1	**Extraordinary Achievement Credits**(1.National level Achievements 2.National Level Competitive exams 3.Standard Industrial Certifications 4.Major Contribution to society)	Additional Credit based on Certification	8
	Credit Offering for Specialization		
1	Specialization in Emerging Areas	Direct Credit Transfer through Online Certification	20
	(2019-23 batch onwards)	**Grand Total**	**165+24+8+20=217**

Credit Distribution Chart (Post Graduate)

Sr. No	Course Work - Subject Area As per Model Curriculum	Credits Distribution As per Model Curriculum	Credits Distribution As per TCET Autonomy Scheme
1	Professional Subjects-Core (PC)	16	16
2	Professional Subjects – Electives (PE),relevant to the chosen specialization/ branch;	19	19
3	Open Subjects- Electives (OE), from other technical and/or emerging subject areas;	3	3
4	Project Work, Seminar and/or Internship in Industry or elsewhere.	28	28
5	Mandatory Courses (MC);	2	2
6	Audit Course (AC)	-	-
	TOTAL CREDITS	**68**	**68**

Scheme	Sem I &II	Sem III & IV	Total
Choice Based Credit Grading Scheme (CBCGS 2019-23 Batch)	36	32	68
Credits Under Choice Based Credit Grading Scheme(CBCGS UoM-Rev. 2016-20 Batch)	36	30	66

Ph.D. (Technology) Computer Engineering

The Department of Computer Engineering offers Ph.D. program and 10 students are enrolled under the UoM. The research students are at various levels of progress. Henceforth the Examination and meetings will be conducted as per UGC guidelines.

1. The admission to Ph.D. Program,
2. Course work,
3. Research Recognition Committee Meetings,
4. Research Advisory Committee Meetings
5. Annual Progress seminar presentations
6. Awarding Ph.D. from UoM

The Department will also follow the UGC guidelines changing from time to time in future.

Credit Distribution Summary

Academic Credits: Credit is a kind of weightage given to the contact hours to teach the prescribed syllabus, which is in a module form.

- 1 credit is allocated 15 contact hours for Theory(TH)/Tutorial(TUT)
- 1 credit is allocated to 30 contact hours for Practical(PR)/Activity(AC)/Integrated Theory & Practice(ITP)/Field Work(FW)
- 1 credit for 30 contact hours for Collaborative Learning(CL)/Peer Learning(PL)

Credit Distribution Summary for various Batches -Degree will be awarded by University of Mumbai

Scheme	F.E	S.E	T.E	B.E	Total	HSD	Credit for award of Degree	Optional Credits		Grand Total
								Specialization	Achiever's Credits	
As per AICTE Model curriculum	38	45	43	33	159	-	159	-	-	159
Choice Based Credit Grading Scheme with Holistic Student Development(CBCGS-H **2019-23 onwards** Batch)	42	44	43	36	165	24	189	20	08	217
Choice Based Credit Grading Scheme with Holistic Student Development(CBCGS-H **2018-22** Batch)	54	44	43	36	177	24	201	20	08	229
Choice Based Credit Grading Scheme with Holistic Student Development(CBCGS-H UoM- **2017-21** Batch)	54	52	53	52	211	Audit	211	20	08	239
Credits Under Choice Based Credit Grading Scheme(CBCGS-H UoM-**2016-20** Batch)	54	52	53	52	211	Audit	211	-	08	219

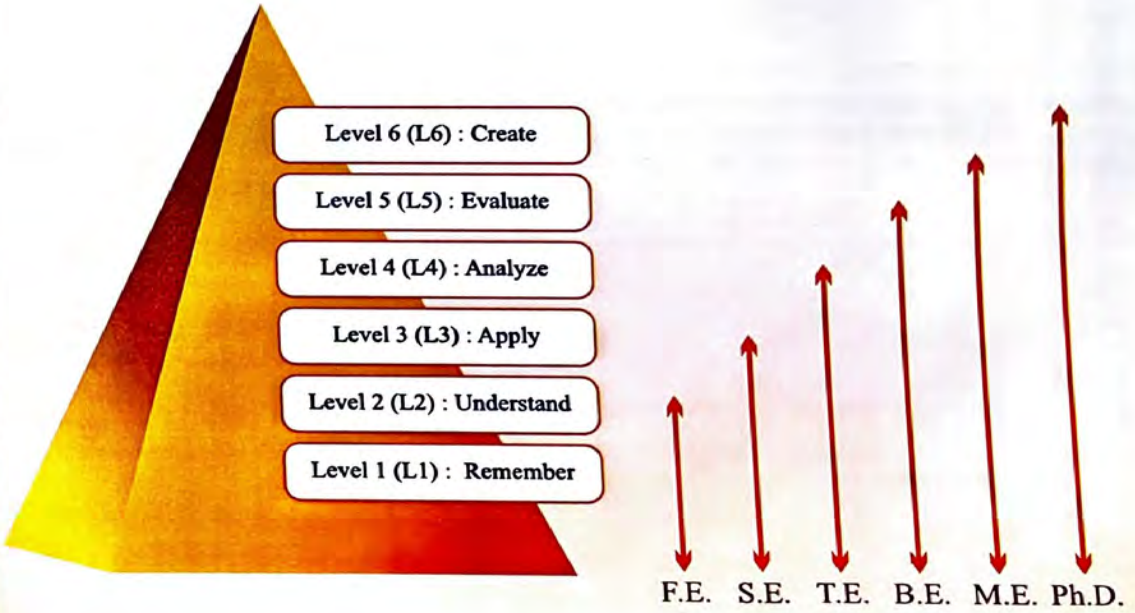
Level Of Achievement	Rules for Achieving Credits	Felicitation during Degree Certificate Distribution Ceremony
1. National level Achievements **2. National Level Competitive exams** **3. Standard Industrial Certifications** **4. Major Contribution to society**	1.Credit Offerings will be given against the notifications put up by the Institute 2. Additional Optional credits which can be earned over a period of 4 years. For 2017-21 batch these credits are to be earned in 2 years.	1.Qualifing Examinations conducted by GATE/GRE/CAT(4 credits) 2.Winner of National Level Hackathon/Project Competitions/Government Consultancy Projects /Recognition by the state or Central Government(2 credits) 3. Qualifying Examination of Industry Certifications by Microsoft/ Oracle/ Java/ PMI/ CISCO (2 credits)

1. F.E.: First Year of Engineering, S.E.: Second Year of Engineering, T.E.: Third Year of Engineering, B.E.: Bachelor of Engineering.
2. Difference in credits at S.E. (1 credit) is compensated at B.E. (3 credits) for 2018-22 and 2019-23 batch onwards.
3. Additional credits are given to increase student's employability prospect.
4. Nomenclature may change in future as per UGC/AICTE/UoM guidelines.

Course duration and Suggested Cognitive level Attainment as per Revised Bloom's Texonomy

(offering by Faculty and Subject Treatment)

- Duration of Theory course: Minimum 45 hours
- Duration of Tutorial course: Minimum 15 hours
- Duration of Practical/Activity course: Minimum 30 hours
  Duration of Integrated Theory/Practice (ITP) OR Field Work (FW) of minimum 30 hours
  Duration of Collaborative Learning (CL)/ Peer Learning (PL) of minimum 30 Hours
- Professional Core courses: S.E can attain up to Level 4-5 as per the subject treatment by faculty. Engineering Science courses at F.E. can reach up to Level 3-4
- Major B. E projects and Professional Electives can attain up to Level 6.
- Projects at S.E and T. E can attain up to Level 4
- All levels like L1, L2, L3..... Should be mentioned in the syllabus
- For Attainment Measurement(Examination Audit) only HIGHEST level should be considered



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

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Scheme and Syllabus for Autonomy

S.E (Sem- IV)

(As per TCET Autonomy Scheme-2019)

S.E. Semester –III (Computer Engineering)
Choice Based Credit Grading Scheme with Holistic Student Development(CBCGS- H 2019)
Approved by Board of Studies and Academic Council Under TCET Autonomy Scheme (w. e. f. A.Y. 2019-20)
(Meeting held on 10th and 20th July 2019 respectively)

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)	Term Work (25)	Total
			Theory	Tutorial	Practical	Contact Hours		IA(25)	ESE(75)	PR/OR	TW	
1	PCC- CS301	Mathematics III(Applied)	3	1	-	4	4	25	75	-	25	125
2	PCC- CS302	Data Structures	3	-	2	5	4	25	75	25	25	150
3	PCC- CS303	Database Management System	3	1	2	6	5	25	75	25	25	150
4	ESC301	Digital Logic Design and Analysis	3	-	2	5	4	25	75	-	25	125
5	ESC302	Computer Organization and Architecture	3	-	2	5	4	25	75	25	25	150
6	SI301	Seminar / Workshop * Professinal Training #	-	-	2*	2*	1	-	-	-	25	25
		Total	**15**	**2**	**8+2*=10**	**25+2*=27**	**22**			**Total marks**		**725**
Course Description			**Non Credited Mandatory Course**									
1	MC301	Environmental studies@	1	-	-	1	(Non Credit)	Passing is mandatory for this course		25		

Course Description			Teaching scheme (Holistic Student Development - HSD)					Assessment/Evaluation Scheme		
								Presentation	Report	Term Work (50)
								AC	AC	
1	HSD-CSPS301	Professional Skills- III(Object oriented Programming using Java)	1	-	2	3	2	25	25	50
2	HSD-CSPBL301	Project Based Learning - I	-	-	2	2	1	25	25	50
3	HSD-CSABL301	Activity Based Learning-III(Co-curricular/ Extra-curricular/Extension)	-	-	2	2	1	25	25	50
		Total	**2**	**-**	**6**	**7+1=8**	**4**		**Total marks**	**150**
		Total	**18**	**2**	**16**	**33+2*=35**	**26**		**Grand Total marks:**	**875**

1. * 30 contact hours for Seminar/Workshop and other activities shall be conducted during 10th week throughCollaborative learning (CL) and Peer learning (PL)
2. # Professional Training shall be offered at the end of semester between 21st and 25th week during **ODD** semester
3. @There will be no direct contact hrs of Environmental Studies for 2018-22 batch
4. IA- In-Semester Assessment, ESE- End Semester Examination, PR- Practical Examination, TW – Term Work Examination, OR- Oral Examination, AC- Activity

Dr. Sheetal Rathi	Dr. R.R. Sedamkar	Dr. Deven Shah	Dr. B.K. Mishra
HOD-COMP/Chairman BOS	Dean-Academic	Vice-Principal	Principal

S.E. Semester –IV (Computer Engineering)
Choice Based Credit Grading Scheme with Holistic Student Development(CBCGS- H 2019)
Approved by Board of Studies and Academic Council Under TCET Autonomy Scheme (w. e. f. A.Y. 2019-20)
(Meeting held on 10th and 20th July 2019 respectively)

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)	Term Work (25)	Total
			Theory	Tutorial	Practical	Contact Hours		IA(25)	ESE(75)	PR/OR	TW	
1	BSC401	Mathematics IV	3	1	-	4	4	25	75	-	25	125
2	PCC- CS401	Design and Analysis of Algorithms	3	1	2	6	5	25	75	25	25	150
3	PCC- CS402	Operating System	3		2	5	4	25	75	-	25	125
4	PCC-CS403	Computer Networks	3	-	2	5	4	25	75	25	25	150
5	PCC-CS404	Computer Graphics	3	-	2	5	4	25	75	25	25	150
6	SI401	Internship#/Seminar/ Workshop*	-	-	2	2	1	-	-	-	25	25
		Total	**15**	**2**	**8+2***	**25+2*= 27**	**22**			**Total marks**		**725**
Course Description			**Non Credited Mandatory Course**									
1	MC401	Value education	1	-	-	1	(Non-Credit)	Passing is mandatory for this course		25		

Course Description			Teaching scheme (Holistic Student Development - HSD)					Assessment/Evaluation Scheme		
								Presentation	Report	Term Work (50)
								AC	AC	
1	HSD-CSPS401	Professional Skills- IV (Introduction to Python)	1	-	2	3	2	25	25	50
2	HSD-CSPBL401	Project Based Learning - II	-	-	2	2	1	25	25	50
3	HSD-CSABL401	Activity Based Learning-IV(Co-curricular/ Extra-curricular/Extension)	-	-	2	2	1	25	25	50
		Total	**1**	**-**	**6**	**7+1=8**	**4**		**Total marks**	**150**
		Total	**17**	**2**	**16**	**33+2*= 35**	**26**		**Grand Total marks:**	**875**

1. *30 contact hours for Seminar/Workshop and other activities shall be conducted during 7th week throughCollaborative learning (CL) and Peer learning (PL)
2. # Internship shall be offered at the end of semester between 21st and 25th week **EVEN** semester
3. IA- In-Semester Assessment, ESE- End Semester Examination, PR- Practical Examination, TW – Term Work Examination, OR- Oral Examination, AC- Activity

Dr. Sheetal Rathi	Dr. R.R. Sedamkar	Dr. Deven Shah	Dr. B.K. Mishra
HOD-COMP/Chairman BOS	Dean-Academic	Vice-Principal	Principal

T.E. Semester –V (Computer Engineering)
Choice Based Credit Grading Scheme with Holistic Student Development(CBCGS- H 2019)
Approved by Board of Studies and Academic Council Under TCET Autonomy Scheme (w. e. f. A.Y. 2019-20)
(Meeting held on 10th and 20th July 2019 respectively)

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)	Term Work (25)	Total
			Theory	Tutorial	Practical	Contact Hours		IA(25)	ESE(75)	PR/OR	TW	
1	PCC-CS501	Theory of Computer Science	3	1	-	4	4	25	75	-	25	125
2	PCC-CS502	Introduction to Intelligent System	3	1	2	6	5	25	75	25	25	150
3	PCC-CS503	Software Engineering	3	-	2	5	4	25	75	-	25	125
4	ESC501	Microprocessor	3	-	2	5	4	25	75	25	25	150
5	PEC-CS501X	Professional Elective 1	3	-	2@	5	4	25	75	-	25	125
6	SI501	Seminar / Workshop*/Professional Training#	-	-	2	2	1	-	-	25	25	50
		Total	**15**	**2**	**8+2*=10**	**27**	**22**			**Total marks**		**725**
Course Description			**Non Credited Mandatory Course**									
1	MC501	Indian constitution	1	-	-	1	(Non-Credit)	Passing is mandatory for this course			25	

Course Description			Teaching scheme (Holistic Student Development - HSD)					Assessment/Evaluation Scheme		
								Presentation	Report	Term Work (50)
								AC	AC	
1	HSD-CSPS501	Professional Skill V(Industry / Research /Entrepreneurship)	1	-	2	3	2	25	25	50
2	HSD-CSPBL501	Project Based Learning - III	-	-	2	2	1	25	25	50
3	HSD-CSRBL501	Research Based Learning-I/Online/MOOCS	-	-	2	2	1	25	25	50
		Total	**1**	**-**	**6**	**7+1**	**4**		**Total marks**	**150**
		Total	**17**	**2**	**14+2*=16**	**33+2*= 35**	**26**		**Grand Total marks:**	**875**

PROFESSIONAL ELECTIVE I		
Course Code	**Course name**	**Domain**
PEC-CS5011	Advanced Operating System	1
PEC-CS5012	Internet Programming	2
PEC-CS5013	Advance Database management system	3
PEC-CS5014	Multimedia Systems	4
PEC-CS5015	Natural Language Processing	5

1. # Professional Training shall be offered at the end of semester between 21st and 25th week **ODD** semester
2. *30 contact hours for Seminar/Workshop and other activities shall be conducted during 10th week through Collaborative learning (CL) and Peer learning (PL)
3. @ Professional Elective Practicals will be conducted in form of mini projects.
4. IA- In-Semester Assessment, ESE- End Semester Examination, PR- Practical Examination, TW – Term Work Examination, OR- Oral Examination, AC- Activity

Dr. Sheetal Rathi	Dr. R.R. Sedamkar	Dr. Deven Shah	Dr. B.K. Mishra
HOD-COMP/Chairman BOS	Dean-Academic	Vice-Principal	Principal

T.E. Semester –VI (Computer Engineering)
Choice Based Credit Grading Scheme with Holistic Student Development(CBCGS- H 2019)
Approved by Board of Studies and Academic Council Under TCET Autonomy Scheme (w. e. f. A.Y. 2019-20)
(Meeting held on 10th and 20th July 2019 respectively)

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)	Term Work (25)	Total
			Theory	Tutorial	Practical	Contact Hours		IA(25)	ESE(75)	PR/OR	TW	
1	HSMC401	Soft skills and Interpersonal Communication	2	1		3	3	-	-	-	25	25
2	PCC-CS601	Cryptography and System Security	3	-	2	5	4	25	75	25	25	150
3	PCC-CS602	System Programming & Compiler Construction	3	-	2	5	4	25	75	25	25	150
4	PEC-CS601X	Professional Elective II	3	-	-	3	3	25	75	-	25	125
5	PEC-CS602X	Professional Elective III	3	-	-	3	3	25	75	-	25	125
6	OEC601X	Open Elective 1	3	-	-	3	3	25	75	-	25	125
8	SI601	Internship# / Seminar / Workshop*		-	2*	2	1	-	-	-	25	25
		Total	**17**	**1**	**4+2*=6**	**22+2*=24**	**21**	-	-	**Total marks**		**725**
Course Description			**Non Credited Mandatory Course**									
1	MC601	Essence of Indian Knowledge Tradition	1	-	-	1	(Non-Credit)	Passing is mandatory for this course			25	
Course Description			**Teaching scheme (Holistic Student Development - HSD)**					**Assessment/Evaluation Scheme**				
								Presentation		**Report**		**Term Work (50)**
								AC		**AC**		
1	HSD-CSPS601	Professional Skill VI(Industry / Research /Entrepreneurship	1	-	2	3	2	25		25		50
2	HSD-CSPBL601	Project based Learning-IV	-	-	2	2	1	25		25		50
3	HSD-CSRBL601	Research Based Learning-II/Online/MOOCS	-	-	2	2	1	25		25		50
		Total	**1**	**-**	**6**	**7+1**	**4**			**Total marks**		150
		Total	**19**	**-**	**10+2***	**30+2*=32**	**25**			**Grand Total marks:**		**875**

PROFESSIONAL ELECTIVE II			PROFESSIONAL ELECTIVE III			OPEN ELECTIVE I	
Course Code	**Course name**	**Domain**	**Course Code**	**Course name**	**Domain**	**Course Code**	**Course name**
PEC-CS6011	Advanced Algorithm	1	PEC-CS6021	Parallel Computing	1	OEC6011	Digital Marketing
PEC-CS6012	Mobile Computing	2	PEC-CS6022	Cloud Computing	2	OEC6012	Entrepreneurship development and management
PEC-CS6013	Enterprise Resource Planning	3	PEC-CS6023	Data warehousing and Mining	3	OEC6013	Software Process Automation
PEC-CS6014	Digital Signal Processing	4	PEC-CS6024	Image Processing	4		
PEC-CS6015	Soft Computing	5	PEC-CS6025	Machine Learning	5		

1. *30 contact hours for Seminar/Workshop and other activities shall be conducted during 7th week through Collaborative learning (CL) and Peer learning (PL)
2. # Internship shall be offered at the end of semester between 21st and 25th week **EVEN** semester
3. IA- In-Semester Assessment, ESE- End Semester Examination, PR- Practical Examination, TW – Term Work Examination, OR- Oral Examination, AC- Activity

Dr. Sheetal Rathi	Dr. R.R. Sedamkar	Dr. Deven Shah	Dr. B.K. Mishra
HOD-COMP/Chairman BOS	Dean-Academic	Vice-Principal	Principal

B.E. Semester –VII (Computer Engineering)
Choice Based Credit Grading Scheme with Holistic Student Development(CBCGS- H 2019)
Approved by Board of Studies and Academic Council Under TCET Autonomy Scheme (w. e. f. A.Y. 2019-20)
(Meeting held on 10th and 20th July 2019 respectively)

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)	Term Work (25)	Total
			Theory	Tutorial	Practical	Contact Hours		IA(25)	ESE(75)	PR/OR	TW	
1	HSMC701	Finance Management	3	-	-	3	3	-	-	25	25	50
2	PEC-CS701X	Professional Elective IV	3	-	-	3	3	25	75	-	25	125
3	PEC-CS702X	Professional Elective V	3	-	-	3	3	25	75	-	25	125
4	OEC701X	Open Elective II	3	-	-	3	3	25	75	-	25	125
5	SI701	Project I/ Internship* / Seminar / Workshop#	-	-	12	12	6	-	-	50	50	100
		Total	**12**	**-**	**12**	**24**	**18**				**Total marks**	**525**

Course Description			Teaching scheme (Holistic Student Development - HSD)					Assessment/Evaluation Scheme		
								Presentation	Report	Term Work (50)
								AC	AC	
1	HSD-CSPS701	Professional Skill VII (Industry / Research /Entrepreneurship)	-	-	2	2	1	25	25	50
2	HSD-CSRBL701	Research Based Learning-III/Online/MOOCS	-	-	2	2	1	25	25	50
		Total	**-**	**-**	4	4	2		**Total marks**	**100**
		Total	**12**	**-**	**16**	**28**	**20**		**Grand Total marks:**	**625**

PROFESSIONAL ELECTIVE IV			PROFESSIONAL ELECTIVE V			OPEN ELECTIVE II	
Course Code	**Course name**	**Domain**	**Course Code**	**Course name**	**Domain**	**Course Code**	**Course name**
PEC-CS7011	Graph Theory	1	PEC-CS7021	IoT	1	OEC7011	Operations Research
PEC-CS7012	Wireless Networks	2	PEC-CS7022	Adhoc Sensor Networks	2	OEC7012	Cyber Laws and Ethics
PEC-CS7013	Data Analytics	3	PEC-CS7023	Information Retrieval	3	OEC7013	Product finance Management
PEC-CS7014	Augmented & Virtual Reality	4	PEC-CS7024	Human Machine Interface	4	OEC7014	Innovation, creativity and business modelling
PEC-CS7015	Robotics	5	PEC-CS7025	Deep Learning	5		

1. #30 contact hours for Seminar/Workshop and other activities shall be conducted during 10th week throughCollaborative learning (CL) and Peer learning (PL)
2. * Summer Internship of 2 to 4 weeks duration shall be offered at the end of **ODD** semester.
3. IA- In-Semester Assessment, ESE- End Semester Examination, PR- Practical Examination, TW – Term Work Examination, OR- Oral Examination, AC- Activity
4. Note: Compenstaion for minimum contact hours is already done in the previous semesters.

Dr. Sheetal Rathi	Dr. R.R. Sedamkar	Dr. Deven Shah	Dr. B.K. Mishra
HOD-COMP/Chairman BOS	Dean-Academic	Vice-Principal	Principal

B.E. Semester –VIII (Computer Engineering)
Choice Based Credit Grading Scheme with Holistic Student Development(CBCGS- H 2019)
Approved by Board of Studies and Academic Council Under TCET Autonomy Scheme (w. e. f. A.Y. 2019-20)
(Meeting held on 10th and 20th July 2019 respectively)

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)	Term Work (25)	Total
			Theory	Tutorial	Practical	Contact Hours		IA(25)	ESE(75)	PR	TW	
1	HSMC801	Professional Ethics and CSR	3	-	-	3	3	-	-	25	25	50
2	PEC-CS801X	Professional Elective VI	3	-	-	3	3	25	75	-	25	125
3	OEC801X	Open Elective III	3	-	-	3	3	25	75	-	25	125
4	OEC802X	Open Elective IV	3	-	-	3	3	25	75	-	25	125
5	SI801	Project II/ Internship */ Seminar / Workshop#	-	-	12	12	6	-	-	100	50	150
		Total	**12**	**-**	**12**	**24**	**18**	-	-	**Total marks**		**575**

Course Description			Teaching scheme (Holistic Student Development - HSD)				Assessment/Evaluation Scheme		
							Presentation	Report	Term Work (50)
							AC	AC	
1	HSD-CSPS801	Professional Skill VIII(Industry / Research/Case Study/Entrepreneurship)	-	-	2	2	1	25	25	50
2	HSD-CSRBL801	Research Based Learning-IV/Online/MOOCS	-	-	2	2	1	25	25	50
		Total	**-**	**-**	4	4	2		**Total marks**	**100**
		Total	**12**	**-**	**16**	**28**	**20**		**Grand Total marks:**	**675**

PROFESSIONAL ELECTIVE VI			OPEN ELECTIVE III		OPEN ELECTIVE IV	
Course Code	**Course name**	**Domain**	**Course Code**	**Course name**	**Course Code**	**Course name**
PEC-CS8011	Distributed Computing	1	OEC8011	Research Methodology	OEC8021	Foreign Language
PEC-CS8012	Blockchain	2	OEC8012	Product Development and Patenting	OEC8021	Management Information System
PEC-CS8013	Data Science	3	OEC8013	Design Thinking and IPR		
PEC-CS8014	Game Theory	4				
PEC-CS8015	User Experience Design	5				

1. #30 contact hours for Seminar/Workshop and other activities shall be conducted during 7th week throughCollaborative learning (CL) and Peer learning (PL)
2. * Internship shall be offered at the end of semester between 21st and 25th week **EVEN** semester
3. IA- In-Semester Assessment, ESE- End Semester Examination, PR- Practical Examination, TW – Term Work Examination, OR- Oral Examination, AC- Activity

Dr. Sheetal Rathi	Dr. R.R. Sedamkar	Dr. Deven Shah	Dr. B.K. Mishra
HOD-COMP/Chairman BOS	Dean-Academic	Vice-Principal	Principal

S.E. Semester –III

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

B.E. (Computer Engineering)							**S.E. SEM: III**		
Course Name: Mathematics III (Applied)							**Course Code:**PCC-CS301		
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	1	-	4	4	25	75	-	25	**125**
IA: In-Semester Assessment - Paper Duration – 1.5Hours **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: The objective of the course is to understand the notion of mathematical thinking, proof and logic to solve the problems and apply the knowledge of sets, relations, functions, graphs, lattices and coding theory in programming 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 the notion of mathematical thinking, mathematical proofs for problem solving.	L1, L2, L3
2	Make use of logic and reasoning for problem solving.	L1, L2, L3
3	Apply arithmetic modulo to design security problems.	L1, L2, L3
4	Make use offunctions and graphs in programming applications.	L1, L2, L3
5	Make use of basic mathematical objects such as functions and relations.	L1, L2, L3
6	Apply discrete structures into other computing problems	L1, L2, 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, Fundamental Product, Partitions of sets.The Principle of Inclusion and Exclusion,Pigeonhole Principle, Mathematical Induction.	6	L1, L2, L3
2	**Logic** Propositions and logical operations, Truth tables Equivalence, Implications, Laws of logic, Normal Forms, Predicates and Quantifiers	6	L1, L2, L3
3	**Modular Arithmetic** Modulo, Congruence, Primes and the Sieve of Eratosthenes, Testing for primes, Prime Number Theorem, Euler's theorem, Fermat's little theorems, Chinese remainder theorem.	6	L1, L2, L3
4	**Graph Theory** Definitions of graphs, digraphs, Multigraphs, Paths and cycles(Hamiltonian and Eulerian), Subgraphs, Isomorphism, Special kinds of graphs: trees, bipartite graphs, planer graphs.	8	L1, L2, L3
5	**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. Hasse diagram and Lattice. Function: Definition and types of function, composition of functions.Recursive and recursively defined functions.Generating Functions.	10	L1, L2, L3
6	**Algebraic Structures** Algebraic structures with one binary operation: Semigroup, Monoid and Group, Abeliangroup,Cyclic groups, Normal subgroups. Homomorphism, Isomorphism and Automorphism. Coding theory: Coding of binary information and error detection, Decoding and error correction	9	L1, L2, L3
	TotalHours	**45**	

Books and References:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Elements of Discrete Mathematics	C. L. Liu and D. P. Mohapatra	McGraw Hill	SecondEdition	2010
2	Discrete Mathematical Structures with Applications to Computer Science	J. P. Trembley, R. Manohar	McGraw Hill	Fifth Edition	2011
3	Discrete Mathematics	Seymour Lipschutz, Marc Lars Lipson,"	McGraw Hill	Fifth Edition	2010

Online References:

Sr. No.	Website Name	URL	Modules Covered
1	nptel.ac.in	https://nptel.ac.in/courses/111106086/2	M1- M5
2	www.geeksforgeeks.org	https://www.geeksforgeeks.org/groups-discrete-mathematics/	M6
3	www.tutorialspoint.com	https://www.tutorialspoint.com/graph_theory/	M4

List of Tutorials:

Sr. No.	Topic	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	Tutorial on Introduction to Set Theory andProofing Techniques (I)	1	L1, L2
2	Tutorial on Introduction to Set Theory andProofing Techniques (II)	1	L1, L2, L3
3	Tutorial on Logic	1	L1, L2, L3
4	Tutorial on Modular Arithmetic (I)	1	L1, L2
5	Tutorial on Modular Arithmetic (II)	1	L1, L2, L3
6	Tutorial on Graph Theory (I)	1	L1, L2
7	Tutorial on Graph Theory (II)	1	L1, L2, L3
8	Tutorial on Relation and Functions (I)	1	L1, L2
9	Tutorial on Relation and Functions (II)	1	L1, L2, L3
10	Tutorial on Algebraic Structures (I)	1	L1, L2
11	Tutorial on Algebraic Structures (II)	1	L1, L2, L3
12	Quiz on Set Theory and Logics	1	L1, L2, L3
13	Quiz on Graph Theory	1	L1, L2, L3
14	Group discussion on Relations and function using think, pair and share technique	1	L1, L2, L3
15	Quiz on Algebraic Structures	1	L1, L2, L3
	Total Hours	**15**	

Prepared By:	**Checked By:**	**Verified By:**	**Approved By:**
Mr. Yogesh Bhalekar	Mrs. Rashmi Thakur **Program Coordinator**	Mrs. Shiwani Gupta **Dy. HOD-COMP**	Dr. Sheetal Rathi **HOD-COMP**

S.E. Semester –III

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

B.E. (Computer Engineering)							**S.E. SEM : III**		
Course Name : Data Structures							**Course Code :**PCC- CS302		
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 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 Basics, Procedural Programming Languages									

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	Compare linear and non-linear data structures.	L1, L2
2	Apply operations like insertion, deletion, searching and traversing on stack and queue data structure.	L1, L2, L3
3	Apply operations like insertion, deletion, searching and traversing on linked list data structure.	L1, L2, L3
4	Apply operations like insertion, deletion, searching and traversing on tree data structure.	L1, L2, L3
5	Apply operations like insertion, deletion, searching and traversing on graph data structure.	L1, L2, L3
6	Analyze appropriate sorting and searching technique for given problem.	L1, L2, L3, L4

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, Operations on data structures.	3	L1, L2
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.	7	L1, L2, L3
3	**Linked lists** **Linked list**: ADT of Linked lists, operations on linked list, Types of linked lists: Single linked list, Double Linked list, Implementation of linked list, stack implementation using linked list, queue implementation using linked list, Applications of linked list.	8	L1, L2, L3
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, Multiway search tree, Application of tree.	13	L1, L2, L3
5	**Graphs** **Graph:** Terminologies, Graph representation: Matrix and Adjacency list, Graph traversing techniques: BFS, DFS, Applications of graph.	6	L1, L2, L3
6	**Searching and Sorting** **Searching:**Linear search, binary search **Sorting:** Insertion sort, Merge sort, Quick sort **Hashing:** Hash functions, Hash table, Hashing technique, Collision resolution technique	8	L1, L2, L3, L4
	Total Hours	**45**	

Books and References:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Data Structures using C	ReemaThareja	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, YedidyahLangsam, Moshe J Augenstein	Pearson	Second Edition	2006
4	Data Structures with C	SeymoreLipschutz	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	6	L1, L2, L3, L4

		5. Employee Record System 6. Super market Billing System		
		TotalHours	**30**	

Prepared By:	**Checked By:**	**Verified By:**	**Approved By:**
Ms. Prachi Janrao	Mrs. Rashmi Thakur **Program Coordinator**	Mrs. Shiwani Gupta **Dy. HOD-COMP**	Dr. Sheetal Rathi **HOD-COMP**

S.E. Semester –III

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

<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 : Database Management System</td><td colspan="4">Course Code : PCC- CS303</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="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>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>1</td><td>2</td><td>6</td><td>5</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 – 1.5 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: Computer Basics</td></tr>
</table>

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's Taxonomy
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 Databases over File Processing System, 3 Level Architecture of Database System, Data Abstraction and Data Independence, Database Languages, Database Users, Database Administrator and its functions, 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 ofSpecialization**,** 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:** Fundamental Operations in Relational Algebra	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

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**	Identify any real life Database Management System. Identify Entity, Relationship and Attributes with its types for Identified Real life Example	2	L1, L2
2	**Design Experiments**	Develop an Entity-Relationship (ER) diagram for the problem definition Identified and convert it into Relational Database.	2	L1, L2, L3
3		Apply DDL Commands to Specified System	2	L1, L2, L3
4		Apply Basic DML Commands to Specified System	2	L1, L2, L3
5		Apply Constraints for the Specified system.	2	L1, L2, L3
6		Apply Set and String Operations to Specified System	2	L1, L2, L3
7		Apply Aggregate Functions and Create Views for Specified System	2	L1, L2, L3
8		Build Nested Queries on Specified System.	2	L1, L2, L3
9		Apply Referential Integrity on Specified System.	2	L1, L2, L3
10		Develop of Normalized Database for any Real World Example by applying concept of Normalization	2	L1, L2, L3
11	**Advanced Experiments**	Apply Triggers in SQL for Specified System	2	L1, L2, L3
12		Apply Joins in SQL for Specified System	2	L1, L2, L3

13	**Mini/Minor Projects/ Seminar/ Case Studies**	1. Student Management System 2. Library Management System 3. Airline Reservation System 4. Hospital Management System 5. Hotel Management System 6. Billing System	6	L1, L2, L3
		Total Hours	**30**	

List of Tutorials:

Tutorial Number	Topic	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	Solve and Build SQL Queries on DDL Commands.	1	L1, L2, L3
2	Solve and Build SQL Queries on DML Commands	1	L1, L2, L3
3	Solve and Build SQL Queries on Constraints in SQL	1	L1, L2, L3
4	Solve and Build SQL Queries on Aggregate Functions.	1	L1, L2, L3
5	Solve and Build SQL Queries on Set Functions.	1	L1, L2, L3
6	Solve and Build SQL Queries on String Operations	1	L1, L2, L3
7	Solve and Build SQL Queries on Group by and Having Clause	1	L1, L2, L3
8	Outline ER Diagram for given real life problem and convert it into relational Database.	1	L1, L2, L3
9	Solve and Build SQL Nested Queries	1	L1, L2, L3
10	Solve and Build SQL Queries on Referential Integrity	1	L1, L2, L3
11	Solve and Build SQL Queries on Joins	1	L1, L2, L3
12	Solve Build SQL Queries on Real Time Management Systems.	1	L1, L2, L3
13	Develop Database design by applying concept of Normalization to Student Management System	1	L1, L2, L3
14	Develop Database design by applying concept of Normalization to Hospital Management System	1	L1, L2, L3
15	Develop Database design by applying concept of Normalization to Airlines Reservation System	1	L1, L2, L3
	Total Hours	**15**	

Prepared By:	**Checked By:**	**Verified By:**	**Approved By:**
Mrs. Rashmi Thakur	Mrs. Rashmi Thakur **Program Coordinator**	Mrs. Shiwani Gupta **Dy. HOD-COMP**	Dr. SheetalRathi **HOD-COMP**

S.E. Semester –III

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

B.E. (Computer Engineering)							**S.E. SEM : III**		
Course Name : Digital Logic Design & Analysis							**Course Code :**ESC301		
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	**125**
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: Engineering Mathematics									

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, 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) 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, noise margin, with respect to TTL and CMOS Logic and their comparison	3	L1, L2
4	**Analysis and Design of Combinational Logic** Introduction, Half and Full Adder, Half subtractor 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
	TotalHours	**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 ofuniversal 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 Xlinx.	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		Constructionof 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
		TotalHours	**30**	

Prepared By:	**Checked By:**	**Verified By:**	**Approved By:**
Mr. ShaileshSangle	Mrs. Rashmi Thakur **Program Coordinator**	Mrs. Shiwani Gupta **Dy. HOD-COMP**	Dr. SheetalRathi **HOD-COMP**

S.E. Semester –III

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

B.E.(Computer Engineering)							**S.E. SEM : III**		
Course Name : Computer Organization & Architecture							**Course Code :**ESC302		
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	Applyvarious computer arithmetic operations.	L1, L2, L3
3	Explain the working of control unit.	L1, L2
4	Understandvarious 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, Evolution of Computers, Von Neumann model, Instruction cycle, Addressing Modes, Instruction Format, Introduction toSystem buses, Multi-bus organization.	5	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** Control Unit: Soft wired (Micro-programmed) and Hardwired control unit design methods, Address sequencing, Microprogram Sequencer, Micro operation, Micro instruction Format, Control Memory, 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. Memory Access Methods. Cache memory: concept, architecture, mapping, Cache coherency, Interleaved and Associative memory, Memory management unit, Magnetic Hard disks.	9	L1, L2
5	**I/O Organization** Input/ Output systems, Types of data transfer techniques: Programmed I/O, Interrupt driven ,Direct Memory Access and DMA controller, Types of Interrupts, Bus Arbitration, Interface circuits - Parallel and serial port. Features of PCI and PCI Express bus.	9	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 Non-restoring Division	2	L1, L2, L3
8		Develop a C/Java program for Restoring Division	2	L1, L2, L3
9		Experiment with mapping techniques of Direct Mapped Cache memory.	2	L1, L2, L3
10		Experiment with mapping techniques of Cache memory, Associative Mapped cache, Set Associative Mapped cache	2	L1, L2, L3

11		Build a program to compare the performance measures of pipelined and non-pipelined systems.	2	L1, L2, L3
12		Build a C/Java program for Interrupt Handling	2	L1, L2, L3
13	**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	6	L1, L2, L3
		TotalHours	**30**	

Prepared By:	**Checked By:**	**Verified By:**	**Approved By:**
Mr. ShaileshSangle	Mrs. Rashmi Thakur **Program Coordinator**	Mrs. Shiwani Gupta **Dy. HOD-COMP**	Dr. SheetalRathi **HOD-COMP**

S.E. Semester –III

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

B.E. (Computer Engineering)							**S.E. SEM : III**		
Course Name : Environmental Studies							**Course Code :**MC301		
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	-	-	-	-	25	
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: Biology, chemistry, geography, geology, physics.									

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	Interpretand 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**	2	L1, L2
	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	**Natural Resources, Biodiversity and its conservation**	3	L1, L2
	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	**Environmental Pollution**	3	L1, L2, L3, L4
	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.		
4	**Environmental Biotechnology**	2	L1, L2, L3
	Biotechnology for environmental protection- Biological indicators, bio-sensors; Remedial measures- Bio-remediation, photo remediation, bio-pesticides, bio-fertilizers; Bio-reactors- Design and application		
5	**Social Issues and Environment**	3	L1, L2, L3, L4
	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		
6	**Environmental Monitoring**	2	L1, L2, L3, L4
	Monitoring- Identification of environmental problem, tools for monitoring (remote sensing, GIS); Sampling strategies- Air, water, soil sampling techniques		
	TotalHours	**15**	

Books and References:

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

List of Practical/ Experiments: NA

Prepared By:	Checked By:	Verified By:	Approved By:
Mrs. Vidyadhari Singh	Mrs. Rashmi Thakur **Program Coordinator**	Mrs. Shiwani Gupta **Dy. HOD-COMP**	Dr. SheetalRathi **HOD-COMP**

S.E. Semester –III

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

B.E. (Computer Engineering)							**S.E. SEM : III**		
Course Name : Professional Skills-III(Basic Technology Skills) (Object Oriented Programming using Java)							**Course Code :**HSD-CSPS301		
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)**	**Report (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**(AC)**	**(AC)**	
1	-	2	3	2	-	-	25	25	**50**
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 Basics, Procedural Programming Languages									

Course Objective: The course intends to deliverthe 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 withconcept of inheritance and interfaces.	L1, L2, L3
4	Experiment withconcept of exception handling.	L1, L2, L3
5	Experiment withnotion 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
	TotalHours	**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 withconstructor and constructor overloading	2	L1, L2, L3
5		Experiment with String and StringBuffer	2	L1, L2, L3
6		Experiment withsingle and multilevel inheritance (Use super keyword).	2	L1, L2, L3
7		Experiment withdemonstration of try, catch, throw, throws and finally	2	L1, L2, L3
8		Experiment withcreating user defined package	2	L1, L2, L3
9		Experiment with implementing multithreading using Thread class and Runnable interface	2	L1, L2, L3
10		Experiment withApplet to demonstrate Graphics, Font and Color class	2	L1, L2, L3
11		Experiment withcreation 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	6	L1, L2, L3

		2. Hotel Reservation System 3. Airline Reservation System 4. Hospital Management System 5. Online chat application 6. E-commerce website		
		TotalHours	**30**	

Prepared By:	**Checked By:**	**Verified By:**	**Approved By:**
Mrs. Veena Kulkarni	Mrs. Rashmi Thakur **Program Coordinator**	Mrs. Shiwani Gupta **Dy. HOD COMP**	Dr. SheetalRathi **HOD COMP**

S.E. Semester –III

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

B.E. (Computer Engineering)						**S.E. SEM : III**	
Course Name : Project Based Learning – I						**Course Code :**HSD-CSABL301	
Teaching scheme (Holistic Student Development - HSD) Industry Specific/Interdisciplinary					**Examination Scheme (Formative/ Summative)**		
Modes of Teaching / Learning / Weightage					**Assessment/Evaluation Scheme**		
Hours Per Week					**Presentation (25)**	**Report (25)**	**Term Work**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**(AC)**	**(AC)**	
-	-	2	2	1	25	25	**50**
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							

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 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

Prepared By:	Checked By:	Verified By:	Approved By:
Dr. AnandKhandare	Mrs. Rashmi Thakur **Program Coordinator**	Mrs. Shiwani Gupta **Dy. HOD COMP**	Dr. SheetalRathi **HOD COMP**

S.E. Semester –III

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

<table>
<tr><td colspan="7">B.E.(ALL BRANCHES)</td><td colspan="4">S.E. SEM : III</td></tr>
<tr><td colspan="7">Course Name :Activity Based Learning-III</td><td colspan="4">Course Code: HSD-CSABL301</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 (25)</td><td>Presentation (25)</td><td>Report (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>(AC)</td><td>(AC)</td><td rowspan="2">50</td></tr>
<tr><td>-</td><td>-</td><td>2</td><td>2</td><td>1</td><td>-</td><td>-</td><td>25</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:Basics of Computer Programming, General knowledge, Social awareness</td></tr>
</table>

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**	6	L1, L2, L3

	Data collection and Analysis: survey's needs to be developed and conducted, data analysis and results interpretation **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
	TotalHours	**30**	

Books and References:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Competitive Debate	Richard Earl	Alpha	-	2008
2	Times Quiz bookby Times Mind Games	OLovBjortomt	Times Books	-	2016
3	Cracking the codingInterview	GayleLaakmann	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

Prepared By:	**Checked By:**	**Verified By:**	**Approved By:**
Dr. RajaniBahuguna	Mrs. Rashmi Thakur **Program Coordinator**	Mrs. Shiwani Gupta **Dy. HOD-COMP**	Dr. SheetalRathi **HOD-COMP**

S.E. Semester –IV

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

B.E. (Computer Engineering)							**S.E. SEM: IV**		
Course Name: Mathematics IV							**Course Code:** BSC401		
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	1	-	4	4	25	75	-	25	**125**
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: 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 theconcept of probability random variables, mathematical expectations and variance.	L1, L2, L3
2	Differentiate the discrete and continuous random variables.	L2, L3
3	Evaluate the Maximization and minimization of two and three variables.	L2, L3
4	Apply the concept of Correlation and Regression to the engineering problems.	L1, L2
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.	L2, 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	L2, 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.	6	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
5	**Transform Calculus -I** Laplace Transform, Properties of Laplace Transform, Laplace transform of periodic functions, Finding inverse Laplace transform by different methods	10	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	L2, 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	Higher Engineering Mathematics	B.S. Grewal	Khanna Publishers	Thirty Sixth 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 Basic Probability (I)	1	L1, L2
2	Tutorial on Basic Probability (II)	1	L1, L2, L3
3	Tutorial on Basic Statistics (I)	1	L1, L2
4	Tutorial on Basic Statistics (II)	1	L1, L2, L3
5	Tutorial on Linear Programming problems (I)	1	L1, L2
6	Tutorial on Linear Programming problems(II)	1	L1, L2, L3
7	Tutorial on Applied Statistics(I)	1	L1, L2
8	Tutorial on Applied Statistics (II)	1	L1, L2, L3
9	Tutorial on Transform Calculus –I (I)	1	L1, L2
10	Tutorial on Transform Calculus –I (II)	1	L1, L2, L3
11	Tutorial on Transform Calculus -II (I)	1	L1, L2

12	Tutorial on Transform Calculus –II (II)	1	L1, L2, L3
13	Quiz on Basic Probability and Statistics	1	L1, L2, L3
14	Quiz on Linear Programming problems and Applied Statistics	1	L1, L2, L3
15	Quiz on Discussion on Transform Calculus	1	L1, L2, L3
	Total Hours	**15**	

Prepared By:	**Checked By:**	**Verified By:**	**Approved By:**
Mr. YogeshBhalekar	Mrs. Rashmi Thakur **Program Coordinator**	Mrs. Shiwani Gupta **Dy. HOD-COMP**	Dr. SheetalRathi **HOD-COMP**

S.E. Semester –IV

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

B.E. (Computer Engineering)							**S.E. SEM : IV**		
Course Name : Design and Analysis of Algorithm							**Course Code :**PCC- CS401		
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	1	2	6	5	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 Basics, Procedural Programming Languages									

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, SartajSahni, S. Rajsekaran	University Press	Second Edition	--
3	Algorithms	SanjoyDasgupta, Christos Papadimitriou, UmeshVazirani	Tata McGraw-Hill Edition.	--	--

4	Design Methods and Analysis of Algorithm	S. K. Basu	PHI.	--	--
5	Algorithm Design	John Kleinberg, Eva Tardos	Pearson	--	--

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 Binary Search.	2	L1, L2, L3
3		Develop a code forDijkstra's algorithm using Greedy method and analyze it.	2	L1, L2, L3
4	**Design Experiments**	Develop a code Minimum spanning tree, Kruskal's algorithm using Greedy method and analyze it.	2	L1, L2, L3
5		Develop a code forall pair shortest path problem using dynamic programming and analyze it.	2	L1, L2, L3
6		Develop a code forLongest common subsequence using dynamic programming and analyze it.	2	L1, L2, L3
7		Develop a code for 8 queen's problem using backtracking approach and analyze it.	2	L1, L2, L3
8		Develop a code for 15 puzzle problem and analyze it.	2	L1, L2, L3
9		Develop a code for naïve string matching Algorithm	2	L1, L2, L3
10		Develop a code for Rabin Karp algorithm	2	L1, L2, L3
11		Develop a code for The knuth-Morris-Pratt algorithm	2	L1, L2, L3

12		Develop a code to construct the Tennis Tournament using Divide and Conquer technique and analyze it.	2	L1, L2, L3
13	**Mini/Minor Projects/ Seminar/ Case Studies**	**Case study:** 1. Various string matching algorithms and their time and space complexities. **2.** 15 puzzle problem solving using Dijsktra's algorithm. **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
	TotalHours		**30**	

List of Tutorials:

Sr. No	Topic	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	Problem solving session on substitution method	1	L1, L2, L3
2	Problem solving session on recursion tree method	1	L1, L2, L3
3	Problem solving session on master's theorem	1	L1, L2, L3
4	Problem solving session on Divide and Conquer strategy	1	L1, L2, L3
5	Problem solving session on Greedy method	1	L1, L2, L3
6	Problem solving session on Dynamic programming (TSP)	1	L1, L2, L3
7	Problem solving session on Dynamic programming (LCS)	1	L1, L2, L3
8	Problem solving session on Backtracking	1	L1, L2, L3
9	Problem solving session on Branch and Bound	1	L1, L2, L3
10	Problem solving session on Rabin Karp algorithm	1	L1, L2, L3
11	Problem solving session on String matching with finite automata	1	L1, L2, L3
12	Problem solving session on Knuth Morris Pratalgoithm	1	L1, L2, L3
13	Doubt Solving session on module 1-2	1	L1, L2, L3
14	Doubt Solving session on module 3-4	1	L1, L2, L3
15	Doubt Solving session on module 5-6	1	L1, L2, L3
	Total Hours	**15**	

Prepared By:	**Checked By:**	**Verified By:**	**Approved By:**
Ms. PrachiJanrao	Mrs. Rashmi Thakur **Program Coordinator**	Mrs. Shiwani Gupta **Dy. HOD-COMP**	Dr. SheetalRathi **HOD-COMP**

S.E. Semester –IV

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

B.E. (Computer Engineering)							**S.E. SEM : IV**		
Course Name : Operating System							**Course Code :**PCC- CS402		
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	**125**
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 Organization and Architecture, Fundamentals of Data Structures									

Course Objective: 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.

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 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, Interprocess 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.	8	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.	9	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 Simple Shell Scripts	2	L1, L2, L3
3		Write a program to implement any two CPU scheduling algorithms like FCFS, SJF, Round Robin etc.	2	L1, L2, L3
4	Design Experiments	Write a program to implement Dinning Philosopher Problem.	2	L1, L2, L3
5		Write a program to implement Banker's algorithm.	2	L1, L2, L3
6		Build a program to implement FIFOand LRU page replacement policies.	2	L1, L2, L3
7		Build a program to implement SRTF and Priority page replacement policies.	2	L1, L2, L3
8		Develop a program to implement dynamic partitioning placement algorithms i.e Best Fit, FirstFit, Worst-Fit etc	2	L1, L2, L3

9		Build a program to implement FCFS disk scheduling algorithm	2	L1, L2, L3
10		Build a program to implement SSTF disk scheduling algorithm	2	L1, L2, L3
11		Demonstrate SHELL programming in LINUX	2	L1, L2
12		Make use of CPU-OS simulator to analyze and synthesize the following: a. Process Scheduling algorithms. b. Thread creation and synchronization. c. Deadlock prevention and avoidance	2	L1, L2, L3
13	**Mini/Minor Projects/ Seminar/ Case Studies**	**Case Study** 1. Windows Operating System. 2. LINUX Operating System. 3. Multiprocessor Scheduling and Linux Scheduling. **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. **7.** Build an online compiler (with interface for inserting the code to be compiled).	6	L1, L2, L3
	Total Hours		**30**	

Prepared By:	**Checked By:**	**Verified By:**	**Approved By:**
Dr. AnandKhandare	Mrs. Rashmi Thakur **Program Coordinator**	Mrs. Shiwani Gupta **Dy. HOD-COMP**	Dr. SheetalRathi **HOD-COMP**

S.E. Semester –IV

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

<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 : Computer Networks</td><td colspan="4">Course Code :PCC-CS403</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">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 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: Probability, C or Java Programming, Basic algorithms</td></tr>
</table>

Course Objective: The course intends to deliver the fundamental knowledge of the various aspects of computer networking and apply the knowledge of computer networks for analyzing various algorithms spread over various levels.

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 concepts and fundamentals of computer networks and reference models.	L1, L2
2	Demonstrate various transmission media, multiplexing techniques and switching techniques	L1, L2
3	List the functionalities of Data link layer with various design issues and explain framing techniques.	L1, L2, L3, L4
4	Distinguish between the routing protocols of Network layer and solve subnetting and super netting problems.	L1, L2, L3, L4
5	Illustrate the application layer protocols and differentiate between TCP and UDP protocols.	L1, L2
6	Explain the basic concepts of data communication.	L1, L2

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1.0	**Introduction to Computer Networks** Definition of a Computer Network; Components of a computer network: Use of Computer networks; 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:** The OSI Reference Model, The TCP/IP Reference Model, Comparison of the OSI & the TCP/IP Reference Models	5	L1, L2
2.0	**Physical Layer** **Introduction:** Switching Techniques; Comparison of switching techniques: Multiplexing; FDM – Frequency division multiplexing, WDM – Wavelength division multiplexing, TDM – Time division multiplexing. **Transmission Medium:** Guided & Unguided Transmission medium, Twisted pair, Coaxial cable, Optical fiber, Wireless transmission; Electromagnetic spectrum, Radio transmission, Microwave transmission	4	L1, L2
3.0	**Data Link Layer** DLL Design Issues (Services, Framing, Error Control, Flow Control), Error Detection and Correction (Hamming Code, CRC, Checksum), Elementary Data Link protocols, Stop and Wait, Sliding Window(Go Back N, Selective Repeat), HDLC, Medium Access Control sub layer: Channel Allocation problem, Multiple access Protocol (Aloha, Carrier Sense Multiple Access (CSMA/CD), Local Area Networks -Ethernet (802.3)	9	L1, L2, L3,L4
4.0	**Network Layer** Introduction: Design issues of Network layer; Routing, Congestion control, Internetworking: Principles of Routing; Types of routing algorithms, Optimality principle, Routing algorithms; Shortest path algorithm, Flooding, Distance vector routing, Hierarchical routing, Link state routing, Comparison of routing algorithms: Protocols-ARP,RARP, ICMP, IGMP, Congestion; Factors of congestion, Comparison of flow control and congestion control, General principles of congestion control, Congestion control algorithms: Open loop congestion control, Closed loop congestion control, QoS parameters, Token & Leaky bucket algorithms	12	L1, L2, L3,L4
5.0	**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
6.0	**Data Communications** Introduction: Theoretical basis for communication; Fourier analysis, Band limited signals, Maximum data rate of a channel: Transmission impairments; Attenuation distortion, Delay distortion, Dispersion, Noise: Data transmission modes; Serial & Parallel, Simplex, Half duplex & full duplex, Synchronous & Asynchronous transmission	6	L1, L2
	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	https://www.javatpoint.com/	https://www.javatpoint.com/computer-network-tutorial	M1-M6
2	www.geeksfrgeeks.org	https://www.geeksforgeeks.org/computer-network-tutorials/	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.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Basic Experiments**	Use basic networking commands in Linux (ping, tracert, nslookup, netstat, ARP, RARP, ip, ifconfig, dig, Route)	2	L1, L2
2		To study TCP/ IP layer's operations using Wireshark	2	L1, L2
3	**Design Experiments**	Setup a network and configure IP addressing, subnetting, masking.	2	L1, L2, L3
4		Build a simple network topology and configure it for static routing protocol using packet tracer.	2	L1, L2, L3
5		Perform File Transfer and Access using FTP	2	L1, L2, L3
6		Demonstrate Socket programming using TCP or UDP	2	L1, L2, L3
7		Use simulator (E.g. NS2) to understand functioning of ALOHA, CSMA/CD.	2	L1, L2, L3

8		Analyze Stop and wait protocol/ sliding window (selective repeat / Go back N) in NS2	2	L1, L2, L3, L4
9		Implement CRC/ Hamming code for error detection and correction	2	L1, L2, L3
10		Simulate congestion control (leaky bucket / token bucket) in NS2.	2	L1, L2, L3
11	**Case Studies**	1. Network discovery tools 2. Remote Login using Telnet	4	L1, L2, L3
12	**Mini/Minor Projects/ Seminar**	1. Network Desktop Manager (Java) 2. Cloud Network in packet tracer 3. IoT network in Cisco Packet Tracer 4. MAC Protocols in NS2 5. A Network Based Multi-Player Eater Game 6. Analysis of RTP Packet Delay and Loss	6	L1, L2, L3
	Total Hours		**30**	

Prepared By:	**Checked By:**	**Verified By:**	**Approved By:**
Dr. R RSedamkar	Mrs. Rashmi Thakur **Program Coordinator**	Mrs. Shiwani Gupta **Dy. HOD-COMP**	Dr. SheetalRathi **HOD-COMP**

S.E. Semester –IV

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

B.E. (Computer Engineering)							**S.E. SEM : IV**		
Course Name : Computer Graphics							**Course Code :**PCC-CS404		
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: Knowledge of C Programming, Basic Data Structures and Mathematics									

Course Objective: The course intends to give the student a understating of drawingbasic 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 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, Animation Multimedia applications, Simulation, Raster and Random scan display, Input Device, Output Device (Cathode Ray Tube, Quality of Phosphors, CRTs for Color Display, Beam Penetration CRT, 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 like Pre and post filtering , super sampling , and pixel phasing) Fill area primitives including scan-line polygon filling, inside-outside test, boundary and flood-fill	8	L1, L2, L3
3	**2D Geometric Transformation** Translation, scaling, fixed pt. scaling, pivot point scaling, rotation, rotation about arbitrary point, , rotation about pivot point homogenous coordinates, 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 Hodgman, WeilerArtherton	9	L1, L2, L3
5	**3D Transformation** 3D display methods, Wireframe model, sweep representation, octrees, Binary space partitioning, curved lines and surfaces, quadric surfaces, spline representation, cubic spline interpolation methods, Bezier, B-spline curves, Fractals 3D translation, scaling, rotation, Rotation about arbitrary axis, parallel and perspective projection	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, diffuse reflection, specular reflection, 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

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	**Design Experiments**	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, Shearing, Reflection)	2	L1, L2, L3
5		Design a program for Cohen Sutherland line Clipping Algorithm	2	L1, L2, L3
6		Design a program for Liang Barsky line	2	L1, L2, L3

		Clipping Algorithm		
7		Develop a program for Sutherland Hodgeman Polygon clipping Algorithm	2	L1, L2, L3
8		Develop a program for Bezier curve for n control points	2	L1, L2, L3
9		Design a program for Fractals: Koch curve	2	L1, L2, L3
10		Build a program to apply basic OpenGL functions to draw basic primitives	2	L1, L2, L3
11		Build a program to perform projection of a 3D object on Projection Plane: Parallel and Perspective.	2	L1, L2, L3
12		Build a program to Implement of Fractals	2	L1, L2, L3
13	**Mini/Minor Projects/ Seminar/ Case Studies**	**Case Study** 1. Computer Graphics in Automotive Design 2. Codesign case study in Computer Graphics 3. Computer Graphics for Office Automation. **Mini Project** 1. Walking Robot 2. Maze Game 3. Bus Stop Simulation 4. Bull's Eye	6	L1, L2, L3
	Total Hours		**30**	

Prepared By:	**Checked By:**	**Verified By:**	**Approved By:**
Dr. SheetalRathi	Mrs. Rashmi Thakur **Program Coordinator**	Mrs. Shiwani Gupta **Dy. HOD-COMP**	Dr. SheetalRathi **HOD-COMP**

S.E. Semester –IV

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

B.E. (Computer Engineering)							**S.E. SEM : IV**		
Course Name : Value Education							**Course Code :** MC401		
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	-	-	-	-	25	
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:NA.									

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, L4, L5, L6
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, L4, L5
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 spiritualty with education.	3	L1, L2, L3, L4, L5, L6
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, L4, L5
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
	TotalHours	**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	APHPublishingCorporation	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	Second Edition	2016
6	Life Amazing Secrete	Gaur Gopal Das	Penguin India	1st Edition	2018
7	Ethics from Epic	Govinda Das	Tulsi Publication	1st Edition	2015
8	Peace and Value Education	Kiruba Charles & V. Arul Selvi	Neelkamal Publications	1st 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

List of Practical/ Experiments: NA

Prepared By:	Checked By:	Verified By:	Approved By:
Mr. Vikas Singh	Mrs. Rashmi Thakur **Program Coordinator**	Mrs. Shiwani Gupta **Dy. HOD-COMP**	Dr. SheetalRathi **HOD-COMP**

S.E. Semester –IV

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

B.E. (Computer Engineering)							**S.E. SEM : IV**		
Course Name : Professional Skills - III (Basic Technology Skills) (Introduction to Python)							**Course Code :**HSD-CSPS401		
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)**	**Report (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**AC**	**AC**	
1	-	2	3	2	-	-	25	25	**50**
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 Basics, Procedural Programming Languages									

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**		L1, L2
	Data types in python,Operators in python, Input and Output, Arrays in python, String and Character in python, Importing Packages and Modules	2	
2	**Decision Making and Functions**		L1, L2, L3
	If statement, if-elif-else, while loop, for loop, break statement, Functions	3	
3	**Object Oriented Programming in Python**		L1, L2, L3
	Object Oriented Programming features in Python: Implementing Classes , Objects, methods, encapsulation, Inheritance and polymorphism	2	
4	**Advanced Python**		L1, L2
	Exception Handling, Files handling in Python, Text Processing, Regular expression in python, Reading data	2	
5	**Data Structure in Python**		L1, L2, L3
	List and Tuples, Vectors and DataFrames, Introduction to Numpy and Pandas libraries	2	
6	**Python Integration Primer**		L1, L2, L3
	Graphical User interface, Python database connectivity	4	
	TotalHours	**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		
3.	**Design Experiments Mini/Minor Projects/ Seminar/ Case Studies**	Develop a program based on classes & objects, functions	2	L1, L2, L3
4.		Build a program to implement encapsulation, Inheritance and polymorphism in Python	2	L1, L2, L3
5.		Build Python program demonstrating use of text processing.(regular expression)	2	L1, L2, L3
6.		Build Python program demonstrating Reading data from JASON/HTML files.	2	L1, L2, L3
7.		Build Python program to explore Files and directories (display file, count number of lines)	2	L1, L2, L3
8.		Develop Python program to demonstrate Exception Handling in Python	2	L1, L2, L3
9.		Build Python program to demonstrate Data Structures in Python (List, Tuples, Vectors, DataFrames)	2	L1, L2, L3
10.		Develop Python program to convert arrays into DataFrames and merge them together using Numpy and Pandas Library.	2	L1, L2, L3
11.		Build Python program to create GUI in python using tkinter	2	L1, L2, L3
12.		Develop Python program to demonstrate CRUD (create, read, update and delete) operations on database (SQLite/ MySQL) using python.	2	L1, L2, L3
13.		**Mini Project** 1. Text processing in python 2. Desktop application using python (GUI and database) 3. SPAM mail checking system using python 4. Python libraries in data science 5. Python case study to analyses the	6	L1, L2, L3

		eligibilityof loan. 6. Project based on numpy and pandas.		
	Total Hours		**30**	

Prepared By:	**Checked By:**	**Verified By:**	**Approved By:**
Mr. NitinHarane	Mrs. Rashmi Thakur **Program Coordinator**	Mrs. Shiwani Gupta **Dy. HOD-COMP**	Dr. SheetalRathi **HOD-COMP**

S.E. Semester –IV

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

<table>
<tr><td colspan="5">B.E. (Computer Engineering)</td><td colspan="3">S.E. SEM : IV</td></tr>
<tr><td colspan="5">Course Name :Project Based Learning – II</td><td colspan="3">Course Code :HSD-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">Hours Per Week</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">50</td></tr>
<tr><td>-</td><td>-</td><td>2</td><td>2</td><td>1</td><td>25</td><td>25</td></tr>
<tr><td colspan="8">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="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 with additional functionalities.	L1, L2, L3, L4
2	Able to evaluate the performance of existing projects by implementing it in different programming languages.	L1, L2, L3, L4, L5
3	Able to implement solution suing advanced programming features	L1, L2, L3, L4, L5

Projects Listing:

SN	Title of Project	Type of Project
1	Implementing Dice Rolling Simulator	Application
2	Implementing system for Guessing the Number	Application
3	Implementing Paper- Scissors Game	Application
4	Implementing Airline Booking System	Application
5	Implementing Restaurant Bill calculator System	Application
6	Implementation of System for Text Encryption and Decryption	Application
7	Design and Development of Quiz Application	Core
8	Design and Development of Contacts Book	Core
9	Design and Development of Text Editor	Core
10	Develop and Development of Advanced Calculator	Core

Prepared By:	Checked By:	Verified By:	Approved By:
Dr. AnandKhandare	Mrs. Rashmi Thakur **Program Coordinator**	Mrs. Shiwani Gupta **Dy. HOD-COMP**	Dr. SheetalRathi **HOD-COMP**

S.E. Semester –IV

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

B.E. (ALL BRANCHES)							**S.E. SEM : IV**		
Course Name : Activity Based Learning-IV							**Course Code:** HSD-CSABL401		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (25)**		**Presentation**	**Report**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**(AC)**	**(AC)**	
-	-	2	2	1	-	-	25	25	**50**

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 course intends to inculcate effective communication skills and lifelong learning. Students further develop team work and multi-disciplinary knowledge. They also imbibe ethical values and utilize it for environment and society.

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	Student will be able to converse through listening attentively and then having the perseverance to mold it towards his/her own direction by active participation.	L1, L2, L3
2	Students will able to develop their individual style and tone. Engage critically with creative texts across multiple genres. Develop critique skills for effective in-class workshops of peer work.	L1, L2, L3, L4, L5, L6
3	Students will be able to generate and collect new ideas to uncover creative, tacit knowledge.	L1, L2, L3, L4, L5, L6
4	Students will be able reach out the society of under privileged and help them for education.	L1, L2, L3, L4

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Group Discussion** Definition of GD, Types of GD Prepare, Know the Participants. Discussion points to be noted Importance of posture, Reasoning to find the GD topic category that you are comfortable with Taking charge at right time, retaining the balance. Strictly Follow your Domain. Time Management an important asset. Presenting your view with air of confidence, Paraphrasing/summarizing. Topics. Group Discussion may be based on three kinds of topics: Social Economical Political International affairs **Evaluation will be based on Creativity skills supported by listening and participating proactively.**	7	L1, L2, L3, L4, L5, L6
2	**Creative writing/technical writing** Orientation and Introduction to Writing skills both article form and paper writing (IEEE format) with emphasize on originality, plagiarism check. 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. Understand the format of article/ paper, Choose mentor faculty from college if needed. Students will then shape the article/paper. Drafting and editing of paper for final stage taking care of plagiarism. Demonstration of article/paper by students and evaluation. Technical writing session Non technical writing session. **Evaluation will be on quality of content developed**	8	L1, L2, L3, L4
3	**Idea Generation** Introduction to invention and innovation, managing creativity, Techniques for generating ideas, Steps for Idea generation to implementation. Transforming Idea into project with implementation Brainstorming session with peers for idea generation and assessment, Experience sharing by entrepreneurs or Hackathon Winners **Idea competition and evaluation**	7	L1, L2, L3, L4
4	**Extension: Education**	8	L1, L2, L3, L4, L5, L6

	Introduction to Street play, types of Street play. Presentation about Street play Theme 1: Adult education Theme 2: Slum children education Theme 3: Career Counseling **Evaluation will be based on Creativity skills and Presentation Skills**		
	Total Hours	**26**	

Books and References:

S. No.	Title	Authors	Publisher	Edition	Year
1	Competitive Debate	Richard Earl	Alpha	-	2008
2	Times Quiz bookby Times Mind Games	OLovBjortomt	Times Books	-	2016
3	Cracking the codingInterview	GayleLaakmann	Createspace	-	2011

Online References:

S. 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

Prepared By:	Checked By:	Verified By:	Approved By:
Dr. Rajani Bahuguna	Mrs. Rashmi Thakur **Program Coordinator**	Mrs. Shiwani Gupta **Dy. HOD COMP**	Dr. SheetalRathi **HOD COMP**

T.E. Semester –V

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

B.E. (Computer Engineering)							**T.E. SEM : V**		
Course Name : Microprocessor							Course Code :CSC501		
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**	**150**
4	-	2	6	5	20	80	25	25	
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: Digital Logic and Design and Analysis, Computer Organization and Architecture									

Course Objective: The course intends to equip students with the fundamental knowledge and basic technical competence in the field of Microprocessors and prepare students for higher processor architectures and embedded 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	Demonstrate architecture of x86 processors.	L1, L2
2	Make use of instructions of 8086 to build assembly and Mixed language programs.	L1, L2, L3
3	Explain the concept of interrupts and its real time applications.	L1, L2
4	Inspect the specifications of peripheral chip.	L1, L2, L3, L4
5	Develop 8086 based system using memory and peripheral chips.	L1, L2, L3
6	Illustrate the architecture of advanced processors.	L1, L2

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**The Intel Microprocessors 8086/8088 Architecture** 8086/8088 CPU Architecture, Programmer's Model, Functional Pin Diagram, Memory Segmentation, Banking in 8086, Demultiplexing of Address/Data bus, Study of 8284 Clock Generator, Study of 8288 Bus Controller, Functioning of 8086 in Minimum mode and Maximum mode Timing diagrams for Read and Write operations in minimum and maximum mode	8	L1, L2
2	**Instruction Set and Programming**		

	Addressing Modes, Instruction set – Data Transfer Instructions, String Instructions, Logical Instructions, Arithmetic Instructions, Transfer of Control Instructions, Processor Control Instructions, Assembler Directives and Assembly Language Programming, Macros, Procedures, Mixed Language Programming with C Language and Assembly, Language. Programming based on DOS and BIOS Interrupts (INT 21H, INT 10H)	10	L1, L2, L3
3	**8086 Interrupts** Types of interrupts, Interrupt Service Routine, Interrupt Vector Table, Servicing of Interrupts by 8086 microprocessor, Programmable Interrupt Controller 8259 – Block Diagram, Interfacing the 8259 in single and cascaded mode, Operating modes, programs for 8259 using ICWs and OCWs	6	L1, L2
4	**Peripherals and their interfacing with 8086** **Memory Interfacing** - RAM and ROM Decoding Techniques – Partial and Absolute, **8255-PPI** – Block diagram, Functional PIN Diagram, CWR, operating modes, interfacing with 8086. **8253 PIT** - Block diagram, Functional PIN Diagram, CWR, operating modes, interfacing with 8086. **8257-DMAC** – Block diagram, Functional PIN Diagram, Register organization, DMA operations and transfer modes	14	L1, L2, L3, L4
5	**Intel 80386DX Processor** Architecture of 80386 microprocessor, 80386 registers – General purpose Registers, EFLAGS and Control registers, Real mode, Protected mode, virtual 8086 mode, 80386 memory management in Protected Mode – Descriptors and selectors, descriptor tables, the memory paging mechanism	8	L1, L2, L3
6	**Pentium Processor** Pentium Architecture, Superscalar Operation, Integer & Floating Point Pipeline Stages, Branch Prediction Logic, Cache Organisation and MESI Model	6	L1, L2
	Total Hours	**52**	

Books and References:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	8086/8088 family: Design Programming and Interfacing	John Uffenbeck	PHI	Third Edition	2012
2	Advanced Microprocessors and Peripherals	K M Bhurchandani, A k Ray	McGraw Hill	Third Edition	2015
3	The 80386DX Microprocessor: hardware, Software and Interfacing	Walter A Triebel	Prentice Hall	Fourth Edition	2010
4	Pentium Processor System Architecture	Tom Shanley& Don Anderson,	Addison Wesley	Second Edition	2012

Online References:

Sr. No.	Website Name	URL	Modules Covered
1	www.tutorialspoint.com	https://www.tutorialspoint.com/microprocessor/microprocessor_8086_overview.html	M1,M2,M3
2	www.geeksforgeeks.org	www.geeksforgeeks.org/arithmetic-instructions-8086-microprocessor/	M1,M2,M3
3	www.gabrielececchetti.it	www.gabrielececchetti.it/Teaching/CalcolatoriElettronici/.../i8086_instruction_set.pdf	M1,M2,M3
4	https://nptel.ac.in	https://nptel.ac.in/courses/Webcourse-contents/IISc BANG/Microprocessors%20and%20Microcontrollers/pdf/Teacher_Slides/mod8/M8L1.pdf	M5
5	http://service.scs.carleton.ca	http://service.scs.carleton.ca/sivarama/org_book/org_book_web/slides/chap_1_versions/ch7_1.pdf https://www.researchgate.net/profile/Donald_Alpert/publication/3214681_Architecture_of_the_Pentium_Microprocessor/links/54187f300cf203f155adafc1.pdf	M6
6	https://ekeeda.com	https://ekeeda.com/course-videos/sem-iv/mumbai-university/electronics-and-telecommunication-engineering/microprocessors/study-and-interfacing-of-peripherals--8155@8255,-8253@8254,-8257,-8259-with-8085/4678/10188	M4

List of Practical/ Experiments:

Practical Number	Type of Experiment	Practical/ Experiment Topic	Hrs.	Cognitive levels of attainment as per Bloom'sTaxonomy
1	Basic Experiments	Apply Assembly Language Programing to enter and display 8 bit & 16 bits number	2	L1, L2, L3
2		Convert HEX to BCD and BCD to HEX using ALP.	2	L1, L2
3		Apply Assembly Language Programing to perform string operations. (i)Accept, (ii) Display, (iii) Concatenation (iv) Compare	2	L1, L2, L3
4		Apply Assembly Language Programing to perform string operations. (i)Reverse, ii)Palindrome	2	L1, L2, L3
5	Design Experiments	Develop a calculator usingmacros and procedure. (Menu Based).	2	L1, L2, L3
6		Identify negative numbers from a given sign array using Assembly language.	2	L1, L2, L3,L4
7		Use Mixed Mode Programing Language to shift a number for given number of times.	2	L1, L2, L3
8		Apply 32 bit architecture to switch from real mode to protected mode using DPMI driver.	2	L1, L2, L3
9		Make use of 8086 Trainer kits in: 1. Hexkey pad Mode **2.** Serial Mode	2	L1, L2, L3

10		Demonstrate Interfacing on Intel 8086 with 8255 Programmable Peripheral Interface.	2	L1, L2
11		Demonstrate Interfacing on Intel 8086 with 8253 Programmable Interval Timer	2	L1, L2
12	**Advanced Experiments**	Develop a program to interface mouse driver/keyboard/printer drivers	2	L1, L2, L3
13	**Mini/Minor Projects/ Seminar/ Case Studies**	1. PC-to-PC Communication via RS-232 Serial Port 2. Develop an application on Mixed mode programming 3. Develop an application using Arduino Controller. 4. Develop an application using Raspberry-PI. 5. RISC & CISC Processors 6. Comparative study of Pentium family processors	4	L1, L2, L3, L4, L5, L6
14	**Group Presentation**	1. Von Neumann , Hardwired and Data flow architecture 2. Introduction to Microcontroller 3. Multicore processors i3,i5, i7	2	L1, L2, L3
	Total Hours		**30**	

Prepared By:	**Checked By:**	**Verified By:**	**Approved By:**
Mrs. VaishaliNirgude Mrs. AshwiniPatil	Dr. MegharaniPatil	Mrs. Shiwani Gupta	Dr. SheetalRathi
	Program Coordinator	**Dy. HOD-COMP**	**HOD-COMP**

T.E. Semester –V

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

B.E. (Computer Engineering)							**T.E. SEM : V**		
Course Name : Database Management System							Course Code : CSC502		
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**
4	-	2	6	5	20	80	25	25	
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: Basics Mathematics									

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:

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Illustrate the fundamentals of Database Management System	L1, L2
2	Construct ER and EER diagram for the real life problem and convert it to relational database.	L1, L2, L3
3	Developrelational model from conceptual model and formulate relational algebra queries.	L1, L2, L3
4	Apply SQL queries on a database.	L1, L2, L3
5	Apply concepts of normalization to relational database design.	L1, L2, L3
6	Discover the concept of transaction, concurrency and recovery.	L1, L2, L3, L4

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Introduction to Database Concepts** Introduction, Characteristics of databases, File system v/s Database system, Users of Database system, Data Independence, DBMS system architecture, Database Administrator	4	L1, L2
2	**Entity–Relationship Data Model** The Entity-Relationship (ER) Model: Entity types : Weak and strong entity sets, Entity sets, Types of Attributes, Keys, Relationship constraints : Cardinality and Participation, Extended Entity-Relationship (EER) Model : Generalization, Specialization and Aggregation	8	L1, L2, L3
3	**Relational Model and relational Algebra**	8	L1, L2, L3

	Introduction to the Relational Model, relational schema and concept of keys. Mapping the ER and EER Model to the Relational Model, Relational Algebra – unary and set operations, Relational Algebra Queries.		
4	**Structured Query Language (SQL)** Overview of SQL, Data Definition Commands, Data Manipulation commands, Data Control commands, Transaction Control Commands, Set and string operations, aggregate function - group by, having, Views in SQL, joins , Nested and complex queries, Integrity constraints :- key constraints, Domain Constraints, Referential integrity , check constraints, Triggers	12	L1, L2, L3
5	**Relational–Database Design** Pitfalls in Relational-Database designs, Concept of normalization, Function Dependencies, First Normal Form, 2nd, 3rd, BCNF, multi valued dependencies, 4NF.	8	L1, L2, L3
6	**Transactions Management and Concurrency** Transaction concept, Transaction states, ACID properties, Concurrent Executions, Serializability – Conflict and View, Concurrency Control: Lock-based, Timestamp-based protocols, Recovery System: Failure Classification, Log based recovery, ARIES, Checkpoint, Shadow paging, Deadlock handling	12	L1, L2, L3, L4
	Total Hours	**45**	

Books and References:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Database System Concepts	Korth, Slberchatz,Sudarshan	McGraw Hill	Sixth Edition	2010
2	Fundamentals of Database Systems	Elmasri and Navathe	Pearson education	Fifth Edition	2011
3	Database Management Systems	Raghu Ramkrishnan and Johannes Gehrke	McGraw Hill	Fifth Edition	2010
4	Database Management Systems	G. K. Gupta	McGraw Hill	Sixth Edition	2011

Online References:

Sr. No.	Website Name	URL	Modules Covered
1	https://www.nptel.ac.in/	https://nptel.ac.in/courses/106105175/2	M1-M6
2	www.tutorialspoint.com	https://www.tutorialspoint.com/dbms/	M1-M6
3	www.javatpoint.com	https://www.javatpoint.com/dbms-tutorial	M1-M6

List of Practical/ Experiments:

Practical Number	Type of Experiment	Practical/ Experiment Topic	Hrs.	Cognitive levels as per Bloom's Taxonomy
1	**Basic Experiments**	Identify any Database Management System.	2	L1, L2
2		Identify Entity, Relationship and Attributes with its types for Real life example.	2	L1, L2
3	**Design Experiments**	Develop an Entity-Relationship (ER) diagram for the problem definition Identified and convert it into Relational Database.	2	L1, L2, L3
4		Apply Basic DDL and DML Commands to Specified System	2	L1, L2, L3
5		Apply Constraints for the Specified system.	2	L1, L2, L3
6		Apply Set and String Operations to Specified System	2	L1, L2, L3
7		Apply Aggregate Functions and Create Views for Specified System	2	L1, L2, L3
8		Build Nested Queries on Specified System.	2	L1, L2, L3
9		Apply Referential Integrity on Specified System.	2	L1, L2, L3
10		Develop of Normalized Database for any Real World Example	2	L1, L2, L3
11	**Advanced Experiments**	Apply Triggers in SQL for Specified System	2	L1, L2, L3
12		Apply Joins in SQL for Specified System	2	L1, L2, L3
13	**Mini/Minor Projects/ Seminar/ Case Studies**	1. Student Management System 2. Library Management System 3. Airline Reservation System 4. Hospital Management System 5. Hotel Management System 6. Billing System	6	L1, L2, L3,L4, L5, L6
	Total Hours		**30**	

Prepared By:	**Checked By:**	**Verified By:**	**Approved By:**
Dr. AnandKhandare Mrs. Rashmi Thakur Ms. Deepali Joshi	Dr. MegharaniPatil	Mrs. Shiwani Gupta	Dr. SheetalRathi
	Program Coordinator	**Dy. HOD-COMP**	**HOD-COMP**

T.E. Semester –V

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

B.E. (Computer Engineering)							**T.E. SEM : V**		
Course Name : Computer Networks							Course Code : CSC503		
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**
4	-	2	6	5	20	80	25	25	
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: Probability, C or Java Programming, Basic algorithms									

Course Objective: The course intends to deliver the fundamental knowledge of the various aspects of computer networking and apply the knowledge of computer networks for analyzing various algorithms spread over various levels.

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	Demonstrate the concepts of data communication at physical layer and compare ISO - OSI model with TCP/IP model	L1, L2
2	Demonstrate the knowledge of networking protocols at data link layer	L1, L2
3	Develop the network using IP addressing and subnetting / supernetting schemes.	L1, L2, L3
4	Analyze various routing algorithms and protocols at network layer	L1, L2, L3, L4
5	Analyze transport layer protocols and congestion control algorithms.	L1, L2, L3, L4
6	Outline protocols at application layer	L1, L2

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Introduction to Networking** Introduction to computer network, network application, network software and hardware components (Interconnection networking devices), Network topology, protocol hierarchies, design issues for the layers, connection oriented and connectionless services Reference models: Layer details of OSI, TCP/IP models. Communication between layers.	06	L1, L2
2	**Physical Layer** Introduction to Communication System, digital Communication, Electromagnetic Spectrum Guided Transmission Media: Twisted pair, Coaxial, Fiber optics. Unguided media (Wireless Transmission): Radio Waves, Microwave, Bluetooth, Infrared, Circuit and Packet Switching	06	L1, L2
3	**Data Link Layer** DLL Design Issues (Services, Framing, Error Control, Flow Control), Error Detection and Correction(Hamming Code, CRC, Checksum) , Elementary Data Link protocols , Stop and Wait, Sliding Window(Go Back N, Selective Repeat), HDLC Medium Access Control sublayer Channel Allocation problem, Multiple access Protocol(Aloha, Carrier Sense Multiple Access (CSMA/CD), Local Area Networks - Ethernet (802.3)	10	L1, L2, L3
4	**Network layer** Network Layer design issues, Communication Primitives: Unicast, Multicast, Broadcast. IPv4 Addressing (classfull and classless), Subnetting, Supernetting design problems ,IPv4 Protocol, Network Address Translation (NAT) Routing algorithms : Shortest Path (Dijkstra's), Link state routing, Distance Vector Routing Protocols - ARP,RARP, ICMP, IGMP Congestion control algorithms: Open loop congestion control, Closed loop congestion control, QoS parameters, Token & Leaky bucket algorithms	14	L1, L2, L3, L4
5	**Transport Layer** The Transport Service: Transport service primitives, Berkeley Sockets, Connection management (Handshake), UDP, TCP, TCP state transition, TCP timers TCP Flow control (sliding Window), TCP Congestion Control: Slow Start	10	L1, L2, L3, L4
6	**Application Layer** DNS: Name Space, Resource Record and Types of Name Server. HTTP, SMTP, Telnet, FTP, DHCP	06	L1, L2
	Total Hours	**52**	

Books and References:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Computer Networks	A.S. Tanenbaum	Pearson Education	Fourth Edition	2016
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	2012

Online References:

Sr. No.	Website Name	URL	Modules Covered
1	https://www.javatpoint.com/	https://www.javatpoint.com/computer-network-tutorial	M1-M6
2	www.geeksfrgeeks.org	https://www.geeksforgeeks.org/computer-network-tutorials/	M1-M6
3	www.tutorialspoint.com	https://www.tutorialspoint.com/computer_fundamentals/computer_networking	M1-M6

List of Practical/ Experiments:

Practical Number	Type of Experiment	Practical/ Experiment Topic	Hrs.	Cognitive levels as per Bloom's Taxonomy
1	**Basic Experiments**	Comprehend basic networking commands in Linux (ping, tracert, nslookup, netstat, ARP, RARP, ip, ifconfig, dig, route)	2	L1, L2
2		Build a network and configure IP addressing, subnetting, masking.	2	L1, L2, L3
3	**Design Experiments**	Build a simple network topology and configure it for static routing protocol using packet tracer.	2	L1, L2, L3
4		Analyse the operation of TCP/IP layers throughWireshark tool	2	L1, L2, L3,L4
5		Experiment with CRC/ Hamming code using C/Java implementation	2	L1, L2, L3,L4
6		Examine Stop and wait protocol/ sliding window (selective repeat / Go back N)	2	L1, L2, L3
7		Experiment with simulator (Eg. NS2) to understand functioning of ALOHA, CSMA/CD.	2	L1, L2, L3,L4
8		Experiment with Socket programming using TCP or UDP	2	L1, L2, L3
9		Examine congestion control (leaky bucket / token bucket) using NS2.	2	L1, L2, L3

10		Experiment with Perform File Transfer and Access using FTP	2	L1, L2, L3, L4
11	**Case Studies**	1. Network discovery tools 2. Remote Login using Telnet	4	L1, L2, L3,L4
12	**Mini/Minor Projects/ Seminar**	1. Network Desktop Manager (Java) 2. Cloud Network in packet tracer 3. IoT network in Cisco Packet Tracer 4. MAC Protocols in NS2 5. A Network Based Multi-Player Eater Game 6. Analysis of RTP Packet Delay and Loss	6	L1, L2, L3,L4, L5, L6
	Total Hours		**30**	

Prepared By:	**Checked By:**	**Verified By:**	**Approved By:**
Dr. R.R.Sedamkar Mrs. KalpanaGangwar Ms. PradnyaSaval	Dr. MegharaniPatil **Program Coordinator**	Mrs. Shiwani Gupta **Dy. HOD- COMP**	Dr. SheetalRathi **HOD- COMP**

T.E. Semester –V
Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS- H 2019)

B.E. (Computer Engineering)							**T.E. SEM :V**		
Course Name : Theory of Computer Science							**Course Code :**CSC504		
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	1	-	4	4	20	80	-	-	**100**
IA:In-Semester Assessment- Paper Duration – 1 Hours **ESE :End Semester Examination- Paper Duration - 3 Hours**									
Prerequisite: Basic Mathematics, Discrete Structures and Graph Theory									

Course Objective: The course intends to deliver the fundamental concepts of theory of computation describing formal mathematical models of computation such as FA, PDA, LBA and TMby comparing their power, limitations, languages and their applications in computation and complexity theory.

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	Construct Finite Automata.	L1, L2, L3
2	Construct Regular Expression for given language and convert RE to FA and FA to RE.	L1, L2, L3
3	Compare different types of Grammars and simplify CFG.	L1, L2, L3, L4
4	Construct Push down automata and its variants.	L1, L2, L3
5	Construct Turing Machine and its variants and Compare Power and Limitations of TMs.	L1, L2, L3, L4
6	Compare constraints of a language to power of machines	L1, L2

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Basic Concepts and Finite Automata** Alphabets, Strings, Languages, Closure properties. Finite Automata (FA) and Finite State machine (FSM). Deterministic Finite Automata (DFA) and Nondeterministic Finite Automata (NFA): Definitions, transition diagrams and Language Recognizers, NFA to DFA Conversion, Equivalence between NFA with and without ε- Transitions, Minimization of DFA, FSM with output: Moore and Mealy machines, Equivalence, Applications and limitations of FA.	6	L1, L2, L3
2	**Regular Expressions and Languages**		L1, L2, L3

	Regular Expression (RE): Equivalence of RE and FA, Arden's Theorem, RE Applications. Grammars and Chomsky hierarchy, Regular Grammar (RG), Equivalence of Left and Right linear grammar, Equivalence of RG and FA. Regular Language (RL): Closure properties of RLs, Decision properties of RLs, Pumping lemma for RLs.,	5	
3	**Grammars** **Context Free Grammars (CFG):** Definition, Sentential forms, Leftmost and Rightmost derivations, Parse tree, Ambiguity. Simplification and Applications. Normal Forms: Chomsky Normal Forms (CNF) and Greibach Normal Forms (GNF).	5	L1, L2, L3, L4
4	**Push Down Automata(PDA)** Definition, Transitions, Language of PDA, Language acceptance by final state and empty stack ,PDA as generator, decider and acceptor of CFG, Deterministic PDA , Non-Deterministic PDA, Application of PDA. Pumping lemma for CFL's, Closure properties of CFL's	9	L1, L2, L3
5	**Turing Machine (TM)** 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. Context Sensitivity and Linear Bound Automata.	9	L1, L2, L3,L4
6	**Undecidability** Decidability and Undecidability, Recursive and Recursively Enumerable Languages. Halting Problem, Rice's Theorem, Post Correspondence Problem,	5	L1, L2
	Total Hours	**39**	

Books and References:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Introduction to Automata Theory, Languages and Computation	John. E. Hopcroft, Rajeev Motwani, J. D. Ullman,	Pearson Education Asia	Third Edition	2006
2	Elements of the Theory of computation	H.R. Lewis and C.H.Papadimitrou	Prentice Hall Inc	Second Edition	1997
3	Introduction to languages and the Theory of Computation	John C Martin	TMH	Third Edition	2007
4	Introduction to Computer Theory	Daniel I.A. Cohen	John Wiley	Second Edition	1996

Online References:

Sr. 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 ofFinite 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, L4
7	Tutorial on Simplification of Context Free Grammar.	1	L1, L2, L3, L4
8	Tutorial on Conversion of CFG into Normal Forms (CNF & GNF).	1	L1, L2, L3, L4
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**	

List of Practical/ Experiments: - NA

Prepared By:	Checked By:	Verified By:	Approved By:
Dr. Rekha Sharma Mrs. VaishaliNirgude Mr.Vikas Singh	**Dr. MegharaniPatil** **Program Coordinator**	**Mrs. Shiwani Gupta** **Dy. HOD-COMP**	**Dr. SheetalRathi** **HOD-COMP**

T.E. Semester –V

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

B.E. (Computer Engineering)							**T.E. SEM : V**		
Course Name : Department Level Optional Course -I (Multimedia Systems)							**Course Code :**CSDLO5011		
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**	
4	-	-	4	4	20	80	-	-	**100**
IA:In-Semester Assessment- Paper Duration – 1 Hours **ESE :End Semester Examination- Paper Duration - 3 Hours**									
Prerequisite: Computer Fundaments and Graphics									

CourseObjective: The course intends to deliver basic fundamentals, compression techniques, multimedia communication standards and hands-on experience in building multimedia 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	Identify basics of multimedia and multimedia system architecture	L1, L2, L3
2	Explain different multimedia components	L1, L2
3	Distinguish the file formats for different multimedia components.	L1, L2, L3, L4
4	Analyze the different compression algorithms.	L1, L2, L3, L4
5	Explain various multimedia communication techniques.	L1, L2
6	Apply different security techniques in multimedia environment.	L1, L2, L3

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Introduction to Multimedia** Objects and Elements of Multimedia, Applications of Multimedia, Multimedia Systems Architecture – IMA, Workstation, Network, Types of Medium (Perception, Representation), Interaction Techniques, I/O devices - Salient features (Electronic Pen, Scanner, Digital Camera, Printers, plotters), Storage Media (Jukebox, DVD), Multimedia Databases	8	L1, L2, L3
2	**Text & Digital Image**		L1, L2

	Visual Representation, Digital Representation. File Formats: RTF, TIFF. Compression Techniques : Huffman Coding, RLE, CCITT group 3 1D, Digital Image Representation (2D format, resolution) Types of Images (monochrome, gray, color), examples of images (X-Ray, fractal, synthetic, acoustic).File formats: BMP, JPG , Compression Techniques: fundamentals (coding, interpixel and psychovisual redundancies),Types – lossless and lossy, Lossless Compression Algorithms– Shannon-Fano, CCITT group 4 2D, Lossy Compression Algorithm – JPEG	9	
3	**Digital Audio**		L1, L2, L3, L4
	Basic Sound Concepts: computer representation of sound, File Formats – WAV, MPEG Audio Compression: PCM, DM, DPCM	7	
4	**Digital Video**		L1, L2, L3, L4
	Digitization of Video, types of video signals (component, composite and Svideo), File Formats: MPEG Video, H.261 , Compression: MPEG	8	
5	**Multimedia Network Communication and Representation**		L1, L2
	Quality of Service, Multimedia over IP (RTP, RTSP, RTCP,RSVP), Representation- Authoring systems and user interface	10	
6	**Multimedia Security**		L1, L2, L3
	Requirements and properties ,Mechanisms – Digital Signatures, Steganographic methods , Sample applications – unidirectional distributed systems, information,systems and conference systems	10	
	Total Hours	**52**	

Books and References:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Multimedia System Design	Prabhat K. Andleigh&KiranThakrar,	PHI	First Edition	2015
2	Multimedia Communication Systems: Techniques, Standards & Networks	K. R. Rao, Zoran S. Bojkovic&Dragorad A. Milovanovic	TMH	First Edition	2002
3	Multimedia Systems	K. Buford	PHI	First Edition	2002
4	Fundamentals of Multimedia	Ze-Nian Li & Mark S. Drew,	PHI.	First Edition	2004

Online References:

Sr. No.	Website Name	URL	Modules Covered
1	www.ftms.edu.my	http://www.ftms.edu.my/images/Document/MMGD0101%20-%20Introduction%20to%20Multimedia/MMGD0101%20chapter%201.pdf	M1
2	www.engrcs.com	https://people.cs.pitt.edu/~chang/231/seminars/S07subrata.pp	M6
3	www.cosy.sbg.ac.at	https://www.cosy.sbg.ac.at/~uhl/ctmdf.pdf	M3-M4

List of Practical/ Experiments: - NA

Prepared By:	Checked By:	Verified By:	Approved By:
Mrs. Veena Kulkarni Mr. Manish Rana	Dr. MegharaniPatil **Program Coordinator**	Mrs. Shiwani Gupta **Dy. HOD-COMP**	Dr. SheetalRathi **HOD-COMP**

T.E. Semester –V

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

B.E. (Computer Engineering)							**T.E. SEM : V**		
Course Name : Department Level Optional Course -I (Advanced Operating Systems)							Course Code : CSDLO5012		
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**
4	-	-	4	4	20	80	-	-	
IA:In-Semester Assessment- Paper Duration – 1 Hours **ESE :End Semester Examination- Paper Duration - 3 Hours**									
Prerequisite: Operating System									

Course Objectives: Course should be able to comprehend the knowledge of advanced operating system and apply this knowledge 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	Comprehendthe knowledge of standard and advance operating systems	L1, L2
2	Interpret the concepts of File management and Buffer management	L1, L2
3	Comprehendthe knowledge of UNIX process management	L1, L2, L3
4	Analyze design issues of Advanced operating systems and compare different types of operating systems	L1, L2, L3, L4
5	Illustrate use of multiprocessor operating	L1, L2, L3
6	Illustrate use of Real time operating Concepts	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
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 Unix Process and Memory management	14	L1, L2
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	12	L1, L2, L3
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	6	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	8	L1, L2, L3
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	**52**	

Books and References:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	The Design of the UNIX Operating System,	Maurice J. Bach.	PHI	Fifth Edition	2018
2	Distributed Computing	Mahajan and ESEma Shah,	Oxford	Second Edition	2017
3	Advanced Concepts in Operating Systems,	MukeshSinghal, Niranjan G Shivaratri.	TMH	First Edition	2016
4	Mobile Computing	Rajkamal,	Oxford.	First Edition	2016

5	Real Time Operating System	Jane W.S. Liu	Pearson	Fifth Edition	2016

Online References:

Sr. No.	Website Name	URL	Modules Covered
1	https://lecturenotes.in	https://lecturenotes.in/subject/185/advanced-operating-system-aos	M1,M2,M5
2	https://www.docsity.com	https://www.docsity.com/en/study-notes/computer-science/advanced-operating-systems/	M1-M6
3	www.elprocus.com	https://www.elprocus.com/real-time-operating-system-rtos-and-how-it-works/	M1 to M3

List of Practical/ Experiments: - NA

Prepared By:	Checked By:	Verified By:	Approved By:
Dr. AnandKhandare	Dr. MegharaniPatil **Program Coordinator**	Mrs. Shiwani Gupta **Dy. HOD-COMP**	Dr. SheetalRathi **HOD-COMP**

T.E. Semester –V

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

B.E. (Computer Engineering)							**T.E. SEM : V**		
Course Name : Department Level Optional Course -I (Advanced Algorithm)							**Course Code :** CSDLO5013		
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**
4	-	-	4	4	20	80	-	-	
IA:In-Semester Assessment- Paper Duration – 1 Hours **ESE :End Semester Examination- Paper Duration - 3 Hours**									
Prerequisite: Procedural Programming Languages									

Course Objectives: The course intends to deliver the advanced knowledge of different typesofalgorithms and data structures along with their analysis and application to the real life problems.

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 analysis techniques for algorithms.	L1, L2,L3
2	Discover the role of probability and randomization in the analysis of algorithm	L1, L2, L3
3	Identify appropriate algorithm to be find max flow of given network.	L1, L2, L3
4	Identify appropriate data structure and design techniques for different problems	L1, L2, L3, L4
5	Understand various algorithmsComputational Geometry.	L1, L2, L3
6	Distinguish 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**	8	L1, L2,L3
	Introduction- Complexity-complexity of recursive algorithms, finding complexity by tree method, master method, proving technique (mathematical induction). **Amortized analysis**- aggregate analysis, accounting analysis, potential analysis		
2	**Probabilistic Analysis and Randomized Algorithm**	5	L1, L2,L3
	The hiring problem Indicator, random variables,**Randomized** algorithms Probabilistic analysis		
3	**Maximum Flow**	8	L1, L2, L3
	Flow networks , the ford Fulkerson method ,max bipartite matching , push Relabel Algorithm, The relabel to front algorithm		
4	**Advanced Data Structure**	13	L1, L2, L3, L4
	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.		
5	**Computational Geometry**	9	L1, L2, L3
	Line Segment properties, Determining whether any pair of segment intersects, finding the convex hull, Finding the closest pair of points.		
6	**NP Completeness And Approximation Algorithms**	9	L1, L2, L3, L4
	NP-Completeness: NP-Completeness and reducibility, NP-Completeness proofs, NP-Complete problems-The vertex cover problem, Clique problem		
	Total Hours	**52**	

Books and References:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Introduction to Algorithms	Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein	PHI	Second Edition	2014
2	Fundamentals of Computer Algorithms	Horowitz, Sahani and Rajsekaran	Galgotia	Second Edition	2011
3	Algorithms – Design and Analysis	Harsh Bhasin	Oxford	Second Edition	2015
4	Design Methods and Analysis of Algorithm	S. K. Basu	PHI	Second Edition	2012

Online References:

Sr. No.	Website Name	URL	Modules Covered
1	www.geeksforgeeks.org	https://www.geeksforgeeks.org/analysis-algorithm-set-5-amortized-analysis-introduction/	M1-M2
2	www.brilliant.org	https://brilliant.org/wiki/flow-network/	M1-M3, M6
3	www.geeksforgeeks.org	https://www.geeksforgeeks.org/np-completeness-set-1/	M1-M4, M6

List of Practical/ Experiments: - NA

Prepared By:	Checked By:	Verified By:	Approved By:
Ms. PrachiJanrao Mrs. JesalVarolia	**Dr. MegharaniPatil** **Program Coordinator**	**Mrs. Shiwani Gupta** **Dy. HOD-COMP**	**Dr. SheetalRathi** **HOD-COMP**

T.E. Semester –V

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

B.E. (Computer Engineering)							**T.E. SEM : V**		
Course Name : Web Design Lab							**Course Code :**CSL501		
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**	
-	-	2+2*	4	2	-	-	25	25	**50**
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: Computer Basics									

Course Objective: The course intends to provide insight into designing and developing static and dynamic web pages with client side validation and server side scripting. The course offers a platform to learn technologies like HTML5 and CSS3 which adheres to MVC framework for Web application 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	Interpret the core concepts and features of Web Technology	L1, L2
2	Develop static web pages using HTML5 and CSS3	L1, L2, L3
3	Apply the concept of client side validation and design dynamic web pages using JavaScript and JQuery	L1, L2, L3
4	Distinguish client and server side technologies and create Interactive web pages using PHP, AJAX with database connectivity using MySQL.	L1, L2, L3, L4
5	Interpret the basics of XML, DTD and XSL and develop web pages using XML / XSLT	L1, L2
6	Analyze end user requirements and Create web application using appropriate web technologies and web development framework	L1, L2, L3, L4

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**INTRODUCTION TO WWW** Internet Standards – Introduction to WWW – WWW Architecture – SMTP – POP3 – File Transfer Protocol Overview of HTTP, HTTP request – response — Generation of dynamic web pages- W3C Validator, How web works - Setting up the environment (LAMP/XAMP/WAMP server)	2	L1, L2
2	**CLIENT SIDE PROGRAMMING** Markup Language (HTML): Introduction to HTML and HTML5 - Formatting and Fonts –Commenting Code – Anchors – Backgrounds – Images – Hyperlinks Lists – Tables – Frames - HTML Forms and controls. Cascading Style Sheet (CSS): The need for CSS, Introduction to CSS 3 – Basic syntax and structure ,CSS Properties-Inline Styles – Embedding Style Sheets Linking External Style Sheets – Backgrounds –Box Model(Introduction , Border Properties, Padding Properties, Margin Properties), Manipulating text - Margins and Padding - Positioning using CSS., Creating page Layout and Site Designs	6	L1, L2, L3
3	**INTRODUCTION TO JAVASCRIPT** Introduction - Core features - Data types and Variables - Operators, 6 Expressions, and Statements, Functions - Objects - Array, Date and Math related Objects Document Object Model - Event Handling Controlling Windows & Frames and Documents Form handling and validations. Advanced JavaScript - Browser Management and Media Management – Classes – Constructors – Object-Oriented Techniques in JavaScript Object constructor and Prototyping - Sub classes and Super classes – JSON - jQuery and AJAX., Rich Internet Application with AJAX, JQuery Framework	6	L1, L2, L3
4	**SERVER SIDE PROGRAMMING** Introduction - Programming basics - Print/echo - Variables and constants – Strings and Arrays Operators, Control structures and looping structures – Functions – Reading Data in Web Pages Embedding PHP within HTML - Establishing connectivity with MySQL database, cookies, sessions and Authentication AJAX with PHP - AJAX with Databases	8	L1, L2, L3 ,L4
5	**XML**		L1, L2

	Dynamic page generation (adding interactivity, styles, using HTML, DHTML, XHTML, CSS, Java Script), XML –DTD(Document Type Definition) - XML Schema XML –DTD(Document Type Definition) - XML Schema - Document Object Model - Presenting XML - Using XML Parsers: DOM and SAX,XSL-eXtensible Style sheet Language	4	
6	**WEB DEVELOPMENT FRAMEWORK**	2	L1, L2, L3, L4
	Introduction to Composer - MVC Architecture Web Application Development using web development framework :- Introduction to Laravel, Development of Web pages using Laravel., Example web applications – Interactive websites, web based information systems , blogs, social networking sites etc.		
	Total Hours	**28**	

Books and References:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Developing Web Applications	Ralph Moseley, M.T. Savliya	McGraw Hill	Second Edition	2013
2	Web Technology Black Book		Dreamtech Press	First Edition	2010
3	Learning PHP, MySQL, JavaScript, CSS & HTML5	Robin Nixon	McGraw-Hill	Third Edition	2017
4	Professional Rich Internet Applications: AJAX and Beyond	Dana Moore, Raymond Budd, Edward Benson	Wiley publications	-	2007
5	Internet and World Wide Web - How To Program‖,	Harvey & Paul Deitel& Associates, Harvey Deitel and Abbey Deitel	Pearson Education,	Fifth Edition,	2011
6	Web Technologies‖,	Achyut S Godbole and AtulKahate,	Tata McGraw Hill,	Second Edition,	2012.
7	JavaScript: The Complete Reference‖,	Thomas A Powell, Fritz Schneider	Tata McGraw Hill	Third Edition,	2013

Online Resources:

Sr. No.	Website Name	URL	Modules Covered
1	www.nptel.ac.in	https://nptel.ac.in/courses/106106156/9	M1-M6
2	www.edx.org	https://www.edx.org/course/html5-and-css-fundamentals-2	M1-M6
3	www.coursera.org	https://www.coursera.org/learn/html-css-javascript-for-web-developers	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	ExplainInstallation 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 Form Design and Client Side Validation using : a. Javascript and HTML5 b. Javascript and JQuery	2	L1, L2, L3
5		Develop a college Website that has a list of courses and when clickedprovides details of that course. Use all three kinds of CSS.	2	L1, L2, L3
6		Develop simple web page using PHP.	2	L1, L2, L3
7		Develop interactive web pages using PHP with database connectivity MYSQL.	2	L1, L2, L3
8		Develop a Web page that convert temperature in Fahrenheit to Celsiusand vice versa.	2	L1, L2, L3
9		Develop XML web page using DTD, XSL.	2	L1, L2, L3
10		Develop a webpage using Ajax and PHP	2	L1, L2, L3
11		Utilize the process of hosting the website with Domain Registration Process.	2	L1, L2, L3
12		Develop a Web application using Laravel Framework.	2	L1, L2, L3
13	**Mini/Minor Projects/ Seminar/ Case Studies**	1. Online Second-hand Book Buying & Selling Portal 2. College E Print Service Management 3. Online Pizza Ordering System 4. ERP system 5. Online grocery website	6	L1, L2, L3
	Total Hours		**30**	

Prepared By:	Checked By:	Verified By:	Approved By:
Ms. Deepali Joshi Ms. Tahera Shaikh	**Dr. MegharaniPatil** **Program Coordinator**	**Mrs. Shiwani Gupta** **Dy. HOD-COMP**	**Dr. SheetalRathi** **HOD-COMP**

T.E. Semester –V

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

B.E. (Computer Engineering)							**T.E. SEM : V**		
Course Name : Business Communication & Ethics							Course Code :CSL502		
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 (25/50)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	**50**
-	-	2+2*	4	2	-	-	-	50	
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: Digital Logic and Design and Analysis, Computer Organization and Architecture									

Course Objectives: The course intends to develop Communicate skill effectively in both verbal and written form and demonstrate knowledge of professional and ethical responsibilities.

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	Make use ofprecise language, suitable vocabulary and apt style to write a technical report	L1, L2, L3
2	Develop a technical research paper with desirable formats	L1, L2, L3
3	Develop life skills/ interpersonal skills to progress professionally by building strong relationships	L1, L2, L3
4	Plan effective participation in meetings and write effective documents required for meetings	L1, L2, L3
5	Show awareness of contemporary issues knowledge of professional and ethical responsibilities	L1, L2
6	Apply the traits of a suitable candidate for a job/higher education, upon being trained in the techniques of holding a group discussion, facing interviews and writing resume/SOP	L1, L2, L3

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Report Writing** Objectives of Report Writing Language and Style in a report Types : Informative and Interpretative (Analytical, Survey and Feasibility)and Formats of reports (Memo, Letter, Short and Long Report)	**05**	L1, L2, L3
2	**Technical Writing** Technical Paper Writing (IEEE Format) Proposal Writing	**03**	L1, L2, L3
3	**Introduction to Interpersonal Skills** Emotional Intelligence Leadership and Motivation Team Building Assertiveness Conflict Resolution and Negotiation Skills Time Management Decision Making	**08**	L1, L2, L3
4	**Meetings and Documentation** Strategies for conducting effective meetings Notice, Agenda and Minutes of a meeting Business meeting etiquettes	**02**	L1, L2, L3
5	**Introduction to Corporate Ethics** Professional and work ethics (responsible use of social media - Facebook, WA, Twitter etc.) Introduction to Intellectual Property Rights Ethical codes of conduct in business and corporate activities (Personal ethics, conflicting values, choosing a moral response and making ethical decisions)	**02**	L1, L2
6	**Employment Skills** Group Discussion Resume Writing Interview Skills Presentation Skills Statement of Purpose	**06**	L1, L2, L3
	Total Hours	**26**	

Books and References

Sr. No	Title	Authors	Publisher	Edition	Year
1.	Organizational Behavior	Fred Luthans	McGraw Hill	Second Edition	1978
2.	Report Writing for Business	Lesiker and Petit	McGraw Hill	Tenth Edition	1998
3.	Technical Writing and Professional Communication	Huckin and Olsen	McGraw Hill	Second Edition	1991
4.	Personal Development for Life and Work	Wallace and Masters	Thomson Learning	Tenth Edition	2010
5.	Effective Business Communication	Heta Murphy	McGraw Hill	Seventh Edition	1997
6.	Business Correspondence and Report Writing	Sharma R.C. and Krishna Mohan	Tata McGraw-Hill Education	Fifth Edition	2002
7.	Managing Soft Skills for Personality Development	Ghosh, B. N	Tata McGraw Hill	Third Edition	2012
8.	BCOM	Dufrene, Sinha	Cengage Learning	Second edition	2016
9.	Management Communication	Bell, Smith	Wiley India Edition	Third Edition	2010
10.	Soft Skills	Dr. Alex, K	S Chand and Company	First Edition	2009
11.	Professional Ethics	Subramaniam, R	Oxford University Press	Second Edition	2013
12.	Organizational Behavior	Robbins Stephens P.,	Pearson Education	Eleventh Edition	2012
13.	https://grad.ucla.edu/asis/agep/advsopstem.pdf				

Online References:

Sr. No.	Website Name	URL	Modules Covered
1	courses.lumenlearning.com	https://courses.lumenlearning.com/sac-businesscommunication/chapter/13-4-report/	M1
2	bizfluent.com	https://bizfluent.com/about-6364726-report-writing-business-communication.html	M1
3	www.managementstudyguide.com	https://www.managementstudyguide.com/effective-report-writing.htm	M1

List of Tutorials:

Sr. No.	Topic	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	Mock Group Discussion	1	L1, L2, L3
2	Mock Group Discussion	1	L1, L2, L3
3	Mock Group Discussion	1	L1, L2, L3
4	Mock Group Discussion	1	L1, L2, L3
5	Final Group Discussion	1	L1, L2, L3
6	Meetings and Documentation	1	L1, L2, L3
7	Meetings and Documentation	1	L1, L2, L3
8	Report Synopsis and Topic Finalization	1	L1, L2, L3
9	Memo Report	1	L1, L2, L3
10	Technical Proposal	1	L1, L2, L3
11	Interpersonal Skills: Activity	1	L1, L2, L3
12	Interpersonal Skills: Activity	1	L1, L2, L3
13	Interpersonal Skills: Activity	1	L1, L2, L3
14	Resume and Mock Interview	1	L1, L2, L3
15	Mock Interview	1	L1, L2, L3
	Total Hours	**15**	

Prepared By:	**Checked By:**	**Verified By:**	**Approved By:**
Ms. Jyoti Vanawe	Dr. Megharani Patil **Program Coordinator**	Mrs. Shiwani Gupta **Dy. HOD-COMP**	Dr. Sheetal Rathi **HOD-COMP**

T.E. Semester –VI

B.E. (Computer Engineering)							T.E. SEM: VI		
Course Name: Software Engineering							Course Code: CSC601		
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	
4	-	2	6	5	20	80	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: Object Oriented Programming, Frontend Backend connectivity

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: 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 use and basic models in software engineering	L1, L2
2	Analyze the scenarios and apply the knowledge 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
4	Understand the design concepts and apply them to the project	L1, L2, L3
5	Identify risks, manage the change to assure quality in software project.	L1, L2, L3
6	Apply the principles of testing and develop test plan for the project	L1, L2, L3

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Introduction** Introduction to software engineering, Importance of Software engineering Software Process, Various models for Software Development(Waterfall, Spiral, Agile(Scrum), V-Model, RAD), Capability Maturity Model (CMM).	10	L1, L2
2	**Requirements Analysis and Modelling** Requirement Elicitation, Software requirement specification (SRS),Data Flow Diagram(DFD), Feasibility Analysis, Cost- Benefit Analysis, ER diagram, Developing Use Cases (UML), Requirement Model – Scenario-based model, Class-based model, Behavioral model.	11	L1, L2, L3,L4
3	**Project Scheduling and Tracking** Software Project Estimation: LOC, FP, Empirical Estimation Models - COCOMO II Model Project scheduling: Defining a Task Set for the Software Project, Timeline charts, Tracking the Schedule, CPM	7	L1, L2, L3
4	**Software Design** Design Principles, 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	8	L1, L2, L3
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	8	L1, L2, L3
	Total Hours	**52**	

Books and References:

	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 Practices	Ugrasen Suman	Cengage Learning	1st edition	2012
5	An integrated approach to Software Engineering	Pankaj Jalote	Springer/Narosa	1st edition	2012

Online Resources:

S. 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-introduction-importance.html	M1-M3,
3	www.tutorialspoint.com	https://www.tutorialspoint.com/software_testing/software_testing_qa_qc_testing.htm	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	Apply the knowledge of SRS and prepare Software Requirement Specification (SRS) document in IEEE format for the project	2	L1, L2, L3
2		Use project management tool to prepare schedule for the project.	2	L1, L3
3	Design Experiments	Sketch a DFD (upto 2 levels) and prepare Data Dictionary for the project.	2	L1, L3
4		Sketch UML Use case Diagram for the project.	4	L1, L3
5		Sketch a Class Diagram for the project.	4	L1, L3
6		Sketch Activity, State Transition diagram for the project.	4	L1, L3
7		Sketch Sequence and Collaboration diagram for the project	4	L1, L3
8		Change specification and use any SCM Tool to make different versions	2	L1, L3
9		Apply the knowledge of test cases for the project using white box testing.	2	L1, L2, L3
10	Mini/Minor Projects/	**Mini Project:** 1. Online banking system		

	Seminar/ Case Studies	2. Online hotel management system 3. Online sales Order Processing and Invoicing	4	L1, L2, L3, L4
		Total Hours	**30**	

Prepared By:	Checked By:	Verified By:	Approved By:
Ms. Veena Kulkarni	Dr. Megharani Pathil **Program Coordinator**	Mrs. Shiwani Gupta **Dy. HOD-COMP**	Dr. Sheetal Rathi **HOD-COMP** **Chairman BOS**

T.E. Semester –VI

B.E. (Computer Engineering)							T.E. SEM: VI		
Course Name : System Programming & Complier Construction							Course Code : CSC602		
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
4	-	2	6	5	20	80	25	25	
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: Theory of Computer Science, Microprocessor									

Course Objective: The objective of this course is to understand the role and functioning of various system programs such as macro processor, Assembler, Loader and linker etc. over application program, it aims to give knowledge of the principal structure of a compiler and about the basic theories and methods used to implement the different parts of the compiler.

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 role and functioning of different system programs.	L1,L2,L3,L4
2	Describe the various data structures and passes of assembler design.	L1,L2,L3,L4,L5
3	Use of macros in modular programming design.	L1,L2,L3
4	Distinguish different loaders and linkers and their contribution in developing efficient user applications.	L1,L2,L3,L4
5	Analyze the analysis and synthesis phase of compiler for writhing application programs and construct different parsers for given context free grammars.	L1,L2,L3,L4
6	Evaluate the synthesis phase to produce object code optimized in terms of high execution speed and less memory usage.	L1,L2,L3,L4,L5

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Introduction to System Software** Concept of System Software, Goals of system softwares, system program and system programming, Introduction to various system programs such as Assembler, Macro processor, Loader, Linker, Compiler, Interpreter, Device Drivers, Operating system, Editors, Debuggers.	3	L1,L2,L3,L4
2	**Assemblers** Elements of Assembly Language programming, Assembly scheme, pass structure of assembler, Assembler Design: Two pass assembler Design and single pass Assembler Design for Hypothetical / X86 family processor, data structures used.	11	L1,L2,L3,L4,L5
3	**Macros and Macro Processor** Introduction, Macro definition and call, Features of Macro facility: Simple, parameterized, conditional and nested. Design of single pass macro processor, data structures used.	7	L1,L2,L3
4	**Loaders and Linkers** Introduction, functions of loaders, Relocation and Linking concept, Different loading schemes: Relocating loader, Direct Linking Loader, Dynamic linking and loading.	6	L1,L2,L3,L4
5	**Compilers: Analysis Phase** Introduction to compilers, Phases of compilers: Lexical Analysis- Role of Finite State Automata in Lexical Analysis, Design of Lexical analyser, data structures used. Syntax Analysis- Role of Context Free Grammar in Syntax analysis, Types of Parsers: Top down parser- LL(1), Bottom up parser- Operator precedence parser, SLR Semantic Analysis, Syntax directed definitions.	12	L1,L2,L3,L4
6	**Compilers: Synthesis phase** Intermediate Code Generation: Types of Intermediate codes: Syntax tree, Postfix notation, Three address codes: Triples and Quadruples. 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.	13	L1,L2,L3,L4,L5
	Total Hours	**52**	

Books and References:

S. No.	Title	Authors	Publisher	Edition	Year
1	Systems Programming	J. J. Donovan	Tata McGraw Hill	1st edition	1972
2	Systems programming	D. M. Dhamdhere	Tata McGraw Hill	3rd edition	2011

3	Compilers Principles, Techniques and Tools	A. V. Aho, R. Shethi, Monica Lam , J.D. Ulman	Pearson Education	2nd edition	2013
4	Lex &yacc	John R. Levine, Tony Mason & Doug Brown	O'Reilly	2nd edition	1990
5	Compiler construction	D,M.Dhamdhere	MACMILLAM.	2nd edition	1983

Online References:

S. No.	Website Name	URL	Modules Covered
1	www.tutorialspoint.com	https://www.tutorialspoint.com/compiler_design/index.htm	M5, M6
2	www.geeksforgeeks.org	https://www.geeksforgeeks.org/compiler-design-tutorials/	M5, M6
3	www.javatpoint.com	https://www.javatpoint.com/compiler-tutorial	M5, M6
4	https://nptel.ac.in	https://nptel.ac.in/courses/106108052/	M5, M6
5	www.guru99.com	https://www.guru99.com/compiler-design-tutorial.html	M1, 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	Compute First () and Follow () set of given grammar.	2	L1,L2,L3
2		Analyse and Apply code optimization techniques to increase efficiency of compiler.	2	L1,L2,L3, L4
3	Design Experiments	Apply 2 pass Assembler for X86 machine.	4	L1,L2,L3
4		Apply single pass Macro Processor.	4	L1,L2,L3
5		Apply Intermediate Code Generator using 3-Address code.	2	L1,L2,L3
6		Apply code generator for target machine architecture	2	L1,L2,L3
7	Advanced Experiments	Build Lexical nalyzer using LEX / Flex tool	2	L1,L2,L3
8		Build Parser Generator using YACC tool.	2	L1,L2,L3
9	Mini/Minor Projects/ Seminar/	1. Experiment with Top Down Parser - Predictive Parser (LL1) and Recursive Decent Parser (RDP).	6	L1,L2,L3,L4

		2. Apply Bottom Up Parser – LR (0), LR (1), LALR. 3. Apply Text Editor.		
10	Case Studies/ Group Presentation	1. Study of System Programs 2. Apply the concept of Loader. 3. Apply the concept Linker. 4. Evaluate DFA and NFA.	4	L1,L2,L3,L4, L5
		Total Hours	**30**	

Prepared By:	Checked By:	Verified By:	Approved By:
Mrs. Vaishali Nirgude	Dr. Megharani Patil **Program Coordinator**	Mrs. Shiwani Gupta **Dy. HOD-COMP**	Dr. Sheetal Rathi **HOD-COMP** **Chairman BOS**

T.E. Semester –VI

B.E. (Computer Engineering)					T.E. SEM: VI				
Course Name : Data Warehousing & Mining					Course Code : CSC603				
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	
4	-	2	6	5	20	80	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: Basic database concepts, Concepts of algorithm design and analysis.									

Course Objectives: The course intends to deliver the fundamentals of warehousing and mining by providing a platform to learn, analyze, and choose relevant models and algorithms for real world applications.

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

SN	Course Outcome	Cognitive levels of attainment as per Bloom's Taxonomy Levels
1	Understand Data Warehouse fundamentals, Data Mining Principles.	L1,L2,L3
2	Design data warehouse with dimensional modelling and apply OLAP operations.	L1,L2,L3
3	Identify appropriate data mining algorithms to solve real world problems	L1,L2,L3
4	Compare and evaluate different data mining techniques like classification, prediction, clustering and association rule mining	L1,L2,L3,L4
5	Describe complex data types with respect to spatial and web mining.	L1,L2,L3,L4
6	Benefit the user experiences towards research and innovation.	L1,L2,L3

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy Levels
1	**Introduction to Data Warehouse and Dimensional modelling:** 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, Fact less Fact tables, Update to the dimension tables, Aggregate fact tables.	06	L1,L2,L3
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.	06	L1,L2, L3
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	10	L1,L2, L3
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
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 Itemsets using Vertical Data Format, Introduction to Mining Multilevel Association Rules and Multidimensional Association Rules	10	L1,L2,L3, L4
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	8	L1,L2, L3
	Total Hours	**52**	

Books and References:

S. No.	Title	Authors	Publisher	Edition	Year
1	Data Warehousing: Fundamentals for IT Professionals	PaulrajPonniah	Wiley India	2nd Edition	2010
2	Data Mining Concepts and Techniques	Han, Kamber	Morgan Kaufmann	3rd Edition	2011
3	Data warehousing	ReemaTheraja	Oxford University Press	1st Edition	2009
4	Data Mining Introductory and Advanced Topics	M.H. Dunham	Pearson Education	1st Edition	2002
5	Data Mining	Ian H. Witten, Eibe Frank and Mark A. Hall	Morgan kaufmann	3rd Edition	2011
6	Introduction to Data Mining	Pang-Ning Tan, Michael Steinbach and Vipin Kumar	Pearson Publisher	1st Edition	2005
7	Data Mining Methods	R. Chattamvelli	Narosa Publishing House	2nd Edition	2009

Online References:

S. No.	Website Name	URL	Modules Covered
1	guru99	https://www.guru99.com/data-mining-vs-data-warehouse.html	M1-M4
2	tutorialspoint	https://www.tutorialspoint.com/dwh/dwh_overview	M2,M3,M4
3	geeksforgeeks	https://www.geeksforgeeks.org/	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	Build Data Warehouse/Data Mart for a given problem statement i) Identifying the source tables and populating sample data ii) Design dimensional data model i.e. Star schema, Snowflake schema and Fact Constellation schema (if applicable)	2	L1, L2
2		To perform various OLAP operations such as slice, dice, drilldown, rollup, pivot	2	L1, L2, L3

3	**Design Experiments**	Implementation of Classification algorithm(Decision Tree/ Bayesian)	2	L1, L2, L3
4		Implementation of Linear Regression	2	L1, L2, L3
5		Implementation of Clustering algorithm (K-means/ Agglomerative).	2	L1, L2, L3
6		Implementation of Association Rule Mining algorithm (Apriori).	4	L1, L2, L3
7		Perform data Pre-processing task and Demonstrate performing Classification, Clustering, Association algorithm on data sets using data mining tool (WEKA,R tool, XL Miner, etc.)	4	L1, L2, L3
8		Implementation of page rank algorithm	4	L1, L2, L3
9		Implementation of HITS algorithm.	4	L1, L2, L3
10		Implementation of Spatial Clustering Algorithm- CLARANS Extensions	4	L1, L2, L3
		Total Hours	**30**	

Prepared By:	**Checked By:**	**Verified By:**	**Approved By:**
Mrs. Rashmi Thakur	Dr. Megharani Patil **Program Coordinator**	Mrs. Shiwani Gupta **Dy. HOD-COMP**	Dr. Sheetal Rathi **HOD-COMP** **Chairman BOS**

T.E. Semester –VI

B.E. (Computer Engineering)									
Course Name : Cryptography & System Security							T.E. SEM: VI		
Teaching Scheme (Program Specific)							Course Code : CSC604		
Modes of Teaching / Learning / Weightage					Examination Scheme (Formative/ Summative)				
Hours Per Week					Modes of Continuous Assessment / Evaluation				
					Theory (100)		Practical/Oral (25)	Term Work (25)	Total
Theory	Tutorial	Practical	Contact Hours	Credits	IA	ESE	PR/OR	TW	
4	-	2	6	5	20	80	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: Computer Networks, Discrete Mathematics

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, The OSI security architecture, Network security model, Classical Encryption techniques, Symmetric cipher model, mono-alphabetic and polyalphabetic substitution techniques: Vigenere cipher, Playfair cipher, Hill cipher, transposition techniques: keyed and keyless transposition ciphers, steganography. Modular Arithmetic and Number Theory: - Euclid's algorithm—Prime numbers-Fermat's and Euler's theorem- Testing for primality -The Chinese remainder theorem, Discrete logarithms.	9	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, ElGamal Algorithm. Key management techniques: using symmetric and asymmetric algorithms and trusted third party. 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, ElGamal and Schnorr signature schemes.	10	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	11	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.	7	L1, L2, L3, L4
	Total Hours	**52**	

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, traceroute, 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	2	L1, L2, L3, L4

		mode. b.) Explore how the packets can be traced based on different filters.		
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 Hours	**30**	

Prepared By:	Checked By:	Verified By:	Approved By:
Mrs. Vidyadhari Singh	Dr. Megharani Patil **Program Coordinator**	Mrs. Shiwani Gupta **Dy. HOD-COMP**	Dr.Sheetal Rathi **HOD-COMP** **Chairman BOS**

T.E. Semester –VI

B.E. (Computer Engineering)					T.E. SEM: VI				
Course Name : Machine Learning					Course Code : CSDLO6021				
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	
4	-	4	8	6	20	80	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: Algebra, Probability, Statistics

Course Objective: The course should be able to introduce Machine Learning techniques and become familiar with regression, clustering, classification and dimensionality reduction techniques.

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 types, issues, applications and steps to develop ML application	L1, L2
2	Understand ANN and DL	L1, L2
3	Understand optimization techniques and apply Hyperparameter tuning for model selection	L1, L2, L3, L4
4	Apply regression and trees for learning and assess the outcome	L1, L2, L3, L4
5	Apply classification and clustering algorithms for learning	L1, L2, L3
6	Apply dimensionality reduction methods	L1, L2, L3, L4

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Introduction to Machine Learning** 1.1 Machine Learning 1.2 Types of Machine Learning 1.3 Issues in Machine Learning 1.4 Application of Machine Learning 1.5 Steps in developing ML application	6	L1, L2
2	**Introduction to Neural Network and Deep Learning** 2.1 Introduction 2.2 Biological neuron and ANN 2.3 NN architecture 2.4 McCulloh Pitt model 2.5 Introduction Deep Learning 2.6 Applications of Deep Learning	6	L1, L2
3	**Optimization Techniques and Hyper parameter tuning** 3.1 Derivative Based Optimization – Steepest Descent, Newton Method 3.2 Derivative Free Optimization – Random Search, Downhill Simplex 3.3 Bias Variance tradeoff, Learning curve, Validation curve, Grid search	12	L1, L2, L3, L4
4	**Learning with Regression and Trees** 4.1 Learning with Regression: Logistic Regression, Regularization, Use case, Evaluation Metric 4.2 Learning with Trees: Decision Tree, Construction using Gini Index, Bagging Ensemble (Random Forest), Boosting Ensemble (XGBoost), Use case, Evaluation Metric	12	L1, L2, L3, L4
5	**Learning with Classification and Clustering** 5.1 Classification: Support Vector Machine, k Nearest Neighbor, Use case 5.2 Clustering: Expectation Maximization, Supervised Learning after clustering, Use case	6	L1, L2, L3, L4
6	**Dimensionality Reduction** 6.1 Feature Extraction (Principal Component Analysis, Single value decomposition) 6.2 Feature Selection (Filter, Wrapper, Embedded)	10	L1, L2, L3, L4
	Total Hours	**52**	

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	2010
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

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?utm_source=gg&utm_medium=sem&utm_content=07-StanfordML-IN&campaignid=1950458127&adgroupid=69480953983&device=c&keyword=machine%20learning%20online%20course&matchtype=b&network=g&devicemodel=&adpostion=1t2&creativeid=351281535285&hide_mobile_promo&gclid=Cj0KCQiAn8nuBRCzARIsAJcdIfMYXtdIwVvfyr6ee_ewWcWrBdFmGWrJnWif67PHGt-sEH6r68QbhUoaAvmJEALw_wcB	M1-M6

List of Practical/ Experiments:

S.N.	Type of Experiment	Practical/ Experiment Topic	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	Basic Experiments	Experiment a use case utilizing online datasets in order to apply Logistic Regression and measure the performance.	2	L1, L2, L3, L4
2		Experiment a use case utilizing online datasets in order to apply Decision Tree and measure the performance.	2	L1, L2, L3, L4
3		Experiment a use case utilizing online datasets in order to apply SVM and measure the performance.	2	L1, L2, L3, L4
4		Experiment a use case utilizing online datasets in order to apply kNN and measure the performance.	2	L1, L2, L3, L4
5		Experiment a use case utilizing online datasets in order to apply clustering and measure the performance.	2	L1, L2, L3, L4
6	Design Experiments	Experiment a use case utilizing online datasets in order to apply ensemble and measure the performance.	4	L1, L2, L3, L4
7		Experiment a use case utilizing online datasets in order to perform feature extraction in order to enhance performance.	4	L1, L2, L3, L4
8		Experiment a use case utilizing online datasets in order to perform feature selection in order to enhance performance.	4	L1, L2, L3, L4

9		Experiment a use case utilizing online datasets in order to perform hyperparameter tuning in order to enhance performance.	4	L1, L2, L3,
10	**Case Study**	Present a case study on the mini project developed as extension to any one experiment listed above.	4	L1, L2, L3, L5
		Total Hours	**30**	

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	4	L1,L2
7	Train and Validate Model	4	L1,L2,L3,L4
8	Tune Hyper parameters	4	L1,L2,L3,L4
9	Test and Evaluate Model	4	L1,L2,L3,L4,L5
10	Prepare report	4	L1,L2
	Total Hours	**30**	

Prepared By:	Checked By:	Verified By:	Approved By:
Mrs. Shiwani Gupta	Dr. Megharani Patil **Program Coordinator**	Mrs. Shiwani Gupta **Dy. HOD-COMP**	Dr.Sheetal Rathi **HOD-COMP** **Chairman BOS**

B.E. (Computer Engineering)					T.E. SEM: VI				
Course Name : Advance Database System					Course Code : CSDLO6022				
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	
4	-	4	8	6	20	80	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: Database Basics

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	8	L1, L2, L3
2	**Query processing and Optimization** • Overview • Measures of Query cost • Selection operation • Sorting • Join Operations, and other Operations **Evaluation of Expression Query Optimization :** • Translations of SQL Queries into relational algebra • Heuristic approach & cost based optimization	6	L1, L2, L3
3	**Overview of Distributed Database System** Features and Design Issues of Distributed Databases, Types of Distributed Databases, Distributed Database Architectures.	10	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.	12	L1, L2, L3, L4
5	**Document Oriented Database** Need of object oriented database, Impedance matching problem between OO languages and Relational database, Case study db4O, Need of Document Oriented database, difference between Document Oriented Database and Traditional database. Types of encoding XML, JSON, BSON, Representation XML, Json Objects. Case study on document Oriented Database such a Mariadb	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	**52**	

Books and References:

	Title	Authors	Publisher	Edition	Year
1	Fundamentals of Database Systems	Elmasri & Navathe	PEARSON Education.	7th Edition	2016
2	Database systems concepts	Korth, Silberschatzsudarshan	McGraw Hill	7th Edition	2016
3	Database Management System	Raghu Ramkrishnan & Johannes Gehrke	Tata McGraw-Hill Edition.	3rd Edition	2002
4	Learning MySQL and Mariadb	Ruosell J.T. Dyer	O'Reilly	1st Edition	2015

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

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 SQL Commands to Real life Problem.	2	L1, L2, L3
2		Apply DCL Commands for Database Security	2	L1, L2, L3
3		Study of Hashing and Indexing Techniques	2	L1, L2
4		Identify the case study and formalize detail definition of problem based on any advanced Database	2	L1, L2, L3

5	Design Experiments	Design EER model for the identified problem definition.	4	L1, L2, L3
6		Apply sorting, join operations for the specified problem statement.	4	L1, L2, L3
7		Perform Horizontal Fragmentation and check its correctness criteria on real time Database	4	L1, L2, L3
8		Perform Vertical Fragmentation and check its correctness criteria on real time Database	4	L1, L2, L3
9		Perform Mixed Fragmentation and check its correctness criteria on real time Database	4	L1, L2, L3
10	Case Study	Case Study on any one advanced topic like Temporal Database, Spatial Database, Multimedia Database or Mobile Database	2	L1, L2, L3,L4,L5
		Total Hours	**30**	

Mini Project Hours Distribution

Sr. No	Work to be done	Hrs.	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
4	Database Design	2	L1,L2,L3
5	Linking of GUI with Advanced Database	8	L1,L2,L3
6	Reports Design	2	L1,L2
7	Testing of Mini Project	2	L1,L2,L3,L4
8	Preparation of Report	4	L1,L2,L3,L4
	Total Hours	**30**	

Prepared By:	Checked By:	Verified By:	Approved By:
Mrs. Rashmi Thakur	Dr. Megharani Patil **Program Coordinator**	Shiwani Gupta **Dy. HOD-COMP**	Dr. Sheetal Rathi **HOD-COMP** **Chairman BOS**

B.E. (Computer Engineering)									
Course Name : Enterprise Resource Planning							T.E. SEM: VI		
Teaching Scheme (Program Specific)					Examination Scheme (Formative/ Summative)		Course Code : CSDLO6023		
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	
4	-	4	8	6	20	80	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: 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:

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	10	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	8	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.(Zaveri)	10	L1, L2, L3, L4
	Total Hours	**52**	

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

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	Make a list of Resource of the Selected Domain.	2	L1, L2, L3
2		Categorized the Resource as per the function level process and Identify module of the domain.	2	L1, L2, L3

3		Explain process of each module of the domain.	2	L1, L2, L3
4		Perform Business process re-engineering (BPR) on selected Module.	2	L1, L2, L3
5		Implement new system based on BPR.	4	L1, L2, L3,L4
6		Perform Impact analysis of the new system as the BPR -Prepare study on JD Edward Tool.	2	L1, L2, L3
7		Perform Impact analysis of the new system as the BPR-Prepare study on Microsoft Dynamics	4	L1, L2, L3
8	**Design Experiments**	Download any open source ERP Tool and prepare Installation Guideline and information about the Tool.	4	L1, L2, L3
9		Make Data Entry in the Software in all modules & generate report.	4	L1, L2, L3
10	**Seminar/ Case Studies**	**Case study:** 1. Give case study 2/3 student of any organization. Make a report before-after situation at organization (Domain). 2. Cases of ERP like MySAP for Business suite implementation at ITC, ERP for Nestle GLOBE Project, Oracle ERP Implementation at Maruti Suzuki etc.	4	L1, L2, L3,L4,L5
		Total Hours	**30**	

Mini Project Hours Distribution

Sr. No	Work to be done	No. of hours	Cognitive levels of attainment as per Bloom's Taxonomy
1	Study Open Source ERP tool for implementation	2	L1.L2
2	Project Title and Business Module Identification	2	L1,L2
3	Installation of ERP tool	2	L1,L2
4	Choose and identify the processes	2	L1,L2,L3
5	Make Data Entry in the Software in all modules	2	L1,L2,L3
6	Perform BPR	4	L1,L2
7	Perform BPR Cont...	4	L1,L2,L3,L4

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	

Prepared By:	Checked By:	Verified By:	Approved By:
Dr. Harshali P. Patil	Dr. Megharani Patil **Program Coordinator**	Shiwani Gupta **Dy. HOD-COMP**	Dr. Sheetal Rathi **HOD-COMP** **Chairman BOS**

B.E. (Computer Engineering)					T.E. SEM: VI				
Course Name : Advance Computer Network					Course Code : CSDLO6024				
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	
4	-	4	8	6	20	80	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:

Course Objective: The objective of the course is to make learners aware about advances in computer networking technologies and overview of advance internet, QoS based and management protocols, traffic engineering and capacity planning.

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	Identify the advance data communication technologies.	L1, L2
2	Interpret the understanding of WAN Technology typically ATM.	L1, L2, L3
3	Differentiate between various packet switching protocols such as X.25, X.75	L1, L2, L3, L4
4	Distinguish between the issues of advance internet routing protocols and also QoS based protocols	L1, L2, L3, L4
5	Analyze issues of traffic requirements and perform capacity planning.	L1, L2, L3, L4
6	Describe the understanding of protocol used for management of network.	L1, L2

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Data Communications** Defining Data Communication needs, Transmission Hierarchy. **Optical Networks:** SONET/SDH standard, Architecture, Format, Hardware	4	L1, L2
2	**WAN Technology** Introducing ATM Technology, Need and Benefit, Concept, Faces of ATM Why ATM, BISDN Reference Model, ATM Layer, ATM Adaptation Layer	8	L1, L2, L3
3	**Traffic Engineering** **Requirement Definition:** User requirement Traffic Sizing , Traffic Characteristics, Protocols, Time and Delay Considerations **Traffic Engineering and Capacity planning:** Throughput calculation, Traffic Engineering basics, Traditional traffic Engineering and Queued data and Packet Switched packet modeling, Queuing Disciplines (M/M/1), Design parameters for Peak: delay or latency, availability and reliability.	12	L1, L2, L3, L4
4	**Protocols and Interfaces** **Introduction to TCP/IP:** Issues in IPV4, IPV6 protocol **Mature Packet Switching Protocols:** ITU Recommendation X.25, User Connectivity, Theory of Operations, Network Layer Functions, X.75 Internetworking Protocol	8	L1, L2, L3, L4
5	**Advance Routing Protocols** **Internet Routing Protocols :** OSPF, RIP, BGP **Multicast Routing:** Reverse Path Broadcasting, Internet Group Management Protocol, Reverse Path Multicasting, Discrete Vector Multicasting protocol **IP forwarding Architectures** **Overlay Model:** Classical IP over ATM and LANE **Multiprotocol Label Switching MPLS:** Fundamentals of Labels, Label Stack, VC Merging, Label Distribution Protocol, Explicit routing for Traffic Engineering Integrated services, RSVP, Differentiated Services **Multimedia Over Internet:** RTP, Session Control Protocol H.323	14	L1, L2, L3, L4
6	**Network management** **Network Management:** SNMP Concept and format, Management Components: SMI, MIB	6	L1, L2
	Total Hours	**52**	

Books and References:

	Title	Authors	Publisher	Edition	Year
1	Internetworking with TCP/IP	Steven, David L	Pearson	Second Edition	2006
2	Computer Communications and Networking Technologies	M. A. Gallo and W. M. Hancock	Cengage Learning	First Edition	2002
3	Communication Networks	Leon-Garcia	Tata McGraw-Hill	Second Edition	2004
4	Data Network Design	Darren L. Spohn	Tata McGraw-Hill	Third Edition	2002
5	TCP/IP Protocol Suite	Behrouz Forouzan	Tata McGraw-Hill	Fifth Edition	2001
6	High-Speed Networks and Internets	William Stallings	Pearson Education	Second Edition	2010
7	Computer Networks	Andrew Tanenbaum	Prentice Hall	Fifth Edition	2011
8	Internetworking with TCP/IP	Douglas E. Comer	Pearson Education	Sixth Edition	1999
9	Computer Networking, A Top-Down Approach Featuring the Internet	James F. Kurose, Keith W. Ross	Addison Wesley	Fifth Edition	2013

Online Resources:

S. No.	Website Name	URL	Modules Covered
1	www.oreilly.com	https://www.oreilly.com/library/view/network-infrastructure-and/9780471749066/09_c04.html	M1
2	www.ciscopress.com	http://www.ciscopress.com/articles/article.asp?p=2832405&seqNum=5	M2
3	www.moviri.com	http://www.moviri.com/download/Movinar_Network_Capacity_Planning.pdf	M3
4	www. study-ccna.com	https://study-ccna.com/routing-protocols/	M4,M5

List of Practical/ Experiments:

Practical Number	Type of Experiment		Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	Basic Experiments	Understand the implantation of SONET/SDH standard.	2	L1, L2
2		Illustrate IP address, subnet and subnet mask on a network using CISCO packet tracer.	2	L1, L2, L3, L4
3	Design Experiments	Illustrate of Border gateway protocol in Cisco packet Tracer	2	L1, L2, L3, L4
4		Illustrate Initial Switch Configuration in Cisco Packet Tracer	2	L1, L2, L3, L4
5		Illustrate a network using Distance vector routing	2	L1, L2, L3, L4
6		Illustrate a network using Link State Routing	4	L1, L2, L3, L4
7		Illustrate RIP protocol using cisco packet tracer	4	L1, L2, L3, L4
8		Illustrate M/M/1 queuing technique.	4	L1, L2, L3, L4
9	Mini/Minor Projects/ Seminar/ Case Studies	Presentation: Research paper on ATM Networks	4	L1, L2, L3
10		Case Study on: SNMP for Network Management	4	L1, L2, L3
		Total Hours	**30**	

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.	2	L1.L2
2	Project Title and Modules Identification	2	L1,L2
3	Design & Methodology	2	L1,L2
4	Implementation of Module 1	2	L1,L2,L3
5	Result Phase I	2	L1,L2,L3
6	Implementation of Module 2	4	L1,L2
7	Result Phase II	4	L1,L2,L3,L4
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**	

Prepared By:	Checked By:	Verified By:	Approved By:
Dr. R.R. Sedamkar Ms. Pradnya Saval	Dr, Megharani Patil **Program Coordinator**	Mrs. Shiwani Gupta **Dy. HOD-COMP**	Dr.Sheetal Rathi **HOD-COMP** **Chairman BOS**

B.E. Semester –VIII

B.E. (Computer Engineering)							B.E. SEM: VIII		
Course Name: Human Machine Interaction							Course Code: CSC801		
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
4	-	2	6	5	20	80	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: Web Technologies, Software Engineering

Course Objective: The course intends to deliver fundamental knowledge about GUI design guidelines and apply the knowledge to design intuitive GUI 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	Understand the foundation of human machine interaction.	L1, L2
2	Analyze the importance of human psychology effective user friendly interfaces.	L1, L2, L3, L4
3	Evaluate UI design for intuitive GUI and justify.	L1, L2, L3, L4, L5
4	Design interactive screens using different applications to meet user requirements.	L1, L2, L3, L4, L5, L6
5	Synthesize interactive design process in real world mobile applications.	L1, L2, L3, L4, L5, L6
6	Create the machine interaction application for social and technical task.	L1, L2, L3, L4, L5, L6

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Foundations of HMI** The Human: History of User Interface Designing, I/O channels, Hardware, Software and Operating environments, The Psychopathology of everyday Things, Psychology of everyday actions, Reasoning and problem solving. The computer: Devices, Memory, processing and networks. Interaction: Models, frameworks, Ergonomics, styles, elements, interactivity, Paradigms.	6	L1, L2
2	**Design & Software Process** Mistakes performed while designing a computer system, Human interaction with computers, importance of human characteristics human consideration, Human interaction speeds .Interactive Design basics, process, scenarios, navigation, Iteration and prototyping. HMI in software process: software life cycle, usability engineering, Prototyping in practice, design rationale. Design rules: principles, standards, guidelines, rules. Recognize the goals, Goal directed design process. Evaluation Techniques: Universal Design	10	L1, L2, L3, L4
3	**Graphical User Interface** The graphical User Interface: Popularity of graphics, the concept of direct manipulation, graphical systems, Characteristics. Web user Interface: Interface popularity, characteristics. The merging of graphical Business systems and the Web. Principles of user interface design.	6	L1, L2, L3, L4, L5
4	**Screen Designing** Design goals , Screen planning and purpose, organizing screen elements, ordering of screen data and content , screen navigation and flow, Visually pleasing composition, amount of information, focus and emphasis, presentation information simply and meaningfully, information retrieval on web, statistical graphics, Technological Consideration in interface design.	14	L1, L2, L3, L4, L5, L6
5	**Interface Design For Mobile Devices** Mobile Ecosystem: Platforms, Application frameworks: Types of Mobile Applications: Widgets, Applications, Games, Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools.	8	L1, L2, L3, L4, L5, L6
6	**Interaction Styles And Communication** Windows: Characteristics, Components, Presentation styles, Types of Windows, Management, operations. Text messages: Words, Sentences, messages and text words, Text for web pages. Icons, Multimedia and colors.	8	L1, L2, L3, L4, L5, L6
	Total Hours	**52**	

Books and References:

SN	Title	Authors	Publisher	Edition	Year
1	Human Computer Interaction.	Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale	Pearson	3rd Edition	2004
2	The Essential Guide to User Interface Design	Wilbert O. Galitz	Wiley publication	3rd Edition	2007
3	About Face3: Essentials of Interaction design	Alan Cooper, Robert Reimann, David Cronin,	Wiley publication	3rd Edition	2007
4	Designing with the mind in mind	Jeff Johnson	Morgan Kaufmann Publication	2nd Edition	2015
5	Design of everyday things	Donald A. Normann	Peter Lindsay	3rd Edition	2002
6	Mobile Design and Development	Brian Fling	O'Reilly	1st Edition	2009

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

List of Practical/ Experiments:

Practical Number	Type of Experiment	Practical/ Experiment Topic	Hrs.	RBT Levels
1	Basic Experiments	(a) Sketch interface for Mobile app/ Website that can teach mathematics to children of 4-5 years age in schools in Rural /Urban Sector	2	L1, L2, L3, L4
		(b) Sketch interface for Mobile App/Website that can help people to sell their handmade products in metro cities		
		(c)Sketch interface for ATM machine/KIOSK screen for rural people		
		(d)Sketch interface for Mobile App/Website to get an experience for passengers whose flight /train is delayed.		
2		Design an UI application for Institute event management.	2	L1, L2, L3, L4, L5, L6

3	Design Experiments	Design of User interface for the system using various interaction styles.	2	L1, L2, L3, L4, L5, L6
4		Redesign the interface to minimize the screen complexity by calculating screen complexity of existing Graphical User Interface.	2	L1, L2, L3, L4, L5, L6
5		Design appropriate icons pertaining to a given domain. (e.g. Greeting cards)	2	L1, L2, L3, L4, L5, L6
6		Design a interface for Home appliances	2	L1, L2, L3, L4, L5, L6
7		Design a navigator for a student new in your Institute.	2	L1, L2, L3, L4, L5, L6
8		Develop an application using interactive data access through Graphics (QR, BAR Code, Image etc.) and generating a print form.	4	L1, L2, L3, L4, L5, L6
9		Develop an application by using statistical graphics and its use in visualization.	4	L1, L2, L3, L4, L5, L6
10	Mini Projects	• Mobile App for a person new in tourist city/ village. • Motor paralysis for disabled people • KIOSK for hospital/school/educational campus/National Institute. • Personal website for an Artisan. • App for Nutrition Management. • App for Disease Prevention & Treatment.	8	L1, L2, L3, L4, L5, L6
		Total Hours	**30**	

Prepared By:	Checked By:	Verified By:	Approved By:
Dr. Megharani Patil Mrs. Vidyadhari Singh	Dr. Megharani Patil **Program Coordinator**	Mrs. Shiwani Gupta **Dy. HOD-COMP**	Dr.Sheetal Rathi **HOD-COMP** **Chairman BOS**

B.E. Semester –VIII

B.E. (Computer Engineering)					B.E. SEM : VIII				
Course Name : Distributed Computing					Course Code : CSC802				
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	
4	-	2	6	5	20	80	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: Computer Basics, Procedural Programming Languages

Course Objective: 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

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

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
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,L3
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	08	L1, L2, L3, L4
5	**Consistency, Replication and Fault Tolerance** Introduction to replication and consistency, Data-Centric and Client-Centric Consistency Models, Replica Management Fault Tolerance: Introduction, Process resilience, Reliable client-server and group communication, Recovery.	10	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. Designing Distributed Systems: Google Case Study.	12	L1, L2, L3, L4
	Total Hours	52	

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 6. Distributed System on One Lane Bridge Project		
		Total Hours	**30**	

Prepared By:	Checked By:	Verified By:	Approved By:
Mr. Vikas Singh	Dr. Megharani Patil **Program Coordinator**	Mrs. Shiwani Gupta **Dy. HOD-COMP**	Dr.Sheetal Rathi **HOD-COMP** **Chairman BOS**

B.E. Semester –VIII

B.E. (Computer Engineering)									
Course Name : Department Level Optional Course -IV (High Performance Computing)							B.E. SEM : VIII		
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	
4	-	2*	6	5	20	80	25	50	175

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 study parallel processing as it pertains to high-performance computing and able 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:

SN	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Illustrate parallel processing approaches	L1,L2
2	Describe different parallel processing platforms involved in achieving High Performance Computing.	L1,L2
3	Compare different design issues in parallel programming.	L1,L2,L3,L4
4	Discuss parallel programming issues and Develop parallel programs	L1,L2,L3,L4
5	Analyze the performance measures of parallel programs	L1,L2,L3,L4
6	Describe parallel programming using message passing paradigm using open source APIs.	L1,L2,L3,L4,L5

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Introduction** Introduction to Parallel Computing: Motivating Parallelism, Scope of Parallel Computing, Levels of parallelism (instruction, transaction, task, thread, memory, function) Classification Models: Architectural Schemes (Flynn's, Feng's, Handler's) and Memory access (Shared Memory, Distributed Memory, Hybrid Distributed Shared Memory) Parallel Architectures: Pipeline Architecture, Array Processor, Multiprocessor Architecture, Systolic Architecture, Data Flow Architecture.	8	L1,L2
2	**Pipeline Processing** Introduction, Pipeline Performance, Arithmetic Pipelines, Pipeline instruction processing, Pipeline stage design, Hazards, Dynamic instruction scheduling	6	L1,L2
3	**Parallel Programming Platforms** Parallel Programming Platforms: Implicit Parallelism: Trends in Microprocessor & Architectures, Limitations of Memory System Performance, Dichotomy of Parallel Computing Platforms, Physical Organization of Parallel Platforms, Communication Costs in Parallel Machines	8	L1, L2, L3, L4
4	**Parallel Algorithm Design** Principles of Parallel Algorithm Design: Preliminaries, Decomposition Techniques, Characteristics of Tasks and Interactions, Mapping Techniques for Load Balancing, Parallel Algorithm Models, Examples of Parallel Algorithms (Bitonic Sort, the parallel formulation of odd-even transposition sort)	14	L1, L2, L3, L4
5	**Performance Measures** Performance Measures : Speedup, execution time, efficiency, cost, scalability, Effect of granularity on performance, Scalability of Parallel Systems, Amdahl's Law, Gustavson's Law, Performance Bottlenecks	6	L1, L2, L3, L4
6	**HPC Programming** Programming Using the Message-Passing Paradigm: Principles of Message Passing Programming, The Building Blocks: Send and Receive Operations MPI: the Message Passing Interface, Topology and Embedding, Overlapping Communication with Computation, Collective Communication and Computation Operations, Introduction to OpenMP	10	L1, L2, L3, L4, L5
	Total Hours	52	

Books and References:

	Title	Authors	Publisher	Edition	Year
1	Introduction to Parallel Computing	Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar	Pearson Education	2nd Edition	2007
2	Parallel Computing	M. R. Bhujade	New Age International Publishers	2nd Edition	2009
3	Advanced Computer Architecture: Parallelism, Scalability, and Programmability.	Kai Hwang, Naresh Jotwani	McGraw Hill	2nd edition	2010
4	Introduction to High Performance Computing for Scientists and Engineers.	Georg Hager, Gerhard Wellein	Taylor & Francis	Special Indian Edition	2011

Online Resources:

S. No.	Website Name	URL	Modules Covered
1	www.vssut.ac.in	www.vssut.ac.in › lecture_notes › lecture1428643084	M1-M6
2	hpc.llnl.gov	https://hpc.llnl.gov › training › tutorials	M M1-M6
3	www.researchgate.net	https://www.researchgate.net › publication › 260724344_An_Introduction	M1-M6

List of Practical/ Experiments:

Practical Number	Type of Experiment	Practical/ Experiment Topic	Hrs.	RBT Levels
1	Basic Experiments	Develop a Program for Execution of Simple Hello world program on MPI platform	2	L1, L2, L3
2		Develop a program to send data and receive data to/from processors using MPI	2	L1, L2, L3
		Program illustrating Broadcast of data using MPI	2	L1, L2, L3
3	Design Experiments	Implement a parallel program to demonstrate the cube of N number within a set range	2	L1, L2, L3
4		Write a parallel program for area of a circle/triangle	2	L1, L2, L3
5		Implement a program to demonstrate balancing of workload on MPI platform	2	L1, L2, L3
6		Using directives of MPI/OpenMP implement parallel programming for calculator application (add, sub, multiplication and division)	2	L1, L2, L3
7		Implement Bionic Sort Algorithm.	4	L1, L2, L3
8		Implement Parallel Odd Even Transposition Algorithm	4	L1, L2, L3

9	Case Studies	**Case study:** • HPC and Topological Data Analysis • Software Architecture HPC system	2	L1, L2
10	Mini/Minor Projects/	**Mini Project:** **Evaluate performance enhancement of HPC for any of the following:** 1. One-Dimensional Matrix-Vector Multiplication 2. Single-Source Shortest-Path/ 3. Sample Sort 4. Two-Dimensional Matrix-Vector Multiplication	6	L1, L2, L3, L4, L5, L6
		Total Hours	**30**	

Prepared By:	Checked By:	Verified By:	Approved By:
Dr. Rekha Sharma	Dr. Megharani Patil **Program Coordinator**	Mrs. Shiwani Gupta **Dy. HOD-COMP**	Dr. Sheetal Rathi **HOD-COMP** **Chairman BOS**

B.E. Semester –VIII

B.E. (Computer Engineering)					B.E. SEM : VIII				
Course Name : Department Level Optional Course -IV (Natural Language Processing)					Course Code : CSDLO 8012				
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/OR	TW	175
4	-	2*	6	5	20	80	25	50	
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: Programming Language Basic, Compiler Concepts									

Course Objective: The course intends to apply 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	Understand field of natural language processing.	L1, L2
2	Analyze capabilities and limitations of current natural language technologies,	L1, L2, L3, L4
3	Apply the model linguistic phenomena with formal grammars.	L1, L2, L3
4	Analyze and test algorithms for NLP problems	L1, L2, L3, L4
5	Understand the mathematical and linguistic foundations underlying approaches to the various areas in NLP	L1, L2
6	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** History of NLP, Generic NLP system, levels of NLP , Knowledge in language processing , Ambiguity in Natural language , stages in NLP, challenges of NLP ,Applications of NLP	4	L1, L2
2	**Word Level Analysis** Morphology analysis –survey of English Morphology, Inflectional morphology & Derivational morphology, Lemmatization, Regular expression, finite automata, finite state transducers (FST) , Morphological parsing with FST, Lexicon free FST Porter stemmer. N –Grams- N-gram language model, N-gram for spelling correction.	9	L1, L2, L3, L4
3	**Syntax Analysis** Part-Of-Speech tagging(POS)- Tag set for English (Penn Treebank) , Rule based POS tagging, Stochastic POS tagging, Issues –Multiple tags & words, Unknown words. Introduction to CFG, Sequence labeling: Hidden Markov Model (HMM), Maximum Entropy, and Conditional Random Field (CRF).	9	L1, L2, L3
4	**Semantic Analysis** Lexical Semantics, Attachment for fragment of English- sentences, noun phrases, Verb phrases, prepositional phrases, Relations among lexemes & their senses –Homonymy, Polysemy, Synonymy, Hyponymy, WordNet, Robust Word Sense Disambiguation (WSD) ,Dictionary based approach	11	L1, L2, L3, L4
5	**Pragmatics** Discourse –reference resolution, reference phenomenon , syntactic & semantic constraints on co reference	9	L1, L2
6	**Applications of NLP** Machine translation, Information retrieval, Question answers system, categorization, summarization, sentiment analysis, Named Entity Recognition.	10	L1, L2,L3
	Total Hours	**52**	

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 applicationsl	Daniel M Bikel and Imed Zitouni	Peasron	--	2013
5	Natural Language Processing with Python	Steven Bird, Ewan Klein	O'Reilly	First Edition	2009

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.	Cognitive levels of Bloom's Taxonomy
1	Basic Experiments	Study different steps of Natural Language Processing	2	L1,L2
2		Study different NLP Packages/Tools	2	L1,L2,L3
3		Implement Word Analysis techniques	2	L1,L2,L3,L4,L5
		Implement Word generation	2	L1,L2,L3

		techniques		
4	Design Experiments	Implement Stop word removal techniques	2	L1,L2,L3
5		Implement Stemming in NLP	2	L1,L2,L3
6		Implement Morphology POS Tagging and in NLP	4	L1,L2,L3
7				L1,L2,L3
9	Advanced Experiments	Implement Chunking in NLP and N-gram language model	4	L1,L2,L3
10	Mini/Minor Projects/ Seminar/ Case Studies	1. Speech Recognition 2. Caption Generation 3. Machine Translation 4. Document Summarization 5. Question Answering 6. Text Classification	10	L1,L2,L3,L4,L5

Prepared By:	Checked By:	Verified By:	Approved By:
Dr. Anand Khandare	Dr. Megharani Patil Program Coordinator	Mrs. Shiwani Gupta Dy. HOD-COMP	Dr. Sheetal Rathi HOD-COMP Chairman BOS

B.E. Semester –VIII

B.E. (Computer Engineering)								
Course Name : Department Level Optional Course -IV (Adhoc Wireless Networks)							**B.E. SEM : IV**	
							Course Code : CSDLO 8013	
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**	
4	-	2*	6	5	20	80	25	50	175

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 Network, Wireless Networking

Course Objective: The course intends to apply knowledge about the architecture of Adhoc Wireless Networks and the protocols used in various network layers. Also, the course discusses the security issues in Adhoc Networks and about Vehicular Adhoc Networks.

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 Adhoc Wireless Networks; describe the characteristics, features of Adhoc networks and discuss the issues in Adhoc Networks	L1, L2
2	Describe the concepts of MAC protocols and analyze the issues in designing MAC protocols for Ad Hoc networks.	L1, L2,L3, L4
3	Describe the concepts of routing protocols for Adhoc Networks, compare them and analyze the issues in designing routing protocols	L1, L2, L3,L4
4	Summarize the concepts of transport layer protocols for Adhoc Networks; interpret the flow control in transport layer of Ad Hoc Networks and investigate the issues in designing transport protocols	L1, L2, L3, L4
5	Cite network security requirementsin Ad Hoc Networks and examine the issues in security provisioning; summarize the concepts of link layer and network security attacks.	L1, L2, L3
6	Describe the concept of VANET; recall and apply the concepts of Adhoc Networks in VANETs.	L1, L2, L3

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Introduction** Introduction to wireless Networks. Characteristics of Wireless channel, Issues in Ad hoc wireless networks, Adhoc Mobility Models: - Indoor and outdoor models, Introduction to Adhoc networks – definition, characteristics features, applications.	04	L1, L2
2	**MAC protocols for Wireless Ad-Hoc Networks** Introduction, Issues in designing MAC for Wireless Ad-Hoc Networks, Design Goals and classification of MAC for Wireless Ad-Hoc Networks, Contention based MAC protocols for Wireless Ad-Hoc Networks, with reservation mechanisms, scheduling Mechanisms, MAC protocols using directional antennas, Other MAC Protocols, IEEE standards MAC Protocols: 802.15.1(WPAN based on Bluetooth), 802.15.4 (WSN/Zigbee), 802.15.6 (WBAN).	10	L1, L2, L3,L4
3	**Routing Protocols for Wireless Ad-Hoc Networks** Introduction, Issues in designing a routing protocol for Wireless Ad-Hoc Networks, Classification of routing protocols, Table driven routing protocols like DSDV, WRP,On- demand routing protocols like ABR, DSR, TORA, AODV, etc., Hybrid Routing Protocols: ZRP, Routing Protocols with efficient flooding mechanism, Hierarchical Routing Protocols, Power aware routing protocols.	8	L1, L2,L3, L4
4	**Transport Layer** Transport layer protocols for Ad hoc wireless Networks: Introduction, Issues in designing a transport layer protocol for Ad hoc wireless Networks, Design goals of a transport layer protocol for Ad hoc wireless Networks, Classification of transport layer solutions: Split Approach , End-to-End approach :TCP-F,TCP-ELFN, Ad-Hoc TCP, TCP Buffering capability and Sequencing information, End-to-End Quality of Service.	12	L1, L2, L3, L4
5	**Security** Security attacks in wireless Ad hoc wireless Networks, Network security requirements, Issues & challenges in security provisioning, Link Layer security attacks: 802.11 MAC , WPA and variations, Network Security Attacks: Routing Protocol Attacks: attacks using falsifying route errors and broadcasting falsifying routes, spoofing attacks, Rushing attacks, Secure routing in Ad hoc wireless Networks.	8	L1, L2, L3
6	**Vehicular Ad-Hoc Network (VANET)** Introduction: Challenges and Requirements, , Layered architecture for VANETs, DSRC /WAVE standard (IEEE 802.11p), IEEE 802.11p protocol Stack (PHY & MAC) , A Survey on Proposed MAC Approaches for VANETs like TDMA, SDMA and CDMA based approaches, DSRC MAC & LLC, Georouting: CBF, Flooding with broadcast suppression, Delay Tolerant Network, Introduction to Opportunistic Networking in Delay Tolerant Vehicular Ad Hoc Networks.	10	L1, L2, L3
	Total Hours	52	

Books and References:

	Title	Authors	Publisher	Edition	Year
1	Ad hoc Wireless Networks Architectures and protocols	Siva Ram Murthy and B.S. Manoj	Pearson Education	Second Edition	2007
2	Adhoc Mobile Wireless Networks	C. K. Toh	Pearson Education	First Edition	2007
3	Adhoc Networking	Charles E. Perkins	Addison – Wesley	Second Edition	2000
4	Emerging Wireless Technologies and the Future Mobile Internet	Dipankar Raychaudhuri, Mario Gerla	Cambridge	--	2011
5	Ad-Hoc Mobile Wireless Networks: principles, protocols and applications	Subir Kumar Sarkar	CRC Press	Second Edition	2007
6	Ad Hoc Networks: Technologies and Protocols	Prasant Mohapatra and Sriramamurthy	Springer International Edition	First Edition	2009
7	Mobile Ad-Hoc Networking	Stefano Basangi, Marco Conti, Silvia Giordano, Ivan Stojmenovic	John-Wiley and Sons Publications	First Edition	2004
8	VANET Applications and Interworking Technologies	Hannes Hartenstein, Kenneth Laberteaux	Wiley Publications	First Edition	2010
9	Vehicular Networking	Christoph Sommer, Falko Dressler	Cambridge University Press	First Edition	2014

Online Resources:

S. No.	Website Name	URL	Modules Covered
1	www.nptel.ac.in	https://nptel.ac.in/courses/106105160/	M1-M4
2	www.cs.jhu.edu	http://www.cs.jhu.edu/~cs647/	M5
3	www.sciencedirect.com	https://www.sciencedirect.com/topics/computer-science/vehicular-ad-hoc-network	M6

List of Practical/ Experiments:

Practical Number	Type of Experiment	Practical/ Experiment Topic	Hrs.	RBT Levels
1	Basic Experiments	Installation of NS2 & NS3 in Fedora 19 (32 bit) OS Linux	2	L1, L2

		Simulating IEEE 802.11 wireless LAN in Ad-Hoc Mode using NS2	2	
2		Implementation a Bluetooth network in NS3 with application as transfer of a file from one device to another	2	L1, L2, L3
3		To implement and compare MAC layer protocols, MACAW, MACA-BI and MACA with piggybacked Reservation using NS-3	2	L1, L2, L3, L4, L5,L6
4		Develop sample wireless network in which a. implement AODV and AOMDV protocol b. Calculate the time to receive reply from the receiver using NS2. c. Generate graphs which show the transmission time for packet. Implement wireless network. Capture data frame and identify fields using NS2.	2	L1, L2, L3, L4, L5,L6
5	**Design Experiments**	Communicate between two different networks (NS-3) which has following specifications: a. One network has Class A network with —TORA protocol b. Second has Class B network —AODV protocoll	2	L1, L2, L3
6		To calculate and compare average throughput for various TCP variants like TCP-F (Feedback) and Ad-Hoc TCP using NS-3	4	L1, L2, L3, L4
7		Explore and use security tools like WEP & WPA and evaluate its performance on mobile terminals	4	L1, L2, L3
8		Simulation of Urban Mobility (SUMO) along with MOVE for simulating the VANETs. Install it on Fedora 19 (32 bit) OS Linux	4	L1, L2, L3
9				
10	**Mini/Minor Projects/ Seminar/ Case Studies**	**Case study:** 1. Self-Organizing Network Architectures and Protocols. 2. Analyzing the security attacks in Mobile Ad Hoc Networks. 3. Privacy Issues in VANETs. **Mini Project:** 1. Defense Mechanism Against Stealthy Attack in Wire less Ad Hoc Network 2. Defense Mechanism Against Data Flooding Attacks 3. Selfish Node Detection 4. Selfish Node Detection 5. Intrusion Detection System in VANET	6	L1, L2, L3, L4, L5,L6
		Total Hours	**30**	

Prepared By:
Mrs. Lydia Suganya

Checked By:
Dr. Megharani Patil
Program Coordinator

Verified By:
Mrs. Shiwani Gupta
Dy. HOD-COMP

Approved By:
Dr. Sheetal Rathi
HOD-COMP
Chairman BOS

B.E. Semester –VIII

B.E. (Computer Engineering)					B.E. SEM : VIII				
Course Name: Institute Level Optional Course-II (Project Management)					Course Code : ILO8021				
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	20	80	-	-	
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: Data Structure, Software Engineering									

Course Objective: 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:

SN	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).	5	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	5	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).	6	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,	8	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	39	

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	2001
3	Planning Projects	Project Management, Gido Clements	Cengage Learning	Seventh Edition	2018
4	Executing Projects, Monitoring and Controlling Projects & Project Contracting	Project Management, Gopalan Wiley India	Wiley India	Second Edition	2014
5	Project Leadership and Ethics & Closing the Project	Project Management, Dennis Lock.	Gower Publishing England	Ninth Edition	2007

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

Prepared By:	Checked By:	Verified By:	Approved By:
Mr. Manish Rana	Dr. Megharani Patil **Program Coordinator**	Mrs. Shiwani Gupta **Dy. HOD-COMP**	Dr. Sheetal Rathi **HOD-COMP** **Chairman BOS**

B.E. Semester –VIII

B.E. (Computer Engineering)							B.E. SEM : VIII		
Course Name: Institute Level Optional Course-II (Finance Management)							Course Code : ILO8022		
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	20	80	-	-	100

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:

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	06	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	06	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.	09	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;	05	L1,L2,L3, L4

	Project Finance. **Capital Structure:** Factors Affecting an Entity's Capital Structure; Overview of 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	03	L1, L2, L3, L4
	Total Hours	**39**	

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

Prepared By:	Checked By:	Verified By:	Approved By:
Mrs. Apeksha Waghmare	Dr. Megharani Patil **Program Coordinator**	Mrs. Shiwani Gupta **Dy. HOD-COMP**	Dr.Sheetal Rathi **HOD-COMP** **Chairman BOS**

B.E. Semester –VIII

B.E. (Computer Engineering)					B.E. SEM : VIII				
Course Name: Institute Level Optional Course-II (Entrepreneurship Development and Management)					Course Code : ILO8023				
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	20	80	-	-	

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: Project Management, Communication Skills

Course Objective: The objective of the course is to acquaint with entrepreneurship and management of business, understand Indian environment for entrepreneurship and introduce the idea of EDP and MSME.

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	Interpret the concept of business plan and ownerships	L1, L2, L3,L4
2	Interpret key regulations and legal aspects of entrepreneurship in India	L1, L2, L3,L4
3	Interpret government policies for entrepreneurs	L1, L2, L3,L4
4	Interpret Indian Environment for Entrepreneurship	L1, L2, L3,L4
5	Interpret issues and problems for effective business	L1, L2, L3,L4
6	Understand business cycle for small businesses	L1, L2

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Overview Of Entrepreneurship** Definitions, Roles and Functions/Values of Entrepreneurship, History of Entrepreneurship Development, Role of Entrepreneurship in the National Economy, Functions of an Entrepreneur, Entrepreneurship and Forms of Business Ownership Role of Money and Capital Markets in Entrepreneurial Development: Contribution of Government Agencies in Sourcing information for Entrepreneurship	4	L1, L2, L3,L4
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	9	L1, L2, L3,L4
3	**Entrepreneurship Development** Women's Entrepreneurship Development, Social entrepreneurship-role and need, EDP cell, role of sustainability and sustainable development for SMEs, case studies, exercises	5	L1, L2, L3,L4
4	**Indian Environment for Entrepreneurship** Key regulations and legal aspects , MSMED Act 2006 and its implications, schemes and policies of the Ministry of MSME, role and responsibilities of various government organizations, departments, banks etc., Role of State governments in terms of infrastructure developments and support etc., Public private partnerships, National Skill development Mission, Credit Guarantee Fund, PMEGP, discussions, group exercises etc.	8	L1, L2, L3,L4
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	8	L1, L2, L3,L4
6	**Achieving Success In The 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	39	

Books and References:

	Title	Authors	Publisher	Edition	Year
1	Entrepreneurship development- Small Business Enterprise	Poornima Charantimath	Pearson	Fifth Edition	2005
2	Entrepreneurship	Robert D Hisrich, Michael P Peters, Dean A Shapherd	McGraw Hill	Sixth Edition	2005
3	Entrepreneurship Development	Dr. TN Chhabra	Sun India Publications	Second Edition	2011
4	Small and Medium Enterprises in Global Perspective	Dr. CN Prasad	New century Publications	Second Edition	2012
5	Entrepreneurial development and management	Mr. Vasant Desai	Himalaya Publishing House	Sixth Edition	2018

Online Resources:

S. No.	Website Name	URL	Modules Covered
1.	www.saylordotorg.github.io	https://saylordotorg.github.io/text_the-sustainable-business-case-book/s09-01-overview-of-entrepreneurship.html	M1
2.	www.toptal.com	https://www.toptal.com/finance/business-plan-consultants/importance-of-business-plan	M2-M3
3.	www.gatheringofangels.com	https://www.gatheringofangels.com/entrepreneur-business-plan/	M4

Checked By:
Dr. Megharani Patil
Program Coordinator

Verified By:
Mrs. Shiwani Gupta
Dy. HOD-COMP

Approved By:
Dr. Sheetal Rathi
HOD-COMP
Chairman BOS

B.E. Semester –VIII

B.E. (Computer Engineering)							B.E. SEM : VIII		
Course Name: Institute Level Optional Course-II (Human Resource Management)							Course Code : ILO8024		
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	20	80	-	-	100

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: Interpersonal, decision-making, organizational, leadership, and speaking skills

Course Objective: This course intends to introduce the students with basic concepts, techniques and practices, latest developments, trends & different aspects of human resource management. It also strives to acquaint the student with the importance of interpersonal & inter-group behavioral skills in an organizational setting required for future stabie engineers, leaders and managers.

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 concepts, aspects, techniques and practices of human resource management	L1, L2, L3
2	Understand the Human resource management (HRM) processes, functions, changes and challenges in today's emerging organizational perspective.	L1, L2, L3
3	Gain knowledge about Organizational structure and Design	L1, L2, L3
4	Apply the knowledge Of Human Resource and Career Planning , training and development	L1, L2, L3, L4
5	Analyze and apply the latest trends in HR, for Organizational Development.	L1, L2,L3, L4
6	Understand and evaluate the role of different information systems and applications in HR.	L1, L2, L3, L4, L5

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Introduction to HR** 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.	4	L1, L2, L3
2	**Organizational Behavior (OB)** 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	9	L1, L2, L3
3	**Organizational Structure &Design** 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.	5	L1, L2,L3
4	**Human resource Planning** Recruitment and Selection process, Job-enrichment, Empowerment - Job-Satisfaction, employee morale Performance Appraisal Systems: Traditional & modern methods, Performance Counselling, Career Planning Training & Development: Identification of Training Needs, Training Methods.	8	L1, L2, L3, L4
5	**Emerging Trends in HR** 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	8	L1, L2, L3, L4
6	**Introduction to Non Deterministic algorithm** HR & MIS: Need, purpose, objective and role of information system in HR, Applications in HRD in various industries (e.g. manufacturing	5	L1, L2, L3, L4, L5

	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.		
	Total Hours	**39**	

Books and References:

	Title	Authors	Publisher	Edition	Year
1	Organizational Behavior	Stephen Robbins	Pearson Education	Sixteenth Edition	2013
2	Human Resource Management	V. S. Rao	Excel publishing	Third Edition	2010
3	Human resource management: Text & cases	Aswathapa	McGraw Hill Education	Sixth Edition	2011
4	Dynamics of Industrial Relations in India,	C. B. Mamoria and S V Gankar	Himalaya Publishing	Fifteenth Edition	2015
5	Essentials of Human Resource management and Industrial relations,	P. Subba Rao	Himalaya Publishing	Fifth Edition	2013
6	Management & Organizational Behavior	Laurie Mullins,	Pearson Publications	Latest Edition	2016

Online Resources:

S. No.	Website Name	URL	Modules Covered
1	Coursera	https://www.coursera.org/specializations/human-resource-management	M1, M5, M4
2	Alison	https://alison.com/tag/human-resources	M1-M4

Prepared By:	Checked By:	Verified By:	Approved By:
Ms. Nisha Varghese	Dr. Megharani Patil **Program Coordinator**	Mrs. Shiwani Gupta **Dy. HOD-COMP**	Dr. Sheetal Rathi **HOD-COMP Chairman BOS**

B.E. Semester –VIII

B.E. (Computer Engineering)									
Course Name: Institute Level Optional Course-II (Professional Ethics and CSR)							B.E. SEM : VIII		
							Course Code : ILO8025		
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	20	80	-	-	100

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: Communication Skills, BCE, Value Education

Course Objective: The objective of the course is to understand professional ethics in business and to recognized corporate social responsibility.

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 rights and duties of business	L1, L2
2	Distinguish different aspects of corporate social responsibility	L1, L2, L3,L4
3	Demonstrate professional ethics	L1, L2, L3,L4
4	Understand legal aspects of corporate social responsibility	L1, L2
5	Understand professional ethics and social responsibility	L1, L2
6	Understand corporate Social Responsibility in Globalizing India	L1, L2

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Professional Ethics and Business** The Nature of Business Ethics; Ethical Issues in Business; Moral Responsibility and Blame; Utilitarianism: Weighing Social Costs and Benefits; Rights and Duties of Business	4	L1, L2, L3,L4
2	**Professional Ethics in the Marketplace and Environment** Professional Ethics in the Marketplace: Perfect Competition; Monopoly Competition; Oligopolistic Competition; Oligopolies and Public Policy Professional Ethics and the Environment: Dimensions of Pollution and Resource Depletion; Ethics of Pollution Control; Ethics of Conserving Depletable Resources.	8	L1, L2, L3,L4
3	**Professional Ethics of Consumer Protection and Job Discrimination** Markets and Consumer Protection; Contract View of Business Firm's Duties to Consumers; Due Care Theory; Advertising Ethics; Consumer Privacy Professional Ethics of Job Discrimination: Nature of Job Discrimination; Extent of Discrimination; Reservation of Jobs.	6	L1, L2, L3,L4
4	**Introduction to Corporate Social Responsibility** Potential Business Benefits—Triple bottom line, Human resources, Risk management, Supplier relations; Criticisms and concerns—Nature of business; Motives; Misdirection. Trajectory of Corporate Social Responsibility in India	5	L1, L2, L3,L4
5	**Corporate Social Responsibility** Articulation of Gandhian Trusteeship Corporate Social Responsibility and Small and Medium Enterprises (SMEs) in India, Corporate Social Responsibility and Public-Private Partnership (PPP) in India	8	L1, L2, L3,L4
6	**Corporate Social Responsibility in Globalizing India** Corporate Social Responsibility Voluntary Guidelines, 2009 issued by the Ministry of Corporate Affairs, Government of India, Legal Aspects of Corporate Social Responsibility—Companies Act, 2013.	8	L1, L2, L3,L4
	Total Hours	**39**	

Books and References:

	Title	Authors	Publisher	Edition	Year
1	Business Ethics: Texts and Cases from the Indian Perspective	Ananda Das Gupta	Springer	First Edition	2016
2	Corporate Social Responsibility: Readings and Cases in a Global Context	Andrew Crane, Dirk Matten, Laura Spence	Routledge	First Edition	2007
3	Business Ethics: Concepts and Cases	Manuel G. Velasquez	Pearson	Seventh Edition	2011
4	Corporate Social Responsibility in India	Bidyut Chakrabarty	Routledge	First Edition	2015

Online Resources:

S. No.	Website Name	URL	Modules Covered
1.	www.tutorialspoint.com	https://www.tutorialspoint.com/engineering_ethics/engineering_ethics_rights_of_engineers.htm	M1-M2
2.	www.shodhganga.inflibnet.ac.in	https://shodhganga.inflibnet.ac.in/bitstream/1060/3/150502/13/13_chapter%206.pdf	M3
3.	www.iosrjournals.org	http://www.iosrjournals.org/iosr-jbm/papers/vol2-issue4/F0244148.pdf?id=5514	M6

Checked By:

Dr. Megharani Patil
Program Coordinator

Verified By:

Mrs. Shiwani Gupta
Dy. HOD-COMP

Approved By:

Dr. Sheetal Rathi
HOD-COMP
Chairman BOS

B.E. Semester –VIII

B.E. (Computer Engineering)					B.E. SEM : VIII				
Course Name: Institute Level Optional Course-II (Research Methodology					**Course Code :** ILO8026				
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	20	80	-	-	100
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: Statistics, Mathematics Basics									

Course Objective: The course intends to understand Research and Research Process, to acquaint students with identifying problems for research and develop research strategies and to familiarize students with the techniques of data collection, analysis of data and interpretation

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	Prepare a preliminary research design for projects in their subject matter areas	L1, L2, L3,L4
2	Accurately collect, analyze and report data	L1, L2, L3,L4
3	Present complex data or situations clearly	L1, L2, L3,L4
4	Review and analyze research findings	L1, L2, L3,L4
5	Illustrate various formation of research problems	L1, L2, L3,L4
6	Analyze various outcomes of research	L1, L2, L3,L4

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Introduction and Basic Research Concepts** Research – Definition, Concept of Construct, Postulate, Proposition, Thesis, Hypothesis, Law, Principle. Research methods vs Methodology, Need of Research in Business and Social Sciences, Objectives of Research, Issues and Problems in Research, Characteristics of Research: Systematic, Valid, Verifiable, Empirical and Critical	9	L1, L2, L3,L4
2	**Types of Research** Basic Research, Applied Research, Descriptive Research, Analytical Research, Empirical Research, Qualitative and Quantitative Approaches	7	L1, L2, L3,L4
3	**Research Design and Sample Design** Research Design – Meaning, Types and Significance, Sample Design – Meaning and Significance Essentials of a good sampling Stages in Sample Design Sampling methods/techniques Sampling Errors	7	L1, L2, L3,L4
4	**Research Methodology** Meaning of Research Methodology, Stages in Scientific Research Process: Identification and Selection of Research Problem, Formulation of Research Problem, Review of Literature, Formulation of Hypothesis, Formulation of research Design, Sample Design, Data Collection, Data Analysis, Hypothesis testing and Interpretation of Data, Preparation of Research Report	8	L1, L2, L3,L4
5	**Formulating Research Problem** Considerations: Relevance, Interest, Data Availability, Choice of data, Analysis of data, Generalization and Interpretation of analysis	4	L1, L2, L3,L4
6	**Outcome of Research** Preparation of the report on conclusion reached, Validity Testing & Ethical Issues, Suggestions and Recommendation	4	L1, L2, L3,L4
	Total Hours	39	

Books and References:

	Title	Authors	Publisher	Edition	Year
1	Practical Research Methods	Dawson, Catherine	UBS Publishers Distributors	-	2002
2	Research Methodology-Methods and Techniques	Kothari, C.R	Wiley Eastern Limited	Second Edition	1985
3	Research Methodology-A Step-by-Step Guide for Beginners	Kumar, Ranjit	Pearson	Second Edition	2005

Online Resources:

S. No.	Website Name	URL	Modules Covered
1.	www.ihmgwalior.net	http://www.ihmgwalior.net/pdf/research_methodology.pdf	M1-M5
2.	https://shodhganga.inflibnet.ac.in/	https://shodhganga.inflibnet.ac.in/bitstream/10603/63521/11/11_chapter3.pdf	M3
3.	www.arcjournals.org	https://www.arcjournals.org/pdfs/ijhsse/v1-i8/8.pdf	M5

Checked By:
Dr. Megharani Patil
Program Coordinator

Verified By:
Mrs. Shiwani Gupta
Dy. HOD-COMP

Approved By:
Dr. Sheetal Rathi
HOD-COMP
Chairman BOS

B.E. Semester –VIII

B.E. (Computer Engineering)									
Course Name : Institute Level Optional Course-II (IPR and Patenting)							**B.E. SEM : VIII**		
Teaching Scheme (Program Specific)							**Course Code : ILO8027**		
Modes of Teaching / Learning / Weightage					**Examination Scheme (Formative/ Summative)**				
Hours Per Week					**Modes of Continuous Assessment / Evaluation**				
					Theory (100)		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	
3	-	-	3	3	20	80	-	-	100

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: Research methodology and Patenting

Course Objective: The objective of the course is understand intellectual property rights protection system, promote the knowledge of Intellectual Property Laws of India as well as International treat procedures and get acquaintance with Patent search and patent filing procedure and 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 Intellectual Property assets	L1,L2
2	Assist individuals and organizations in capacity building	L1,L2
3	Understand the work for development, promotion, protection, compliance, and enforcement of Intellectual Property and Patenting	L1,L2
4	Understand the basics of patenting, rights and infringement	L1,L2
5	Understand the rules in various scenarios	L1,L2
6	Understand the procedure to file a patent	L1,L2

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's 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** **Enforcement of Intellectual Property Rights:** 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.	7	L1,L2
3	**Emerging Issues in IPR** Challenges for IP in digital economy, e-commerce, human genome, biodiversity and traditional knowledge etc.	5	L1, L2
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
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)** **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, Time frame and cost, Patent Licensing, Patent Infringement **Patent databases:** Important websites, Searching international databases	7	L1, L2
	Total Hours	**39**	

Books and References:

	Title	Authors	Publisher	Edition	Year
1	A Handbook on Laws Relating to Intellectual Property Rights in India	Rajkumar S. Adukia	Lexis Nexis	Third Edition	2007

2	Patent system and related issues at a glance	Keayla B K	National Working Group on Patent Laws		2011
3	Intellectual Property Law in India	T Sengupta	Kluwer Law International	Second Edition	2011
4	Intellectual Property and Human Development: Current Trends and Future Scenario	Tzen Wong and Graham Dutfield,	Cambridge University Press	First Edition	2010
5	Intellectual Property: Patents, Copyrights, Trade Marks and Allied Right	Cornish, William Rodolph & Llewelyn, David.	Sweet & Maxwell	7th Edition	2010
6	The enforcement of Intellactual Property Rights: A Case Book	Lous Harns,	WIPO	3rd Edition	2012
7	Intellectual Property Rights	Prabhuddha Ganguli,	TMH	1st Edition	2012
8	Intellectual Property Rights	. R Radha Krishnan & S Balasubramanian	Excel Books	1st Edition	2012
9	Intellectual Property Rights	M Ashok Kumar and mohd Iqbal Ali	Serial Publications	2nd Edition	2011
10	Fundamentals of IPR for Engineers	Kompal Bansal and Praishit Bansal	BS Publications	1st Edition	2012
11	A Manual on Intellectual Property Rights	Entrepreneurship Development and IPR Unit	BITS Pilani	-	2007

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

Checked By:
Dr. Megharani Patil
Program Coordinator

Verified By:
Mrs. Shiwani Gupta
Dy. HOD-COMP

Approved By:
Dr. Sheetal Rathi
HOD-COMP
Chairman BOS

B.E. Semester –VIII

B.E. (Computer Engineering)							B.E. SEM : VIII		
Course Name : Institute Level Optional Course-II (Digital Business Management)							Course Code : ILO8028		
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	20	80	-	-	

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: Database Management and Ecommerce

Course Objective: The objective of the course is to familiarize with digital business concept, acquaint with E-commerce and give insights into E-business and its strategies

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	Identify drivers of digital business	L1,L2,L3
2	Illustrate various approaches and techniques for E-business and management	L1,L2,L3,L4
3	Prepare E-business plan and its application	L1,L2,L3,L4
4	Illustrate various ecommerce threats and the encryption standard	L1,L2,L3,L4
5	Implement various E-Business formulation strategies	L1,L2,L3,L4
6	Identify a case study and present the business plan	L1,L2,L3,L4

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Introduction to Digital Business** **Introduction to Digital Business** Introduction, Background and current status, E-market places, structures, mechanisms, economics and impacts Difference between physical economy and digital economy, **Drivers of digital business-** Big Data & Analytics, Mobile, Cloud Computing, Social media, BYOD, and Internet of Things(digitally intelligent machines/services) Opportunities and Challenges in Digital Business,	9	L1,L2,L3
2	**Overview 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 exchangesand support services, e-supply chains, Collaborative Commerce, Intra business ECand Corporate portals Other E-C models and applications, innovative EC System-From E-government and learning to C2C, mobile commerce and pervasive computing EC Strategy and Implementation-EC strategy and global EC, Economics and Justification of EC, Using Affiliate marketing to promote your e-commerce business, Launching a successful online business and EC project, Legal, Ethics and Societal impacts of EC	6	L1,L2,L3,L4
3	**Digital Business Support services:** **Digital Business Support services:** ERP as e –business backbone, knowledge Tope Apps, Information and referral system **Application Development:** Building Digital business Applications and Infrastructure	6	L1, L2, L3, L4
4	**Managing E-Business** **Managing E-Business**-Managing Knowledge, Management skills for e-business, 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	6	L1, L2, L3, L4
5	**E-Business Strategy** **E-Business Strategy-**E-business Strategic formulation- Analysis of Company's Internal and external environment, Selection of strategy, E-business strategy into Action, challenges and E-Transition (Process of Digital Transformation)	4	L1, L2, L3, L4
6	**Materializing e-business: From Idea to Realization** **Materializing e-business: From Idea to Realization-**Business plan preparation, **Case Studies and presentations**	8	L1, L2, L3, L4
	Total Hours	39	

Books and References:

	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	Third Edition	2002
3	Digital Business and E-Commerce Management	Dave Chaffey	Pearson	Sixth Edition	2014
4	Introduction to E-business-Management and Strategy	Colin Combe	ELSVIER	First Edition	2012
5	Digital Business Concepts and Strategy	Eloise Coupey	Pearson	Second Edition	2004
6	Trend and Challenges in Digital Business Innovation	Vinocenzo Morabito	Springer	Second Edition	2014
7	Digital Business Discourse	Erika Darics, Palgrave Macmillan	Palgrave Macmillan	-	2015

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

Checked By:

Dr. Megharani Patil
Program Coordinator

Verified By:

Mrs. Shiwani Gupta
Dy. HOD-COMP

Approved By:

Dr. Sheetal Rathi
HOD-COMP
Chairman BOS

B.E. Semester –VIII

B.E. (Computer Engineering)					B.E. SEM : VIII				
Course Name : Institute Level Optional Course-II (Environmental Management)					Course Code : ILO8029				
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	20	80	-	-	
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: Social Awareness, General Awareness about Society									

Course Objective: The objective of the course is to understand and identify environmental issues relevant to India and global concerns, learn concepts of ecology and familiarize environment related legislations

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 environmental management	L1,L2
2	Understand ecosystem and biodiversity	L1,L2
3	Understand interdependence, food chain and limiting factors etc.	L1,L2
4	Understand the scope of environment management	L1,L2
5	Understand ISO-14000 and certification	L1,L2
6	Understand environment related legislations	L1,L2

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	10	L1,L2,L3
2	Global Environmental concerns : Global Warming, Acid Rain, Ozone Depletion, Hazardous Wastes, Endangered life-species, Loss of Biodiversity, Industrial/Manmade disasters, Atomic/Biomedical hazards, etc.	6	L1,L2,L3,L4,L5, L6
3	Concepts of Ecology: Ecosystems and interdependence between living organisms, habitats, limiting factors, carrying capacity, food chain, etc.	5	L1, L2, L3, L4,L5
4	Scope of Environment Management, Role and functions of Government as a planning and regulating agency, Environment Quality Management and Corporate Environmental Responsibility	10	L1, L2, L3, L4
5	Total Quality Environmental Management, ISO-14000, EMS certification.	5	L1, L2, L3, L4
6	General overview of major legislations like Environment Protection Act, Air (P&CP) Act, Water (P & CP) Act, Wildlife Protection Act, Forest Act, Factories Act, etc.	3	L1, L2, L3, L4
	Total Hours	**39**	

Books and References:

	Title	Authors	Publisher	Edition	Year
1	Environmental Management: Principles and Practice	C J Barrow, Routledge	Publishers London	First Edition	1988
2	A Handbook of Environmental Management Edited	Jon C. Lovett and David G. Ockwell	EdwardElgar Publishing	-	2010
3	Environmental Management	V Ramachandra and Vijay Kulkarni	TERI Press	-	2009
5	Environmental Management: An Indian Perspective	S N Chary and Vinod Vyasulu	Maclillan India	First Edition	2000
6	Introduction to Environmental Management, Mary K Theodore and Louise Theodore, CRC Press Environment and Ecology	Majid Hussain	Access Publishing.	3rd Ed.	2015

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

Checked By:

Dr. Megharani Patil
Program Coordinator

Verified By:

Mrs. Shiwani Gupta
Dy. HOD-COMP

Approved By:

Dr. Sheetal Rathi
HOD-COMP
Chairman BOS

B.E. Semester –VIII

B.E. (Computer Engineering)							B.E. SEM : VIII		
Course Name: Cloud Computing Lab							Course Code : CSL801		
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	
-	-	4	4	2	-	-	25	50	75
The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)									
Prerequisite: Cloud Computing, Computer Networks									

Course Objective: The objective of the course is to study key concepts of virtualization, apply various deployment models such as private, public, hybrid and community, understand various service models such as IaaS and PaaS and understand Security and Privacy issues in cloud.

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	Adapt different types of virtualization and increase resource utilization.	L1, L2, L3, L4
2	Build a private cloud using open source technologies.	L1, L2, L3
3	Analyze security issues on cloud	L1, L2, L3, L4
4	Develop real world web applications and deploy on commercial cloud.	L1, L2, L3, L4, L5
5	Demonstrate various service models	L1, L2, L3, L4
6	Analyze different features of cloud computing	L1, L2, L3, L4

Books and References:

S. No.	Title	Authors	Publisher	Edition	Year
1	Enterprise Cloud Computing	Gautam Shroff	Cambridge	Third Edition	2010
2	Cloud Security	Ronald Krutz and Russell Dean Vines	Wiley	First edition	2010
3	Getting Started with OwnCloud	Aditya Patawa	Packt Publishing Ltd,	--	2013

Online Resources:

S. No.	Website Name	URL	Modules Covered
1	www.guru99.com	https://www.guru99.com › cloud-computing-for-beginners https://www.w3schools.in/cloud-computing/cloud-computing-architecture/	M1,M2
2	opensourceforu.com	https://opensourceforu.com/2018/02/build-cloud-storage-system-using-oss/	M3,M4
3	www.josso.org	www.josso.org › tutorials	M5, M6

List of Practical/ Experiments:

Practical Number	Type of Experiment	Practical/ Experiment Topic	Hrs.	RBT Levels
1	Basic Experiments	Understand Cloud Computing, Architecture and various types of Cloud Computing.	2	L1, L2
2		Illustrate virtualization in Cloud by Creating and running virtual machines on open source OS.	2	L1, L2
3		Illustrate Infrastructure as a Service (IaaS) by installing OpenStack and use it as IaaS.	2	L1, L2
4	Design Experiments	Illustrate Storage as Service (SaaS) by installing and understanding the features of ownCloud as SaaS.	2	L1, L2, L3
5		Illustrate identity management by installing and using identity management feature of OpenStack.	2	L1, L2, L3
6		Build a program for web feed.	2	L1, L2, L3
7		Illustrate Single-Sing-On by installing and using JOSSO	2	L1, L2, L3
8		a) To implement securing servers in Cloud by installing and using security feature of ownCloud b) To Implement User Management in Cloud by installing and using the Administrative features of ownCloud.	4	L1, L2, L3 L1, L2, L3
9	Case Studies	**Case study:** 1. Amazon EC2 2. Microsoft Azure	2	L1, L2, L3
10	Mini Project	**Mini Project and presentation:** 1. University Campus Online Automation Using Cloud Computing 2. Cloud Based Student Information	40	L1, L2, L3, L4, L5

		Chatbot Project 3. Cloud Based Bus Pass System 4. Cloud computing for Rural banking 5. E-Learning Platform using Cloud Computing 6. Cloud Based Online Blood Bank System 7. Intelligent rule-based phishing websites classification Based on URL Features 8. Cloud Based Local Train Ticketing System 9. eBug Tracker – Bug Tracking System Project 10. Cloud Based Attendance System		
		Total Hours	**60**	

Prepared By:	Checked By:	Verified By:	Approved By:
Ms. Tahera Shaikh Ms. Priti Badhe	Dr. Megharani Patil **Program Coordinator**	Mrs. Shiwani Gupta **Dy. HOD-COMP**	Dr.Sheetal Rathi **HOD-COMP** **Chairman BOS**

B.E. Semester –VIII

B.E. (Computer Engineering)							B.E. SEM : VIII		
Course Name: Major Project-II							Course Code : CSP802		
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
-	-	12	12	6	-	-	50	50	
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 Computer Programming Languages									

Course Objective: 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.

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